

التفكير الابداعي

CREATIVE Thinking

Lecture
#3

Dr. Mahmoud El-Khouly

www.elkhouly.net

Human vs computer



Brains Are Analogue and Computers Are Digital

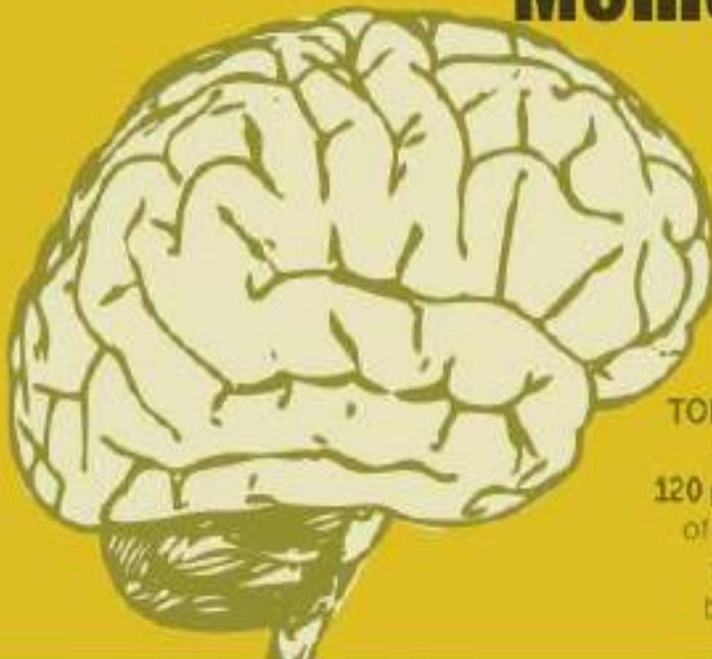
It's easy to think that neurons are essentially binary, given that they fire an action potential if they reach a certain threshold, and otherwise do not fire. This superficial similarity to digital "1's and 0's" belies a wide variety of continuous and non-linear processes that directly influence neuronal processing.

In computers, information in memory is accessed by polling its precise memory address. This is known as byte-addressable memory. In contrast, the brain uses content-addressable memory, such that information can be accessed in memory through "spreading activation" from closely related concepts.



Human Memory and Computer Memory

In some ways, human memory and computer memory are similar. For example, some general characteristics of human short-term memory resemble those of a computer's random access memory (RAM). Human short-term memory is volatile and has a limited capacity. Computer RAM has essentially the same characteristics. Your computer often does not have enough memory to run certain programs, and when you turn it off, bye-bye data!



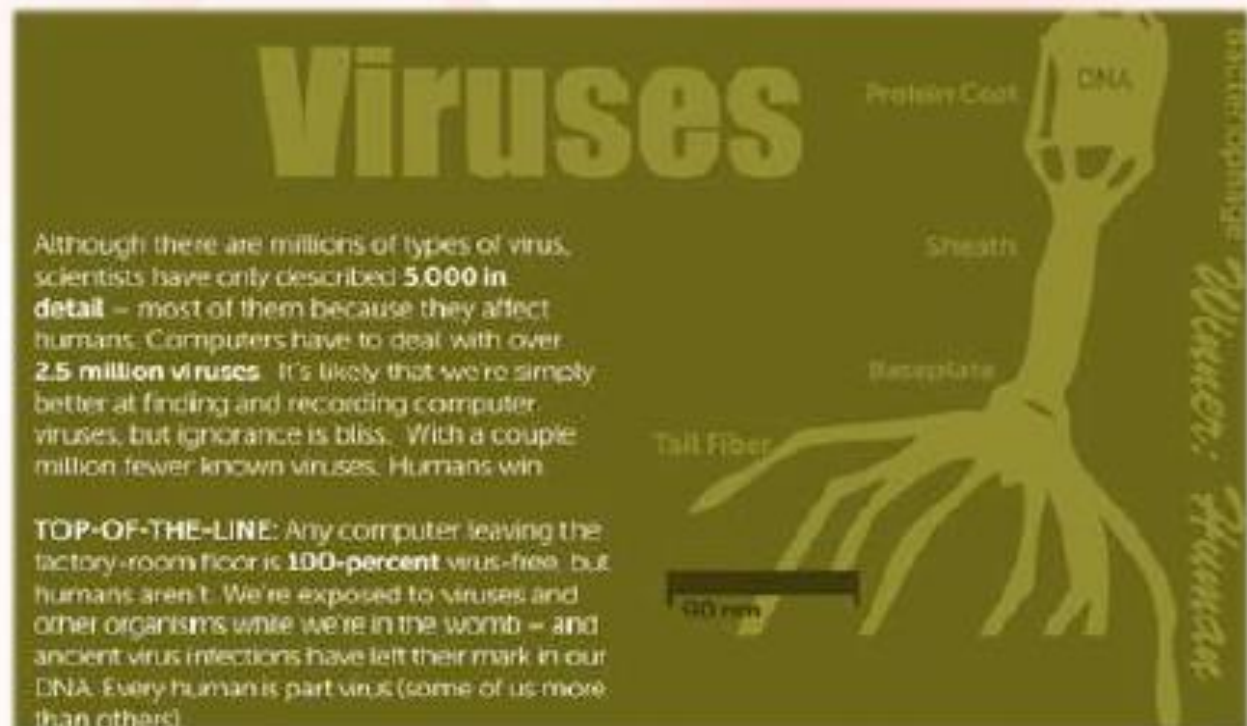
Memorization

The world record for the longest number ever memorized was **PI (3.141)** to the **22,500th** decimal by Daniel Tammet. A **500-gigabyte** hard drive could hold a number about **24 million** times larger.

TOP-OF-THE-LINE: Scientists are currently building a data repository that will hold **120 petabytes** (that's **120 million gigabytes**) of information – ten times larger than any supercomputer's memory today and far beyond the capacity of any puny mortal.

Human Virus and Computer Virus

In computer security, computer virus is a self-replicating computer program that spreads by inserting copies of itself into other executable code or documents. Biological virus spreads by inserting itself into living cells. Extending the analogy, the insertion of a virus into the program is termed as an “infection”, and the infected file, or executable code that is not part of a file, is called a “host”.



Human Speed and Computer Speed

The world's most powerful supercomputer, the K from Fujitsu, computes four times faster and holds 10 times as much data. And of course, many more bits are coursing through the Internet at any moment. The human genome, which grows our body and directs us through years of complex life, requires less data than a laptop operating system. Even a cat's brain smokes the newest iPad—1,000 times more data storage and a million times quicker to act on it.

Speed Reading

There are a number of people who claim to be able to read **10,000 or more words** per minute, but those claims have not been verified by the recognized speed reading authorities. The limits on human speed reading range from **1,000 to 2,000 words** per minute, with greater than **50% comprehension**. The typical document scanner can read at **1000 words** per minute, and though they can't comprehend, they can certainly store those words with near **100% accuracy**.

TOP-OF-THE-LINE: Prototype book scanners can suck down **200 pages** a minute – but that's raw images, before processing the text.





Brain versus Computer (hardware)



Numbers	Human brain	Von Neumann computer
# elements	10^{10} - 10^{12} neurons	10^7 - 10^8 transistors
# connections / element	10^4 - 10^3	10
switching frequency	10^3 Hz	10^9 Hz
energy / operation	10^{-16} Joule	10^{-6} Joule
power consumption	10 Watt	100 - 500 Watt
reliability of elements	low	reasonable
reliability of system	high	reasonable



Brain versus Computer (information processing)



Features	Human Brain	Von Neumann computer
Data representation	analog	digital
Memory localization	distributed	localized
Control	distributed	localized
Processing	parallel	sequential
Skill acquisition	learning	programming

No memory management,

No hardware/software/data distinction

Human brain

- The human brain is an organ weighing 1.3 kg
It is divided into left and right lobes.
- And each section works as an independent brain
- Human intelligence does not depend on the number of neurons (ten thousand million cells in a single brain), but on the degree of interaction and connection between these cells

Human brain

Right brain

Consistency

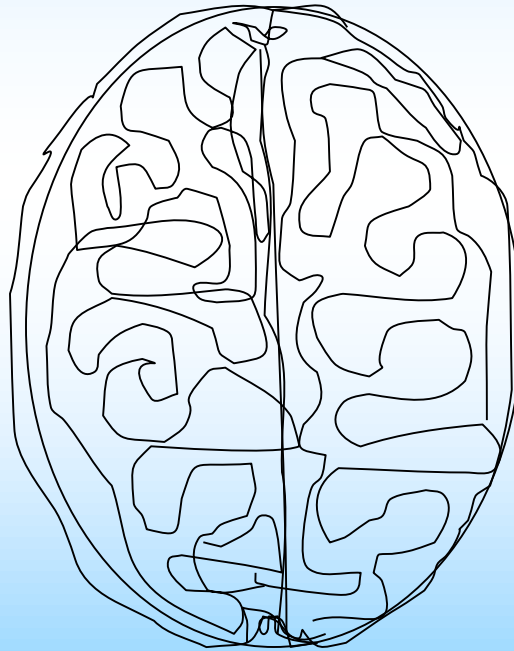
Colors

Imagination

Daydream

Dimensions

Melodies



Left brain

Words

Numbers

Analysis

Logic

Arrangement

Lists

Characterstics for those who use

<i>Left brain</i>	<i>Right brain</i>
prefer verbal and linguistic explanations	prefer visual practical explanations
use language and focus	use mental imagery
process the information in a sequence	process information in a holistic manner
produce ideas with logic	produce ideas with intuition
prefer general ideas	prefer details

<i>Left brain</i>	<i>Right brain</i>
prefer businesses that require concrete thinking	prefer businesses that require abstract thinking
focus on one business	are involved in more than one job at a time
prefer activities that require research and exploration	prefer authoring and composition activities
prefer arranged organized businesses	can easily improvise
prefer specific experiences	prefer free, indeterminate experiences
take problems seriously	face problems without getting serious