



ELASTIC LEARNING: MACHINE LEARNING APPROACHES AND DESIGNING EXPERIENCES FOR STUDENTS POST-PANDEMIC

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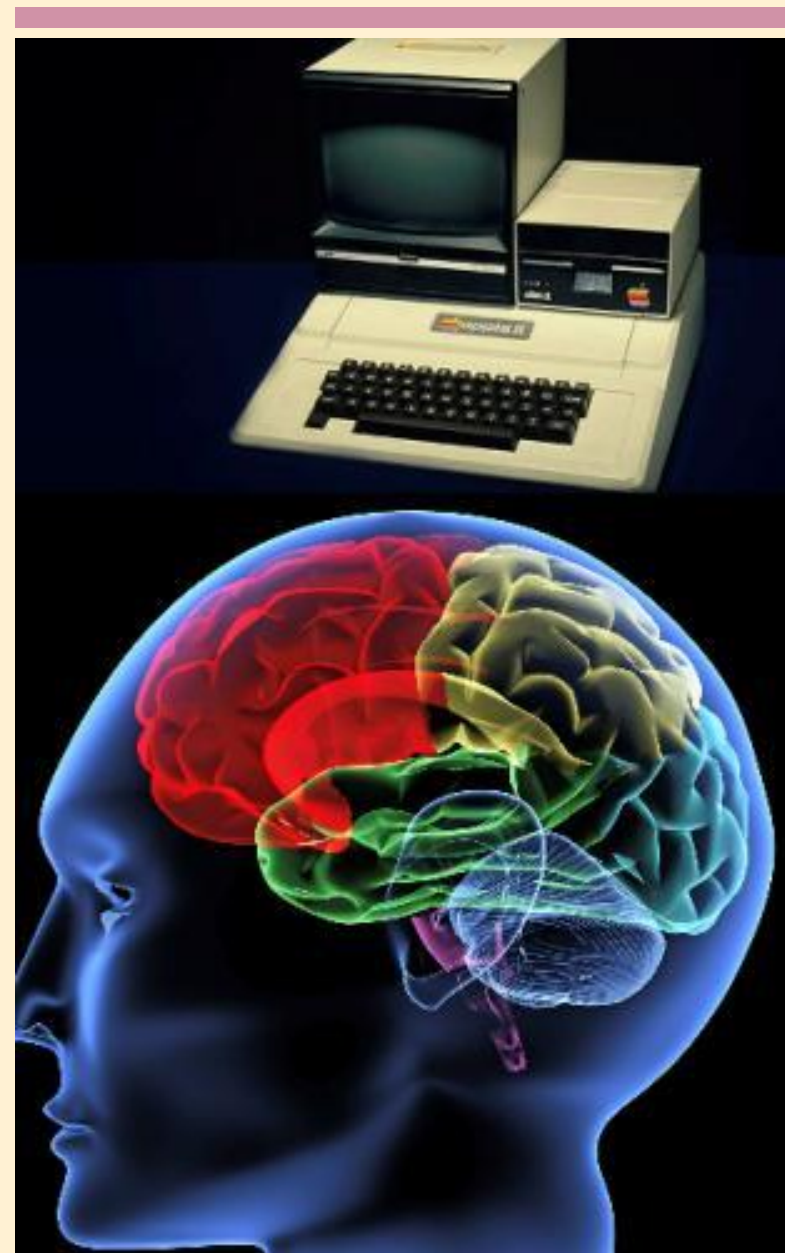


ALPHABET

- Consider the alphabet. Maybe say it out loud.
- Now say it *backwards*!

- A computer has no difficulty in doing this, as it sees the alphabet as data that can be examined differently.

- But humans have to 'save' a separate **backwards** version of the alphabet in order to do it confidently.
 - Kurzweil, 2014.

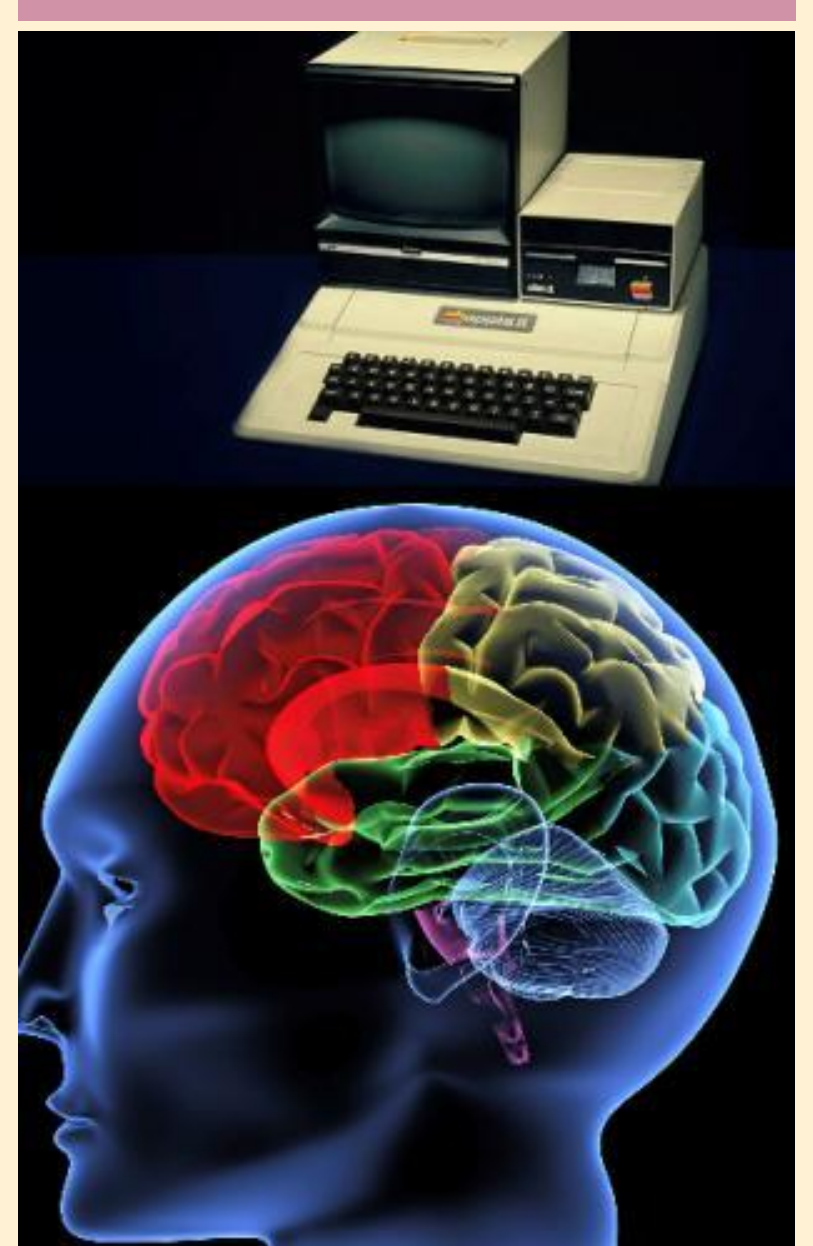


HOWEVER...

- According to a researcher at Cambridge University it doesn't matter in what order the letters in a word are, the only important thing is that the first and last letter be at the right place. The rest can be a total mess and you can still read it without problem.
 - Mlodinow, 2018.

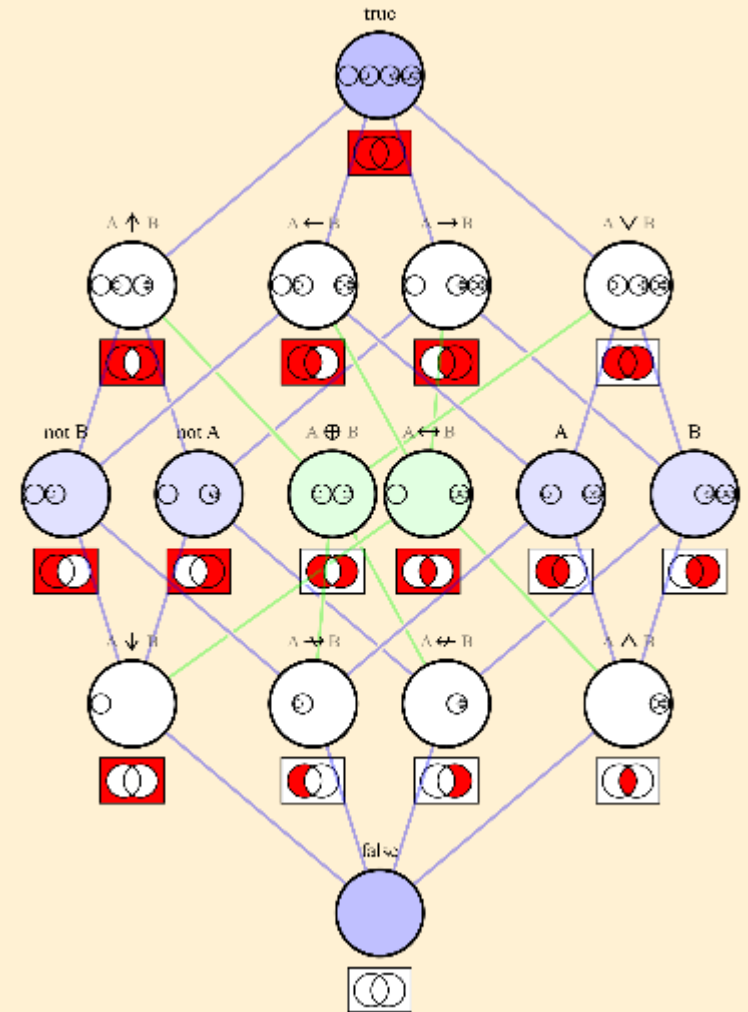
BRAINS AND COMPUTERS

- We can usually read the previous statement with very little difficulty.
- A computer would struggle (and, without a specifically-designed programme, quite likely fail) to do the same.



BRAINS AND COMPUTERS

- Computers usually work *analytically*, based on algorithms, scripts and ultimately logical progressions.
- Humans have been encouraged to do the same – logic is prized.



LANIER'S 'LOCK-IN' (2011)

- Increasing tendency toward logic may be a result of Jaron Lanier's 'lock-in':
- A decision is made about how an important process or device is designed, and then this can never be changed



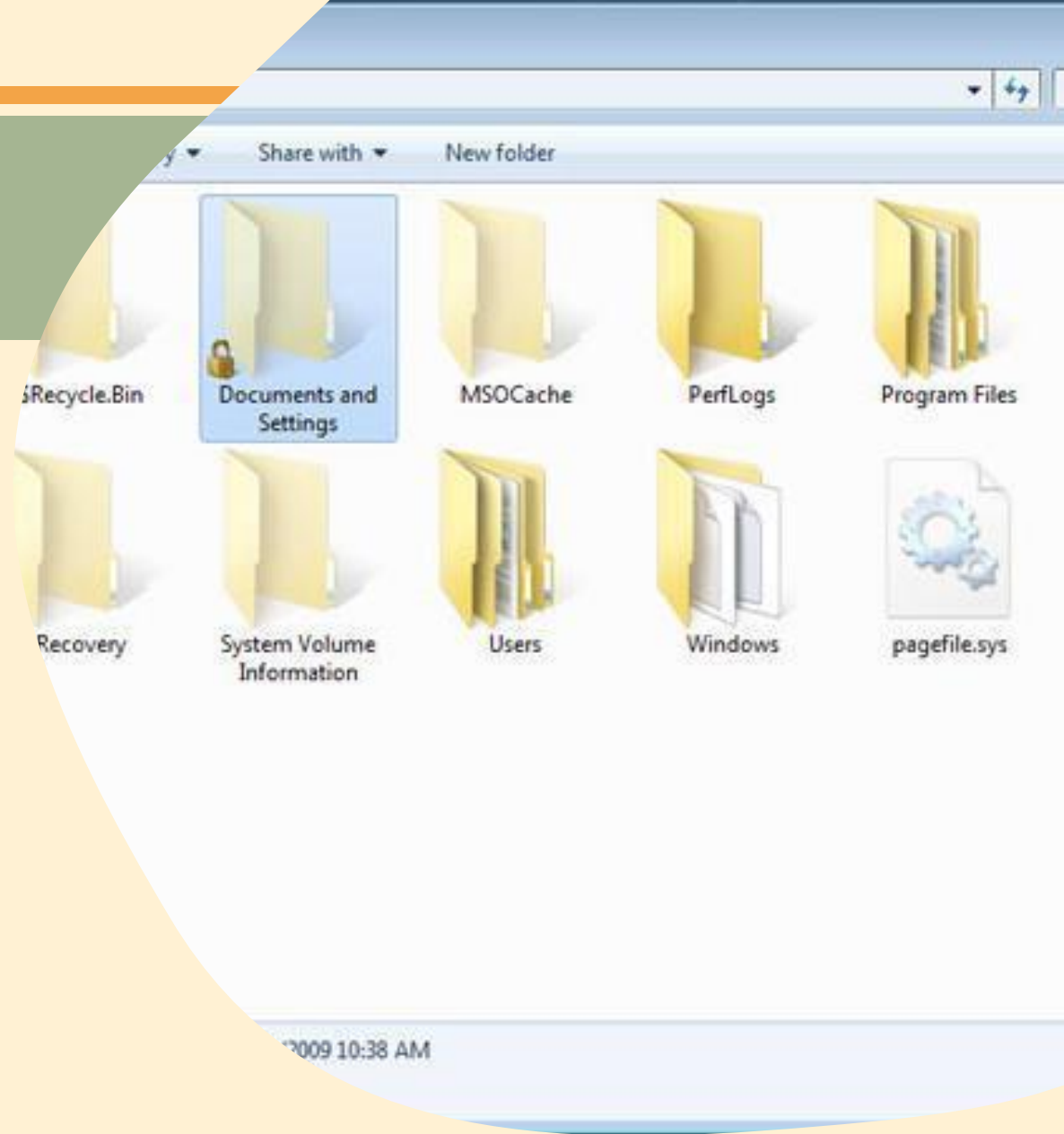


'LANIER'S 'LOCK-IN'

- London Underground was designed for Victorian trains and passenger numbers
- Now it would be too expensive to change it all for modern needs
- Systemic interdependencies

'LANIER'S 'LOCK-IN'

- Computers are the same
- Eg. Once the decision was made to work in Files and Folders, arguably it can no longer be changed
- Computers are so pervasive, Lanier suggests their use has changed the way we think about information, problem-solving etc.

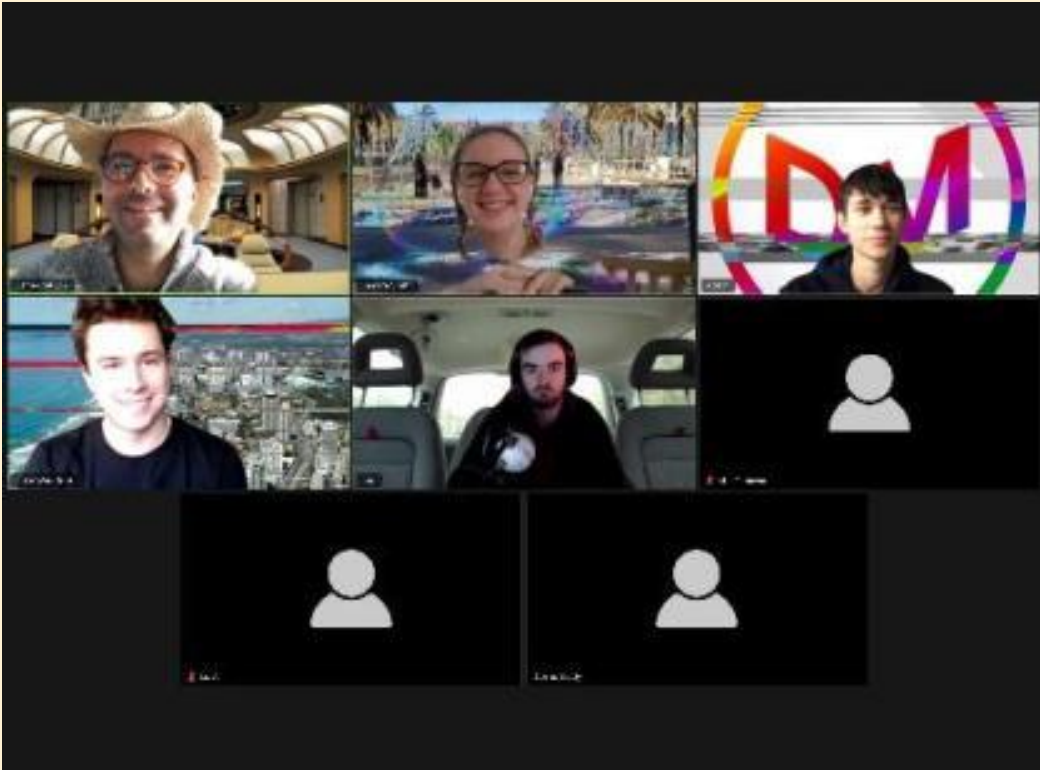


LANIER'S 'LOCK-IN' (2011)

- 'When developers of digital technologies design a program that requires you to interact with a computer as if it were a person, they ask you to accept in some corner of your brain that you might also be conceived of as a program'.
 - Lanier, 2010.



LOCKDOWN



- We've now spent over a year communicating, socialising and learning in an almost exclusively online context
- Will this have accentuated our machine-like thinking?

EDUCATION

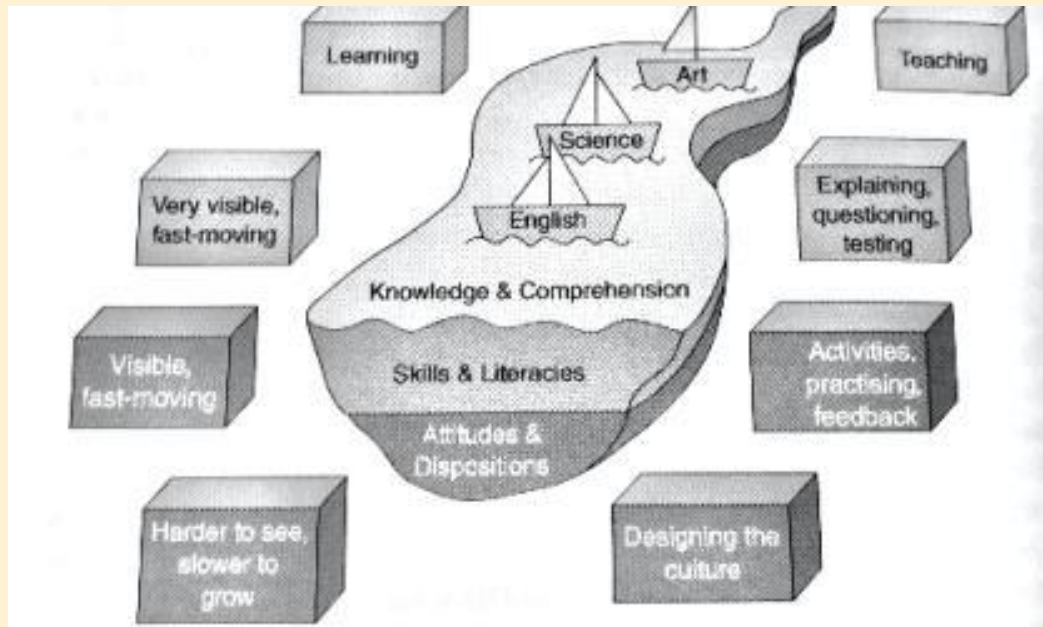


Figure 2.1 The river of learning and teaching

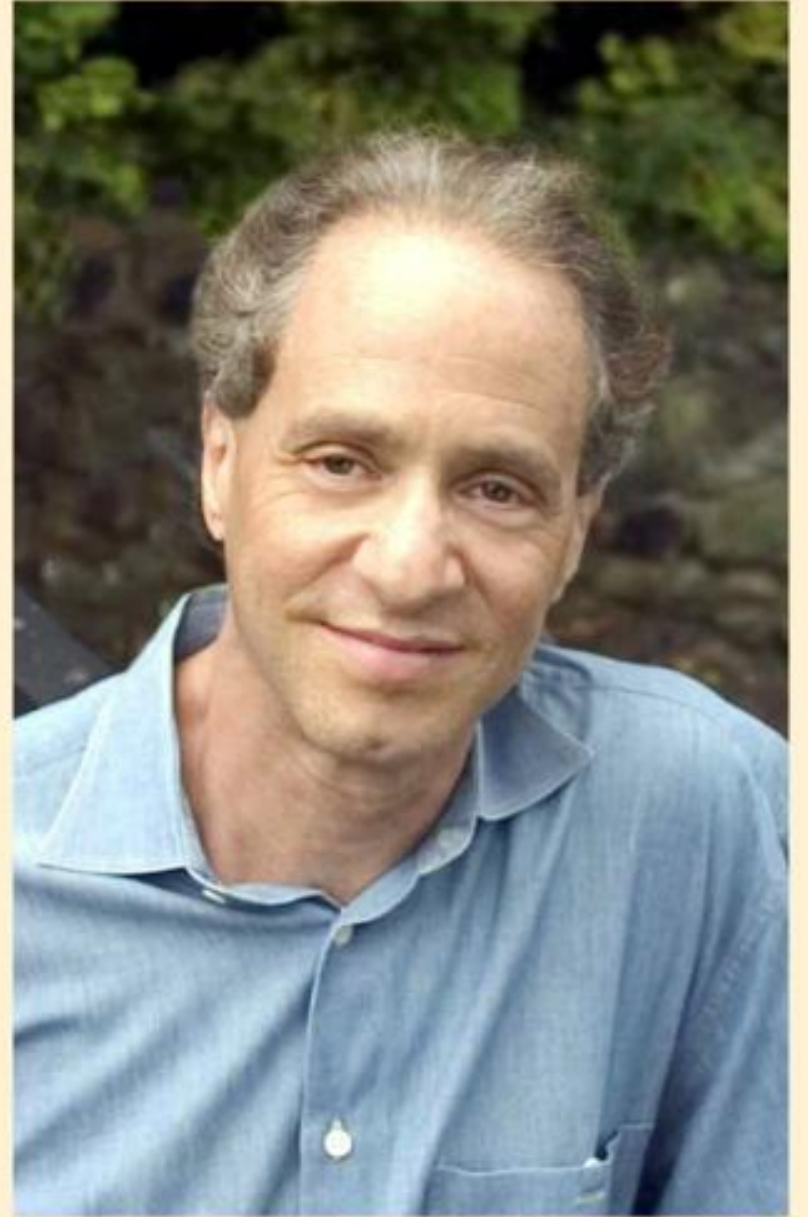
- **Social Constructivists** (Wight & Chapparo perhaps) might tell us that the absence of physical space and connection will have had detrimental consequences on learning.
- Meanwhile Claxton (2021) discusses the three 'speeds' of education with his river analogy;
- Online preferences focus on 'visible' and 'tangible' (fast-moving), harder to include the attitude development (slow) which comes from in-class values and culture of learning

PATTERN-RECOGNITION

- According to a researcher at Cambridge University it doesn't matter in what order the letters in a word are, the only important thing is that the first and last letter be at the right place. The rest can be a total mess and you can still read it without problem.
 - Mlodinow, 2018.

RAY KURZWEIL

- Google's Director of Technology
- Pattern Recognition Theory of Mind (PRTM)
- Law of Accelerating Returns (LOAR)



THE NEOCORTEX

- 2.5mm deep layer of neurons on the surface of the brain
- Associated with all higher-level functions
- Accounts for 80% of the brain's size and weight



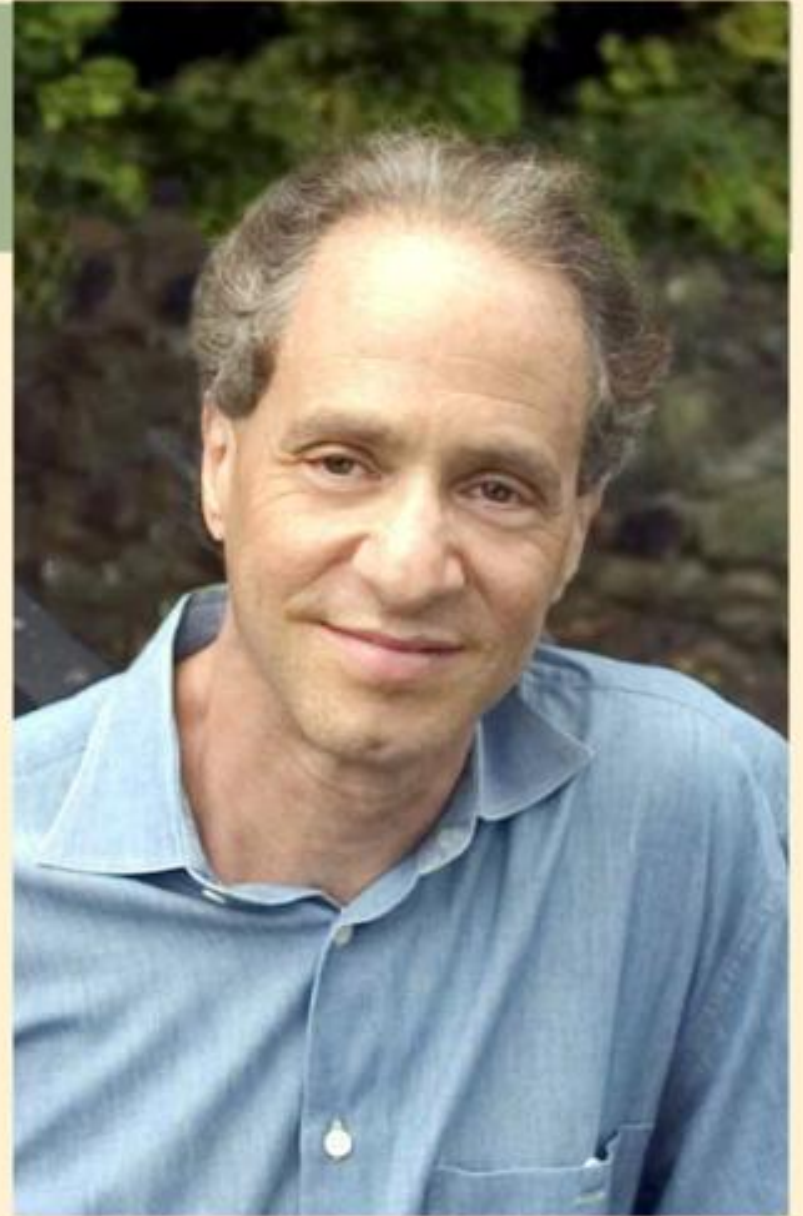
NEOCORTEX



- Six layers – I – VI
- Made-up of 'cortical columns' about 0.5mm wide, containing approx. 60,000 neurons
- 30Bn neurons in neocortex, connected via axons and dendrites

RAY KURZWEIL

- Brain is complex in the way a forest is complex, but we can understand the concept of 'forest' easier than the concept of 'tree'
- Cortical columns made-up of **pattern recognisers**, of about 100 neurons each, repeated many times
- 300,000,000 pattern recognisers in the Neocortex



HIERARCHIES

patterns, and the words are also patterns. Each of these patterns has a set of inputs, a process of pattern recognition (based on the inputs that take place in the module), and an output (which feeds to the next higher level of pattern recognizer).

Southwest to north-central connection:



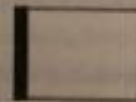
Southeast to north-central connection:



Horizontal crossbar:



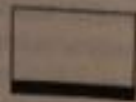
Leftmost vertical line:



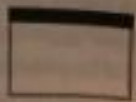
Concave region facing south:



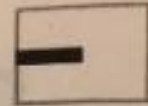
Bottom horizontal line:



Top horizontal line:



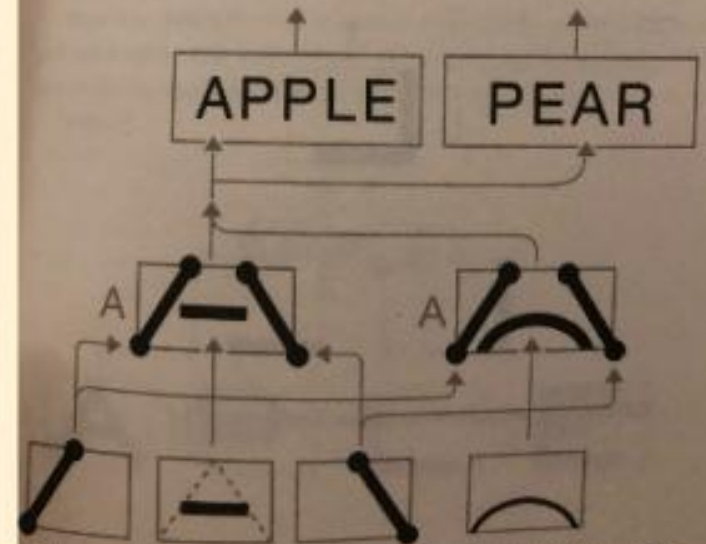
Middle horizontal line:



Loop constituting upper region:

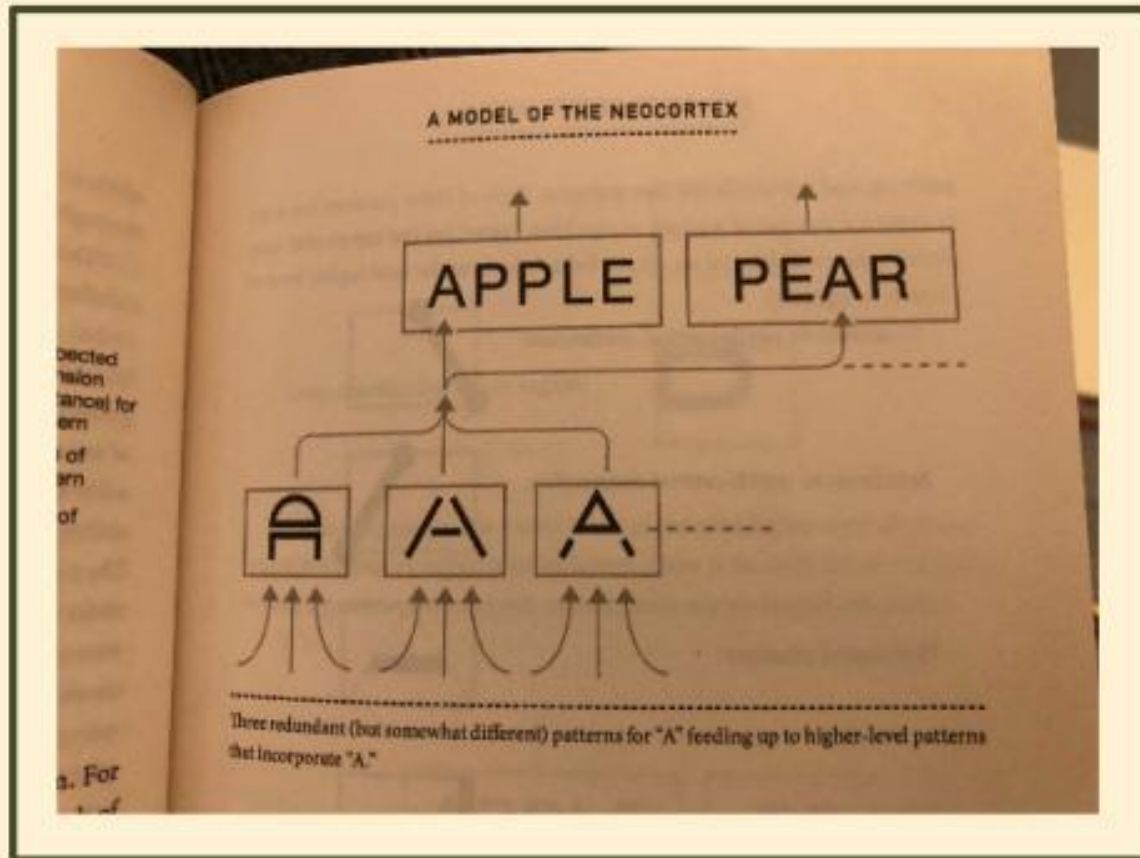


The above patterns are constituents of the next higher level of pattern, which is a category called printed letters (there is no such formal category within the neocortex, however; indeed, there are no formal categories). "A"



Two different patterns, either of which constitutes "A," and two different patterns at a higher level ("APPLE" and "PEAR") of which "A" is a part.

HIERARCHIES

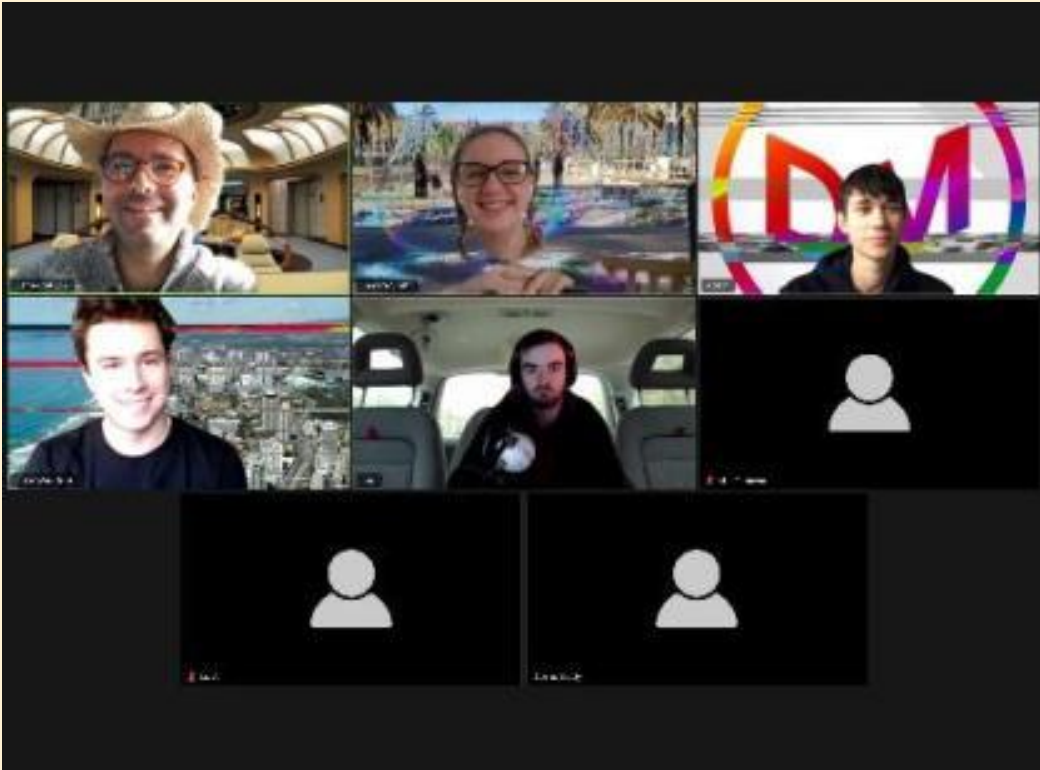


- Pattern recognisers operate within hierarchies
- A recognizer for each part of a letter
- One for the letter itself
- One for the application of the letter in a word
- One for the concept of the word etc. etc.

MEMORIES THROUGH PATTERNS

- Memories rely on pattern recognition in order to be triggered; the stronger a memory is 'wired' to stronger pattern recognition, the stronger it becomes.
- To me, Kurzweil's PRTM clearly reflects what those of us in education who are drawn to a Constructivist position will recognise
- Hierarchical and holarchic, systemic understanding through developed connections and schemas etc.

ONLINE PATTERNS?



- What does this suggest for our students who have been doing their best to learn online for a year?
- Firstly, their pattern recognition is likely to be heavily **visual**, so even if lectures have been text and verbal, visual cues may help transition back to in-class learning.