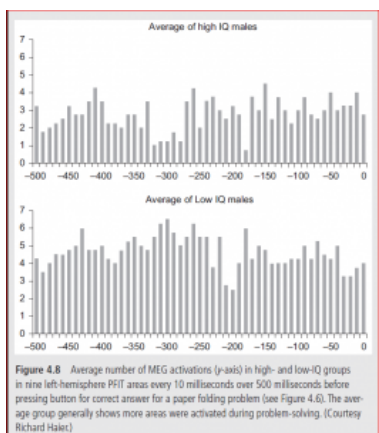# The Unz Review: An Alternative Media Selection

A Collection of Interesting, Important, and Controversial Perspectives Largely Excluded from the American Mainstream Media

Intelligent Brains

JAMES THOMPSON • JANUARY 25, 2017 • 3,500 WORDS • 109 COMMENTS

Figure 4.8 Average number of MEG activations (y-axis) in high- and low-IQ groups in nine left-hemisphere PFIT areas every 10 milliseconds over 500 milliseconds before pressing button for correct answer for a paper folding problem (see Figure 4.6). The average group generally shows more areas were activated during problem-solving. (Courtesy Richard Haier.)

No story about the brain is simple; no one study is definitive; and it takes many years to sort out conflicting and inconsistent findings and establish a weight of evidence.

It is a fundamental truth that any researcher who can put a person in a scanner can publish a paper. Any researcher able to talk 20 undergraduates into being scanned, perhaps while being asked to imagine an ice cream cone, can announce that the brain centre for ice cream cones has been established, at least to the researcher's satisfaction. Behind each aspiring researcher is a perspiring technician, who knows that the raw readout will not be understood by a researcher in too much of a hurry to become well known, so that instead the results will have to be shown as a brightly coloured picture. That picture will then be presented at a conference, and will show, beyond any dispute, that we now know a great deal about the neuroscience of imaginary confectionary. Privately, the technician will know that the same readout could have produced another picture, vaguely similar but different in important respects, and that his version of how to colour-in the results is different from other people's interpretations, but he cannot make too much of this, because other researchers are clamouring for his assistance. The cavalcade of pretty pictures continues.

Here is some background on scanning the brain:

http://www.unz.com/jthompson/processing-speed-and-white-matter-mark

It was with this admittedly slightly sceptical frame of mind that I questioned Rex Jung at a conference about some results he and Rich Haier had obtained,

and was reassured by being given details about how they tried to overcome such problems, not least by reliability checks and large sample sizes.

So, it was with keen anticipation that I turned to Rich Haier's new tome "The Neuroscience of Intelligence". www.amazon.co.uk/Neuroscience-Intelligence-Cambridge-Fundamentals-Psychology/dp/110746143X/

Tome it is. In the best American tradition of weighty volumes, it ploughs into a question which I rate as crucial: "Why are some people smarter than others? This book is about what neuroscience tells us about intelligence and the brain.

What We Know About Intelligence from the Weight of Studies

What is Intelligence? Do You Know It When You See It? Defining Intelligence for Empirical Research; The Structure of Mental Abilities and The g – Factor; Alternative Models; Focus on the g – Factor; Measuring Intelligence and IQ; Some Other Intelligence Tests; Myth: Intelligence Tests are Biased or Meaningless; The Key Problem for "Measuring" Intelligence; Four Kinds of Predictive Validity for Intelligence Tests; Intelligence Definitions and Me

Nature More than Nurture: The Impact of Genetics on Intelligence

The Evolving View of Genetics; Early Failures to Boost IQ; "Fraud" Fails to Stop Genetic Progress; Quantitative Genetic Findings also Support a Role for Environmental Factors; Molecular Genetics and the Hunt for Intelligence Genes; Seven Recent Noteworthy Studies of Molecular Genetic Progress

Peeking Inside the Living Brain: Neuroimaging is a Game- changer for Intelligence Research

The First PET Studies; Brain Efficiency; Not All Brains Work in the Same Way; What the Early PET Studies Revealed and What They Did Not; The First MRI Studies; Basic Structural MRI Findings; Improved MRI Analyses Yield Consistent and Inconsistent Results Imaging White Matter Tracts with Two Methods; Functional MRI (fMRI); The Parieto- frontal Integration Theory (PFIT); Einstein's Brain

50 Shades of Gray Matter: A Brain Image of Intelligence is Worth a Thousand Words

Brain Networks and Intelligence; Functional Brain Effi ciency – is Seeing Believing? Predicting IQ From Brain Images; Are "Intelligence" and "Reasoning" Synonyms? Common Genes for Brain Structure and Intelligence; Brain Imaging and Molecular Genetics

The Holy Grail: Can Neuroscience Boost Intelligence?

Case 1: Mozart and the Brain; Case 2: You Must Remember This, and This, and This … Case 3: Can Computer Games for Children Raise IQ? Where are the IQ Pills? Magnetic Fields, Electric Shocks, and Cold Lasers Target Brain Processes; The Missing Weight of Evidence for Enhancement

As Neuroscience Advances, What's Next for Intelligence Research?

From Psychometric Testing to Chronometric Testing; Cognitive Neuroscience of Memory and Super- Memory; Bridging Human and Animal Research with New Tools Neuron by Neuron; Bridging Human and Machine Intelligence Circuit by Circuit; Consciousness and Creativity; Neuro- poverty and Neuro- Social- Economic Status: Implications for Public Policy Based on the Neuroscience of Intelligence; Final Thoughts

The book tackles the definition of intelligence with flair and good sense. This is a fresh approach, and a welcome change from the usual one. If someone you know doubts intelligence differences, shown them the functional literacy data which Linda Gottfredson references:

NALS level	% Population (white)	Everyday simulated tasks
5	4	Use calculator to determine cost of carpet for a room Use table of information to compare 2 credit cards
4	21	Use eligibility pamphlet to calculate SSI benefits Explain difference between 2 types of employee benefits
3	36	Calculate miles per gallon from mileage record chart Write brief letter explaining error on credit card bill
2	25	Determine difference in price between 2 show tickets Locate intersection on a street map
1	14	Total bank deposit entry Locate expiration date on driver's license

That is right. Only 4% of the white population can do all the tasks in the list. 21% get to the 4th level but cannot do carpet cost type problems, and at the very bottom 14% have very simple skills, which do not include locating an intersection on a street map. For many of you reading this, the finding will seem incredible. It is incredible. Human differences are hard to believe, but they are matters to be demonstrated, beliefs notwithstanding.

http://www.unz.com/jthompson/the-7-tribes-of-intellect

Haier in his sweeping overview makes measured judgments about the major studies in psychometry, including The Bell Curve on the social consequences of

different levels of ability; Terman's work on genius (the first to show that high ability people were not puny, shambling wrecks; but extremely productive and successful, and happier and better-adjusted than controls), the Study for Mathematically Precocious Youth, point out among many other things that the "brighter you are the more you achieve" holds even at the highest levels of intellect "The upper quartile within the top 1% were 18 times more likely to get a STEM doctorate than the bottom quartile within the top 1%."

g- factors derived from different test batteries correlate nearly perfectly with each other as long as each battery has a sufficient number of tests that sample a broad range of mental abilities and the tests are given to people sampled from the wide range of ability (Johnson *et al* ., 2004 , 2008b). A recent study of 180 college students reported that a *g* -factor derived from their performance on a battery of video games correlated highly (0.93) with a *g* - factor extracted from their performance on a battery of cognitive tests (Ángeles Quiroga *et al* ., 2015)

Somewhat to my surprise, Haier believes that epigenetic research shows promise. This is not my field, but Robert Plomin, as far as I know, is doubtful that this will prove fruitful. We shall see.

In a large Dutch twin study (Posthuma *et al* ., 2003b),the same identical twins were given mental test batteries repeatedly over time to assess general intelligence. The heritability estimate of general intelligence was 26% at age 5, 39% at age 7, 54% at age 10, 64% at age 12, and starting at age18 the estimate grew to over 80%. The increases could be due to several factors including more genes "turning on" with increasing age or gene– environment interactions.

In this context, a fascinating study of social class in Poland during its socialist years addressed this issue in an unusual way. This is an older study but quite illustrative (Firkowska et al *., 1978). Here is the summary quoted directly from the published report: "The city of Warsaw was razed at the end of World War II and rebuilt under a socialist government whose policy was to allocate dwellings, schools, and health facilities without regard to social class. Of the 14,238 children born in 1963 and living in Warsaw, 96 percent were given the Raven's Progressive Matrices Test and an arithmetic and a vocabulary test in March to June of 1974. Information was collected on the families of the children, and on characteristics of schools and city districts. Parental occupation and education were used to form a family factor, and the district data were collapsed into two factors, one relating to social marginality, and the other to distance from city center. Analysis showed that the initial assumption of even distribution of family, school, and district attributes was reasonable.6 Mental performance was unrelated either to school or district factors. It wasrelated to parental occupation and education in a strong and regular gradient.It is concluded that an egalitarian social policy executed over a generation failed to override the association of social and family factors with cognitive development that is characteristic of more traditional industrial*

societies." In the context of this chapter, the confounding of genetic and SES factors leads to a possible alternative conclusion: Any influence of social policy on mental performance failed to override the influence of genetic factors. The same confounding is apparent in new studies that suggest that SES accounts for brain differences underlying cognitive/ achievement gaps, and we will detail them in Chapter 6.

Since the confounding of genetic effects with presumed social class effects is a bugbear of mine, I have copied out the main conclusions on the topic from Chapter 6 below:

Dr. David Lubinski has written a comprehensive review of the SES/ intelligence confounding issue (Lubinski, 2009). Although the context for his paper is Cognitive Epidemiology, the argument applies to all research using SES as a variable. Essentially, if a study incorporates measures of both SES and intelligence, statistical methods can help disentangle their respective effects. The interpretation of results from any study of SES cannot disentangle which factor is driving the result unless a measure of intelligence is included in the study. Studies of intelligence without considering SES are also problematic. When both variables are included in multivariate studies in large samples, the results typically show that general cognitive ability measures correlate with a particular variable of interest even after the effects of SES are statistically removed. For example, in a study of 641 Brazilian school children, SES did not predict scholastic achievement, but intelligence test scores did (Colom & Flores-Mendoza, 2007). An even larger classic study had data on 155,191 students from 41 American colleges and universities. Their analyses showed that SAT scores predicted academic performance about the same even after SES was controlled; that is, SES added no additional predictive power (Sackett *et al* ., 2009). Another study of 3,233 adolescents in Portugal found that parents' level of education predicted intelligence in the children regardless of family income (Lemos *et al* ., 2011). These researchers stated their conclusion straightforwardly: "Adolescents from more affluent families tend to be brighter because their parents are brighter, not because they enjoy better family environments."

The chapter goes on to make restrained criticism of the neuro-poverty interpretation placed on scanning results by Prof Noble, which I have discussed in detail before.

http://www.unz.com/jthompson/income-brain-race-and-big-gap

http://www.unz.com/jthompson/income-brain-race-prof-kimberly-noble

The neuropsychology results begin in Chapter 3. This goes into the history of scanning, and the early days of scanning subjects either trying to solve problems while being scanned, and/or comparing brain activity given knowledge of their ability scores.

In 1988 Haier published the first PET study of students taking the Raven's Matices test, showing that the brains of such students differed in terms of areas activated from those students doing a simpler attention task. In a master-stroke he correlated the Raven's scores with brain activity, showing that the brightest students showed less brain activity. That's right: less activity. Hence my frequent advice to earnest people who want to use more of their brain, which is that they should be bright enough to use less of their brain. Why sweat the small stuff?

Haier and colleagues proposed the brain efficiency hypothesis of intelligence:higher intelligence requires *less* brainwork. As Detterman would say, bright people overcome the bottleneck effect of brain inefficiency which is the main cause of the g factor. After studying student who had practiced Tetris many times, brains of experienced players showed less activity than brains of naïve players. Their interpretation was that the brain learned what areas NOT to use and became more efficient with practice. They also noticed a trend in this study for the people with the highest intelligence test scores to show the greatest decreases in brain activity after practice (Haier *et al.*, 1992a). This finding is generally true, but not the whole story. Brains differ in how they learn and operate, and for example men and women matched for equal Maths scores show different patterns of brain activation as they solve mathematical problems.

Intelligence test scores are related to brain glucose metabolism. This helps validate that the test scores were not meaningless numbers representing a statistical artifact. In fact, as neuroimaging studies of intelligence continue to increase, old criticisms about intelligence test scores having no meaning are less and less meaningful, if they were ever meaningful at all.

Haier argues that men and women's brains must be analysed separately, just as different ages must be so analysed.

We found a nearly perfect linear relationship between the g – loading of each subtest of the WAIS and the amount of gray matter correlated to each subtest score (Colom et al .,2006a). Thus, we come to another important observation. IQ tests have the advantages of a standardized test battery but the scores

combine the general factor along with other specific factors. So the question of how intelligence correlates to brain structure and function depends on whether the question is about g or about more specific mental abilities. Inconsistent results among these early studies likely result from confusion on this issue as well as from issues about sampling and image analysis.

Haier is a good explainer. He introduces each new technique with a crisp account of how it works and what data it produces. The result is a kindly introduction to a complex subject, all too often accepted on trust, because the pictures are pretty. Here we get a sober account of what can and cannot be deduced.

Even though fMRI had been used in hundreds of cognitive studies by 2006, only 17 studies included any measure of intelligence or reasoning. Of these 17 fMRI studies, all but three had sample sizes of 16 or fewer and there were a variety of control tasks (or the lack of any control task in some studies) and a variety of intelligence/ reasoning measures. None of the measures in these early studies were based on a battery of tests to estimate the g – factor.

Hence, most of the studies are very probably neuro-bollocks.

Haier and his colleague Rex Jung are proponents of the PFIT model of brain organization. Haier says: *Note that "Integration" emphasizes that communication among the salient areas was key to the model because we have always recognized that identifying specific brain areas was only the beginning of a useful brain model of intelligence. Understanding the temporal and sequential interactions among networks that link the areas would be key.*
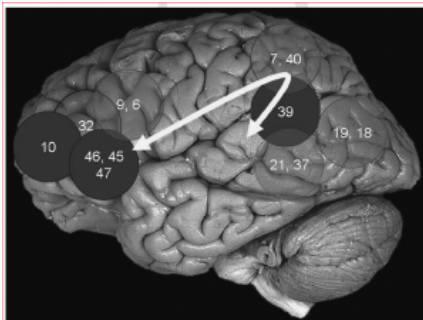
Figure 3.7 The Parieto-frontal Integration Theory (PFIT) showing brain areas associated with intelligence (courtesy Rex Jung). (See also Animation 3.1 on the website.)

In stage 1, information enters the back portions of the brain through sensory perception channels. In stage 2, the information then flows forward to association areas of the brain that integrate relevant memory, and in stage 3 all this continues forward to the frontal lobes that consider the integrated information, weigh options, and decide on any action, so in stage 4 motor or speech areas for action are engaged if required. This is unlikely to be a strictly sequential, one- way flow. Complex problems are likely to require multiple,

parallel sequences back and forth among networks as the problem is worked in real time.

The basic idea is that the intelligent brain integrates sensory information in posterior areas, and then the information is further integrated to higher- level processing as it flows to anterior areas. The PFIT also suggests that any one person need not have all these areas engaged to be intelligent. Several combinations may produce the same level of general intelligence, but with different strengths and weaknesses for other cognitive factors. For example, two people might have the same IQ, or g level, but one excels in verbal reasoning, and the other in mathematical reasoning. They may both have some PFIT areas in common, but it is likely they will differ in other areas.

Our hypothesis is that individual differences in intelligence, whether the g – factor or other specific factors, are rooted both in the structural characteristics of the specific PFIT areas and in the way information flows around these areas. Some people will have more gray matter in important areas or more white matter fibers connecting areas and some people will have more efficient information flow around the PFIT areas. These brain features lead some individuals to score higher on intelligence and mental ability tests, and other individuals to be less effi cient, and less good at problem solving. How the salient brain features may develop is a separate issue for future longitudinal studies of children and adolescents. In the next chapter we will see newer imaging methods that show millisecond changes in information flow throughout the brain so hypotheses about efficient information flow and intelligence can be tested.

Frameworks like the original and revised PFIT have conceptual problems related to a reliance on correlations that are fundamentally not interpretable regarding cause and effect between brain measures and cognitive measures (Kievit et al .,2011). One promising possibility for addressing this limitation that might advance the study of "neuro- g " may be the use of analyses based on multiple indicators and multiple causes (Kievit et al ., 2012).

We are identifying the individual instruments in the orchestra. Learning how they work together to create the symphony of intelligence is a new challenge that requires even better technology such as the magneto- encephalogram (MEG).

Overall, the weight of results across multiple studies provides considerable, if not overwhelming, support for the parietal– frontal distribution hypothesis (albeit with some modifications) and some tentative support for the efficiency hypothesis based on measures of brain connectivity.

On one hand, efficiency remains a popular concept for thinking about neural circuit activity and how it relates to complex cognition (Bassett et al ., 2015).

On the other hand, the concept has been characterized as so vague as to be useless, although it still has potential explanatory power if better defined and measured (Poldrack, 2015).

Will college entry one day be done by a restful brain scan rather than a stressful exam? The IQ-predicting power of brain scans has recently improved considerably, so this might be feasible one day.

Genes influence brain networks and intelligence. Until specific genes and their expression are identified, we cannot distinguish directly whether genes influence brain morphometry, which then influences intelligence, or whether genes influence intelligence, which then influences brain morphometry. It is also possible that many genes influence both brain morphometry and intelligence (pleiotropy) and only some of them are common to both.

Conclusion

This is a good book at several levels. It has some good jokes scattered throughout the text, a great plus in my opinion. It gives a good introductory overview of intelligence research, and is another book to recommend to those who claim to have difficulty understanding the concept of intelligence as a measurable characteristic. It disposes of the popular memes of "boost your IQ by listening to Mozart/remembering numbers a few numbers back/eating special foods/doing crossword/playing computer games" which have to be countered at least once every 5 years. It also disposes of the view that a yet to be constructed test of "rationality" can replace tests of intelligence. It also succeeds in its intended purpose of giving a summary of the development of brain imaging and its application to understanding the link between brain functioning and intelligent behaviour. It hammers home a message about scientific progress: individual studies are unlikely to settle major questions, but a pattern of such studies may eventually lead to identifying general principles underlying the observed results. Results of individual studies confuse for at least two reasons. The first is about error: sample sizes are initially too small (though they are now getting larger), scanning techniques each have their peculiarities which lead errors; and the jumble of experimental tasks contribute noise. The second is about discovery: it may be necessary to study male and female brains separately, because they achieve fairly similar end products by different means; there may indeed be a P-FIT dance of brain messages, but different pathways may exist for bright and dull participants. P-FIT is still in the running, and a version of it may be refined and confirmed. At the moment, it is the leading theory for explaining intelligent brains. Eventually, a convergence of different scanning techniques, and a systematization of intellectual test conditions may lead to very big samples being gathered, sufficient to act as proper standardization samples for brain activity. That will push the whole field forwards from the cottage industry of small samples of restricted range of intelligence subjects doing disparate intellectual tasks to more broadly based collaborative studies using common

methods of scanning and a core of agreed mental tasks.

Keep watching the scans.