The Neuroscience of Intelligence

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FAQ

1. Are you saying intelligence test scores are the most important thing about a person?

*No. No person can be reduced meaningfully to a test score. I am saying that, like it or not, the differences among people in their general ability to solve problems and learn complex material are important aspects of life success. Intelligence test scores estimate this general ability and the scores predict many things. But test scores are not perfect predictors because there are many things that influence any measure of success. The predictions made by a test are best thought about as probabilities. Intelligence by itself is one of many attributes that contribute to the way a person navigates through life. Intelligence without judgment or character, of course, may not serve a person well. Intelligence does not guarantee happiness, health or likeability. Nonetheless, intelligence is a key to being human and we should understand where it comes from and how it develops. Intelligence tests are necessary tools for researching these questions.*

2. What does an IQ point measure?

*IQ points and scores on all intelligence tests are indirect estimates of reasoning ability. There is no direct measure of intelligence like the direct measures of distance or weight. Four feet is twice the distance of two feet and 10 pounds is twice the weight of five pounds. A person with an IQ score of 140 is not twice as “smart” as a person with a score of 70. This inherent measurement problem is a limitation for intelligence research but test scores do have meaning relative to other people. That’s why test scores typically are referenced as percentiles. An IQ score of 130, for example, puts a person statistically in the top 2% of people. Ranking people on IQ scores is what predicts things like academic success or income. For example, the top percentiles of people on IQ test scores are also in the top percentiles of income. There are many individual exceptions, but generally there is a relationship between intelligence and income. This should not be surprising since jobs and professions that pay more often require more complex thinking. Intelligence correlations with other variables like longevity are perhaps more surprising but the message is that intelligence test scores are meaningful despite measurement issues.*

3. Aren’t IQ tests biased against some groups?

*There is no research evidence that standard intelligence tests developed with sophisticated statistical methods (called psychometrics) are biased for or against any group. If there was bias against a group, individuals with low scores might consistently get excellent school grades; or persons with high scores might consistently get bad grades. Both these combinations happen in individual cases so we all can think of such examples. Nonetheless, these generally are exceptions---that’s why IQ scores are not perfect predictors in any individual case. The data show that IQ scores predict academic success, for example, equally well for all groups indicating that the tests themselves are not biased. Note that a difference in an average measurement between two groups does not necessarily mean the measure is biased. For example, on average men are taller than women; no one would conclude this result comes from a bias in tape measures against women. However, since we do not have the equivalent of a tape measure for intelligence, the anti-bias argument is not so obvious.*

4. Are computers that beat humans playing chess, Go, or Jeopardy smarter than people?

*As machine software becomes capable of learning from mistakes and improving performance, it becomes more difficult to answer this question, especially with respect to general intelligence that is used across many situations outside of games with prescribed rules. The answer to this question will become even more complex as computer hardware can be designed based on the way the brain actually works. At some point “artificial” intelligence in machines might be replaced by “real” intelligence.*

5. If intelligence differences among people are mostly genetic, should we waste time trying to increase intelligence?

*Like test scores, genes are best thought of as probabilistic rather than deterministic. Genetic influences on complex characteristics like intelligence are themselves quite complex. Some genes are deterministic meaning that if you have the “bad” gene, you get the characteristic. This is the case with some diseases and in the 21st century, such examples are also examples of hope for discovering ways to correct the “bad” genes. But for intelligence, the data indicate many genes are involved and until we identify specific genes in this large set we won’t know which genes are sensitive to environmental influences and what combinations of genes are most important. Once these things are understood, there likely will be methods to manipulate the salient genes to increase general intelligence and, perhaps, even specific mental abilities like music or math. Meanwhile, there is nothing wrong with trying to maximize the use of a person’s intelligence through education and supportive environments. In my view, neuroscience doesn’t yet have much to help parents and educators accomplish this worthy goal. However, the more intelligence is influenced by genes, the more likely it is that someday we will know how to manipulate those genes to increase intelligence, perhaps dramatically.*

6. Are you saying that family and early environment don’t influence IQ?

*One of the most surprising findings from behavioral genetic studies of intelligence is that the influences of family and other environments are relatively small compared to genetic influences. All environmental influences on intelligence are stronger in children but almost disappear by teen years. This is not a popular finding but it might make sense from an evolutionary perspective given that the environments of early humans were mostly harsh and unpredictable. However, since genetic potential unfolds within an environment, research on gene/environment interactions (epigenetics) is an important but nascent focus in human neuroscience studies. Ironically, progress on understanding environmental influences may accelerate once specific genes for intelligence are identified.*

7. Are you actually suggesting that poverty and economic disadvantages are brain or genetic problems?

*It’s hardly popular to suggest that some individuals have limited potential for education and economic success due to genetic influences on intelligence. To the extent that intelligence is a major factor of education and economic success and not the other way around, it’s time to consider that some persistent social problems result, in part, because many individuals lack the requisite mental abilities to succeed on their own even modestly in the modern world. 51 million Americans have IQ scores below 85. To the extent that intelligence has major genetic inputs, we are faced with the uncomfortable possibility that some part of poverty and low SES (social-economic-status) are driven indirectly by genetics. I call this piece of the problem “neuro-poverty.” It’s a hard-edged concept and the natural reaction among many fair-minded people is to reject it in favor of more obvious and possibly more malleable environmental drivers. My interpretation of the data may be incorrect, but I stand by the need to examine the concept of “neuro-poverty” and it’s implications. For me, the implications lead directly to a strong role for government programs that support people in need, through no fault of their own, both materially and with dignity. I am optimistic that in the long run, an understanding of the neuroscience basis of intelligence might alleviate some aspects of persistent social problems.*

8. What is the relationship between intelligence and education?

*The pace of learning complex material and the amount of material learned are related to general intelligence. Bright students typically learn more material and learn it faster. It would be quite surprising if intelligence and learning were unrelated. Given this basic relationship, here’s a mystery: why is the word “intelligence” absent from virtually every issue discussed about education? Every teacher knows that each student comes to class with a unique combination of mental ability strengths and weaknesses. Educators try to maximize how each student applies these abilities. Shouldn’t what we know about intelligence be part of the discussion about how best to maximize learning for individual students? Many of the problems with the Common Core program could have been avoided by paying attention to robust findings from intelligence research. For example, holding all children to a college-ready standard is not realistic and results in poorer performance overall.*

9. If intelligence is so important for success, why do smart people do dumb things?

*Humans don’t rely solely on intelligence for making decisions. Remember Star Trek’s mega-rational Mr. Spock is fictional (and half alien), and arguably not a fun guy. Emotions usually play at least some role, even if unconscious (intuition). Neuroimaging suggests largely separate neural networks for emotion and intelligence. Perhaps there is more or less overlap in these networks in individuals or perhaps emotion decisions have some priority in many situations based on our evolutionary history---better to run immediately when afraid rather than think about what might be causing the fear. The fact that smart people do dumb things does not negate the important role of intelligence in everyday life but it also underscores that intelligence is not the only important thing. If stupidity was regarded as a disease, we might have a National Stupidity Institute to find a cure by funding neuroscience studies of intelligence to address this question.*

10. Isn’t there anything I can do to increase intelligence for my children or me?

*In my opinion, the weight-of-evidence doesn’t support any claims about increasing intelligence by any means. If there were a way, I’d be the first in line. I believe that dramatic increases may be possible once we understand the basic neuroscience of intelligence. This is a formidable goal but imagine what it would be like learn more, learn faster, and see complex relationships more clearly. Not everyone may dream about this possibility but having the ability to increase intelligence really would change everything.*