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Manifestations of intelligence: Expanding the measurement space to reconsider specific cognitive abilities

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ABSTRACT

Individual differences in intellectual abilities are arguably more important than ever for success in the constantly changing and increasingly complex modern business world. Historically, attention has been focused on the general cognitive ability factor at the center of the intelligence nexus (i.e., the 'g' factor). Although the focus on 'g' has and continues to provide insight into successful behavior in the workplace, there is interest and need to expand the measurement space to include other aspects of the intelligence nexus. Drawing on examples in the differential and educational literatures, we argue that giving attention to constellations of more specific cognitive aptitudes can provide additional insight into the manifestation of the complex skills and competencies that are required for success in today's workplace. Unfortunately, as I-O psychology has pulled away from the study of mental abilities, the effort to increase the measurement space has spawned an increase in construct proliferation (e.g., competency-based constructs such as decision-making, strategic thinking, etc.) that crowds and confuses the construct domain without properly leveraging what is known about specific mental abilities. Thus, our purpose is to encourage I-O psychology to reconnect with the science of mental abilities and measurement theory so as better understand how basic constructs within the intelligence nexus manifest in the context of work.

The scientific study of intelligence plays a prominent role in the history of differential psychology, as these fields of inquiry were in essence born together. Indeed, it was Galton's theorizing about individual differences in intellectual achievement that helped found the field of differential psychology. In the intervening century, the study of intellectual differences – a sub-discipline now referred to as the science of mental abilities – has been exceedingly successful as a scientific effort, as it amassed a wealth of empirical data concerning a number of exciting issues surrounding the nature and development of intelligence, the source of individual and group differences, and the broad and lasting impact of such differences on personal, educational, occupational, social, health, and national outcomes (e.g. Batty, Deary, & Gottfredson, 2008; Deary, 2009 [special issues of Intelligence]; Gottfredson, 1997, 2004; Hough, Oswald, & Ployhart, 2001; Jensen, 1998; Kuncel, Hezlett, & Ones, 2004; Lubinski, 2004 [special section of the Journal of Personality and Social Psychology]; Rindermann, 2008; Schmidt & Hunter, 1998). Further, it was the attempt to measure and understand the structure of intelligence that spurred much of the early work in measurement theory and psychometrics. These quantitative domains have arguably made the largest contribution to the advancement of psychology as a scientific enterprise: it has been said that "*g* is to psychology as carbon is to chemistry" (Brand, 1987, p. 257) and that "no other body of theory in psychology has been so fully rationalized from the mathematical point of view" (Guilford, 1954, p. 341).

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Despite the scientific success of the science of mental abilities, and its application to behavior at work by HR and I-O psychology, some have bemoaned the fact that HR and I-O psychology has lost contact with differential psychology and measurement theory (e.g., Schmidt, 2002; Schmidt & Hunter, 1998; Scherbaum, Goldstein, Yusko, Ryan, & Hanges, 2012). Although there are likely many reasons for this shift in focus, we believe that a primary reason is that the research demonstrating the usefulness of 'g' in predicting many aspects of behavior, particularly in the realm of work, has been exceptionally successful (Murphy, 1996). Namely, some have begun to claim that there must not be much more than 'g' (e.g., Ree & Earles, 1991). This in turn seems to have led many to (inappropriately) decide there is nothing left for intelligence theory to offer I-O psychology and HR beyond what we already know, and in particular that specific cognitive abilities have little value for predicting behavior at work in comparison to 'g'.

While debates about the relative value of broad versus specific measures are common in the organizational sciences (Judge & Kammeyer-Mueller, 2012), HR and I-O psychology seem to have embraced that there is little more to be learned regarding this question when it comes to broad measures of intelligence (e.g., 'g') and specific measures of narrower mental abilities. However, as others have argued (Hogan & Roberts, 1996; Judge & Kammeyer-Mueller, 2012; Reeve & Hakel, 2002), the all or nothing dichotomies set up in these debates are not necessarily productive or debating the right questions. Given that these debates have been productive for other individual differences (e.g., personality) and that specific abilities are the focus of many workplace applications and processes, the extreme stance against specific cognitive abilities by the fields of HR and I-O psychology may not be helpful for increasing our understanding of the manifestations of intelligence in behavior at work.

Although the HR and I-O research literature has largely become focused only on 'g', other areas of psychology have continued to focus on specific cognitive abilities and how constellations of these abilities can lead to novel insights about human behavior and learning. Given that the contributions of this research have obvious applications to behavior in the workplace, it is unfortunate that HR and I-O researchers have drawn little on these findings in efforts to improve our theories and predictions about behavior at work. Moreover, practitioners focusing on talent and human capital management have arguably moved in the opposite direction of the HR and I-O research literature and have become increasingly interested in assessing individual differences in domain-specific skills and knowledge.

Indeed, although specific cognitive abilities are a primary determinant of the acquisition of domain specific cognitive capacities, it is the constellation of these acquired capacities that are often the primary direct antecedents of job performance (though specific abilities often still retain some direct effect on performance as well). As such, practitioners' interest in assessing these acquired behavioral capacities (e.g., decision making, business acumen, adaptability) rather than measuring the more fundamental precursors of those capacities is understandable. Unfortunately, an unintended, but predictable, consequence of disconnecting from the differential psychology and measurement theory is that there has been considerable missed opportunities to better understand behavior at work and develop measures of acquired behavioral capacities that are rooted in theories of cognitive abilities (e.g., Catell-Horn-Carroll model; Schneider & McGrew, 2012). Instead, we have a situation of a proliferation of cognitive constructs that are questionable in terms of their construct validity and likely redundant with constellations of specific cognitive abilities (Le, Schmidt, Harter, & Lauver, 2010).

We have two goals in this paper. First, we seek to provide a (necessarily brief) refresher on the nature and structure of intelligence with a focus on the more specific cognitive abilities included in modern theories of intelligence (e.g., Cattell–Horn–Carroll model of intelligence) that we believe hold considerable promise for understanding and predicting behavior at work. As many have argued (Aiken, West, Sechrest, & Reno, 1990; Scherbaum et al., 2012; Schmidt, 2002), an understanding of basic intelligence theory is necessary if one hopes to develop theoretically adequate and psychometrically sound measures of cognitive capacities and that this understanding is not as widespread as it needs to be. In this process, we hope to dispel the "intelligence is not much more than *g*" myth that appears to have arisen in HR and I-O psychology since the publication of Ree and Earles (1991) ill-titled paper. Second, we advocate for increasing the measurement space in applied situations by using a theoretically and empirically based approach that focuses on constellations of specific cognitive abilities within the intelligence network. Drawing on examples in the differential and educational literatures, we argue that giving attention to constellations of more specific cognitive aptitudes can provide additional insight into and a theoretical basis for the manifestation of the complex skills and competencies that are required for success in today's workplace.

1. What is "intelligence"? A brief update

It is critical to understand that the term "intelligence" does not refer to a single construct; rather, it is a generic term that refers to a nomological network of different constructs such as cognitive abilities, cognitive skills, and acculturated knowledge (Gottfredson, 2009; Jensen, 1998; Reeve & Bonaccio, 2011; Schneider & McGrew, 2012). From a scientific perspective, it is more useful to study the nature and structure of specific constructs within this network to gain a full understanding of intelligence. There are two major aspects of the intelligence nexus, which are distinguishable and amenable to precise operational or empirical descriptions (see Cattell, 1943; Chamorro-Premuzic & Furnham, 2005; Fagan, 2000; Fleishman, 1967; Hebb, 1942; Jensen, 1998; Reeve & Bonaccio, 2011): (1) the ability to learn new things and solve novel problems (i.e., cognitive abilities; intelligence-as-process; fluid intelligence) and (2) the outcomes of learning, namely the achievement of acquired knowledge and skills, which are dependent on prior experience within a specific cultural context (i.e., intelligence-as-knowledge; developed intellect; crystallized intelligence).

Cognitive abilities (or "mental abilities") in general are defined as the sources of variance in performance on tasks requiring one to mentally process, comprehend, and manipulate information (Carroll, 1993; Reeve & Bonaccio, 2011; Schneider & McGrew, 2012). While there are several specific abilities (e.g., quantitative reasoning; visual-spatial perception; cognitive speed), general cognitive