

The Rise and Fall of Job Analysis and the Future of Work Analysis

Juan I. Sanchez¹ and Edward L. Levine²

¹Department of Management and International Business, Florida International University, Miami, Florida 33199; email: sanchezj@fiu.edu

²Psychology Department, University of South Florida, Tampa, Florida 33620; email: elevine@mail.usf.edu

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Abstract

This review begins by contrasting the importance ascribed to the study of occupational requirements observed in the early twentieth-century beginnings of industrial-organizational psychology with the diminishing numbers of job analysis articles appearing in top journals in recent times. To highlight the many pending questions associated with the job-analytic needs of today's organizations that demand further inquiry, research on the three primary types of job analysis data, namely work activities, worker attributes, and work context, is reviewed. Research on competencies is also reviewed along with the goals of a potential research agenda for the emerging trend of competency modeling. The cross-fertilization of job analysis research with research from other domains such as the meaning of work, job design, job crafting, strategic change, and interactional psychology is proposed as a means of responding to the demands of today's organizations through new forms of work analysis.

Contents

INTRODUCTION	398
THE RISE AND FALL OF JOB ANALYSIS	399
THE OBJECT OF STUDY IN JOB ANALYSIS	400
RESEARCH ON WORK ACTIVITY	
INFORMATION	401
Reliability Studies	401
Carelessness Studies	404
Validity Studies	405
Competencies	407
RESEARCH ON WORKER	
ATTRIBUTE INFORMATION ..	408
Reliability Studies	408
Validity Studies	410
RESEARCH ON WORK CONTEXT	
INFORMATION	414
CONCLUSIONS AND FUTURE TRENDS	417

INTRODUCTION

Job analysis constitutes the preceding step of every application of psychology to human resources (HR) management including, but not limited to, the development of selection, training, performance evaluation, job design, deployment, and compensation systems (Brannick et al. 2007, Gael et al. 1988, Harvey 1991, Levine 1983). Because it serves as a foundation of so many applications, one would assume that job analysis research, much like research on other areas of applied psychology such as selection that has had a long history of coverage in the *Annual Reviews* (e.g., from Taylor & Naviz 1961 to Sackett & Lievens 2008), would have been the object of periodic *Annual Review of Psychology* articles. Ours is, however, the very first *Annual Reviews* chapter ever dedicated to job-analytic research, notwithstanding the brief coverage of selected developments in job-analytic research included in prior syntheses of the selection literature (e.g., Borman et al. 1997, p. 301; Hough &

Oswald 2000, p. 632; Landy et al. 1994, p. 266; Sackett & Lievens 2008, p. 429).

This relatively sparse coverage of job analysis research is startling in light of the principle of person-environment fit (P-E fit), which underlies most HR management applications of psychology since early pioneers began to wonder how to best fit individuals to occupations and vice versa (Münsterberg 1913, Parsons 1909). One would argue that a successful P-E match depends on the quality of the study of both sides of this equation, the E side and the interaction between P and E being core elements in job analysis. However, the purpose of our review is not to fill this void by providing an exhaustive account of job analysis research to date, because such monographs are already available elsewhere (Brannick et al. 2007; Harvey 1991; Morgeson & Dierdorff 2011; Pearlman & Sanchez 2010; Sanchez & Levine 1999, 2001), as well as accounts of the history of job analysis (Mitchell & Driskill 1996, Primoff & Fine 1988, Wilson 2007). Instead, we were inspired by calls to adapt job analysis practice and research to the changing nature of work (Sanchez 1994, 2000; Sanchez & Levine 1999; Schneider & Konz 1989; Siddique 2004; Singh 2008), as well as by recent observations that job analysis research is not keeping up with the staffing practices demanded by today's dynamic and diverse workplaces (Morgeson & Dierdorff 2011, Sackett & Laczko 2003). The inability of traditional job analysis to answer the demands of today's organizations is illustrated by the warm reception of the proposal to rename the field "work analysis" (Sanchez 1994; Sanchez & Levine 1999, 2001), a label that best reflects the boundaryless nature of the evolving roles that individuals play within organizations (Ilgen & Hollenbeck 1991, Morgeson & Dierdorff 2011). As a result, we aim to identify not only the trends in the evolution of job analysis research that account for current thinking in the domain, but also those that represent promising avenues by which the job analysis domain may catch up with the needs of today's organizations. With this purpose in mind, we not only culled

Job analysis: the process through which one gains an understanding of the activities, goals, and requirements demanded by a work assignment

HR: human resources

P-E fit:
person-environment
fit

the job analysis literature, but also borrowed insights from research in a number of related domains (e.g., the experience of work, work stress) that, through cross-fertilization, may stimulate the kind of innovative job analysis research demanded by today's world of work. In fact, an overarching conclusion of our review is that we must thoroughly revise the core assumptions that have dominated the job analysis domain in the face of the magnitude of the transformations that have taken place in the world of work over recent decades.

The review is organized as follows. First, we contrast our view that job analysis research has lost ground in recent times with the central role that job analysis was accorded in the beginnings of the field of industrial and organizational psychology. Next, we review the debate concerning what the appropriate object of study should be in job analysis in the context of the various types of job-analytic data, namely work activities, worker attributes, and work context. We then proceed to review research concerning these major types of data, emphasizing the latest research trends such as research on competencies. Because job-analytic research has largely focused on the quality of job-analytic data, we also group research around the primary criteria by which data have been evaluated. Specifically, we distinguish among evaluations that have focused on the reliability, the validity, and the consequences (i.e., the inferences drawn from job-analytic data and the rules employed to draw them). Finally, we offer a set of conclusions and suggestions regarding the repositioning of job analysis research.

An important caveat about the scope of our literature review is in order. The wide variety of job analysis applications has led to clearly separated streams of literature such as research on human factors and engineering psychology (e.g., cognitive task analysis; Schraagen et al. 2000). This line of research has been covered in prior *Annual Reviews* articles (e.g., Carroll 1997, Proctor & Vu 2010). Related applications of job analysis in the study of training needs analysis and in the determination of job worth have also been covered in former *Annual Reviews*

articles (e.g., Aguinis & Kraiger 2009 and England & Dunn 1988, respectively). Thus, our review does not delve into these domain-specific applications, even though the research reviewed here has obvious implications for them.

Moreover, instead of dedicating a separate section to the Occupational Information Network (O*NET), which was developed by the U.S. Department of Labor (Peterson et al. 1999), we interspersed O*NET-related research within those sections where we felt it fit best throughout our review.

THE RISE AND FALL OF JOB ANALYSIS

The reduced space dedicated to job analysis in recent reviews of the selection literature mentioned earlier is justifiable in light of Morgeson & Dierdorff's (2011) compilation of job analysis journal articles published since 1960. They found that, even though the volume of job-analytic research has not decreased in the past two decades, the proportion of job analysis articles published in the top journals in industrial and organizational psychology and HR management has decreased considerably from an all-time high in the 1960–1979 period, when approximately 77% of the total of job analysis articles published appeared in a list of seven top outlets, to just 27% of the total of job analysis articles published since 2000. This decline is dramatically illustrated by the counts of articles published in the *Journal of Applied Psychology* (*JAP*) and in *Personnel Psychology* (*PP*) provided by Cascio & Aguinis (2008), from an all-time peak of 22 articles dedicated to job analysis in the 1978–1982 period to just four in the 2003–2007 period. The declining rate of job analysis publications contrasts sharply with the steady flow of articles concerned with predictors of performance published in *JAP* and *PP* (Cascio & Aguinis 2008).

Accounts of early research in personnel selection in the first part of the twentieth century, however, suggest a better balance between the spread of relative interest in the two sides of the P-E equation than that observed in recent times

(Salgado et al. 2010). For instance, the German psychologist Stern (1911) developed “psychography” to compare an individual profile to the profile of the attributes presumably demanded by an occupation (Lamiell 2000, Stern 1934). A partial English translation of the very first structured job analysis questionnaire created by his German colleague Otto Lipmann was published in the *Monthly Review* of the U.S. Bureau of Census Statistics (1918, pp. 131–133). A similarly balanced P-E emphasis seemed to have dominated pre-WWII occupational research in the United States, where Viteles (1923) was an early adopter of Stern’s psychographic methods. Even the U.S. Department of Labor’s Division of Standards and Research was organized in two sections dedicated to worker and job analysis, respectively (Otis 2009, Primoff & Fine 1988, Shartle 1959).

The reduced status of job analysis research in recent times, however, is not due to a lack of important, pending research developments that respond to the emerging HR trends (e.g., personality-oriented work analysis, team and cognitive task analysis, and strategic competency modeling), which have been advocated elsewhere (Morgeson & Dierdorff 2011; Sackett & Laczko 2003; Sanchez 1994; Sanchez & Levine 1999, 2009; Schneider & Konz 1989; Siddique 2004; Singh 2008). In sections to follow, we not only identify gaps but also uncover insights from related domains to stimulate research of the high caliber sought by top outlets, hopefully taking a step toward remediating the absence of job-analytic research that answers the most pressing HR management questions while advancing scientific knowledge across domains in which job analysis plays a role.

THE OBJECT OF STUDY IN JOB ANALYSIS

Harvey (1991, p. 73) and Harvey & Wilson (2000) took the stance that job analysis should be concerned solely with “objective” or “verifiable” aspects of jobs, such as job behaviors and working conditions, and should

exclude inferences concerning job specifications or human attributes required for performance. By contrast, Sanchez & Levine (2001) argued that deriving the worker characteristics required for job performance is an intrinsic component of job analysis (e.g., Primoff 1975), opining that the formulation of worker attributes is what makes job analysis a truly psychological endeavor. An examination of selection texts suggests that the derivation of worker attributes or job specifications tends to be included under the rubric of job analysis (Gatewood et al. 2008, Guion & Highhouse 2006, Heneman & Judge 2009, Ployhart et al. 2006). Therefore, we review research on not only observables such as work behavior, but also construals such as human attributes thought to be required for successful performance.

The distinction between two broadly defined kinds of job-analytic data, namely tasks and the characteristics or attributes of people performing such tasks, is widely accepted (Sackett & Laczko 2003; Sanchez & Levine 1999, p. 56). We also review a third but equally important type of job analysis data concerning the environment or context in which work activities are performed, including the situational opportunities and constraints that influence behavior (Meyer et al. 2010). These three major objects of job-analytic study (i.e., work behavior, worker attributes, and context) resemble the building blocks of successful job analysis proposed by Fine & Cronshaw (1999, p. 21). In the next three sections, research on each one of these building blocks is grouped according to the criteria along which the job-analytic data were evaluated, beginning with reliability and validity. These psychometric properties are important because they influence the inferences that such data are meant to inform (Dierdorff & Wilson 2003, McCormick 1976, Morgeson & Campion 1997). However, we also include a third class of studies concerned with the type of consequence-oriented criteria, such as the inferences derived from job-analytic data and the rules governing the making of such inferences, that Sanchez & Levine (2000) advocated for the evaluation of job analysis.

We believe that the focus on inferences and on the rules by which they are made is critical to propel job analysis research beyond its current stalemate. Partly, this stalemate might have been fueled by the support obtained for the validity of general mental ability (GMA) tests for most jobs in most settings (see Le et al. 2007 for a summary of these findings), which has fed the conclusion that a detailed job analysis may constitute an unnecessary expense when the purpose is to ascertain the generalizability of GMA tests (Pearlman et al. 1980, p. 376; Schmidt et al. 1981). An unwarranted generalization drawn from this stream of research is that there is not much return on investment in a detailed job analysis because job-analytic information is not helpful to identify the conditions under which a test may or may not work. This conclusion is predicated on the false premises that (a) validity generalization findings regarding GMA tests can be extended to other predictors such as personality and psychomotor tests and employment interviews and, perhaps most importantly, (b) current job-analytic practices already provide the best information the field has to offer in regard to potential occupational moderators of validity. The evidence to be reviewed here suggests otherwise. For instance, O*NET-based determinations of specific ability requirements rely on single-item scales of limited discriminant validity (Harvey & Wilson 2010, Sanchez & Autor 2010). Similarly, inasmuch as meta-analyses suggest that personality measures can predict job performance (e.g., Barrick & Mount 1991, Hough 1992, Salgado 1997, Tett et al. 1991), evidence concerning the specific occupational conditions under which such tests work best is only beginning to emerge (Meyer et al. 2010, Raymark et al. 1997, Tett & Burnett 2003).

We purposefully avoided using the term “descriptor” when referring to any kind of job-analytic information because we disagree with the implicit assumption that the primary purpose of job analysis is to describe jobs. Instead, job analysis should aim to understand the successful experience of work, and therefore many of the pieces of data produced in job

analysis research are unobservable construals meant to explain rather than describe the worker’s behavior.

RESEARCH ON WORK ACTIVITY INFORMATION

Although terms such as job, duty, function, responsibility, and task are often employed to refer to work activities, most researchers agree that these terms reflect work activities ranging from the very specific or molecular level (i.e., task), to a medium level (i.e., functions, duties, or responsibilities), to the general or molar level (i.e., groupings of activities that comprise a job) (Gael 1983, p. 7). A majority of research has been conducted using task inventories prepared in the tradition of Allen’s (1919) “trade analysis.” These inventories depict long lists of prestandardized tasks, which are rated on scales such as frequency, time spent, and difficulty (Christal & Weissmuller 1988). Research has also emerged on the 42 generalized work activities (GWAs) included in O*NET, which were derived through a literature review of various taxonomies of work activity data (Cunningham & Ballentine 1982, McCormick et al. 1972) to form a common metric for all occupations (Cunningham 1996).

Reliability Studies

Studies of the reliability of work activity inventories have employed two basic approaches: intrarater (i.e., test-retest or repeated items within the same administration) and interrater reliability (Gael 1983, p. 23). However, disagreement among incumbents of the same job title may reflect legitimate variation, such as differences in positions classified under the same job title (Harvey 1991, Lindell et al. 1998, Sanchez et al. 1998, Stutzman 1983, Wilson 1997). Sanchez & Levine (2000) warned that interrater disagreement may also reflect idiosyncratic approaches to the manner in which two or more incumbents interpret and carry out the same job. Harvey & Wilson (2000) noted their disagreement with Sanchez

GMA: general mental ability

GWAs: generalized work activities

& Levine's stance, indicating that interrater reliability is an appropriate means to gauge reliability when the object of study is what in their view constitutes verifiable job information (e.g., work behaviors). Nevertheless, the research on reliability of job analysis data yields a complex and not altogether consistent picture.

Dierdorff & Wilson's (2003) meta-analysis revealed that task data produced higher estimates of interrater reliability than statements of broader GWAs (weighted $r = 0.77$ versus 0.60). Dierdorff & Morgeson (2009) reported similar differences in the interrater reliability estimates of GWAs and tasks (i.e., 0.65 versus 0.80). In contrast, in a different meta-analysis Voskuil & van Sliedregt (2002) reported the exact opposite finding, namely that task statements were less reliable than broader behaviors (0.29 versus 0.62). Findings from research on the merits of decomposed (or task-based) versus holistic (job-based) ratings have been equally mixed, with a majority of studies indicating the superior interrater reliability of molecular estimates (Butler & Harvey 1988, Gibson et al. 2004, Harvey et al. 1994, Sanchez & Levine 1994), whereas some suggested no differences (Cornelius & Lyness 1980). One of the reasons offered for these somewhat mixed findings is that the presumably challenging demands of holistic judgments, which require a great deal of information integration (Cornelius & Lyness 1980), are sometimes exceeded by the demands involved in rating a very large number of molecular (task) units. Still another explanation, which is consistent with Dierdorff & Wilson's finding that molecular-molar reliability differences are largely confined to interrater reliability estimates, is that incumbents are more likely to endorse idiosyncratic views of the role expectations associated with their job than of the specific activities involved in discharging such roles. Whether these idiosyncratic opinions regarding their role represent unreliability is questionable because they may capture real differences in how the job is interpreted and even performed (Dierdorff & Morgeson 2007, Dierdorff et al. 2010, Sanchez & Levine 2000).

Jeanneret et al. (1999) reported GWA intraclass correlations obtained in a pilot study of 35 occupations with 4 to 88 incumbents. For the level scale, they reported correlations of at least 0.90 for 35 of the 42 GWAs. Slightly lower reliabilities were reported for the importance and frequency scales (the frequency scale was later eliminated in the final version of O*NET). Their results did not significantly change when GWAs rated as "not relevant" were eliminated, in spite of the potentially inflating effects of "does not apply" items on interrater reliability (Friedman & Harvey 1986, Smith & Hakel 1979). Dierdorff & Morgeson (2009) reported a lower mean interrater reliability of 0.65 for O*NET GWAs using a large sample of incumbents ($N = 47,137$) spanning over 300 different occupations whose ratings had been collected by the U.S. Department of Labor to populate O*NET.

Dierdorff & Wilson (2003) observed that the pattern of reliabilities differed between their interrater and intrarater estimates. These differences were most notable for ratings produced by technical experts ($r = 0.81$ versus 0.47 for intra- and interrater, respectively). Whereas descriptive scales dealing with perceptions of relative value (i.e., importance) showed higher interrater reliabilities than those of scales involving temporal judgments (i.e., frequency), importance and frequency had similarly acceptable intrarater reliabilities. Intrarater ratings of difficulty were lower than interrater ones. Again, it could be that incumbents' ratings of constructs that are most closely associated with the process of learning one's job, such as task difficulty, legitimately change over time, even though perceptions of the relative value of tasks (e.g., task importance) do not.

Taken together, these findings appear to question the assumption that the reliability of work activity ratings can be equivalently measured through either interrater or intrarater designs. Specifically, interrater reliability estimates do not distinguish between variance due to random factors and variance due to legitimate differences in the manner in which each incumbent approaches his/her job.

Similarly, although intrarater designs concerned with the stability of ratings over time are not affected by between-rater differences in idiosyncratic views of the job, they are still likely to reflect true variations in the longitudinal evolution of the incumbent's approach to the job. Longitudinal studies that track incumbent ratings of, for instance, time spent and difficulty may illuminate the learning sequence through which incumbents acquire job mastery.

Note that our recommendation to separately examine the estimates provided by each type of reliability design does not deny the importance of the psychometric properties of job-analytic data. In fact, our recommendation is predicated on one of classical reliability's primary tenets, specifically, the distinction between systematic and random variance. We are simply arguing that some of the variance that is sometimes deemed "random" in work activity ratings may indeed reflect systematic differences in the way some incumbents interpret and, most importantly, perform their job. Sanchez & Levine (2009) argued that the "objectified" (see also Cronshaw 1998) understanding of a job as an object or entity that displays minimal variation across each of the incumbents holding the same job was a reasonable assumption to make when work was organized around the principles of Taylorism such as task standardization and division of labor. However, such an assumption holds less well in today's world of work, where electronic equipment has taken over many standardized activities and where the emphasis often is on empowering employees to perform tasks according to their own discretion, all of which is likely to exacerbate the amount of legitimate, between-position variance within the same job title.

Prior research has indeed suggested that interrater differences may reflect not just perceptual differences of dubious theoretical or practical value, but also tangible correlates in the manner in which incumbents perform their job. For instance, Borman et al. (1992) found that time spent amounts declared for some tasks by high performers differed from those reported by low performers. Dierdorff et al. (2010) and

Morrison (1994) provided further evidence that employees' views of certain work activities were associated with the extent to which they engaged in citizenship behavior. Further evidence that variability in within-job title ratings is not always random was provided by Sanchez et al. (1998), who found that the job-analytic rating profile of branch managers working for a temporary personnel agency moderated sales performance, with high performers endorsing a more sales-oriented conception of the job and low performers endorsing a more administrative view. In a separate study reported in the same article, Sanchez et al. (1998) also revealed that prior professional experience shaped the tasks that assistant public defenders emphasized in their ratings, such that those with prior trial experience declared themselves more likely to litigate rather than settle cases than those without such experience. Prien et al. (2003) reported that social workers with longer professional tenure tended to perform their job quite differently from those with shorter professional tenure. Befort & Hatstrup (2003) found that the importance that managers assigned to task and contextual performance varied as a function of their experience, with more experienced managers placing a higher value on contextual behaviors such as compliance and extra effort.

It appears that the premise that jobs are stable objects with fixed properties, which has prevailed in job analysis research until recently (Cronshaw 1998, Sanchez & Levine 2009), has resulted in a rather passive view of incumbents, who are conceived as merely the recipients of a job assignment rather than the actors who shape it according to their own initiative. Other streams of research, however, have endorsed a more agentic view, thereby recognizing that job incumbents are active agents who perform their jobs according to their role identity, past experience, motivation, and personal and professional goals. Wrzesniewski & Dutton (2001) termed this process job crafting, which they defined as "the physical and cognitive changes individuals make in the task or relational boundaries of their work" (p. 179). Other theories, including role theory (Biddle 1986), share

this view of incumbents as the main architects of their job rather than the mere executors of a predetermined work assignment (Dierdorff et al. 2009, Grant 2007, Roberts et al. 2005). This notion applies perhaps even more to self-directed work teams (Mathieu et al. 2008).

Within-job title variability, however, may not exist uniformly across all individuals and all jobs. For instance, job incumbents have been shown to differ in their motivation to craft their job in unique ways, and antecedents of this motivation, such as self-image, perceived control, readiness to change (e.g., Lyons 2008), role orientation (Parker 2007), and the desire to make a prosocial difference (Grant 2007), have been uncovered. However, certain jobs are more likely to provide situational opportunity to engage in job crafting than others (Wrzesniewski & Dutton 2001). Research should attempt to gain a better understanding of the sources of interrater variation (Sanchez & Levine 2000), which should largely coincide with the factors promoting or inhibiting the situational opportunity to shape one's role as explained by job crafting and role theories.

A number of studies have begun to pursue this research goal. First, Sanchez et al. (1998) hypothesized that job complexity would make idiosyncratic interpretations of the job more likely. Using a sample of incumbents and job analysts for 19 jobs, they found that agreement between incumbents and nonincumbents was indeed moderated by job data-oriented occupational complexity, such that agreement was highest for the less complex jobs. Using individual-level O*NET ratings from 20,000 incumbents across 98 occupations collected by the U.S. Department of Labor, Dierdorff & Morgeson (2007) found support for a series of role theory-based predictions arguing that the context wherein employees work promotes or restricts within-title variance. These authors found that some elements of the occupational context (i.e., interdependence and routinization) increased the level of agreement in O*NET ratings, presumably because they suppressed individuation in role enactment. They also found that autonomy reduced

rating consensus, presumably because it promotes exploring new tasks. Lievens et al. (2010) found that certain kinds of work activities, such as the extent to which occupations involved equipment-related and direct contact activities, increased consensus on competency ratings, whereas managerial activities decreased it.

As a whole, these findings enhance our understanding of the conditions that foster job individuation, thereby strengthening job crafting theory, which has recognized the existence of situational antecedents of job crafting but focused instead on its individual difference antecedents (e.g., Grant 2007). In addition, because the presence of interrater disagreement among incumbents of the same job title understandably hurts the face validity of the job analysis data (Jones et al. 2001, Sanchez & Levine 2000), a better understanding of the nonrandom sources of disagreement should increase practitioners' ability to explain to end users the pros of further exploring the sources of within-job title variation (e.g., uncovering different approaches to carrying out work activities in the same job that may impact outcomes such as employee performance; Borman et al. 1992, Sanchez et al. 1998). This is a particularly pressing concern given the calls for greater discretion for workers in loosely organized units such as self-directed work teams.

Carelessness Studies

A stream of research has developed around ways to detect rater indifference or purposeful obstruction in work activity ratings. One approach taken has relied upon repeating some of the same items to see if respondents answer them consistently. However, the presence of repeated items in the same inventory may puzzle respondents (Wilson et al. 1990), who may choose to answer them inconsistently for a variety of reasons.

A different route to assess the trustworthiness of the data gathered involves the computation of veracity and carelessness indices, which typically include work activities that are known to be performed by all

incumbents or bogus items that are known not to be part of the job at all, respectively (Pine 1995). Green & Veres (1990) found that indices relying on the frequency with which bogus items were endorsed correlated significantly with the elevation of respondents' task ratings. Green & Stutzman (1986), however, reported that different indices of carelessness led to discarding different incumbents' data. These procedures warrant continued research because it is not inconceivable that the inclusion of bogus items may, as occurs with repeated items, induce the respondents to answer these items in unsuspected ways. In addition, Dierdorff & Rubin (2007) found that these items might not always capture carelessness or biases, but rather legitimate variations in incumbents' interpretation (and possible enactment) of their job, such as differences in incumbents' perceived role ambiguity. Further research is needed to uncover the constructs and response sets that arise when these types of items are employed. From a practical standpoint, discarding those respondents' data whose answers suggest carelessness according to these indices may, as it did in the case of those responding inconsistently to repeated items (Wilson et al. 1990), result in significant reductions in reliability and sample size. A more potentially fruitful research avenue involves reducing the time and the cognitive demands imposed on subject matter experts (SMEs) through cognitive-oriented redesign of lengthy inventories (Willis 2005).

Validity Studies

Assessments of the validity of work activity information span a number of different approaches that vary in the manner and in the degree to which they assess validity. One of the most straightforward approaches involves asking SMEs how well the inventory covers the scope of activities that comprise the job, usually in the form of a percentage judgment. Wilson (1997) conducted a field experiment revealing that both incumbents and supervisors provided unrealistically high judgments of inventory completeness, even when presented

with inventories where two-thirds of the tasks had been removed. Wilson recommended a serious re-examination of this approach to estimate the quality of work inventories, which may be vulnerable to experimenter demands and other forms of biases. A potentially fruitful research avenue involves conducting interviews and other forms of qualitative research on the types of work behaviors that are missing in these inventories. For instance, well-rounded incumbents may be most likely to detect the absence of other-oriented and extrarole activities, which are work requirements of critical importance in today's organizations (Borman & Motowidlo 1993).

Early research by McCormick and his associates revealed that asking SMEs to make precise estimates of time spent (e.g., allocating a percentage of time to each work activity) was problematic (McCormick 1960), as SMEs lacked the ability to judge time spent with such precision. As a result, later research adopted primarily "relative scales," which were supposed to represent a less demanding judgment because they simply asked SMEs to compare tasks to each other (e.g., "compared to all other tasks on the job, how much time do you spend on this one?"). Harvey (1991) challenged the use of relative scales, arguing that relative scales require ipsative judgments that preclude cross-job comparisons, plus they do not meet the statistical assumptions needed for many types of data analysis. These limitations, however, appear to be more conceptual than empirical, as Manson et al. (2000) found that relative and absolute scales of the same and different constructs had generally satisfactory patterns of convergent and discriminant validity and provided virtually equivalent rank-orderings of tasks within the same job. Absolute judgments, however, are sometimes necessary to quantify, for instance, the frequency and time spent on physically challenging tasks such as lifting objects of different weights. This type of research on job analysis for physically arduous jobs is sorely needed, given an aging population, the postponement of retirement age, and the larger number of workers seeking partial

SMEs: subject matter experts

or total disability certification (Fleishman et al. 1986). In the United States, the Social Security Administration (SSA) decided that O*NET was not a suitable replacement of the *Dictionary of Occupational Titles* (DOT) for purposes of disability determination, so the SSA is now embarked on a project to develop an occupational information system capable of evaluating the physical and mental demands of work (Occup. Inform. Advis. Panel 2009).

Research on the construct validity of work activity scales such as criticality or importance has been bolstered by the job-relatedness provisions of the Uniform Guidelines (Equal Employ. Opport. Comm. 1978), which call for selection procedures that are demonstrably linked to job behaviors identified to be critical or important. Prior research suggested that work activity scales load on one of two major factors: a time-oriented factor represented by time spent, frequency, and duration scales, and an importance/complexity factor involving scales of criticality, overall importance, difficulty, and difficulty of learning (Friedman 1990, 1991; Manson et al. 2000; Sanchez & Fraser 1992; Sanchez & Levine 1989). It is thus not surprising that O*NET scales of importance and level, which are employed for GWAs and other types of items, are largely redundant (their intercorrelation is $r = 0.95$ according to analyses performed using pilot O*NET data by Hubbard et al. 2000). Subsequent analyses using the aggregated ratings included in the 14.0 O*NET database by Sanchez & Autor (2010) revealed similarly high importance by level correlations for GWAs ($r = 0.92$), with type of scale (i.e., importance versus level) accounting for only 0.50% of the variance in GWA ratings.

Still another indirect but fairly widespread approach to assessing the validity of work activity data involves examining the presence and the magnitude of presumptively extraneous sources of variance in work activity ratings. The logic underlying these studies is that third variables such as job experience, sex, and other demographic variables are job unrelated; therefore, their detection would signal the presence of some kind of bias in job-analytic

data, thus casting doubt on their validity. Work experience seems to be the most widely studied extraneous influence. Evidence of experience effects, however, has been elusive. Whereas some studies have failed to detect experience effects (Schmitt & Cohen 1989, Silverman et al. 1984), a majority of them have uncovered some form of experience effect (Borman et al. 1992, Ford et al. 1991, Landy & Vasey 1991, Tross & Maurer 2000). As we argued in the section dedicated to reliability, we believe that just searching for effects of experience and of other demographic variables is not likely to advance the theory and practice of job analysis beyond what we currently know. First, as illustrated earlier, many substantive variables are confounded with demographic variables such as work experience (e.g., Lindell et al. 1998, Prien et al. 2003, Sanchez et al. 1998); therefore, interrater differences associated with work experience may reflect true differences in how incumbents not only interpret but also perform the job. For instance, the differences between less- and more-experienced branch managers and stockbrokers uncovered by Borman et al. (1992) and Sanchez et al. (1998), respectively, in regard to sales-oriented tasks had tangible correlates such as higher sales among those who emphasize sales-oriented tasks.

The occasionally null correlations between work activity ratings and performance (Aamodt et al. 1982, Conley & Sackett 1987, Wexley & Silverman 1978) are not surprising in light of studies suggesting that job crafting is unlikely to surface when the job context does not provide a great deal of discretion to incumbents (Dierdorff & Morgeson 2007, Lievens et al. 2010, Lindell et al. 1998). Also, different approaches to carrying out work activities may impact performance criteria that have not been measured in a given setting. However, even if differences in work activity ratings associated with experience were merely perceptual and did not affect the manner in which incumbents performed the job, such differences could not easily be attributed to erroneous or biasing factors. Consider, for example, the case of an arguably “objective” property of the job

such as task importance. When judging task importance, it appears that experienced job incumbents focus on time spent, as suggested by the relationship between these two variables, whereas inexperienced ones focus on difficulty of learning the task (Ford et al. 1991, Sanchez 1990). That is, the conceptual definition of their job differs across incumbents because new employees rely on their still fresh memory of how hard it is to learn certain tasks when they evaluate their importance. This memory has probably faded among experienced incumbents, whose judgments of time spent on each task may provide a more logical standard of what tasks are truly important. Affirming that some incumbents are correct whereas others are mistaken overlooks that incumbents employ a different frame of reference when judging the importance of their job demands.

We argue that future research should follow the path already initiated by others (Prien et al. 2003, Sanchez et al. 1998) and focus on understanding the substantive roots of why work experience and other demographic characteristics influence work activity ratings rather than on whether such effects are present. Morgeson & Dierdorff (2011) suggested that Tesluk & Jacobs' (1998) model of work experience, which distinguishes among indices of work experience (i.e., amount, time, density, timing, and type) and levels of analysis (i.e., task, job, work group, organization, and career/occupation), provides a useful framework along which theoretical and empirical inquiry may proceed. Indeed, we agree that continued "fishing" for differences observed among incumbents as a function of demographic breakdowns of dubious theoretical value (e.g., incumbents' race or sex) will simply replicate what we already know, namely that statistically significant differences among such groupings of incumbents are erratic, their effect sizes small, and their practical significance questionable (Arvey et al. 1977, 1982; Hazel et al. 1964; Landy & Vasey 1991; Meyer 1959; Schmitt & Cohen 1989). More substantive variables, such as the manner in which incumbents define their professional and social identity, may better explain

differences in how they view their jobs, including which tasks they deem most important. This information might be useful in, for example, framing training programs according to the level of career maturity of prospective trainees. Again, our recommendation is that instead of trying to hide or eliminate disagreement, job analysis research should embrace it by looking more deeply into its causes. Legitimate disagreement represents unique ways in which incumbents experience their job, and a better understanding of their ideographic representations might increase our grasp on the various forms in which jobs can be crafted along with their requirements and consequences. It is this broader purpose of understanding the experience of work that in our opinion holds the key to the future of work analysis (Rosso et al. 2010) because of its potential to better explain worker outcomes such as performance.

Competencies

Many organizations have incorporated competency modeling (CM) as opposed to job analyses in their HR applications (Lucia & Lepsinger 1999, Schippmann 1999). The difference between job analysis and CM, however, seems still blurry, as the two are often lumped together. A group of experts surveyed regarding the main differences between job analysis and CM opined that, unlike job analysis, CM is linked to strategic goals, but also that it is less rigorous than job analysis in regard to data collection, level of detail, assessment of reliability, and documentation of the research process (Schippmann et al. 2000). A more definitive answer to the difference between CM and job analysis probably awaits clarity in the definition of "competency," which has been vaguely defined as "any individual characteristic that can be measured or counted reliably and that can be shown to differentiate significantly between superior and average performers" (Spencer et al. 1994, p. 4). Some have recently suggested that competencies refer to knowledge, skill, ability, and other

CM: competency modeling

KSAOs: knowledge, skill, ability, and other characteristics

characteristics (KSAOs) that are needed for effective performance in the jobs in question (Campion et al. 2011). However, some degree of consensus is beginning to emerge around the view of competencies as broadly defined elements of the job performance space (Tett et al. 2000), which led us to include them in this section dedicated to work activities. In the words of Bartram (2005), competencies are “sets of behaviors that are instrumental in the delivery of desired results or outcomes” (p. 1187). Sanchez & Levine (2009) also noted that most lists of competencies resemble loosely coupled patterns of behavior or “behavioral themes” that are considered to be critical success factors or strategic performance drivers (see also Becker et al. 2001). Lievens et al. (2010) also took the position that competencies are best classified as part of the performance space.

The definition of competencies as sets of behaviors or behavioral themes that are instrumental in the delivery of strategic results is seemingly consistent with the primary purpose of CM. In this respect, Sanchez & Levine (2009) suggested that whereas the purpose of job analysis is to better understand and measure work assignments, the primary purpose of CM is to influence the manner in which such assignments are performed so that presumably strategic, behavioral themes are emphasized when performing every job. They drew a parallel with the notions of “trait relevance” and “situation strength,” which correspond to the notions of “channel” and “volume” in signal detection theory (Tett & Burnett 2003). In other words, whereas job analysis is concerned with determining attribute or trait relevance or the appropriate channels that are called for by the nature of the work assignment, CM attempts to raise the volume of those channels that signal the importance of certain behavioral themes aligned with the organization’s strategy—i.e., situation strength. These “loud” signals are intended to create a shared climate or collective understanding of the behavioral themes that are expected and rewarded (Bowen & Ostroff 2004, Chatman & Cha 2003, O’Reily & Chatman 1996, Werbel & DeMarie

2005). Thus, according to Sanchez & Levine (2009), job analysis and CM belong in different domains: Job analysis is best positioned in the domain of applied measurement, whereas CM is closest to a mechanism of informal control.

The relatively scarce CM research to date has largely mirrored the research questions that are often pursued in job analysis research, thus focusing on the accuracy, interrater agreement, and discriminant validity of competency ratings. Not surprisingly, the results of such exercises are frequently disappointing because ratings of broadly defined competencies often have trouble meeting the levels of interrater agreement found for job analysis data, such as job tasks (Lievens et al. 2004, Lievens & Sanchez 2007, Morgeson et al. 2004). Instead, Sanchez & Levine (2009) suggested that CM research should focus on the main dependent variable of CM, that is, the extent to which CM influences employees’ day-to-day behavior along strategic lines, including the development of competency language that is accessible to end users, the development of behavioral examples that are demonstrative of each competency for different jobs, and the cross-fertilization of job analysis and CM to develop measurement models for each competency, so that the underlying traits of the relatively complex behavioral syndromes dubbed competencies are better understood.

RESEARCH ON WORKER ATTRIBUTE INFORMATION

Reliability Studies

Generalizability analysis has been employed to evaluate the proportion of variance in job analysis ratings that is attributable to idiosyncratic sources as compared to the facets of the job that are purportedly being evaluated (Dierdorff & Morgeson 2007, Lievens et al. 2010, Sanchez et al. 1998). This approach is based on the premise that variance due to raters prevents the reliable aggregation of ratings across raters. Van Iddekinge et al. (2005) used this approach to analyze KSAO ratings

produced by 381 raters across five organizations. They partitioned the variance due to raters, rater-by-KSAO, and error, and found considerable idiosyncratic variance as represented by the rater-by-KSAO component. Subsequent analyses found that variance components due to rater-by-KSAO and to error were not explained by the organization, position level, and demographic characteristics of the raters, hence casting doubt on the sources of variance underlying these ratings.

In regard to personality attributes, which are termed work styles in the O*NET model, Borman et al. (1999) reported a median intraclass reliability of 0.66 for the level scale using a pilot O*NET study of 35 occupations with 4 to 88 incumbents. The attribute Dependability had the lowest reliability at 0.15, and personality attributes had a similar range of reliabilities when evaluated on the importance scale. Using ratings collected by the U.S. Department of Labor to populate O*NET from 47,137 incumbents spanning more than 300 occupations, Dierdorff & Morgeson (2009) found that variance due to raters was more pervasive among ratings of personality traits (up to 35%) than among responsibility ratings (16%). Similarly, sample-size weighted estimates of reliability were 0.45 and 0.80 for personality traits and tasks, respectively.

Turning now to the domain of abilities, research by Fleishman and his colleagues resulted in the development of a set of single-item scales to gauge job requirements along 52 abilities (Fleishman & Quaintance 1984, Fleishman & Reilly 1992). This set of scales has been incorporated into O*NET in a functionally equivalent form as compared to the original developed by Fleishman, even though the critical incidents (Flanagan 1954) or behavioral anchors included in the scales, which represent various levels of the abilities, were apparently rescaled for O*NET (Peterson et al. 1999, p. 185). Fleishman et al. (1999) employed the same O*NET pilot study of 35 occupations with 4 to 88 incumbents mentioned earlier to assess the reliability of the 52 ability scales. They reported that most of the

intraclass correlation reliabilities were above 0.80. The O*NET project developed similar, behaviorally anchored scales for other types of worker attribute data such as personality requirements (termed work styles) and skills.

Unlike those in other O*NET domains, questionnaires relating to the ability and skill domains are completed by occupational analysts, not incumbents. Apparently, the decision to have analysts rate abilities and skills was based on theoretical and practical considerations, including the assumption that trained analysts are more likely to understand the ability and skill constructs than incumbents are. Whether O*NET work styles, which capture similarly psychological constructs but in the personality arena, should continue to be rated by incumbents warrants further research. Nevertheless, a study conducted by the O*NET Center found that incumbents provided higher ratings than analysts and that analysts' ratings were more reliable than incumbents' ratings were, even though these differences were deemed minimal (Tsacoumis & Van Iddekinge 2006). A series of reliability studies conducted on the analyst ratings associated with each wave of O*NET data collection reported median intraclass correlation reliabilities of 0.95 (Tsacoumis 2009a). These reliability studies used a maximum of 31 unique analysts, who apparently are responsible for all of the ability and skill ratings produced in the various cycles of O*NET data collection to date, with some occupations having been rated by a minimum of eight analysts (Tsacoumis & Van Iddekinge 2006). Whether these intraclass correlations overestimate the reliability of O*NET ratings, however, has been the object of debate (Harvey 2009, Tsacoumis 2009b).

Other research has shown that analysts may produce more reliable activity-attribute linkages, i.e., the presumptive extent to which an attribute is called for in carrying out an activity, than incumbents would (Baranowski & Anderson 2005). However, a potentially more important aspect than whether analysts or incumbents are employed to make ratings is the information or stimulus on which such ratings are based. For example, in O*NET,

since analysts neither interview nor observe incumbents, the rating materials are the sole information on which analyst ratings are based. The O*NET rating materials provided to analysts are prepared to rid the rating stimulus materials of items (i.e., knowledge, skills, education and training, and work styles) thought to be unimportant for ability ratings (Donsbach et al. 2003). The materials are further simplified by selecting GWAs and work context items that were judged to be relevant to the focal ability, regardless of the occupation, by a panel of eight industrial and organizational psychologists. These GWA and work context items were further screened by selecting those that had achieved a certain cut-off among incumbent ratings. Although it can be argued that these streamlined materials (they occupy about one page of information for each ability rating, according to appendix E of the Donsbach et al. 2003 report) eliminate unnecessary information and therefore result in more reliable ratings, future research should investigate whether or not such reliability gains are made at the expense of eliminating potentially relevant job information, including information that could be gained firsthand by interviewing or observing incumbents rather than by studying a paper description of the job. In this respect, Voskuijl & Sliedregt's (2002) meta-analysis suggests that occupational analysts produce more reliable ratings when such ratings are based on actual contact with job incumbents rather than a job description ($r = 0.87$ versus 0.71). Prior research also suggests that increasing (rather than reducing) the amount of job information can indeed have a positive effect on job-analytic ratings of both work activity and worker attributes (Harvey & Lozada-Larsen 1988, Lievens et al. 2004).

Hubbard et al. (2000) reported that the behavioral anchors used in the O*NET ability rating scales were potentially confusing. They speculated that these anchors may be confusing because they were drawn from occupations with which most job incumbents are unfamiliar and, therefore, the level of difficulty of the requirements is confounded with the degree of

familiarity with the occupation. For instance, the anchor "reading a scientific article describing surgical procedures," which appears at the high end of the reading comprehension scale, may in fact gauge a relatively low level of reading comprehension for trained surgeons. Further research on how to anchor attribute scales for validity, user acceptability, and ease of usage is warranted, but as it has also occurred in the performance appraisal domain (Tziner et al. 2000), the employment of critical incidents as behavioral anchors may not be the answer.

Still a more substantive argument advanced to explain the typically lower reliabilities obtained for worker attributes is that they represent unobservable construals that require a larger "inferential leap" than ratings of more observable aspects of the job such as work activities (Dierdorff & Morgeson 2009). Whether reliable ratings of ostensibly complex, unobservable construals such as the "flexibility of closure" ability can be reliably formulated using the type of single-item scales employed in O*NET has also been questioned (Harvey 2009, Harvey & Wilson 2010). Further research comparing single- to multiple-item scales of these constructs is warranted.

Validity Studies

A stream of research that has indirectly examined the validity of worker attributes is concerned with the extent to which ratings are influenced or biased by cognitive processes. This research stems from the recognition that job analysis places a great burden on the information-processing capabilities of SMEs (Arvey et al. 1982), and it draws from the literature on the shortcomings of human judgment (Hogarth 1981).

The use of rater training has been explored to eliminate or reduce the potential biases thought to influence raters. Sanchez & Levine (1994) found that a rater training program intended to reduce the presumptively biasing effect of Tversky & Kahneman's (1974) representativeness and availability heuristics increased interrater agreement as long as the

number of ratings was low to moderate. Using the frame of reference (FOR) rater training paradigm, which attempts to standardize the FOR employed by raters, Lievens & Sanchez (2007) found that rater training increased interrater agreement and discriminant validity of competency ratings. Aguinis et al. (2009) used FOR training to reduce the correlation between SMEs' self-reported personality and job-analytic ratings of personality requirements (rater training also lowered job-analytic ratings). Although rater training interventions might indeed suppress idiosyncratic variance, whether this suppression of idiosyncratic views comes at the expense of significant information losses in the manner in which incumbents experience the demands of their job merits further research.

Morgeson & Campion (1997) identified 16 distinct potential social and cognitive sources of biases in job analysis ratings. Social sources are thought to represent normative pressures from the social environment in which individuals are embedded (e.g., conformity, group polarization, impression management), whereas the cognitive sources capture limitations in raters' information-processing capabilities (e.g., information overload, heuristics). Morgeson et al. (2004) began to test some of these biasing factors. Specifically they hypothesized that self-presentation biases would result in higher ratings and more frequent endorsements of ability statements than of task statements. Their findings supported their prediction, because ability statements that were identical to task statements but were preceded by the phrase "ability to" drew higher ratings than their corresponding tasks.

Overall, a potential concern with studies examining social or cognitive biases lies in the absence of a true score that would allow an objective estimation of bias. For instance, the elevated ratings assigned to certain items by certain individuals may simply reflect these individuals' unique but legitimate approach to performing the job. In addition, differences in rating elevation between scales of different constructs do not necessarily signal the

presence of biases. For instance, abilities may be legitimately scaled quite differently from tasks, as a higher level of ability may indeed be required by an only moderately important or infrequent task. As others have noted (Hogarth 1981, Kruglanski 1989), many of the so-called biases or inaccuracies observed in laboratory tasks reflect simplifying judgment strategies that indeed have functional value when judging complex environments such as one's job. In our opinion, experimental and quasi-experimental studies that attempt to detect or reduce biases or "inaccuracy" in job-analytic judgments should make sure that the differences that are thought to demonstrate such biases do not reflect substantive variance that may increase our understanding of how people truly approach and experience their jobs. A less-than-desirable course of action for job analysis research would be to repeat the same mistakes made in the performance appraisal literature, whose findings regarding performance rating biases and inaccuracy have been qualified on the account of their limited utility (Bretz et al. 1992).

Turning now to the discriminant validity of worker attributes, the factorial structure of O*NET ability ratings has been explored (e.g., Fleishman et al. 1999). It appears that the single ratings employed to gauge each one of the 52 abilities included in the model can understandably be reduced to a smaller set of higher-order factors (e.g., a broad psychomotor/perceptual factor grouping abilities such as depth perception and dynamic strength), which are capable of explaining the majority of the variance in these ratings. The seemingly high colinearity among the single ratings representing each ability is not altogether surprising because ability estimates based on limited job information may understandably produce items showing less discriminant validity than those resulting from assessment scores of individuals on those same abilities. This redundancy is likely to increase when average ratings across SMEs are factor analyzed, as illustrated by Sanchez & Autor's (2010) finding that a single factor accounts for 43% of the variance in the aggregated ability ratings included in the 14.0 version

FOR: frame of reference

of the O*NET database—aggregated ratings are the only O*NET ratings publicly available to O*NET users or to researchers outside of the O*NET development team. Harvey & Wilson (2010) also provided evidence suggesting that ratings of O*NET abilities can be more parsimoniously explained by a reduced set of higher-order factors. Whether information on ability requirements and on other worker attributes is too redundant should be determined in future investigations. The criteria for such determination should include practical significance and cost-effectiveness of data collection (e.g., gathering data on fewer abilities may not impact many of the typically coarse human resource usages of O*NET data uncovered in a recent survey of O*NET users; Natl. Res. Coun. 2010, pp. 140–148).

In addition to potential redundancy among worker attributes, there seems to be redundancy in the two scales employed to rate attributes in O*NET, namely importance and level. Sanchez & Autor (2010) reported level by importance Pearson correlations among the aggregated ratings of 832 occupations included in the O*NET 14.0 database of 0.97, 0.95, and 0.97 for abilities, skills, and knowledge, respectively. Similarly, the type of scale (i.e., importance or level) accounted for just 3%, 1.54%, and 1.31% of the variance in ability, skill, and knowledge ratings, respectively. These findings suggest the information provided by these two scales in the O*NET database is largely redundant. Overall, more research is needed on the discriminant and convergent validity of worker attribute scales, which is certainly more scarce than research on the scales employed to characterize work activities such as time spent and criticality (Friedman 1990, 1991; Sanchez & Fraser 1992; Sanchez & Levine 1989).

One of the worker attribute scales in need of additional research attention is trainability or the extent to which worker attributes are appropriately learned after significant exposure on the job or in a training program versus possessed by applicants at the point of hire or easily acquired soon afterward. This determination is mandated by the Uniform Guidelines on

Employee Selection Procedures (Equal Employ. Opportun. Commis. 1978), which advises against the use of easy-to-learn or already mastered KSAOs in selection procedures. A study by Van Iddekinge et al. (2011) correlated ratings of the extent to which KSAOs were needed at entry with an external criterion of perceived KSAO trainability formulated by a panel of 31 organizational psychologists. Their findings indicated less validity evidence for ratings of the more abstract “AO” attributes than for those of more concrete “KS” attributes. Whereas job experts rated certain attributes as needed-at-entry, psychologists identified them as ones that could be developed on the job.

More uncommon are studies that have attempted to validate attribute ratings against consequence-oriented criteria of the type proposed by Sanchez & Levine (2000) and Levine & Sanchez (2007), such as the inferences made using job-analytic ratings. Jones et al. (2001) found that job analysts made better predictions of worker attribute trainability than incumbents and students when trainability ratings were compared with actual changes in student learning. Although the results of Jones et al. (2001) suggest that the validity of worker attribute ratings may vary depending on the source of the ratings, we recommend that, in keeping with themes we have developed earlier, the psychological factors that account for these differences should be the focus. In this respect, the work of Jones et al. highlights the idea that ratings of presumably more malleable KSs require different expertise from those of more fixed abilities and other characteristics AOs, a point that has also been raised by others (e.g., Harvey 1991, Morgeson & Campion 1997).

Still another example of consequence-oriented evaluation was provided by Levine et al. (1980), who showed that different depictions of jobs analyzed by different methods led HR professionals to develop very similar examination plans in the selection context. Yet there were small rated differences in the quality of assessment and screening approaches, suggesting for instance that the critical incidents method resulted in higher-quality examination

plans than those derived from other methods. Manson (2004), on the other hand, found that the amount and specificity of information had an effect on the cognitive challenge and the quality of the selection plans prepared on the basis of job-analytic information, thereby supporting the collection of at least moderately specific information such as the ten most important tasks and ten most important KSAOs. However, the question of whether detailed job analysis has consequences that are equivalent to those of cursory job analysis is moot unless one considers the goals that the job analysis serves. For instance, even though different job-analytic methodologies varying in the degree of detail have been found to produce similar job classifications (Sackett et al. 1981), whether detailed job analyses make a difference in potentially more complex decisions, such as developing a testing plan, warrants further research.

Another approach that is ripe for an examination of its consequential validity is the mechanical estimation of worker attributes through job component validation (Arvey et al. 1992, Cunningham 1964, Goiffin & Woycheshin 2006, McCormick et al. 1972, Sanchez & Fraser 1994). Job component validation, which may be classified as a case of synthetic validity, involves statistically capturing the form in which worker attributes are predictable from scores on more specific job components. For example, LaPolice et al. (2008) used a job component validation approach that relied on O*NET data to identify adult literacy requirements across occupations. They found multiple correlation coefficients ranging from 0.79 to 0.81 (corrected for shrinkage) when predicting literacy scores from O*NET items. Jeanneret & Strong (2003) followed a similar procedure to predict general aptitude test scores using GWA data from O*NET and found lower multiple correlations ranging from 0.35 to 0.89. An issue with job component validation research is how good the statistical predictions or multiple Rs need to be in order to consider the mechanically estimated scores to be equivalent to actual ratings of SMEs (Harvey 2011,

Walmsley et al. 2011). However, whether scores determined through job component validation are statistically different from those directly produced by SMEs may not be as important as determining if, when, and through what rules they lead to practically different inferences and decisions regarding, for instance, an assessment strategy.

Indeed, future evaluations of the consequences of job-analytic data should consider the rules governing the manner in which data are employed to support inferences. For instance, the exact same data on work activities and worker attributes may produce rather different selection plans when the elaborate procedures for establishing linkages between work activities and underlying worker attributes outlined by several authors (Baranowski & Anderson 2005, Goldstein et al. 1993, Landy 1988) are applied than when the selection plan is determined solely on the grounds of loosely defined professional judgment. Similarly, the very specific rules provided by Fine & Cronshaw (1999, pp. 133–136) regarding the use of a task bank to develop behavioral questions in an employment interview may result in more valid interviewing than simply letting interviewers formulate their own questions after studying the job analysis. More research on the impact of the rules through which job-analytic data are transformed into inferences, including inferences regarding appropriate assessment tools, is needed, because the failure to demonstrate that detailed information matters may feed continued skepticism about the need to invest in detailed job analyses. Such research should serve to inform evidence-based standards of job analysis practice for HR programs.

The conclusion that a molar job analysis suffices in most applications has been formulated in the context of discussing the validity of GMA tests, which has proven robust in spite of relatively large task differences among jobs (Le et al. 2007). Unfortunately, this argument against detailed job analysis probably found fertile grounds in many business settings, where job analysis is accused of being a legalistic obstacle to flexibility and innovation (Drucker 1987,

Olian & Rynes 1991). As Sanchez & Levine (1999) lamented, the job-relatedness provisions embodied in the Uniform Guidelines on Employee Selection Procedures (Equal Employ. Opportun. Commis. 1978) and in the Americans with Disabilities Act (U.S. Dept. Justice 1991) were not meant to boost the role of job analysis as a risk-management device to be used in litigation. Instead, these provisions were meant to promote the development of selection procedures that were tied to business results and, as a result, would be more effective at identifying top performers. Nevertheless, one of the unintended consequences of this legislation has been promoting the perception of job analysis as a necessary evil whose sole purpose is to mitigate the risk associated with potential legal challenges to selection procedures (Olian & Rynes 1991). Research demonstrating that job analysis, and specifically, detailed job analysis, can be consequential in terms of facilitating better inferences is needed to overcome prejudice against job analysis (Sanchez & Levine 2000).

An impediment to the acceptability of worker attributes as the language of choice when discussing work lies in the development of suitable job-analytic terminology. Industrial and organizational psychologists have long aspired to a “common metric” in the language of work through which work requirements could be compared across jobs. This aspiration led to the development of the DOT (U.S. Dept. Labor 1965a,b). In fact, one of the motivations behind the DOT’s replacement, namely O*NET, was the DOT’s reliance on occupation-specific tasks that interfered with cross-occupational comparisons. A review of current usages of O*NET (Natl. Res. Council 2010, pp. 139–155), however, suggested that many of the psychologically worded items employed in O*NET, especially those intended to capture abilities like “flexibility of closure” in the abilities domain, are understandably eschewed in favor of more user-friendly labels in applications like career planning.

The popularity of competency models that translate these types of worker attribute terms into more accessible ones for end users suggests

that traditional taxonomies of worker attributes that employ rather arcane terminology are unlikely to become the language of choice when discussing the content of work, at least among end users (Sanchez & Levine 2009). Understandability is a key determinant of the extent to which such terminology is likely to be adopted in HRM systems (Bowen & Ostroff 2004), and therefore traditional job analytic terminology may have to be revised to rid it of unnecessary jargon. Our recommendation is not to water down job analysis research by replacing traditional terms with pop-psychology ones, but simply to recognize that the acceptability of job analysis by its end users is key in any job analysis application and that such acceptability is better served by user-friendly terminology accessible to those in charge of performing the jobs (Sanchez & Levine 2009).

RESEARCH ON WORK CONTEXT INFORMATION

Interactional psychology has recognized that the situation or context moderates the relationship between dispositions or traits and behavior (Frederiksen 1972, Hatrup & Jackson 1996, Johns 2006, Mischel 1977). Situational strength refers to the characteristics of situations that do or do not restrict the expression of individual differences, particularly those in nonability domains such as personality traits (Meyer et al. 2010, Mullins & Cummings 1999, Weiss & Adler 1984). Although situational strength has been operationalized in ways that recognize the importance of situational constraints (LaFrance et al. 2003), it has not been operationalized in job-analytic terms until recently. Meyer et al. (2009) constructed an O*NET-based measure of situational strength using 14 items from the GWAs and work context domains. They distinguished between two aspects of situational strength: constraints and consequences. Although their meta-analysis of validity coefficients of personality measures showed stronger validity coefficients for occupations that were deemed weak from a situational strength viewpoint, the differences were small.

Meyer et al. (2010) provided a more in-depth analysis of the various occupational elements that may contribute to situational strength and which should be incorporated in future studies.

One of the obstacles to the infusion of an interactional view of context in job analysis is that the traditional view of contextual factors such as physical working conditions, environmental hazards, and the machines, tools, and equipment employed on the job has typically considered them to be a “main effect” type of job demand. That is, context, just like work activities, has been considered a source that calls for certain worker attributes, such as harsh working conditions calling for physical resilience. Drawing an analogy with signal detection theory (Tett & Burnett 2003), job analysis has traditionally viewed context as job demands that, like work activities, determine the “channels” or worker attributes required for job performance. This view of context is not an interactive one at all because it ignores that context is an interactional variable that alters the functional relationships between job demands and behavior (Johns 2006). In the terminology of signal detection theory, an interactional approach suggests that context raises or lowers the “volume” of certain channels; for example, performing certain work activities may call for increased levels of social sensitivity if performed in a certain social context.

Tett & Burnett (2003) propose that context provides trait-relevant cues through three sources (organizational, social, and task) that moderate the relationship between traits and work behavior. They further speculate that job demands, which are presumably derived from the job responsibilities or work activities to be carried out on the job, activate certain traits, but that such activation interacts with context or situation features that distract, constrain, release, or facilitate the expression of those traits or worker attributes. For instance, agreeableness may be activated by job demands involving helping customers, but it may be distracted by groupthink conditions in one’s work unit and constrained by a mechanistic atmosphere in the

organization (Tett & Burnett 2003). This approach goes beyond the more simplistic worker activity \times worker attribute matrix that has been proposed elsewhere (Baranowski & Anderson 2005) because it suggests that such activity-attribute relationships are altered by contextual variables.

Further understanding of these contingencies requires a departure from the manner in which SMEs are usually approached in job analysis research. Indeed, SMEs are typically employed as “observers” of an allegedly external reality dubbed the job, while their subjective experience of such a reality has been largely ignored in a manner that is consistent with the rejection of subjectivity as a valid object of psychological study that has prevailed in industrial and organizational psychology (Weiss & Rupp 2011). A person-centric approach to the analysis of work is needed to better understand how the demands of work as job incumbents experience and interpret them are affected by contextual aspects that may augment or constrain them. In other words, job analysis should delve more deeply into the study of the psychology of the workers’ experience and, more specifically, into the contextual aspects that are perceived to modify the extent to which job demands call for certain responses. Qualitative job analysis methods such as the critical incidents technique (Flanagan 1954) may be used to identify these types of contingencies by exploring the relationships between the three basic elements of a critical incident: the situation, the behavior to which it is perceived to have led, and the consequences of such behavior.

Note that when we advocate delving deeper into the manner in which incumbents experience their work, we are not promoting a purely phenomenological approach to job analysis that denies or ignores the objective reality in which job incumbents are embedded; neither do we advocate solipsism or the belief that reality (work experiences in our case) is the creation of one’s mind (Connell & Nord 1996). Instead, we are simply arguing for the study of how incumbents perceive and interpret the objective reality of their work because such study does,

in our opinion, hold the key to a better understanding of work requirements.

Research from other domains may also provide useful conceptual models to frame these contextual influences. For instance, work stress research has noted that reactions to aspects of the work environment are moderated by secondary appraisals or the extent to which employees perceive to have an adequate repertoire of coping responses (Lazarus & Folkman 1984). In this respect, certain job demands accompanied by contextual factors that are perceived to make them insurmountable would exacerbate the need for certain worker attributes. This approach probably requires new types of job-analytic inquiries from SMEs, such as the extent to which they feel capable of coping with certain job demands under varying sets of contextual conditions. Other examples of interactional models that could be fruitfully borrowed by job analysis researchers exist in the assessment center literature, where trait activation theories have been employed to explain behavioral inconsistencies as a function of situational cues (e.g., Lievens et al. 2006).

One more area that relates to context concerns the research topic of person–work environment fit. That stream of research attempts to assess work environments and their components such as teams, jobs, supervisors, vocations, or organization culture on the one hand and parallel personal attributes on the other (Edwards et al. 2006, Kristof-Brown et al. 2005). The extent of match or mismatch is then related to presumptive outcomes such as job satisfaction or job performance. Although a modicum of success at predicting these outcomes has been demonstrated using measures of match (Kristof-Brown et al. 2005), the methods employed to assess environments and their components and the degree of fit fall outside the realm of conventional job analysis approaches. Indeed, often the most successful predictions are found when respondents report their perceptions of the degree to which they fit with their environment, a method termed molar fit by Edwards et al. (2006). Although this research stream on P-E fit is not considered part

of job analysis, it highlights the need to broaden the notion of work context, which should also incorporate multilevel variables such as shared team cognition, shared climate, and other team and organization-level variables. A better understanding of these cross-level interactions should illuminate mechanisms by which contextual cues modify the demands on workers to employ types and levels of worker attributes (Ployhart & Moliterno 2011).

Conventionally, job analysis assumes that there will be a linear relationship between the attributes and job outcomes—a more-is-better notion. However, an emerging stream of research suggests that contextual factors interact with worker attributes such that there is a nonlinear relationship between certain personality attributes such as openness to experience and certain contextual conditions such as support for creativity (Baer & Oldham 2006, Burke & Witt 2002, George & Zhou 2001, Shalley et al. 2004). Further research is needed on whether these nonlinear relationships may apply to cognitive attributes. For example, the widely used Wonderlic Personnel Test provides min-max normative test scores for a host of jobs such that people scoring above and below the ideal range are predicted to be less successful once hired (e.g., Levine 1997). The potential determination of these types of nonlinear relationships depends to a large extent on future improvements in the measurement of work context at multiple levels of analysis so that the contextual conditions that act as moderators of worker attributes can be reliably pinpointed. Clearly, more research is needed to refine extant taxonomies of work context influences. For instance, in spite of the generally acceptable reliabilities reported in pilot O*NET studies, whether there is conceptual and empirical overlap between the task, physical, and social context variables adopted in O*NET deserves further examination (Strong et al. 1999).

Future research should also acknowledge that work context is a dynamic phenomenon, and therefore there are wide variations in work context within the same job title. Dierdorff & Morgeson (2007) and Dierdorff et al. (2009)

have reported research suggesting that work context induces variations in the manner in which incumbents of the same job experience job demands, especially incumbents of managerial and other loosely defined jobs. This conception is consistent with interactional models of behavior such as the cognitive-affective personality system model proposed by Mischel & Shoda (1995, 1998), in which within-person variability is explained by situation-response contingencies such as, “if this situation, then that response.” Mischel & Shoda (1995, 1998) summarized empirical evidence suggesting that individual variability in behavior across situations can be explained by within-job variations in context, which are likely to trigger different job demands throughout the course of discharging one’s job responsibilities. Future research may incorporate experience-sampling methodology, which is increasingly being employed to study dynamic organizational phenomena such as momentary performance (Fisher & Noble 2004) and organizational citizenship behavior (Ilies et al. 2006).

CONCLUSIONS AND FUTURE TRENDS

Recent reviews of the job-analytic literature have largely been organized around decisions related to the procedure through which job information should be gathered, thereby emphasizing the various choices among the sources, methods, and level of detail of the data to be gathered (Pearlman & Sanchez 2010; Sackett & Laczko 2003; Sanchez & Levine 1999, 2001). The view of job analysis as an information-gathering process whose sole purpose is to serve as the antecedent of other applications has possibly fed the notion of job analysis as essentially nothing more than a set of methods. As Pearlman & Sanchez (2010) put it, job analysis is “. . . seldom an end in itself but is almost always a tool in service of some application, a means to an end.” The notion of job analysis as an information-gathering tool might have unintentionally created the impression that its sole purpose is to do the dirty work needed for subsequent, truly scientific endeavors such as

selection. Several authors have expressed their discontent with this prevailing perception of job analysis within the discipline of industrial and organizational psychology (Cunningham 1989, Mitchell & Driskill 1996, Morgeson & Dierdorff 2011), which Harvey (1991) synthesized as the “image problem” of job analysis.

The view of job analysis as a support or subservient activity might have deterred interest in cutting-edge research on the job analysis domain. This view might be unintentionally fueled by the stance that jobs consist of solely objective or verifiable behaviors and working conditions and that their analysis is therefore a somewhat cut-and-dry actuarial task. This emphasis on observables implicitly assumes that jobs are epistemologically self-sustaining objects, and it resembles the approach taken in the physical and biological sciences, where an object is studied externally through primarily unobtrusive observation and measurement (Cronshaw 1998). Primoff & Fine (1988) perceptively noted that this objectified approach to job analysis is shortsighted, because job analysts should not forget that unlike (to use the words of Primoff & Fine) flowers and rocks, jobs do not exist separately from the individuals who perform them. In fact, Primoff & Fine observed that the sole process of analyzing the job often changes it, as incumbents are led to reflect on their approach to fulfill their job duties, and this reflection frequently alters the manner in which the job is performed afterward. We maintain that it is the insight into work demands as experienced by incumbents that turns job analysis into a truly psychological endeavor (Sanchez & Levine 1999, p. 72) whose primary goal is precisely to gain an understanding of the psychological requirements of jobs. Fortunately, our review of job analysis research suggests that the job analysis domain has already turned that corner, and accordingly, the scope of job analysis research is being expanded toward a better understanding of work demands as experienced by job incumbents, both individually and collectively through shared perceptions. As such, our hope is that this review will be the

first of many to cover job and work analysis in the *Annual Review of Psychology* over time, thereby documenting meaningful advances that may enable optimization of the outcomes produced and enjoyed by people in one of the most critical domains of human activity—their work.

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Contents

Prefatory

Working Memory: Theories, Models, and Controversies <i>Alan Baddeley</i>	1
---	---

Developmental Psychobiology

Learning to See Words <i>Brian A. Wandell, Andreas M. Rauschecker, and Jason D. Yeatman</i>	31
--	----

Memory

Remembering in Conversations: The Social Sharing and Reshaping of Memories <i>William Hirst and Gerald Echterhoff</i>	55
---	----

Judgment and Decision Making

Experimental Philosophy <i>Joshua Knobe, Wesley Buckwalter, Shaun Nichols, Philip Robbins, Hagop Sarkissian, and Tamler Sommers</i>	81
--	----

Brain Imaging/Cognitive Neuroscience

Distributed Representations in Memory: Insights from Functional Brain Imaging <i>Jesse Rissman and Anthony D. Wagner</i>	101
--	-----

Neuroscience of Learning

Fear Extinction as a Model for Translational Neuroscience: Ten Years of Progress <i>Mohammed R. Milad and Gregory J. Quirk</i>	129
--	-----

Comparative Psychology

The Evolutionary Origins of Friendship <i>Robert M. Seyfarth and Dorothy L. Cheney</i>	153
---	-----

Emotional, Social, and Personality Development

Religion, Morality, Evolution <i>Paul Bloom</i>	179
--	-----

Adulthood and Aging

Consequences of Age-Related Cognitive Declines <i>Timothy Salthouse</i>	201
--	-----

Development in Societal Context

Child Development in the Context of Disaster, War, and Terrorism: Pathways of Risk and Resilience <i>Ann S. Masten and Angela J. Narayan</i>	227
--	-----

Social Development, Social Personality, Social Motivation, Social Emotion

Social Functionality of Human Emotion <i>Paula M. Niedenthal and Markus Brauer</i>	259
---	-----

Social Neuroscience

Mechanisms of Social Cognition <i>Chris D. Frith and Uta Frith</i>	287
---	-----

Personality Processes

Personality Processes: Mechanisms by Which Personality Traits “Get Outside the Skin” <i>Sarah E. Hampson</i>	315
--	-----

Work Attitudes

Job Attitudes <i>Timothy A. Judge and John D. Kammeyer-Mueller</i>	341
The Individual Experience of Unemployment <i>Connie R. Wanberg</i>	369

Job/Work Analysis

The Rise and Fall of Job Analysis and the Future of Work Analysis <i>Juan I. Sanchez and Edward L. Levine</i>	397
--	-----

Education of Special Populations

Rapid Automatized Naming (RAN) and Reading Fluency: Implications for Understanding and Treatment of Reading Disabilities <i>Elizabeth S. Norton and Maryanne Wolf</i>	427
---	-----

Human Abilities

Intelligence <i>Ian J. Deary</i>	453
---	-----

Research Methodology

Decoding Patterns of Human Brain Activity <i>Frank Tong and Michael S. Pratte</i>	483
--	-----

Human Intracranial Recordings and Cognitive Neuroscience <i>Roy Mukamel and Itzhak Fried</i>	511
Sources of Method Bias in Social Science Research and Recommendations on How to Control It <i>Philip M. Podsakoff, Scott B. MacKenzie, and Nathan P. Podsakoff</i>	539
Neuroscience Methods	
Neuroethics: The Ethical, Legal, and Societal Impact of Neuroscience <i>Martha J. Farah</i>	571
Indexes	
Cumulative Index of Contributing Authors, Volumes 53–63	593
Cumulative Index of Chapter Titles, Volumes 53–63	598
Errata	
An online log of corrections to <i>Annual Review of Psychology</i> articles may be found at http://psych.AnnualReviews.org/errata.shtml	