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NEUROSCIENCE OF INTELLIGENCE OR NEUROSCIENCE OF G?

The Neuroscience of Intelligence

By Richard J. Haier. New York, NY: Cambridge University Press, 2017. 270 pp. Paper, \$37.99.

In this review, I summarize main aspects of Richard J. Haier's book *The Neuroscience of Intelligence* and evaluate some of its main arguments. On the whole, it is a stunningly good book. At the same time, it is limited by the almost exclusive emphasis of modern cognitive neuroscience on studying general intelligence, to the exclusion of broader aspects of intelligence. I end with a discussion of whether studying general intelligence is sufficient in modern times.

A review of Richard Haier's book gives me, as a reviewer, an opportunity to see whether I am able to put into practice a precept I have tried to follow for the entirety of my long career, namely, that a review should be based on the quality of a work, not on the extent to which a reviewer agrees with an author. Richard Haier and I have markedly, even extremely different views of intelligence, so here is my chance to see whether I can make good on my precept.

Richard Haier is one of the most brilliant researchers today—or at any time—in the field of intelligence. He and some of his colleagues, such as Rex Jung, have come close to redefining the field of the neuroscience of intelligence. At the time it was done, Haier's early positron emission tomography work was mind-blowing: For example, contrary to what almost anyone would expect, it showed that brighter people actually put less cognitive work into solving complex problems than do less bright people (Haier et al., 1988, 1992a; 1992b). Although early work in this field was theoretically oriented (e.g., Luria, 1966), much of the later work became largely empirical, with no serious guiding theory behind it. In contrast, Jung and Haier (2007) proposed a parietal–frontal integration theory that masterfully integrated what was known at the time about intelli-

gence. With possible slight modifications, the theory still has great traction today.

Writing in cognitive neuroscience is often hard for nonexperts to read. Reports are often so technical that, without extensive background knowledge in neuroscience, one can barely understand them. In contrast, Haier's book is one that anyone with a basic knowledge of psychology and the brain can read and understand. The book is eminently readable. Haier is a gifted writer and takes the reader through all the background steps needed to understand his arguments. The book is written as a textbook, with pedagogical features such as learning objectives, boxes, summaries, review questions, and further reading. It is lavishly illustrated with graphs and tables and even has color plates. It is the most comprehensive introduction available to the neuroscience behind performance on measures of general intelligence, or *g*.

The book is divided into six chapters, which makes it more easily readable than the typical very lengthy and bulky text. However, the chapters are rather long and are divided into between six and eleven sections. The first chapter deals with what we know about intelligence from past research. The second chapter covers nature and nurture, with special emphasis on the role of genetics. The third chapter deals with neuroimaging studies. The fourth chapter is about brain networks and images of the brain. The fifth chapter addresses the question of whether neuroscience somehow can be used to increase intelligence. And the sixth and last chapter discusses the future of neuroscientific research on intelligence.

The book is comprehensive with regard to modern neuroscientific studies of intelligence. It does not extensively cover older work, such as of Luria (1966) or Hebb (1949). Both Luria's work (theory of simultaneous processing, successive processing, and planning) and Hebb's work (Intelligence A and B) later proved to be important in the development of neuropsychological theory behind the measurement of *g*, for example, in the work of J. P. Das (Das, Naglieri, & Kirby, 1994) and Alan and Nadeen Kaufman (Kaufman & Kaufman, 2018). The terms *electroencephalograph* (EEG) and *event-related potential* do not even appear in the index. Although this is not my field of expertise, I found these omissions puzzling (“EEG” and “evoked potential” are in the glossary, however). Michael Gazzaniga, Ward Halstead, Jerre Levy, and Nobel Prize winner Roger Sperry also are neither in the index nor, so far as I could find, in the

references. These contributors to the field, although concerned with intelligence, were not particularly concerned with the *g* factor, which may be why they were omitted. Some important contemporary researchers, such as Dirk Hagemann at the University of Heidelberg, Germany, and Elena Grigorenko at the University of Houston and Yale University (who has written about the genetics of intelligence for successive editions of a Cambridge *Handbook of Intelligence*) are not to be found (at least not by me). Thus, you will find a lot of terrific information in this book but not everything and perhaps not as much as would be ideal about the broader history of neuroscientific attempts to understand intelligence beyond bases for measures of *g*. That said, recent biologically based attempts to study intelligence have focused mostly, although not exclusively, on the *g* factor and aspects of *g*, so the emphasis of Haier's book largely reflects the current state of the field (for exceptions, see McClearn et al., 1997; Rimfeld et al., 2017).

Haier's book was up to date at the time it was written. But the field is moving so quickly that no book on the neuropsychology of intelligence can stay up to date for long. Those looking for updates will find them in Haier (in press-a, in press-b). It is a tribute to the field that it is moving so rapidly that a 2017 book is already out of date. And it is a tribute to the author that he is already updating a book published just a year ago.

Although in some ways this book is like a textbook, in other ways it is not much like a textbook at all. In particular, it makes no attempt to be "balanced" regarding different points of view on intelligence and where the neuropsychology of intelligence fits into its study. For example, Haier states that "intelligence is 100% biological" (p. 35), a belief shared by some but certainly not all intelligence researchers (see handbooks edited by Sternberg, 2011, in press-a; Sternberg & Kaufman, 2011). Haier largely dismisses the role of culture in intelligence (the term "culture" is not mentioned in the index), and he appears largely to accept the arguments regarding IQ and *g* of Richard Herrnstein and Charles Murray (1994) and of Arthur Jensen, including his early *Harvard Educational Review* article (Jensen, 1969). Haier does not cite or seriously discuss the rather extensive objections to both works (e.g., Fraser, 1995; Jacoby & Glauber, 1995; see also Sternberg, 1995; Sternberg & Grigorenko, 1997). My point here is not that Haier is wrong per se but rather that he often does not present alternative points of view in a way that fully ac-

knowledges why anyone who is serious about studying intelligence would hold alternative views. Rather, those who do not accept the arguments of Jensen, Herrnstein and Murray, and sometimes Haier can come across looking a bit like investigators who are unable to or do not want to see the truth.

Rather comprehensive alternative viewpoints can be found in Sternberg (in press-a, in press-b). I simply would like to say here, briefly, why some scholars question some of the assumptions that underlie this book.

First, I believe most scholars in the field of intelligence believe that general intelligence (so-called *g*) exists in some form and that it is important for school and life after school (Deary, 2000; Hunt, 2011; Mackintosh, 2011; Sternberg & Grigorenko, 2002). But how general is general intelligence? This is where scholars start to disagree. I have proposed that intelligence comprises at least two additional skill sets, creative skills and practical (common-sense) skills (Sternberg, 2011). These additional skills are measurable and distinguishable from general intelligence (Sternberg, 2010; Sternberg et al., 2000; Sternberg & Sternberg, 2017). Formally collected empirical data are important, but anyone reading this article has met high-*g* people who lack common sense (practical intelligence). They are rife in academia. And there are many smart people who are smart just so long as they are told what to do but who are not creatively intelligent (i.e., they think well convergently but not divergently; see Kaufman & Sternberg, 2011, in press; Sternberg, 2018). Creatively intelligent people tend to be analytically smart (i.e., high *g*), but many smart people are not particularly creative. Anyone who has supervised graduate students already knows that (see also works reviewing the scientific literature on creative intelligence and creativity more generally; e.g., Plucker, 2016; Sawyer, 2011).

Second, there is irrefutable evidence that people's conceptions of intelligence differ across cultures and good evidence that what constitutes intelligence differs as well (see Serpell, 2000; Sternberg, 2004; Sternberg & Grigorenko, 2004). How smart would any of us be in a stone-age culture where all our scholarly skills would matter for naught? How about in war zones like Syria today? How would we do in outsmarting our enemies on the battlefields of Ancient Rome? In our work, we even have found negative correlations between IQ and some aspects of practical intelligence among rural Kenyan children, for whom combating parasitic illnesses requires great

practical intelligence (Sternberg et al., 2001). This is not to discount the importance of *g*. But it is to say that different cultures value and require different skill mixes for success. Some Westerners have decided that a skill mix we think is important in contemporary Western cultures is equally important in any place, at any time. That is unlikely to be true.

Third, almost all serious definitions of intelligence (see Neisser et al., 1996) view ability to adapt to the environment as a cornerstone of intelligence. How well have humans done in adapting? Are humans creating the conditions for possibly irreversible climate change, causing deadly and intelligence-killing as well as people-killing pollution, filling oceans with 8 million tons of plastic junk, creating weapons that could destroy the world several times over, electing corrupt and merciless dictators, really intelligence (Sternberg, 2018)? If that is intelligence, what is stupidity? All this may seem beside the point. It may be beside the point in the study of IQ or *g*, but is it beside the point in the study of intelligence as adaptation to the environment?

Despite the book's being very "hard-science" in its orientation, it does recognize the importance of linking the study of intelligence to the study of societal problems. In the final chapter (6), Haier has a substantial and informed discussion of "neuro-poverty and neuro-social-economic status (SES): Implications for public policy based on the neuroscience of intelligence" (p. 192ff). This is an excellent addition to the book, expanding its focus from laboratory investigations to implications for the everyday world.

In Chapter 6, Haier follows Herrnstein and Murray (1994) in arguing that SES may depend in large part on levels of *g*. I agree with Haier that higher intelligence can drive higher SES. But I believe he may overestimate the socioeconomic mobility of U.S. society and other societies as well. In our cultural research, we have noted how, in some societies, getting out of poverty is, if not impossible, exceedingly difficult (Sternberg & Grigorenko, 1999). If you are born as a Dalit in an urban Indian slum, your chances of attaining a higher SES are practically nonexistent, unless you are a character in a movie. Intergenerational mobility in the United States has been on the decline, and has reached the point where it is very low relative to many other parts of the world (Davis & Mazumder, 2017; Reeves & Krause, 2018; World Economic Forum, 2016). Much as it would make sense, following Herrnstein and Murray as well as Haier, that SES would depend in part on intelligence,

it appears that in many societies today, and especially in the United States, being born poor is most often a dead-end street, regardless of people's cognitive abilities.

In sum, Richard Haier has written a brilliant tour de force about neuroscientific approaches to *g*. The book should be read by anyone in any aspect of the field of intelligence. My estimate is that his views represent a consensus of much of the field. But nevertheless, whether the book tells us as much about intelligence as he and many others in the field believe is at least open to debate.

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