

Intelligence: A Measure of Brain Efficiency and the Ability to Integrate Information

A Review of


The Neuroscience of Intelligence

by Richard J. Haier

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Intelligence is a general mental ability that involves many skills, including the ability to reason, plan, think abstractly, and learn from experience in addition to other abilities. Intelligence can be dichotomized as involving crystallized intelligence (ability to learn and retain information and knowledge) and fluid intelligence (novel problem solving). Intelligence can be measured in many ways and most specifically with intellectual assessments. An intelligence quotient (IQ) is a composite score derived from standardized subtests measuring difference aspects of intelligence. These tests typically measure a broad range of cognitive functions involving verbal and nonverbal abilities. IQ testing has been shown to have excellent test-retest reliability and to demonstrate various types of validity, including convergent and predictive validity. IQ strongly predicts learning ability. Specifically, IQ scores predict complex job performance (Schmidt & Hunter, 2004).

Despite an enormous amount of evidence in support of intelligence testing, intelligence tests and the individual and group differences as found in intelligence testing research have been met with considerable public and social conflict. Critics claim that IQ tests do not measure intelligence but rather a specific skill set valued by those who created IQ tests. Others believe that higher socioeconomic status and all the benefits that go with it ultimately cause cumulative benefits that help either boost IQ or teach information that results in IQ enhancement.

Although there may be many ways to conceptualize the group differences, researchers in this realm have been met with significant scrutiny, and popular media have had a significant impact on the public view of intelligence testing. One example of the controversy associated with this line of reasoning can be seen in the reaction to the book *The Bell Curve* by Herrnstein and Murray (1994). Public opinion tended to question the validity of intelligence testing due to the discovery of group differences on intelligence testing.

A great strength of *The Neuroscience of Intelligence* is that it concisely provides evidence from disparate areas of science to provide support for intelligence testing. It is a book that may help us move toward a much needed and constructive dialogue regarding issues pertinent to IQ and intelligence. In recent history, these issues, particularly in regard to race, have been considered the proverbial "third rail." This text helps to make the case that IQ is dictated by both genes and environment. In fact, the author explains various complexities in researching these issues, such as the fact a genetic marker associated with higher intelligence test scores has yet to be identified.

This book highlights how IQ has been shown to predict an amazing number of life outcomes. For example, IQ scores have been shown to strongly predict job performance, especially in complex jobs (Schmidt & Hunter, 2004) and longevity (Murray, Pattie, Starr, & Deary, 2012). Moreover, this text also provides an immense service in that it helps dispel the many misconceptions and false beliefs that abound in the lay community regarding intelligence. For example, the author points out the methodological flaws and media distortions relating to IQ research. Conversely, readers are given valuable insights regarding some of the fatal flaws in studies that supported the Mozart effect and other interventions to boost IQ.

Each chapter in *The Neuroscience of Intelligence* addresses an important issue relevant to intelligence. This text provides a plethora of information about brain-related issues, which will be informative for most readers. Haier does an excellent job in making functional brain imaging and research on the neuroscience of intelligence very understandable. It is an enormous strength of this text. Chapter 1 does a superb job in informing the reader about what intelligence is, and it explains that the measures of intelligence such as IQ testing are just proxies for intelligence (*g*). Moreover, this chapter reviews the myths about intelligence testing and the weight of evidence supporting the utility, accuracy, and limitations of IQ testing.

Chapter 2 describes aspects of the twin and sibling studies and other forms of data that support the strength of genetics in determining intelligence. These delicate and potentially controversial topics are presented in a thoughtful and factual manner. Although the chapter emphasizes the impact of nature over nurture, it handles nurture variables in a respectful and empirical manner.

Chapters 3 and 4 are a real highlight of this book for people who are interested in or who work in the neurosciences. These chapters confer insights about structural (MRI) and functional (functional MRI and positron emission tomography) brain imaging and how empirical brain research relates to intelligence testing findings. The chapter also reviews diffusion tensor imaging findings and how increased brain connectivity relates to increased brain efficiency (Haier, Siegel, Tang, Abel, & Buchsbaum, 1992) resulting in improved intelligence. Haier discusses empirical brain imaging findings that support the long-held clinical beliefs that more intelligent brains transfer and integrate information more effectively. In this line of thinking, white matter tracts such as the arcuate fasciculus and others become very important facilitatory structures. So while there are no intelligence centers in the brain, the research reviewed suggests that the frontal and parietal lobes appear most associated with intelligence. Haier discusses his brain model of intelligence (parieto-frontal integration theory) and the communication between these brain areas.

Chapter 5 concentrates on the most important question of whether neuroscience interventions can impact or improve intelligence. The notable public service of this chapter

is that it debunks the vast array of pseudoscience-based interventions that have been proposed to increase intelligence. Finally, the Mozart effect myth is put to rest and “brain games” are put into the appropriate context of being potentially beneficial to work certain skills, but certainly not in increasing intelligence. This chapter also briefly explains that while transcranial magnetic stimulation and transient direct current stimulation may be beneficial for some brain functions, it is obvious that research does not support any substantial effects on intelligence.

Overall, *The Neuroscience of Intelligence* is a compelling text that addresses a complex body of research (intelligence research) that has often been misinterpreted and manipulated by secondary and tertiary sources. This book is a must read for psychology and other social science students. Given the broad range of misinformation about intelligence testing, despite the academic and clinical need for that testing, it would be beneficial for this text to be widely read. It would serve as a great learning tool to teach undergraduate students about intelligence also how science and politics interact.

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