TCC Online Conference: Singularity Strategies for Learning

· SHAUN FOSTER

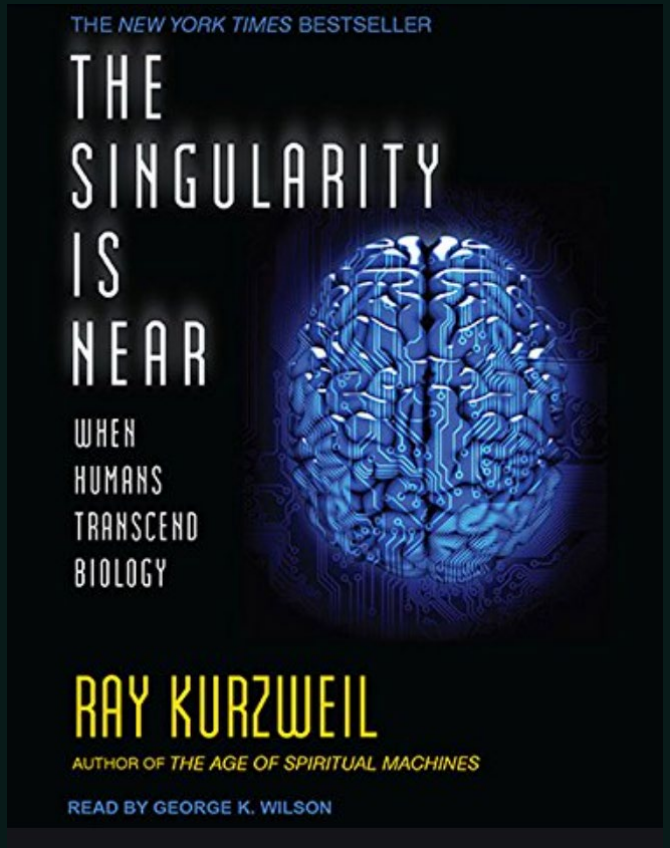
· DIRECTOR OF 3D DIGITAL DESIGN

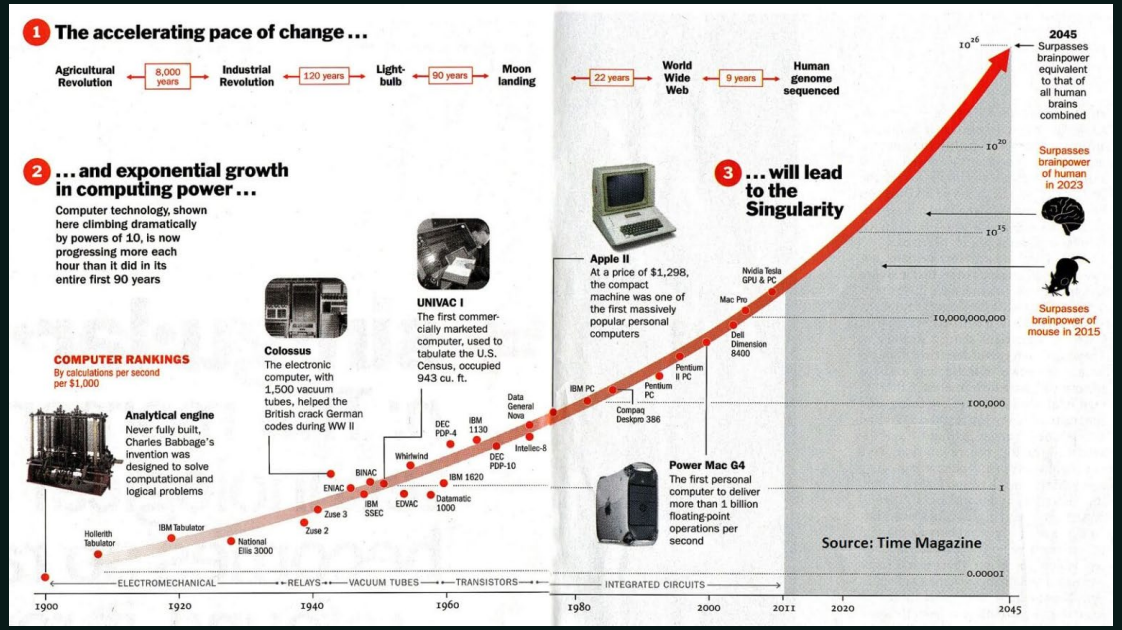
· ROCHESTER INSTITUTE OF TECHNOLOGY

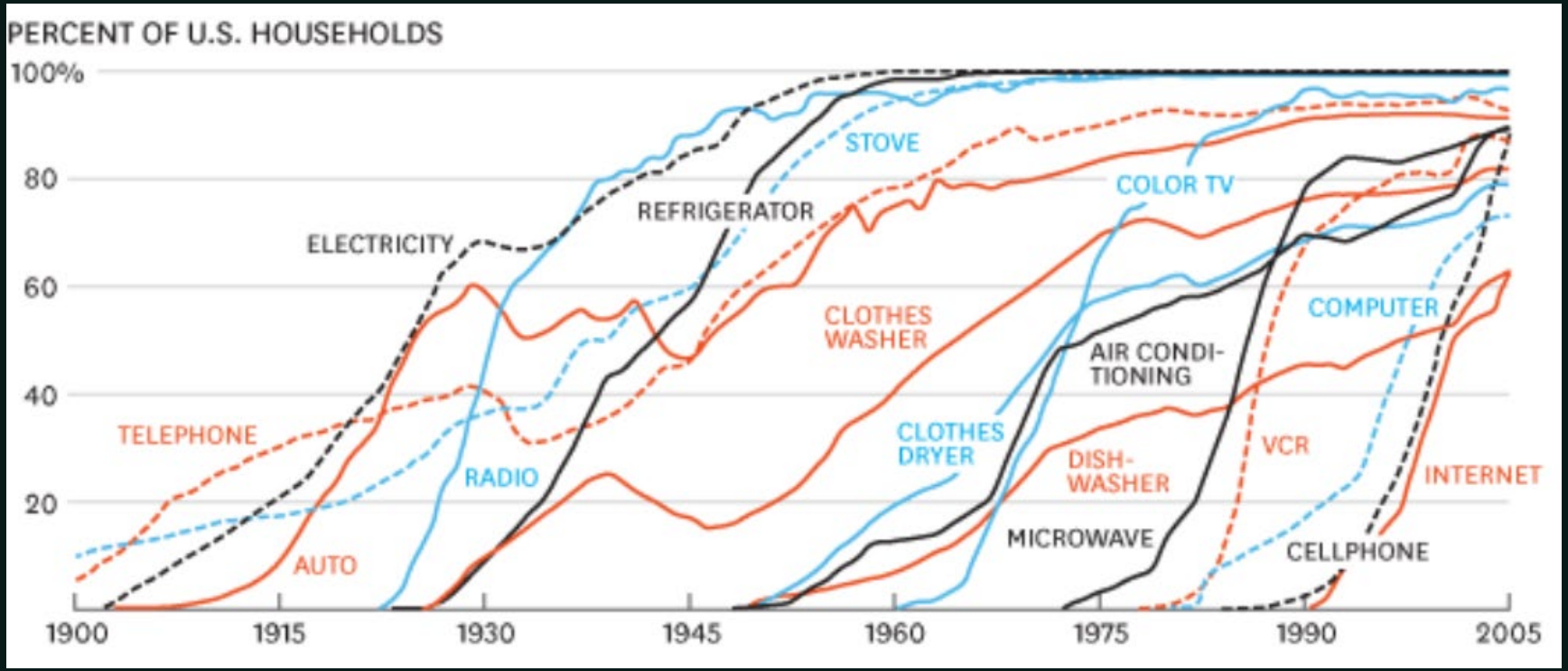
· APRIL 14, 2021

Overview

- Introduction
- “Singularity” emergent (defined)
- Knowledge Acceleration Implications
- “(some) New tools & technologies” (blend)
- Strategies & Mental Models

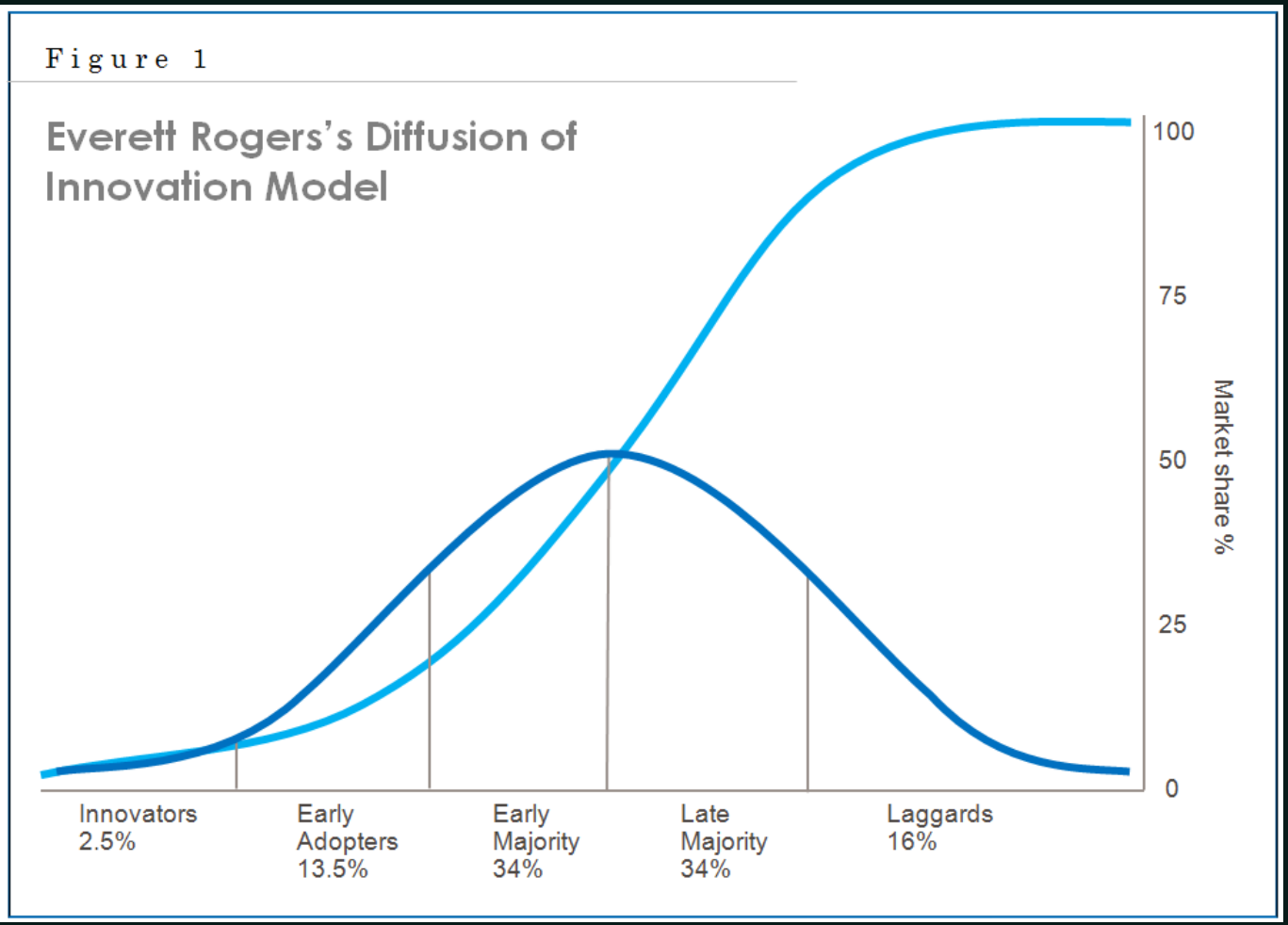

THE NEW YORK TIMES BESTSELLER
THE SINGULARITY IS NEAR
WHEN HUMANS TRANSCEND BIOLOGY
RAY KURZWEIL
AUTHOR OF THE AGE OF SPIRITUAL MACHINES
READ BY GEORGE K. WILSON


1 The accelerating pace of change ...
Agricultural Revolution
8,000 years
Industrial Revolution
120 years
Light-bulb
90 years
Moon landing
22 years
World Wide Web
9 years
Human genome sequenced
2 ... and exponential growth in computing power ...
Computer technology, shown here climbing dramatically by powers of 10, is now progressing more each hour than it did in its entire first 90 years
COMPUTER RANKINGS
By calculations per second per $1,000
Analytical engine
Never fully built, Charles Babbage's invention was designed to solve computational and logical problems
Colossus
The electronic computer, with 1,500 vacuum tubes, helped the British crack German codes during WW II
UNIVAC I
The first commercially marketed computer, used to tabulate the U.S. Census, occupied 943 cu. ft.
3 ... will lead to the Singularity
Apple II
At a price of $1,298, the compact machine was one of the first massively popular personal computers
Power Mac G4
The first personal computer to deliver more than 1 billion floating-point operations per second
2045
Surpasses brainpower equivalent to that of all human brains combined
Surpasses brainpower of human in 2023
Surpasses brainpower of mouse in 2015
Source: Time Magazine
Hollerith Tabulator
IBM Tabulator
National Ellis 3000
Zuse 2
Zuse 3
ENIAC
BINAC
IBM SSEC
EDVAC
Datamatic 1000
IBM 1620
Whirlwind
DEC PDP-4
IBM 1130
DEC PDP-10
Data General Nova
Intellec-8
IBM PC
Compaq Deskpro 386
Pentium PC
Pentium II PC
Dell Dimension 8400
Mac Pro
Nvidia Tesla GPU & PC
ELECTROMECHANICAL
RELAYS
VACUUM TUBES
TRANSISTORS
INTEGRATED CIRCUITS
1900
1920
1940
1960
1980
2000
2011
2020
2045
10^26
10^20
10^15
10,000,000,000
100,000
1
0.00001



Technology Adoption Curve(s)

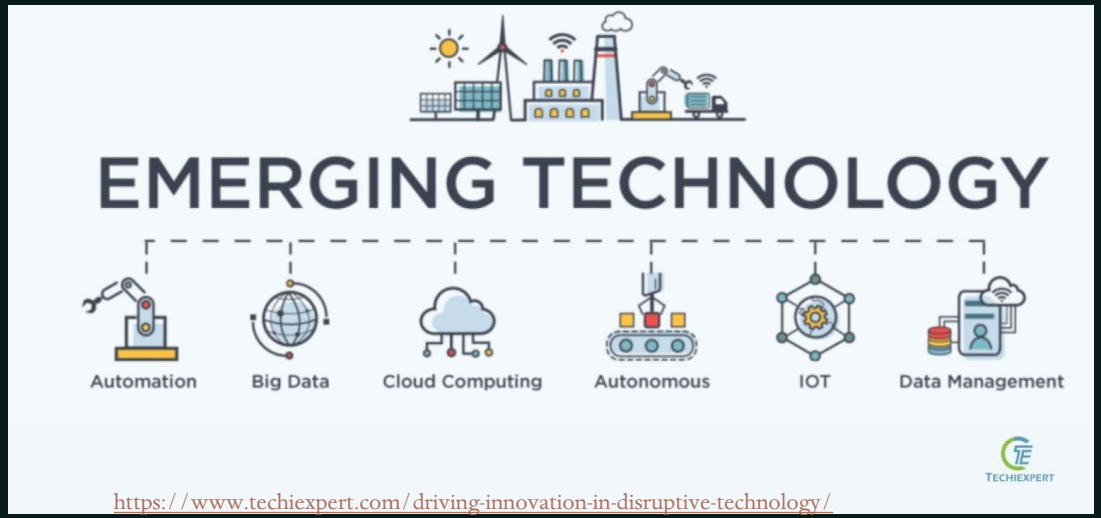
Figure 1


Everett Rogers's Diffusion of Innovation Model
100
75
50
25
0
Market share %
Innovators 2.5%
Early Adopters 13.5%
Early Majority 34%
Late Majority 34%
Laggards 16%

Accelerating Speed of Technology Driven Change

Linear / Incremental

Logarithmic / Disruptive



https://www.techiexpert.com/driving-innovation-in-disruptive-technology/

Half Life of Knowledge: Dealing with 2 questions:

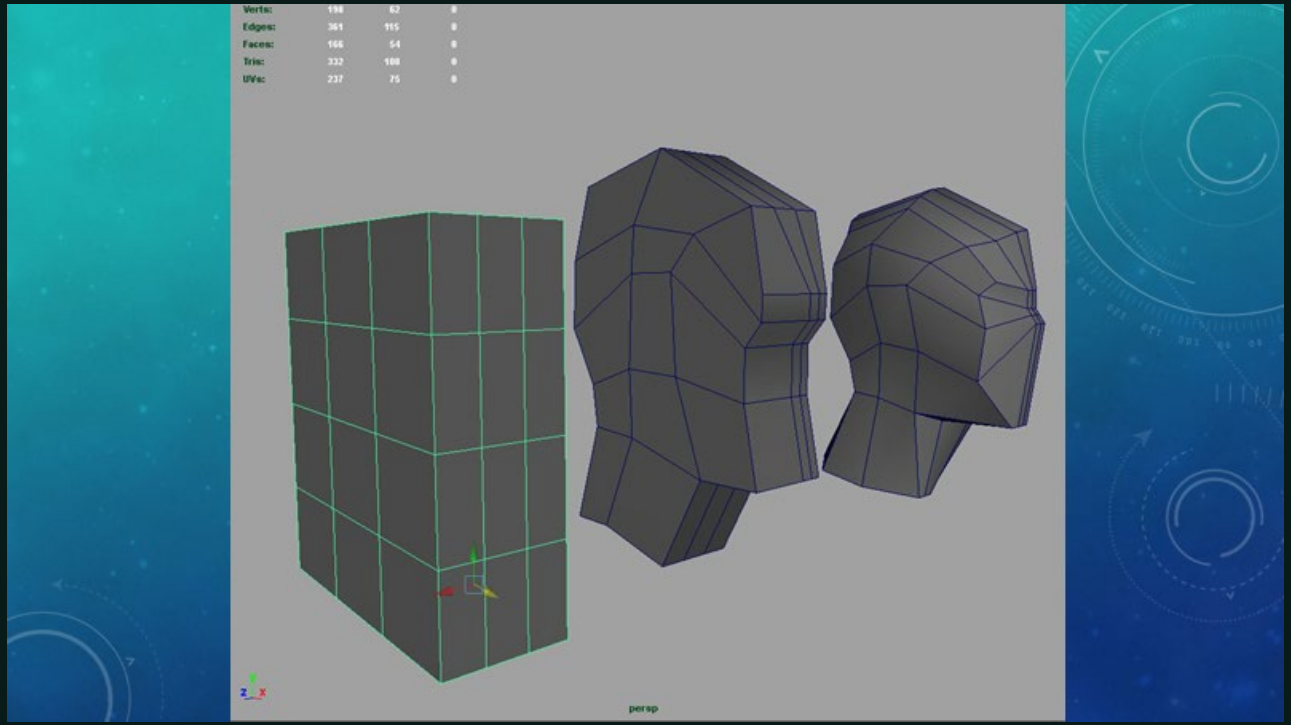
What is foundational?

- Deeper
- Broader

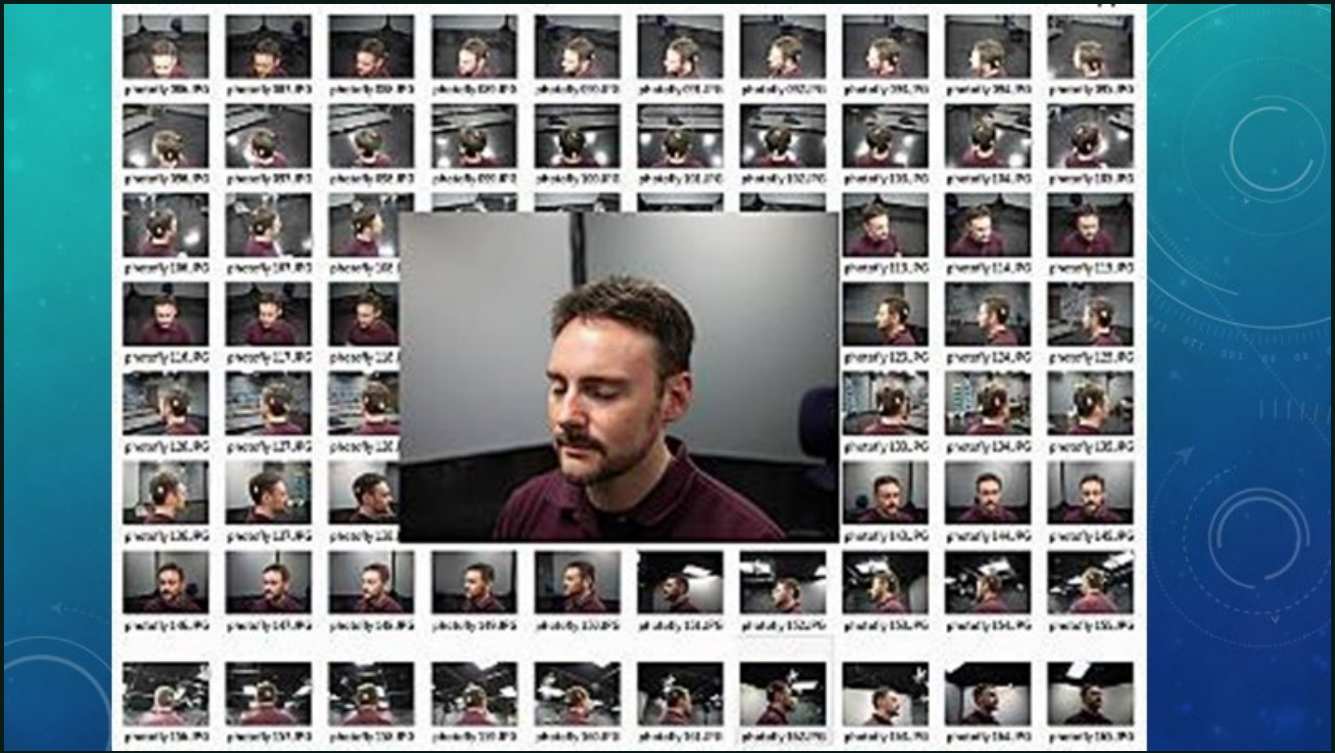
What skills are most important? (Are "soft skills" moving to the center?)

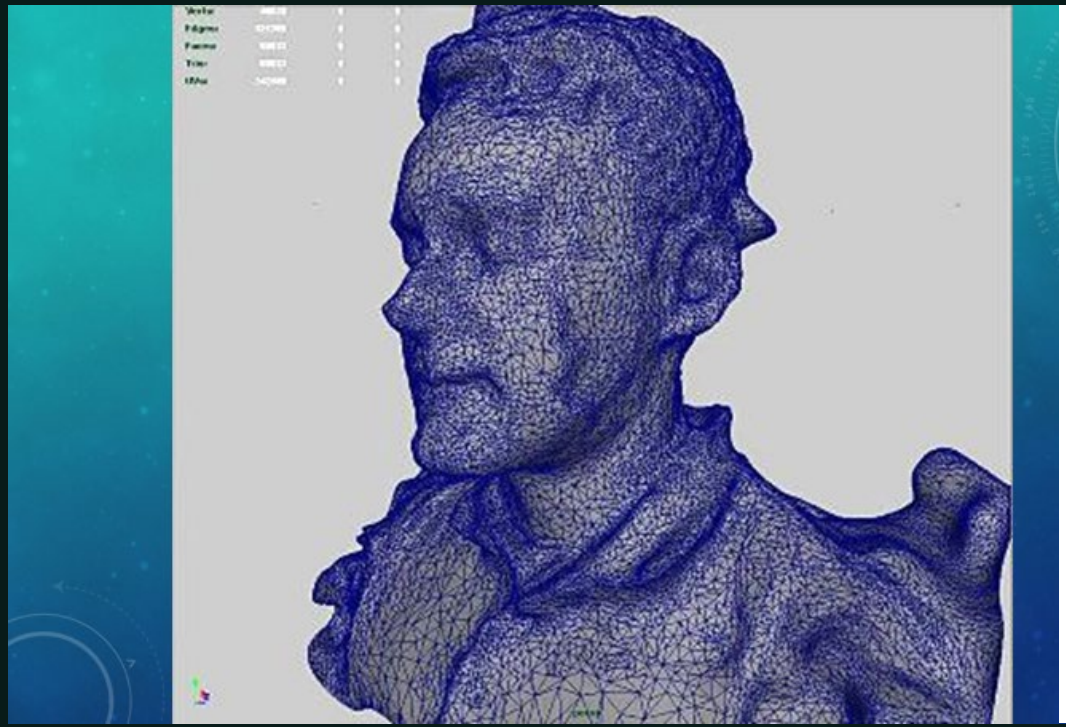
- Communication
- Critical Thinking

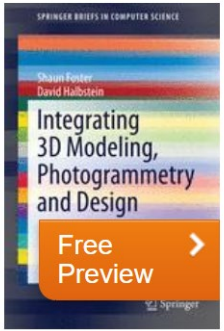
Personal Case Study:
3D Modeling, Photogrammetry & LiDAR



Pictures & Processing







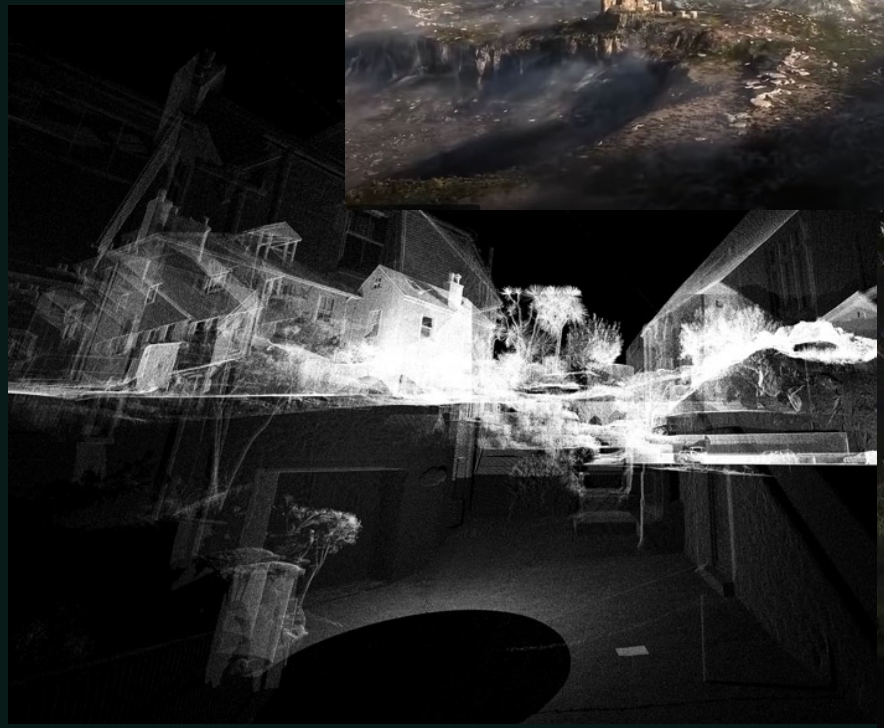
© 2014

Integrating 3D Modeling, Photogrammetry and Design

Authors: **Foster**, Shaun, **Halbstein**, David

iPad Pro (6/2020) / iPhone 12 (10/2020)

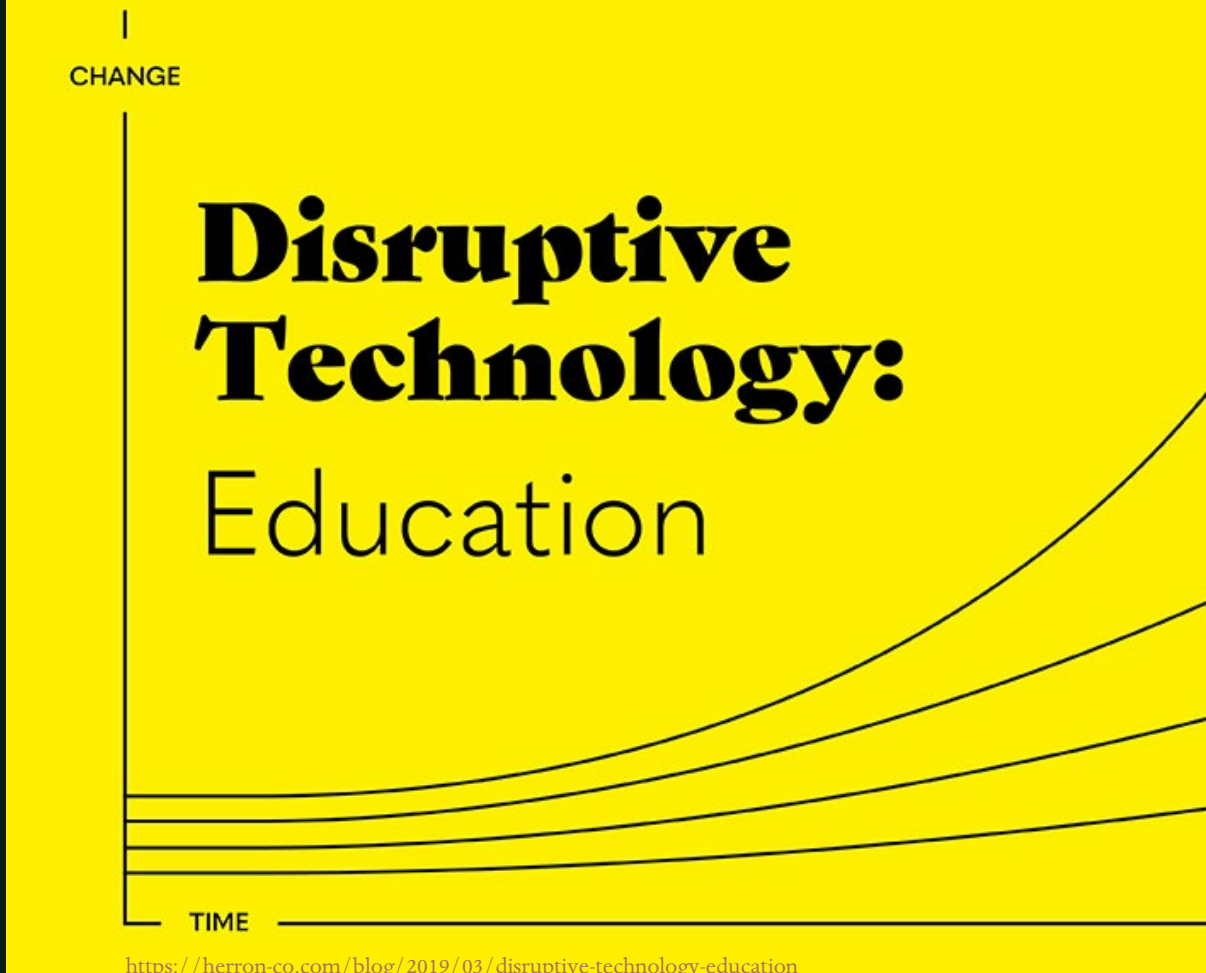
LiDAR



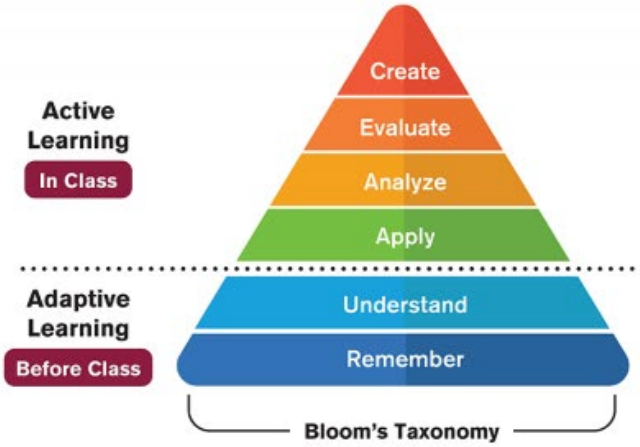
Game: *The Vanishing of Ethan Carter*

Herron & Co 1/2019:

- Adaptive Learning
- Massive open online courses (MOOCs)
- Minimally Invasive Education
  - TED: New experiments in self-teaching | Sugata Mitra



https://herron-co.com/blog/2019/03/disruptive-technology-education



Adaptive Learning

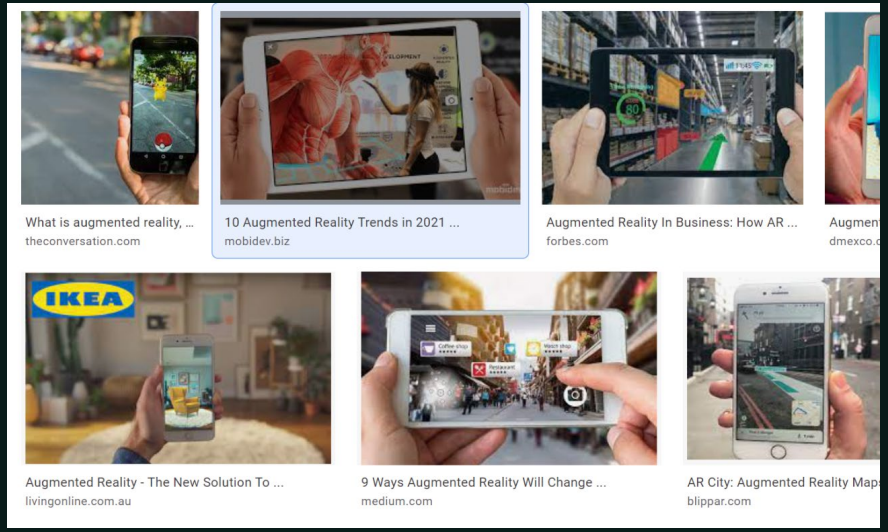
(gap filling - multi-pass learning)
AI driven Learning: "Adaptive Learning Algorithms"
Talk: Use Algorithms for Adaptive Education 11/2019 Squirrel AI Learning BKT / KST
Adaptive 3.0

https://news.asu.edu/20190820-solutions-asu-develops-world-first-adaptive-learning-biology-degree

New Interfaces: AR/VR

- Virtual Reality (VR)
- Augmented Reality (AR) Ai.R-Cord

Delivering Surgical Training 5x Faster with VR | Spotlight | Unreal Engine



Virtual Production / Mixed Reality

XR / VP

Mixed Reality (XR)

Virtual Production

Travis Scott and Fortnite Present: Astronomical
1:43 / 8:57

Emergent Interfaces

Virtual Reality (VR)

- Eye Tracking

Augmented Reality (AR)

- Face
- GIS
- Glasses

Mixed Reality (XR)

- Sensors and Feedback

Virtual Production

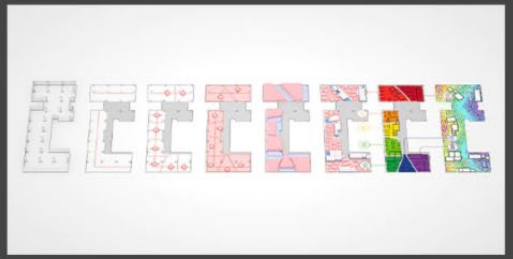
The world's most detailed globe
Launch Earth
Google Earth

Project “Anywhere”

AI Infused Tools: Generative Design, Optimization

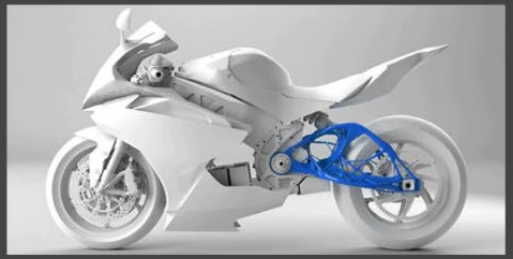
Nvidia Gau GAN

Benefits of generative design



Explore a wider range of design options

In the time you can create one idea, a computer can generate thousands, along with the data to prove which designs perform best.



Make impossible designs possible

Generative design lets you create optimized complex shapes and internal lattices. Some of these forms are impossible to make with traditional manufacturing methods. Instead, they're built using new additive manufacturing methods.

Optimize for materials and manufacturing methods

Set goals and parameters, and the software will create high-performing design options based on those constraints. The software resolves conflicting design constraints so you can focus on innovating.

Strategies & Mental Models

8 Shortcuts to Stay Relevant in Learning and Development 9/19

Engagement to Autonomy: Four Strategies for Face-to-Face or Online Learning in First-Year Experience Courses 6/2020

ACCELERATION PROBLEM:

MENTAL MODELS & METAPHORS

Interfaces

Deep vs Broad

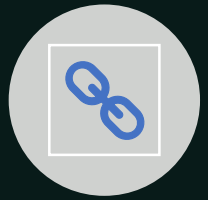
Prosthetic Knowledge

Branching systems & control

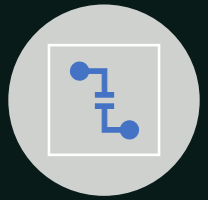
Surroundings & Flow Control

Knowledge Delivery Methods

VIDEO BASED LEARNING



HEAVILY HYPERLINKED



SYNCHRONOUS & ASYNCHRONOUS

SIMUL-CRITIQUES

LEARNING “TEAMS” (RESEARCH GROUPS)

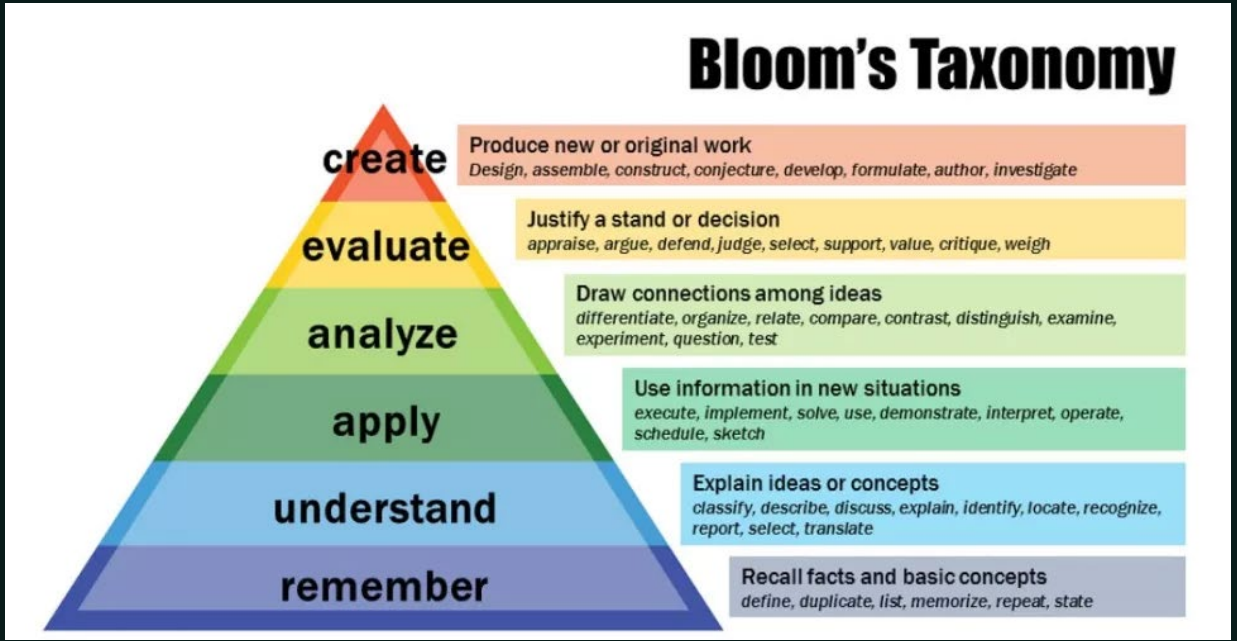
EDW “Experimental Design Workshops”

https://dynamind-elearning.com/change-sage-stage-guide-side

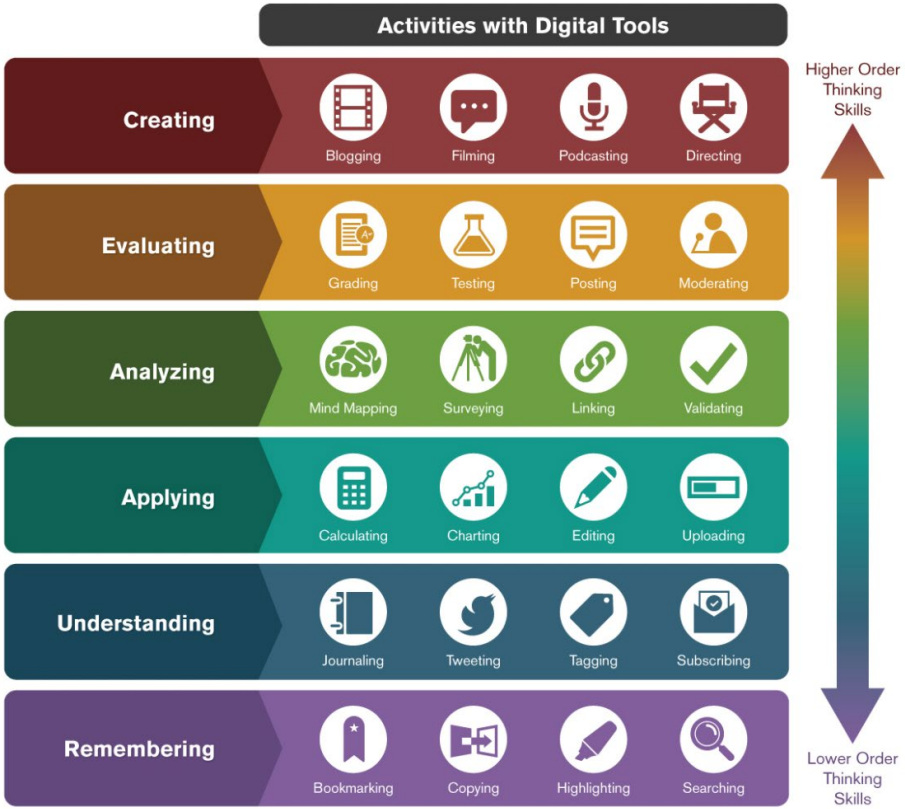
Changing Nature of “Teacher”

Knowledge Holder

- Hyperlink
- Inspirational
- Expectations
- Judge / Coach



Bloom's Digital Taxonomy

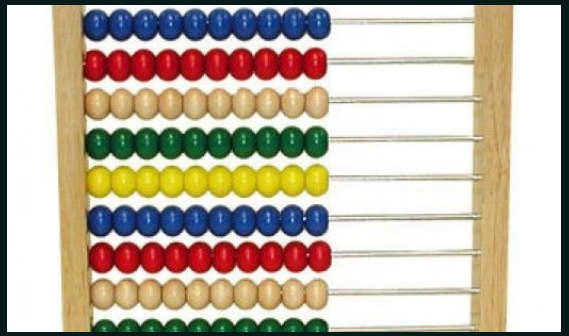


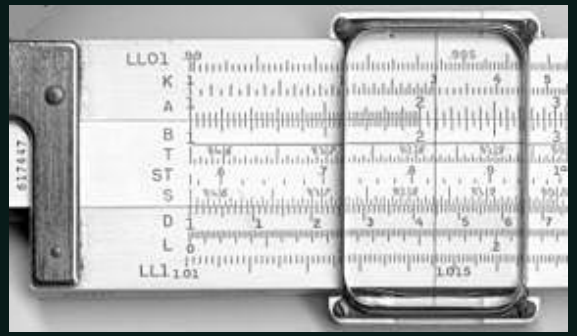
Infographic Credit: Ron Carranza

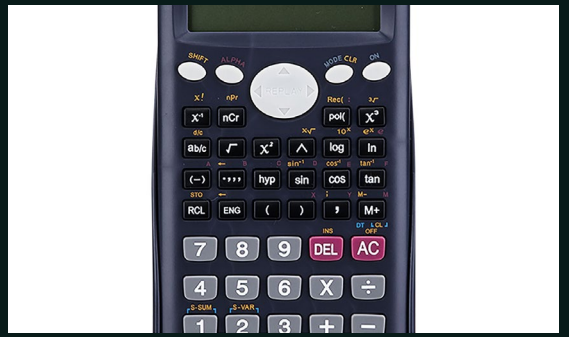
Abacus, Slide Rulers & Calculators

The abacus is a calculating tool that may be as old as 2700–2300 BC. It has been used for centuries and is still widely used by merchants, traders, and clerks in Asia, Africa, and elsewhere.

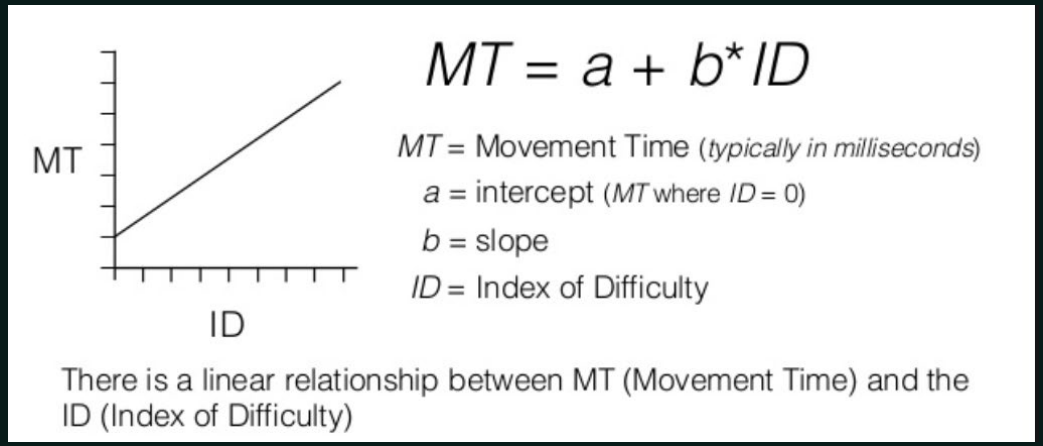
https://wehavekids.com/education/How-to-teach-Abacus-to-kids

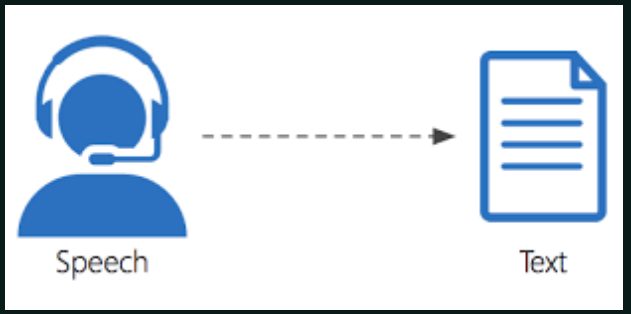


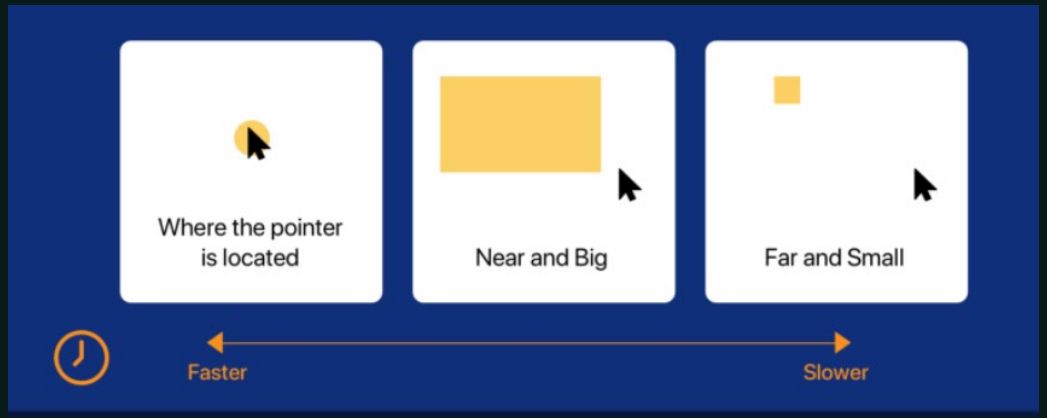


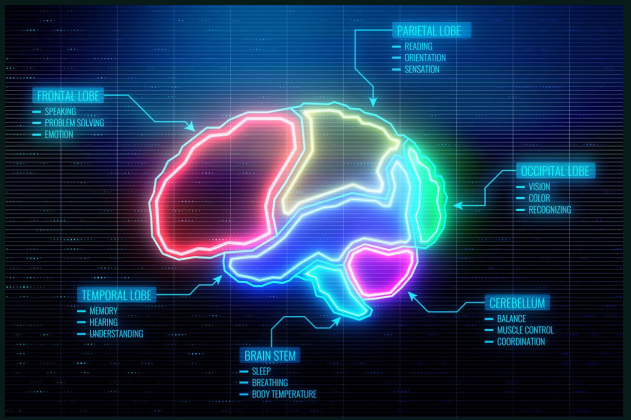


Interfaces: Fitt's Law & Achieving Acceleration









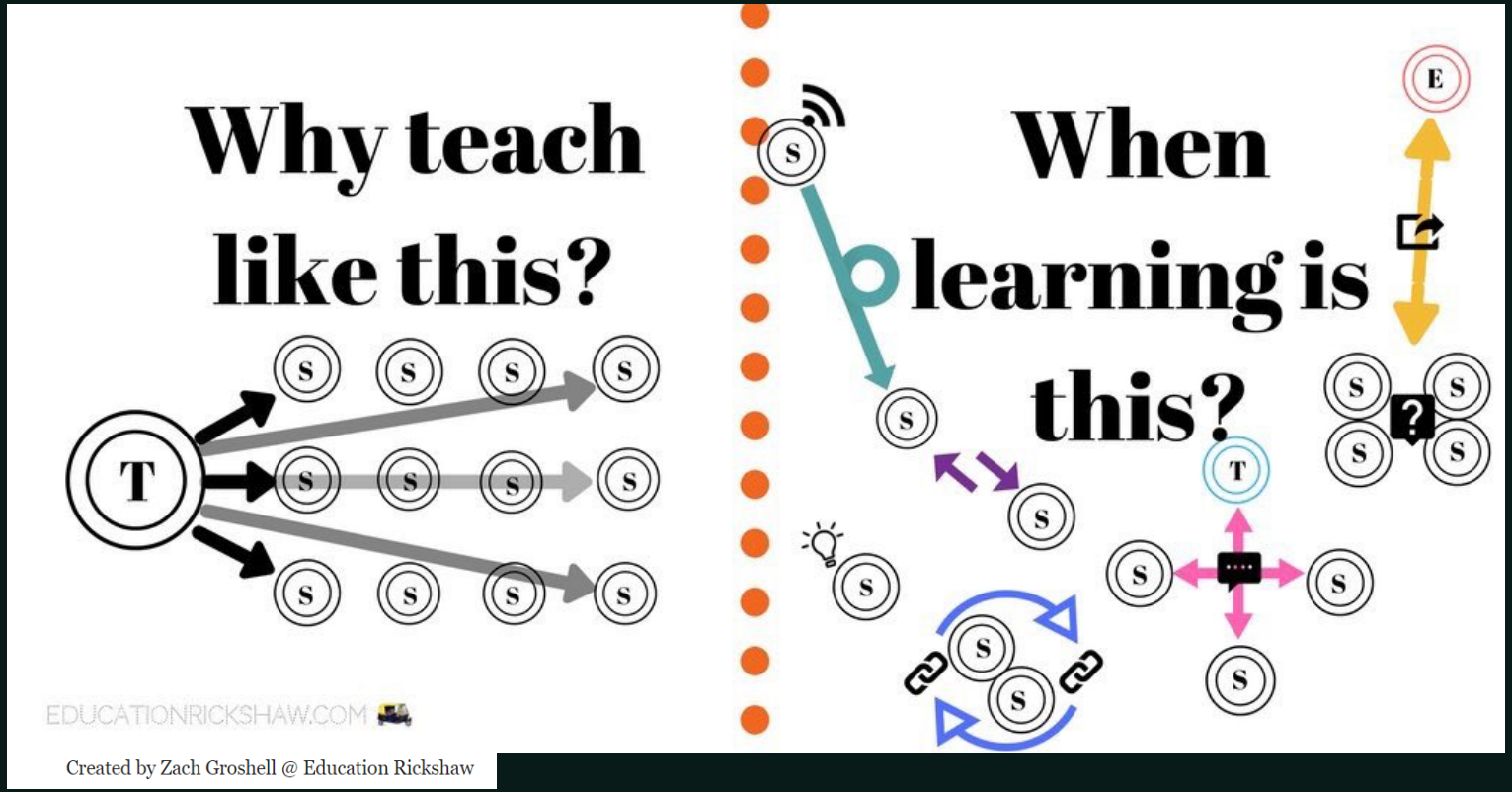
Going

Beyond

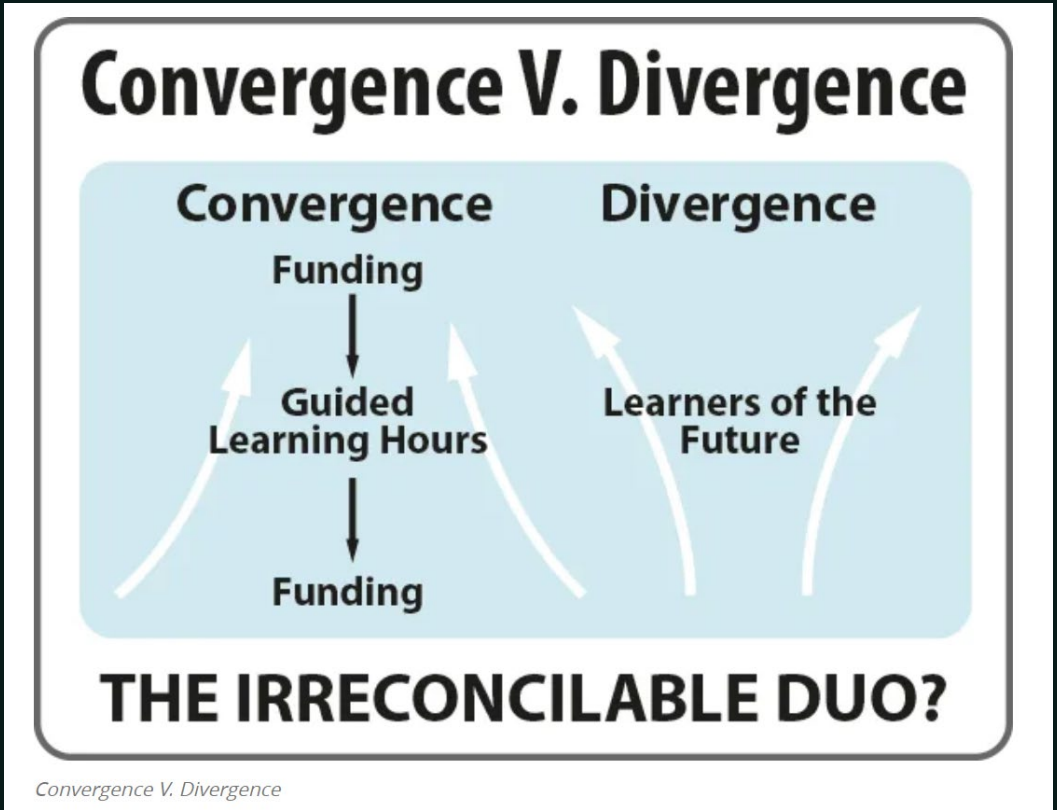
Above

Self referential

When and how do you switch your teaching?

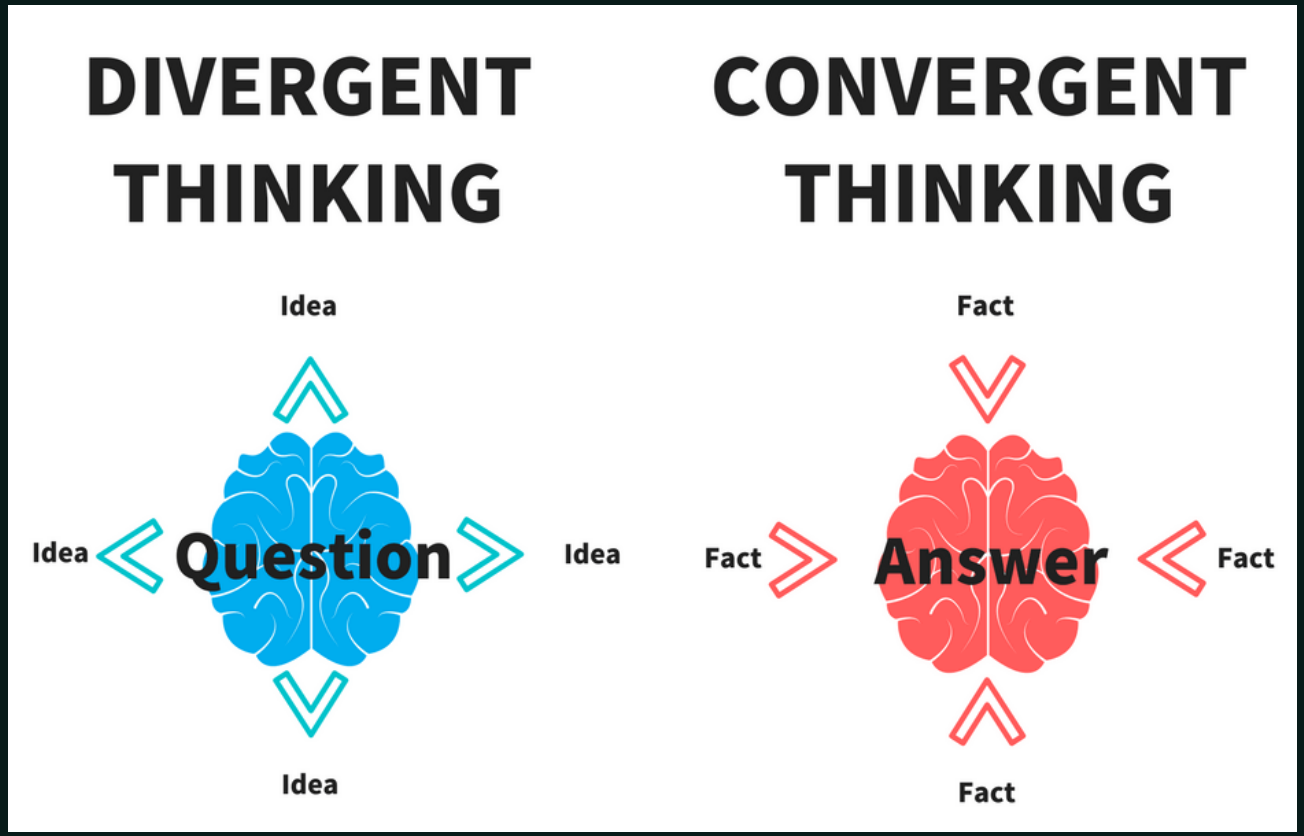


Understanding technology drives both



Convergence V. Divergence

Convergence & Divergence



Example:

Compass over Maps

Strategies: Optimize Flow Control

Protections, Warm-up, Exercise, Cool-down

Turn off distractions

Interact with

test knowledge

Chunk Knowledge

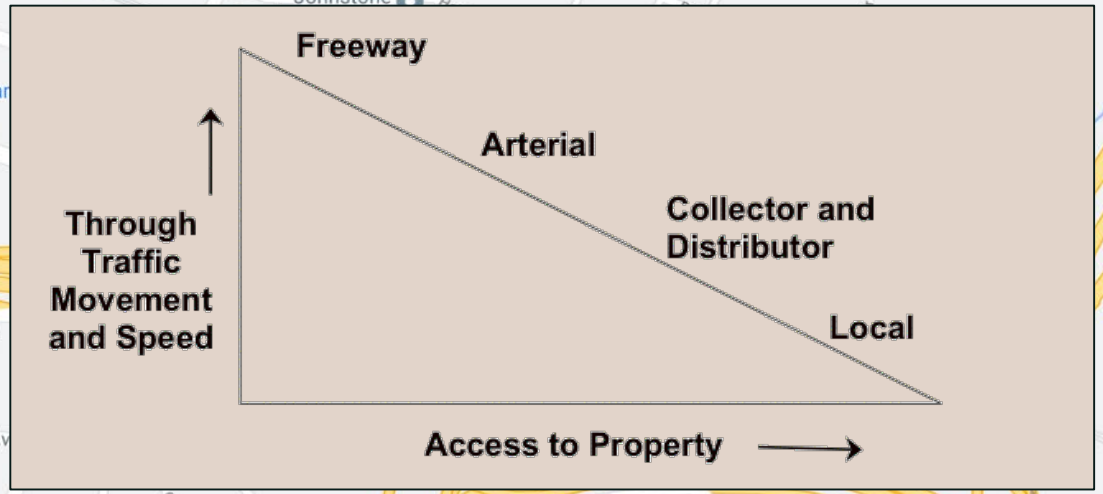
Repetition

23 Sites for Free Online Education, 2/2/2021

1. Coursera
2. Khan Academy
3. Open Culture Online Courses
4. Udemy
5. Lifehack Fast Track Class
6. Academic Earth
7. edX
8. Alison
9. iTunesU Free Courses
10. Stanford Online
11. Open Yale Courses
12. UC Berkeley Class Central
13. MIT OpenCourseWare
14. Carnegie Mellon Open Learning Initiative
15. Codecademy
16. Code
17. University of Oxford Podcasts
18. BBC Podcasts
19. TED-Ed
20. LessonPaths
21. Memrise
22. National Geographic Kids
23. Fun Brain

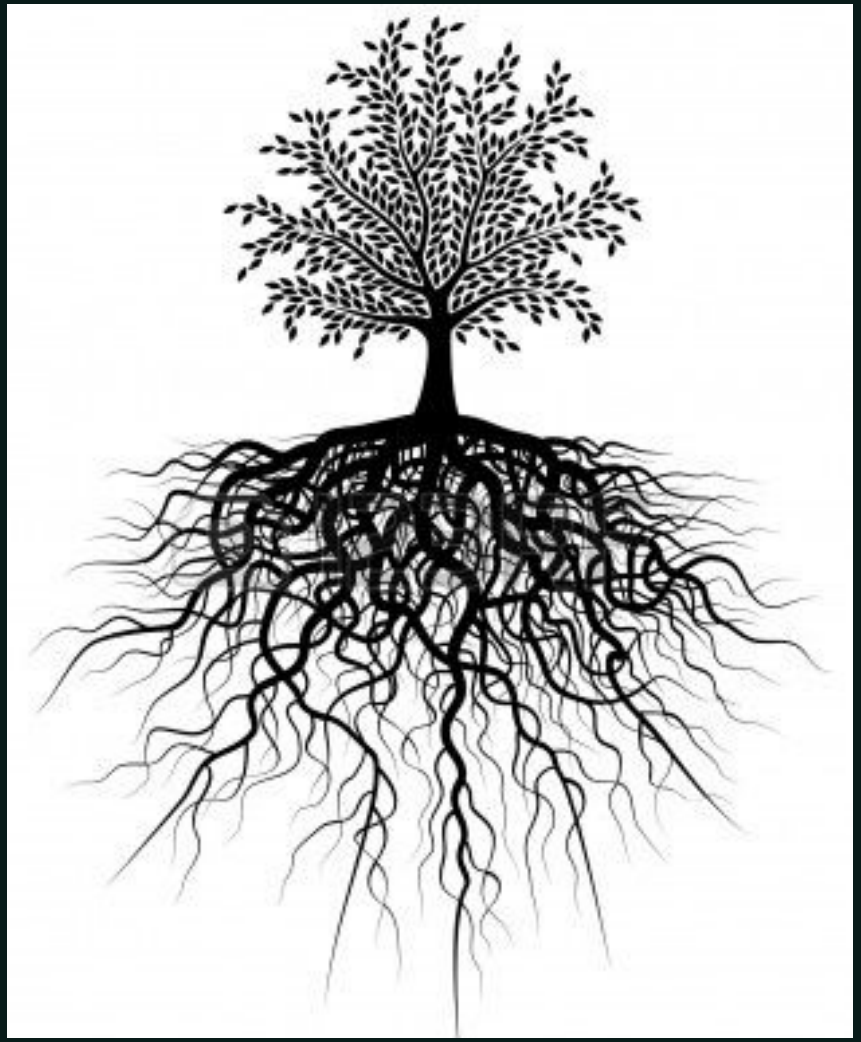
Highway vs Local roads (vectors & branching)

Hierarchy of Roads



Grass vs Sassafras

Rhizome vs Tree



Prosthetic knowledge

n. Information that a person does not know, but can access as needed using technology.

Aimee Mullins talks about her prosthetic legs

Advantage: JIT information
Disadvantage: Not Integrated
ST vs LT Knowledge

Biology is the new digital

The Age of Living Machines: How the Convergence of Biology and Engineering Will Build the Next Technology Revolution
By: Susan Hockfield

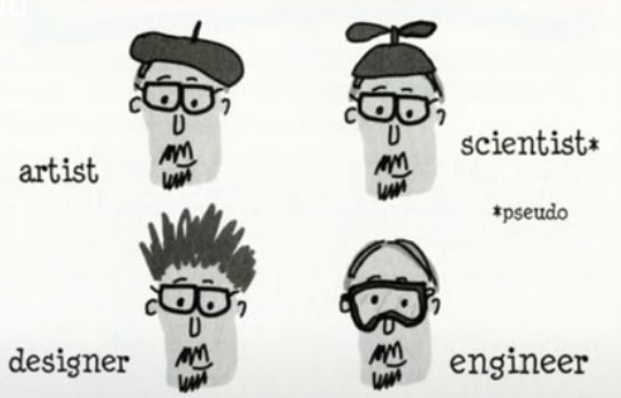
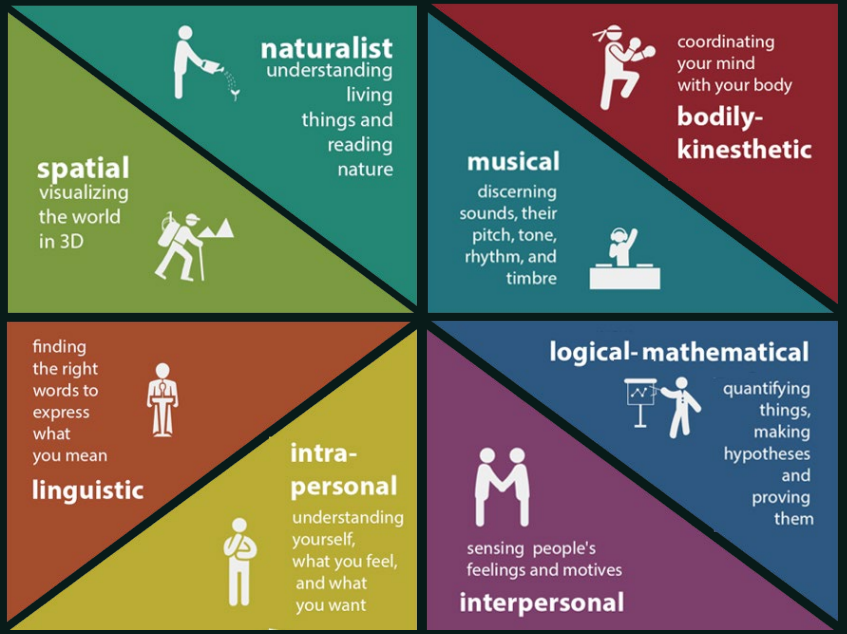


Image: Rich Gold

Multimodal knowledge flows

Howard Gardner Theories of Multiple Intelligences.



Professor Nan B. Adams argues that based on Gardner's definition of multiple intelligences, **digital intelligence** – a **meta-intelligence** composed of many other identified intelligences and stemmed from human interactions with digital computers – now exists.

Organizational: Advantages / Disadvantages

Transform when possible

Upstream manage

Flow around

My Rule of 3

Teaching & Learning should benefit

- Open Community
- My Students
- Myself

Summary & Questions

Covered:

- “Singularity”
- Knowledge Acceleration Implications
- New and blending technologies
- Strategies, resources & mental models
- **Questions**