“Intelligent people use their brains more effectively.” Why is this and what exactly is intelligence? To what extent is its development influenced by genes, education and environmental influences? Intelligence researcher Prof. Dr. Detlef Rost gives us the answers to these questions.
Professor Rost, you have spent decades researching intelligence and giftedness. Can you tell us in simple terms exactly what intelligence is?

Prof. Dr. Detlef Rost: Intelligence is the ability to think. Or, to be more specific, intelligence can be defined as the ability to solve new problems quickly and effectively and to identify situations where lessons learned and problem-solving strategies can be applied and where they cannot. To put it another way: intelligence is demonstrated primarily through abstract thinking and problem-solving. However, it is important to note that the problems don’t have to be new to the world at large, just new for the individual.

Is an intelligence test proof of intelligence and don’t things like emotional intelligence also play a role?

Rost: Intelligence tests are a scientifically proven method of identifying intelligence that have been used since the 1920s. They contain a lot of different tasks to be completed, including verbal tasks, i.e. the ability to identify linguistic regularities and analogies as well as the evaluation of the individual's vocabulary. In addition, there are numerical tasks, such as the completion of number sequences. The same refers also to figural tasks, which consist of figures or geometric elements. The important thing, however, is the speed with which the tasks are completed. The difference between Einstein and me is that it probably took Einstein just a few years to develop the theory of relativity, while it would take me many years to understand it. Emotional intelligence is actually a misnomer. Although a popular concept in the lay community, it is a highly controversial topic among academics. If you start postulating a separate “intelligence” for every human ability and activity, the situation will quickly get out of hand. It simply doesn’t make sense.

Where exactly is intelligence located in our brain and is it also possible to provide physiological proof of intelligence?

Rost: Our intelligence resides primarily in the frontal lobe, in the prefrontal cortex. We now know that gifted people use their brains more efficiently. If you give gifted and less gifted individuals the same tasks to complete, the gifted individuals do so with less effort. You can actually measure this, for example by examining the blood flow through certain areas of the brain. Intelligent people use their brains more effectively. The scientific term for this is neural efficiency.

To what extent is intelligence influenced by genetics?

Rost: Generally speaking, there is a 50/50 split between genetic disposition and environmental influences when it comes to the difference in intelligence among young adults in our information society. As we get older, the genetic factor becomes more important, while the influence of environmental factors declines.

In studies of Britons and Germans, Michael A. Woodley of Menie and his colleagues from the Technical University in Chemnitz were able to show that over a period of 80 years, the brain mass in men increased by 52 grams and by 23 grams in women.

Roman scholar Marcus Tullius Cicero coined the term intelligentia: “Intelligence is the power which enables the mind to comprehend reality.”

When an animal nibbles an acacia, it releases an odourless gas. Trees in the immediate vicinity detect this signal and then increase the tannin content of their leaves so that they taste unpleasant and cause health problems in animals.

About Prof. Dr. Detlef Rost

Prof. Dr. Rost has been working and conducting research at the University of Marburg since 1981. His main areas of interest are educational and developmental psychology. Since 2013, he has been a visiting professor at the Faculty of Psychology at Southwest University, Chongqing, China. He is more widely known for his research into the topic of giftedness, in which he has refuted a number of common misconceptions. Along with numerous publications, Prof. Dr. Rost has written two books: “Intelligenz: Fakten und Mythen” (Intelligence: Facts and Myths) and the comprehensive “Handbuch Intelligenz” (Handbook of Intelligence).
In Western industrialised countries, genetic factors underlie about 80 per cent of the difference in intelligence among seniors, whereas for very young children the figure is only around 30 per cent. Our genetic disposition to intelligence comes into play more as we age; genes therefore prevail.

You can also look at this as a kind of passing-on of positive traits. People who are more “genetically intelligent” tend to go to better schools, receive more encouragement and study more challenging subjects; they may choose more intelligent partners and have a greater appreciation for more sophisticated concepts. This means that intelligent individuals are generally raised in a more stimulating environment, receive greater support and seek out more challenging environments that can provide more stimulation. This is referred to as gene-environment interaction. Innate differences in intelligence that are initially minor become greater throughout a person’s life; the gap effectively widens. An intelligent child is more likely to be born into a higher social class. The more homogeneous a society, the stronger the influence of genetics on differences in intelligence. If all people lived in exactly the same environment, differences in intelligence would be wholly attributable to genetic factors.

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In the 1980s, New Zealand political scientist James Flynn stated that the average IQ had increased by three to five per decade since the beginning of the 20th century. There are signs that the IQ has stopped increasing in Western countries, although it continues to increase in developing countries.

The concepts of fluid and crystallised intelligence are also often used in this context. Fluid intelligence is our innate basic intelligence – including our general ability to solve problems in many situations and abstract logical thinking. It peaks at around age 20, and then gradually declines. This basic intelligence is used in education, and forms the basis for crystallised intelligence. This is the knowledge taught in schools and universities, for example, though is not limited to such institutions. Crystallised intelligence can be increased into old age.

How important is the role played by schools in developing intelligence?

Rost: Schools provide the best and most sustainable support structure for intelligence. Surveys conducted both nationally and internationally show an increase in IQ of between 0.3 and 0.5 points per school month. Around 75 per cent of the increase in intelligence is due to formal education, while 25 per cent is attributable to other environmental stimuli. If we were to shorten the amount of time spent in secondary education by a year, the average intelligence of our young people would decline accordingly. Over the course of many years, students spend approximately six to eight hours per day, five or six days per week, 42 weeks per year being taught in a variety of disciplines by different “trainers”, i.e. teachers. This is the most sustainable means of developing intelligence. Short-term programmes aimed at developing intelligence do not have longer-term effects. By the way, I’d like to dispel the persistent myth that very gifted individuals are socially awkward or eccentric. Highly gifted individuals are just like the rest of us, they are simply cognitively more efficient.
How do you maintain and increase intelligence throughout your lifetime?

Rost: As an adult, you should watch television programmes with high-quality content and discuss them with your partner or with friends. You should read books that provide substance, take part in evening classes, attend lectures as a senior student or engage in lifelong learning. In short, it is important to seek out intellectual stimulation and take it on board, and to engage in intellectual pursuits in your everyday life. Learning something new actually makes you intelligent and keeps you mentally fit.

Compared with the past, children nowadays know more from an earlier age and are better at expressing themselves. Does this mean that our children are becoming more intelligent?

Rost: This is what we call the Flynn effect, named after a New Zealand political scientist. If you were to set an intelligence test from 40 years ago today, the results would be better, i.e. more problems would be solved correctly, as we appear to have developed better cognitive abilities. The Flynn effect has been observed worldwide; however, there are signs of a possible end to this progression. Simply put, children are cleverer than they were fifty years ago. Among the proposed reasons for this are improved education. In the past, students learned by rote, but nowadays preference is given to critical thinking and reflexivity. There are also greater environmental stimuli. Children often learn to read before starting school because they are surrounded by words. Another possible explanation is improved nutrition in the form of vitamins, proteins and secondary plant nutrients. The optimum balance seems to have been achieved.

You’re about to go to China, where Festo has been active for many years. What exactly do you do there, and how does learning in the Middle Kingdom differ from the way we learn here?

Rost: Since 2013, I’ve been spending two months in the spring and two months in the autumn at Southwest University in Chongqing. I conduct research in a number of different areas, including educational psychology and stress in schools. There are significant differences between schools in China and Germany. It’s not unusual to have sixty or seventy students in a class, but this isn’t a problem because the children are highly disciplined. Their method of learning differs from ours, too. There’s a lot of learning by rote and accumulation of knowledge. Students still have some inhibitions when it comes to asking critical questions, but the situation is improving every year. Children and students are very hard-working and diligent. I really enjoy my work in China.

We wish you safe travels and would like to thank you for such an interesting discussion.

In his work “Hereditary Genius”, British natural scientist Francis Galton applied knowledge from genetics to human intellectual capacity for the first time, and so began the debate about the cause of differences in intelligence: is intelligence determined by genes or by environmental factors?

BIRDS and monkeys

are among the most intelligent creatures of the animal kingdom. They can memorise numbers, make tools and are even able to recognise themselves in a mirror test.

CRYSSTALLISED intelligence

In science, crystallised intelligence is understood as an individual’s intelligence based on experience, acquired knowledge and verbal skills. It increases over the years and can even be improved into old age.

FLUID intelligence,

also known as fluid thinking, is the ability to use abstract logical thinking, identify and apply analogies and thus solve problems. It peaks at around age 20, and then gradually declines.