INTELLIGENCE:
THE SURPRISING TRUTH

Stephen Ceci, Ph.D., lays out 12 facts about intelligence that may astound even the experts.

By Stephen Ceci, Ph.D.

Every culture has a word for “smart,” and for “stupid.” And everyone feels entitled to have an opinion about intelligence. Unlike, say, brain surgery, intelligence is not an area of expertise that is considered off-limits. Because it’s something that our society particularly values, just about everyone has taken a test that measures intelligence, whether it’s billed as an IQ test or not. Will you be assigned to the radar corps or the mess tent?

OVER THE PAST TWO DECADES, A NATIONAL DEBATE has raged about intelligence: what is it, who has it and how do we measure it? The argument is fueled by findings from two camps of research. There are the psychometricians, who look at the statistics and biology of IQ and try to determine how much of intelligence is innate. And then there are the cultural ecologists, who focus on environment and point out the mutability of intelligence and the unfairness of IQ tests. Unfortunately, the two lines of study seldom meet because their methods are so different. Rarely does one camp communicate with the other.

Birth order doesn’t predict IQ, and there is no causal role for family size in determining a child’s IQ.

That leaves most ordinary citizens on the outside of the debate, free to cling to their personal beliefs about intelligence. The only trouble is our theories of intelligence are too narrowly constructed. They tend to ignore real data, even though a voluminous literature exists on the topic.

At the very least, intelligence can be defined as the ability for complex thinking and reasoning. One thing the research shows for sure: much of the ability for complex reasoning depends on the situation. A person can be a genius at the racetrack but a dolt in the stock market, even though both pursuits require comparable mental activities. But the knowledge is organized in the mind differently in different domains, so what a person knows about the track can lie fallow on Wall Street.

I would like to present a dozen research-supported facts about intelligence that most people, including some IQ experts, might find surprising:

The truth is that smart people tend to have small families, but it is not small families per se that make people smart.

FACT 1: IQ correlates with some simple abilities

Glance at the two lines below in Figure 1 and decide which is longer; now decide whether the two letters in each pair of figure 1b have the same name or are physically identical. Finally, name the number in 1c. Simple, huh?

No one with a measurable IQ has difficulty answering that the line on the right is longer. But those with a higher IQ respond to the question faster.

Even individuals with an IQ below 70 can do this task at a high level of accuracy, but they need up to five times longer than subjects with a higher IQ. This may be because such tasks require a series of physiological processes, and the nervous systems of individuals with low
IQs are less efficient, requiring longer, visual displays. Whether you accept this explanation, studies show that IQ is modestly related to the speed at which you do some pretty simple things.

**FACT 2: IQ is affected by school attendance**

Although intelligence does influence the decision to stay in school, staying in school itself can elevate IQ. Or, more accurately, prevent it from slipping. Each additional month a student remains in school may increase his IQ above what would have been expected had he dropped out. The idea that schooling increases IQ may surprise anyone who views it as a measure of innate intelligence.

The earliest evidence comes from the turn of the last century, when the London Board of Education studied children who had very low IQ scores. The report revealed that the IQ of children in the same family decreased from the youngest to the oldest. The youngest group—ages 4 to 6—had an average IQ of 90, and the oldest children—12 to 22—had an average of only 60. This suggests that factors other than heredity are at work. The older children progressively missed more school, and their IQs plummeted as a result.

A few other facts about school attendance:

- IQ is affected by delayed schooling. Researchers in South Africa studied the intellectual functioning of children of Indian ancestry. For each year of delayed schooling, the children experienced a decrement of five IQ points. Similar data has been reported in the U.S.
- IQ is affected by remaining in school longer. Toward the end of the Vietnam War, a draft priority was established by lottery. Men born on July 9, 1951, were picked first so they tended to stay in school longer to avoid the draft; while men born July 7 had no incentive to stay in school longer because they were picked last in the lottery. As a result, men born on July 9 not only had higher IQs, they also earned more money—approximately 7% more.

- Dropping out of school can also diminish IQ. In a large-scale study, 10% of all males in the Swedish school population born in 1948 were randomly selected and given an IQ test at age 13. Upon reaching age 18 (in 1966), 4,616 of them were tested again. For each year of high school not completed, there was a loss of 1.8 IQ points.
- IQ is affected by summer vacations. Two independent studies have documented that there is a systematic decline in IQ scores over the summer months. With each passing month away from school, children lose ground from their end-of-year scores. The decline is pronounced for children whose summers are least academically oriented.

**FACT 3: IQ is not influenced by birth order**

The idea that birth order influences personality and intelligence is long-standing. First-borns are allegedly smarter and more likely to become leaders than are later-born siblings. Recently, however, this belief has come up against scrutiny. The idea that large families make low-IQ children may be unfounded because researchers have discovered that low-IQ parents actually make large families.

The truth is that smart people tend to have small families, but it is not small families per se that make people smart. Hence, birth order doesn’t predict IQ, and there is no causal role for family size in determining a child’s IQ.

Also, no structural aspects of family size influence a child’s IQ. Otherwise two siblings closer in age would have more similar IQs than two siblings spaced far apart. But this is not the case.

**FACT 4: IQ is related to breast-feeding**

My colleagues and I were skeptical when we first heard claims that breast-fed infants grew into children with higher IQs than their siblings who were not breast-fed. There are factors that differ between breast-fed and non-breast-fed children, such as the amount of time mother and child spend together through nursing and the sense of closeness they gain from nursing.

It turns out, however, that even when researchers control for such factors, there still appears to be a gain of 3 to 8 IQ points for breast-fed children by age three. Exactly why is unclear. Perhaps the immune factors in mother’s milk prevent children from getting diseases that deplete energy and impair early learning. Breast milk may also affect nervous system functioning. Mother’s milk is an especially rich source of omega-3 fatty acids that are building blocks of nerve cell membranes and crucial to the efficient transmission of nerve impulses.
FACT 5: IQ varies by birth date
Most states have restrictions on the age of students entering schools, as well as policies mandating attendance until age 16 or 17. School attendance drops off for students born during the final three months of the year, as they are more likely to enter school a year later. When these individuals come of age, they have been in school one year less than their classmates.

For each year of school completed, there is an IQ gain of approximately 3.5 points.

Researchers have shown that for each year of schooling completed, there is an IQ gain of approximately 3.5 points. Students born late in the year, as a group, show a lower IQ score. Given the random processes involved in being born early versus late within a given year, we can assume that the genetic potential for intelligence is the same in both groups.

FACT 6: IQ evens out with age
Imagine interviewing two biological siblings, adopted by two different middle class families, at age five and again at 18. Will their IQs be more alike when they are younger and living in the homes of their adoptive parents, or when they are older and living on their own? Many people reason that IQs will be more alike when they’re younger because they are under the influence of their respective middle class parents. Once they are on their own, they may diverge as they become exposed to different experiences that may influence their intelligence differently.

IQ has risen about 20 points with every generation.

But according to data, this isn’t true. As these siblings go out on their own, their IQ scores become more similar. The apparent reason is that once they are away from the dictates of their adoptive parents, they are free to let their genotypes express themselves. Because they share approximately 50% of their segregating genes, they will become more alike because they are propelled to seek similar sorts of environments. Genes may be more potent in making siblings alike than similarities in home environments.

FACT 7: Intelligence is plural, not singular
Regardless of their views about the existence and the strength of so-called general intelligence, researchers agree that statistically independent mental abilities exist—such as spatial, verbal, analytical and practical intelligence.

The rise in IQ has been attributed to many factors, such as better nutrition, more schooling and better-educated parents.

In 1995, Yale psychologist Robert Sternberg and colleagues developed new evidence that practical and analytical intelligence are two different things. They demonstrated that the skills of practical intelligence, such as common sense, were important in predicting life outcomes, but were not associated with IQ-type analytic intelligence. There may even be at least seven or eight different kinds of intelligence, says researcher Howard Gardner of Harvard, including interpersonal, intrapersonal, linguistic, motoric and musical intelligence.

FACT 8: IQ is correlated with head size
The relationship between head size and IQ has long been a subject of controversy. Popular writers such as Stephen J. Gould have rightly objected to the crude and biased means 19th-century scholars used to establish this correlation, which were based on head size and contour. But modern neuroimaging techniques demonstrate that cranial volume is correlated with IQ. Evidence also comes from studies of the helmet sizes of members of the Armed Services, whose IQs were measured during basic training. The correlations, however, are quite small.

FACT 9: Intelligence scores are predictive of real-world outcomes
People who have completed more school tend to earn more—over a lifetime, college graduates earn $812,000 more than high school dropouts, and those with professional degrees earn nearly $1,600,000 more than the college grads. But more schooling can’t be the only factor in earning differences, because at every level of schooling, there is a variety of intellectual ability.

Research appears to confirm our mothers’ wisdom that diet influences brain functioning.

As Figure 2 shows, even among those with comparable levels of schooling, the greater a person’s intellectual ability, the higher that person’s weekly earnings. Workers with the lowest levels of intellectual ability earn only two-
thirds the amount workers at the highest level earn. Because differences in schooling are statistically controlled, the rise in earning must be due to other factors, such as intelligence.

**FACT 10: Intelligence is context-dependent**

The setting in which we measure intelligence matters. In 1986, a colleague and I published a study of men who frequented the racetracks daily. Some were excellent handicappers, while others were not. What distinguished experts from non-experts was the use of a complex mental algorithm that converted racing data taken from the racing programs sold at the track. The use of the algorithm was unrelated to the men’s IQ scores, however. Some experts were dockworkers with IQ scores in the low 80s, but they reasoned far more complexly at the track than all non-experts—even those with IQs in the upper 120s.

In fact, experts were always better at reasoning complexly than non-experts, regardless of their IQ scores. But the same experts who could reason so well at the track were often abysmal at reasoning outside the track—about, say, their retirement pensions or their social relationships.

**FACT 11: IQ is on the rise**

IQ has risen approximately 20 points with every generation, a steady increase called the “Flynn Effect,” after New Zealand political scientist James Flynn. If people taking an IQ test today were scored with the norms of their grandparents’ performances 50 years ago, more than 90% of them would be classified as “geniuses,” while if our grandparents were scored today, most of them would be classed as “borderline mentally retarded.” No one believes that real intelligence has risen as swiftly as IQ—if our grandparents were born today, they’d do just as well on IQ tests as they did a half century ago.

The rise in IQ has been attributed to many factors, such as better nutrition, more schooling, better-educated parents and more complex spatial environments thanks to smart toys and computers. The rise in IQ suggests that whatever it is that IQ tests test, it is not some inherent quality of the mind.

---

**FACT 12: IQ may be influenced by the school cafeteria menu**

Recent research appears to confirm our mothers’ wisdom that diet influences brain functioning. Eat your fish; it’s brain food.

In one large-scale analysis of approximately 1 million students enrolled in the New York City school system, researchers examined IQ scores before and after preservatives, dyes, colorings and artificial flavors were removed from lunch offerings. They found a 14% improvement after the removal. And the improvement was greatest for the weakest students. Prior to the dietary changes, 120,000 of the students were performing two or more grade levels below average. Afterward, the figure dropped to 50,000.

Intelligence, IQ, heredity and ecology are intertwined in complex and intriguing ways. Technical journals are awash with data, and one should consider the facts before leaping to conclusions about what is and what is not intelligence. We should all challenge the implicit theories of intelligence; otherwise we are in danger of misinterpreting the truth.

---

**READ MORE ABOUT IT:**


Resolving the debate of birth order, family size and intelligence, Rodgers, J.L., et al. (American Psychologist, 2000)