Industrial and Organizational Psychology
PERSPECTIVES ON SCIENCE AND PRACTICE

Intelligent Interventions

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In 1957, Cronbach lamented that the correlational school of psychology rarely interacted with the experimental school of psychology and vice versa. The correlational school focused on individual differences and what could be measured, whereas the experimental school focused on the environment and what could be manipulated. Over half a century later, we still see the vestiges of that dichotomy in the focal article on intelligence, which is perhaps the premier individual difference variable. In this commentary, we expand on the Scherbaum, Goldstein, Yusko, Ryan, and Hanges (2012) article by advocating that industrial–organizational (I–O) psychologists conduct experimental research on intelligence to develop and find interventions that can make people, their behavior, or their context smarter.

To consider interventions, one must have some reason to believe environmental manipulations might influence the variable

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of interest. Intelligence is often ignored as a variable to be manipulated because it is considered largely inherited and immutable (i.e., not amenable to manipulation). One reason for this belief is that estimates of the variance in intelligence attributable to heredity are as high as 80% (e.g., Jensen, 1980). In this commentary, we question whether this presumed limit is (a) all that limiting, (b) valid, and (c) relevant. A second reason for the lack of discussion of interventions to affect intelligent behavior is ignorance regarding how interventions might work. To counter this, we describe some of the types of interventions I–O psychologists might consider researching.

The So-Called Limit of Heritability

Assuming 80% represents the variance in intelligence that is inherited, which leaves 20% of the variance ''available'' to environmental influences. Hunter and Schmidt (2004) point out that, if one can alter these influences by two standard deviations, intelligence will be altered by nearly a standard deviation (13.4 points for a standard deviation of 15). For a variable that can affect over 50% of the variance in performance, such a change could have a substantial impact on organizational and individual outcomes.

However, there is substantial reason to believe the 80% heritability value only represents one end of a range of heritability values relating to intelligence. In particular, Nisbett (2009) argues that geneticists reject the idea of a single-point estimate for heritability. Heritability depends on the population and environments in which those populations exist. For example, height is found to have a similar level of heritability as intelligence in industrialized countries (around 80%), where nutritional standards are high, but to have a much lower level of influence in countries with nutritional challenges. Socioeconomic status (SES) seems to play a similar role regarding intelligence. Specifically, Turkheimer, Haley, Waldron, D'Onofrio, and Gottesman (2003) found that the heritability of IQ was about .70 for children whose parents were upper-middle class, but it was about .10 for children whose parents were of lower social class. Nisbett noted that one problem with the twins-raised-apart studies that were used to obtain the 80% figure is that most adoptive parents in the United States are upper-middle class, severely limiting the range of this important environmental variable. Indeed, when the range of SES of adopting parents was wide (e.g., in France), researchers found that individuals raised by high-SES parents scored 12 points higher on IQ tests than those adopted by low-SES parents, regardless of whether their mother was low or high SES. They also compared the IQ scores of siblings who were either adopted or not adopted and found that children adopted into high-SES families scored 12–16 points higher. Consider that these results are based on ''natural'' interventions and one messy factor (i.e., SES). Imagine the effects one might get if it is known why SES matters or what factors other than SES matter?

Indeed, the variance explained approach is also limited. It is limited by the sources of variance that exist naturally and by the sources considered. Regarding the first point, if researchers are to develop manipulations that represent heretofore nonexisting environments, then one might move the level of intelligence to heights not yet seen (except in science fiction). For example, the invention of antibiotics and new sanitation systems substantially altered life expectancy. Mental exercises might be developed that similarly affect intelligence. Regarding the second point, if researchers consider sources of variance across time or type of intelligence, then more opportunities to intervene emerge. To understand both these sources of variance, consider Figure 1 from Cattell (1987). This figure shows the change in fluid and crystallized intelligence over a person's lifetime. Both change dramatically and on very different trajectories. What is potentially most interesting to I–O psychologists is that despite the decline over adulthood in fluid intelligence, which is presumably the more

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immutable of the two, performance is positively related to age in meta-analysis of objective performance (McEvoy & Cascio, 1989). It appears crystallized intelligence is compensating and then some.

Interventions of the Right Kind

To be sure, interventions or environmental factors that have been shown to matter are not generally in the purview of I–O psychologists (e.g., prenatal care) or amenable to manipulation (e.g., SES). However, some important factors are. Consider the Black–White differences in intelligence that have haunted our profession. Fryer and Levitt (in press), two economists, find that among children 8–12 months old, there are almost no discernable differences in cognitive ability between Black and White individuals. However, differences begin to emerge as early as 2 years old and that by kindergarten the achievement gap grows to 0.64 standard deviations in math and 0.40 in reading. Theoretically, emerging differences can be genetic, but Fryer and Levitt find that there are large differences in environmental factors between Black and White individuals as they grow older. In one attempt to address these differences, Fryer (2011) tested an intervention to close the achievement gap by providing financial incentives to 20,000 students across 200 schools. The intervention had no effect, similar to findings by I–O psychologists on the effects of financial incentives on quality indices of performance (Jenkins, Mitra, Gupta, & Shaw, 1998). We are not saying that incentives are fruitless manipulations but that the nature of the intervention matters and I–O psychologists know something of these issues. Moreover, as Highhouse and Schmitt (in press) argue, I–O psychologists should take their expertise to educational institutions not only because we might better those institutions but also because the product of those institutions are so relevant. As encouragement, we note that Dobbie and Fryer (2011) found that the Promise Academy charter schools in the Harlem Children Zone are extremely effective in reducing the Black–White achievement gap mentioned above.

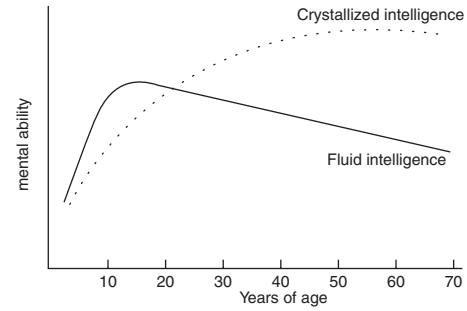

Figure 2. Fluid and crystallized intelligence across the life span. From Cattell (1987).

School and other early childhood environmental exposures are not the only places interventions might have an impact, adult interventions might be effective as well. For instance, research has found that regular exercise might not increase fluid intelligence, but it can help keep it from dropping off as rapidly (Figure 1). Clearly, crystallized intelligence is more amendable to change and training programs are likely to help. I–O psychologists could certainly help determine how best to construct, implement, and assess those programs.

In addition to helping design and test interventions that might make one smarter, I–O psychologists should be involved in understanding when to apply interventions to make performance smarter. That is, rather than limit interventions to changing a person, researchers can think about the conditions that reduce or facilitate the ability to use the fluid intelligence a person has and the conditions when fluid intelligence is most likely to be important for performance. Then, I–O psychologists can assess policies or procedures that fit facilitation with need. For instance, if fluid intelligence is critical when creativity is needed and acute stress interferes with fluid intelligence (Nisbett, 2009), then creating a stress-free environment when creativity is needed will likely be beneficial. The dynamics may be critical here. That is, it might be best that some pressure, of some kind, be placed on employees in R&D departments or in jobs

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that require creative products but that for periods of time these demands are somehow relaxed. Research of this kind would clearly involve interventions, be relevant to I–O psychologists, and benefit from a deep understanding of intelligence, jobs, and organizational contexts.

Indeed, another place I–O psychologists can contribute involves job design. Intelligence is generally conceived of as the degree to which members of a species can adapt proximally to their environment. Humans are proud of their relative status on intelligence but have been found wanting compared to normative models of behavior. However, recent research has found that when stimuli is presented in a way more consistent with the problems that needed to be solved during most of human's natural history, better decision making and problem solving occurs. For instance, presenting frequencies rather than probabilities tends to lead to more accurate decision making (Gigerenzer, Gaissmaier, Kurz-Milcke, Schwartz, & Woloshin, 2007). Therefore, I–O psychologist can use this research to facilitate task and job designs to fit the environment to the nature of human intelligence. A related intervention would be to use understandings of human intelligence to determine where external supports are most likely to be useful. That is, computers are much better at producing reliable decisions and solving mathematical problems more rapidly and accurately than humans. Offloading intelligence, or knowing when to, might be a major way to enhance intelligent behavior.

Finally, a key role for I–O psychologists is the design and interpretation of studies to assess the interventions. Interventions might be easy to come by; ones that work are another matter. Nisbett (2009) describes at length that many studies investigating the effectiveness of interventions to increase intelligence are lacking in their ability to make causal statements because they do not use randomized controlled designs or other internally valid quasi-experimental designs. We believe the best way to reestablish a research program with regard to intelligence is to examine interventions to increase intelligence using internally valid designs. From a public policy and scientific perspective, the research will allow causal statements about effective and efficient interventions. In addition, the perception of our field will be greatly enhanced by this research because the science could positively affect everyone.

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