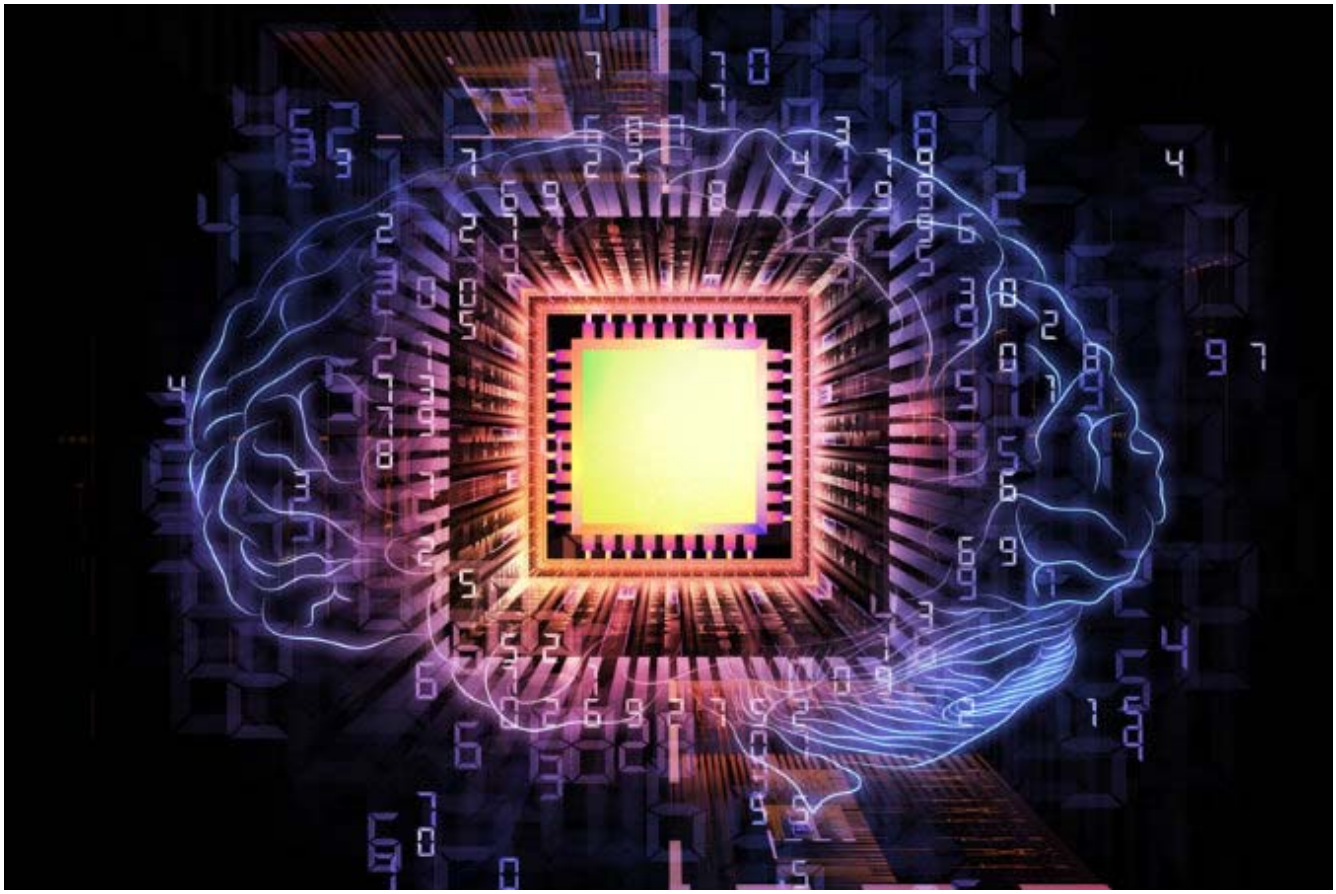
Why the Most Advanced Computer Is Still No Match for the Human Brain

By Tara MacIsaac, Epoch Times | December 11, 2014 | Last Updated: December 13, 2014 12:10 am



It is a humbling thing in this era of advanced science to realize that the human brain remains an enigma.

Furthermore, as we spend millions of dollars on developing huge supercomputers and use enormous amounts of energy (fueled by non-renewable resources) to power our devices, the comparatively tiny, efficient, and affordable human brain outperforms the best computers in many ways.

It takes 82,944 processors and 40 Minutes for a supercomputer to simulate a single second of human brain activity.

Last year, the K supercomputer was used by researchers at the Okinawa Institute of Technology Graduate University in Japan and Forschungszentrum Jülich in Germany in an attempt to simulate a single second of human brain activity.

The computer could accommodate a network model of 1.73 billion neurons (nerve cells). The human brain has, however, some 100 billion neurons. To put that in perspective, **the human brain has about as many neurons as there are stars in the Milky Way**.

Though the computer succeeded in simulating one second of brain activity, it took 40 minutes.

An employee of the Korea Institute of Science and Technology Information checks the supercomputers at the research institute in Daejeon, South Korea, Nov. 5, 2004. (Chung Sung-Jun/Getty Images)

The K supercomputer was the fastest computer in the world in 2011. It can process 10.51 Petaflops per second (Petaflop/s), which you can understand as about 10,510 trillion calculations per second. Since advancements in technology move fast, we'll put that in perspective for 2014. The K supercomputer is currently the fourth fastest computer, with the Tianhe-2 in first place at 33.86 Petaflop/s (33,860 trillion calculations per second). So we've tripled the processing power of our most advanced computer in three years.

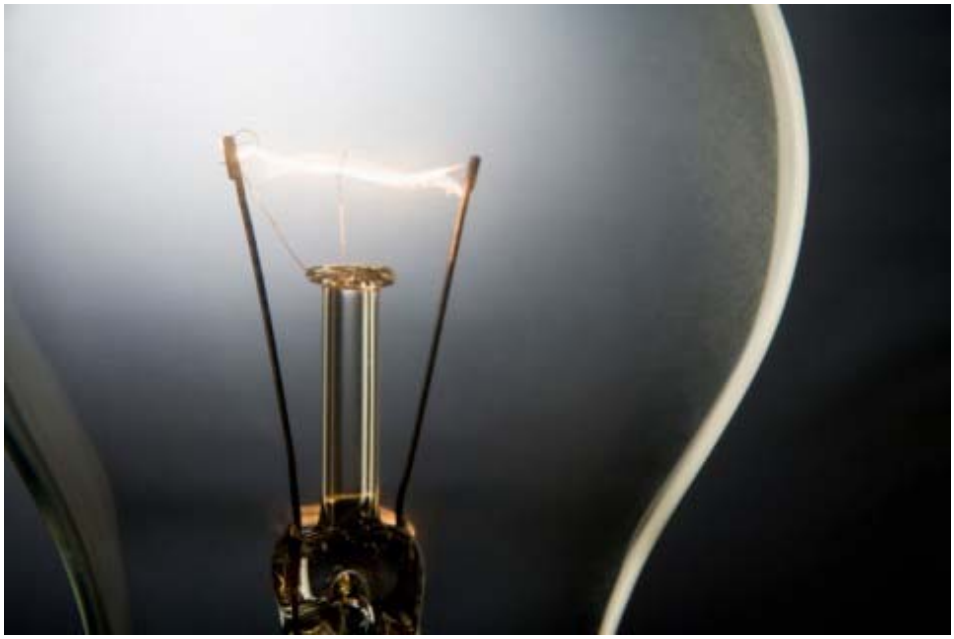
To bring it down to a scale most people can relate to, the graphics unit inside the iPhone 5s produces about 0.0000768 Petaflop/s. **Thus, the fastest computer in the world is some 440,000 times faster than the graphics unit inside the iPhone 5s, but slower than the human brain.**

A study led by Martin Hilbert of the Annenberg School of Communication at the University of Southern California and published in the journal Science in 2011 assessed the world's ability to compute information. Hilbert put it this way: "To put our findings in perspective, the 6.4*1018 instructions per second that human kind can carry out on its general-purpose computers in 2007 are in the same ballpark area as the maximum number of nerve impulses executed by one human brain per second."

Your brain is so cheap, it's free.

Rare birth defects aside, we're all born with brains, and they fit right in our heads! The Tianhe-2 cost about $390 million to build, according to Forbes. At peak power it draws more than 17.6 megawatts of power, and the computer complex covers about 2,300 square feet (720 square meters). Some other supercomputers, deemed energy efficient, consume about 8 megawatts.

To put that in perspective, one megawatt equals 1 million watts. A 100-watt light bulb draws 100 watts as soon as it is turned on, since "watt" refers to the power used instantaneously. So the fastest computer in the world draws as much power as 176,000 light bulbs.



(Monkey Business Images/Monkey Business/Thinkstock)

Jeff Layton, Ph.D., a Dell enterprise technologist, wrote in a blog post: **“These systems are terribly large, expensive, and power hungry.”**

Of course, the brain requires power too. The energy comes from food, which, in our modern agricultural system burns fuel.

It’s also really handy.

While the computers we use in daily life can be quite useful, some experts have expressed doubt about the usefulness of supercomputers.

The South China Morning Post reported in an article about the Tianhe-2, which is located in China: “Unlike home computers that can handle various tasks, ranging from word processing to gaming and web browsing, supercomputers are built for very specific purposes. To exploit their full computational capabilities, researchers have to spend months, if not years, writing or rewriting software codes to train the machine to do a job efficiently.”

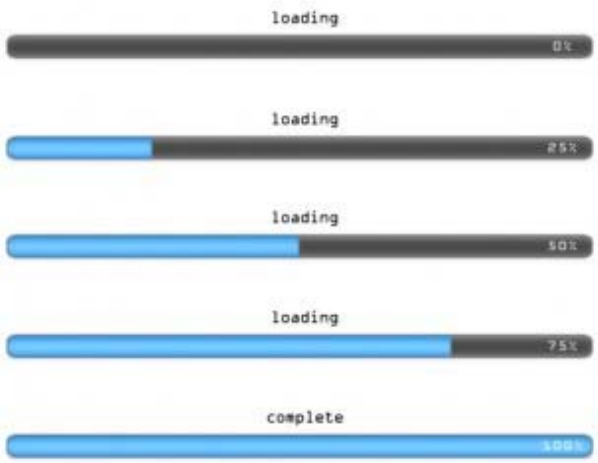
MORE: We May Be Living in the Matrix, Says Engineer

A senior scientist at the Beijing Computing Centre, whom the Post did not name, said: “The supercomputer bubble is worse than a real estate bubble. A building will stand for decades after it is built, but **a computer, no matter how fast it is today, will become garbage in five years**.”

How does your brain’s bandwidth compare to a modem?

Delimiting a measure for the processing speed of the human mind has been attempted by multiple scientists. The figures they’ve come up with have varied, depending on the approach. Comparing the bandwidth of a modem with the “bandwidth” of a brain is not an exact science.

First, we’ll look at how many bits per second (bps) your brain can process, then we’ll look at how many bps an average modem can process. You can think of this in terms of how long it takes you to upload a picture via the Internet versus how long it takes you to process what you see before your eyes.



(RealCG Animation Studio/iStock/Thinkstock)

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Dr. Tor Nørretranders, an adjunct professor of the Philosophy of Science at Copenhagen Business School, wrote a book titled “The User Illusion: Cutting Consciousness Down to Size,” in which he stated that the conscious mind processes about 40 bps, whereas the subconscious mind processes 11 million bps.

Austrian theoretical physicist Herbert W. Franke states that the human mind can consciously absorb 16 bps and can consciously hold in the mind at one time about 160 bps. Interestingly, he notes that

the mind can thus reduce the complexity of any situation to 160 bits.

Fermin Moscoso del Prado Martin, a cognitive psychologist from the Université de Provence in France, determined that the human brain can process some 60 bps. In a comment on a Technology Review article about his work, he noted that he has not determined an upper limit, meaning he cannot say with certainty that the brain is unable to process above and beyond 60 bps.

Now, let's look at how fast your household modem is.

(Vladru/iStock/Thinkstock)

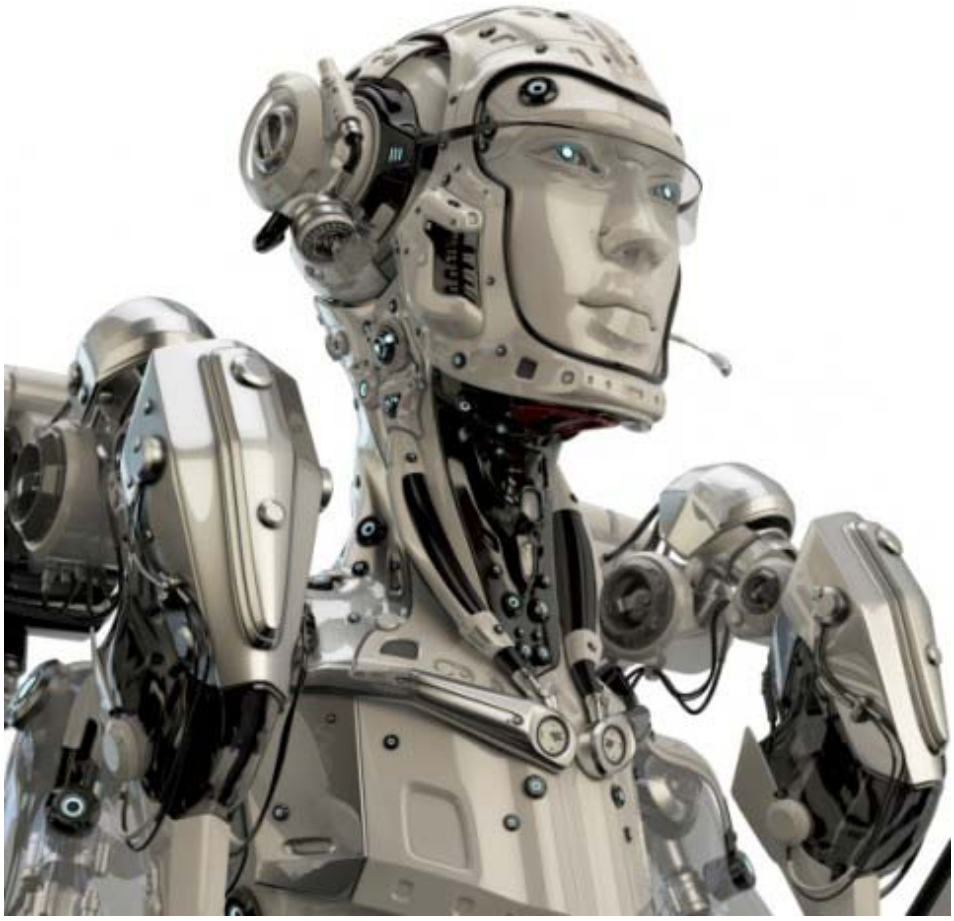
One megabit per second (Mbps) is equal to 1 million bps; household modems can operate at anywhere from 50 Mbps to several hundred Mbps. That's millions of times faster than your conscious mind, and at least five times that of your subconscious. **Score one for computers here, they do outperform brains in this regard.** Of course, so little is still understood about the subconscious that these figures are far from certain.

And even if we're relatively slow at imbibing data, how we process it is amazing.

We learn, we invent.

Artificial intelligence (AI) is making headway on developing computers that are creative. But, **the most advanced AI is far behind the human brain as it was even many thousands of years ago.**

In an article written for MakeUseOf.com, electrical engineer and freelance writer Ryan Dube commented on the following statement by author Gary Marcus: "The fundamental difference between computers and the human mind is in the basic organization of memory."



(Vladislav Ociacia/iStock/Thinkstock)

Dube wrote: “To retrieve data, the computer uses logical storage locations. A human brain, on the other hand, remembers where information is stored based on cues. Those cues are other pieces of information or memories connected to the information you need to retrieve.

MORE: **What Is the DNA of Your Mind?**

“This means that the human mind can connect an almost unlimited number of concepts in a variety of ways, and then sometimes disconnect or recreate connections based on new information. This allows the human to step outside the boundaries of what has already been learned—leading to new art and new inventions that are the trademark of the human race.”

The brain is still little-understood, and we may yet uncover unfathomable benefits.

National Geographic illustrated how grand the task of mapping the human brain with precision is. It reported in it’s February 2014 edition titled “The New Science of the Brain,” that scientists have created a 3-D model of part of a mouse brain the size of a grain of salt. To map out this tiny part of the mouse brain with accuracy, they used an electron microscope to image it in 200 sections, each as thick as a human hair. “**A human brain visualized at this level of detail would require an amount of data equal to all the written material in all the libraries of the world**,” wrote National Geographic.

In 2005, researchers at Caltech and UCLA found that only a few of the brain’s 100 billion neurons are used to store information about any given person, place, or concept. For example, they found that when test subjects were shown pictures of actress Jennifer Aniston, one particular neuron in the brain would respond. Another neuron was dedicated to actress Halle Berry.