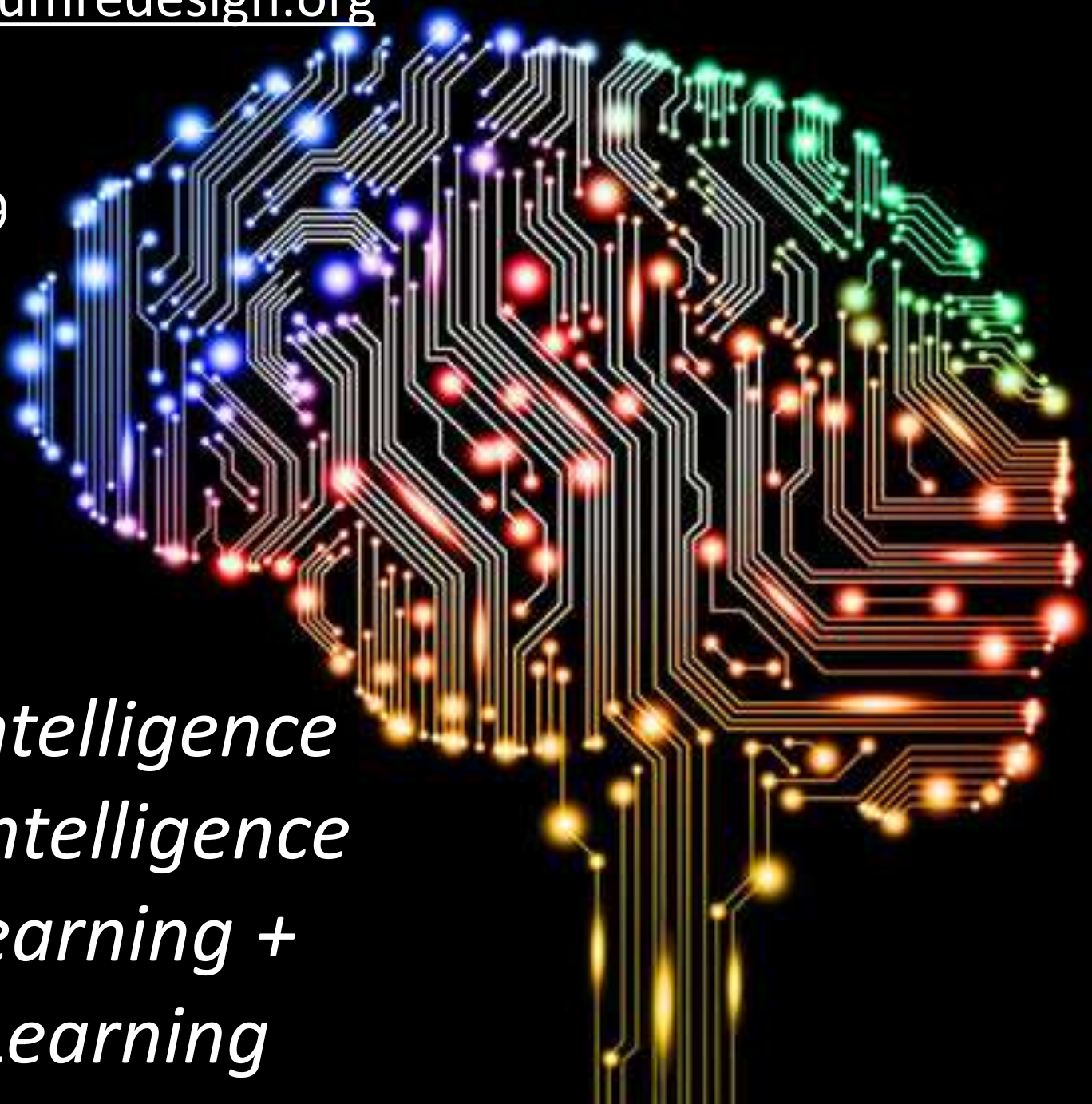
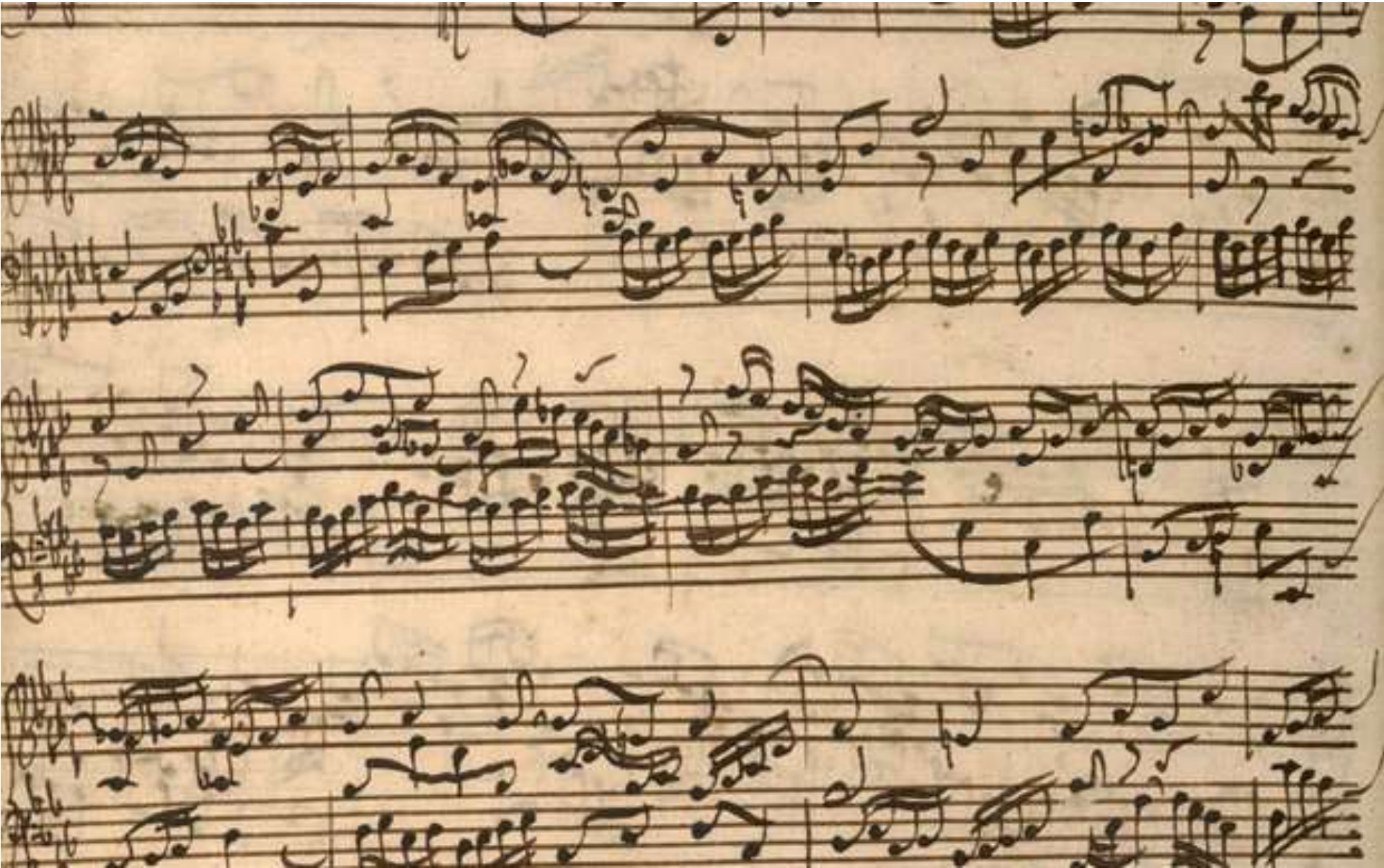
charles@curriculumredesign.org
@CurrRedesign
#4DEdu #AIED
October 25, 2019
AACC-ATE-NSF
Conference



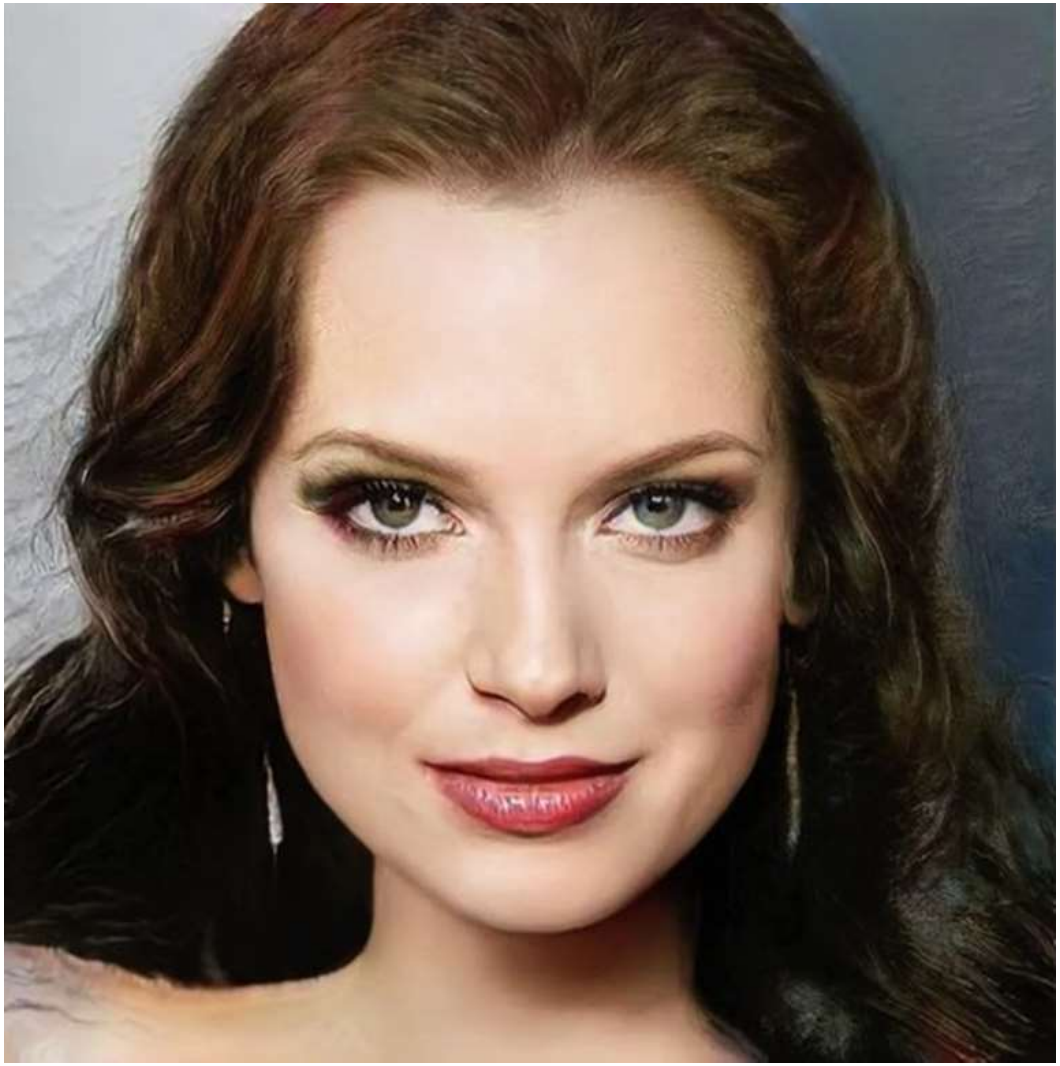
Artificial Intelligence
+ Human Intelligence
= Deep Learning +
Deeper Learning

Music exercise – Audio



A Classic

Name this Actress



Change in Profiles

Substitution:

- Traders: 600 down to… 2
- Computer scientists: +200
- + IT support

"We're headed for a world where you're either going to be able to write algorithms and speak that language or be replaced by algorithms…"

Bridgewater hedge fund billionaire Ray Dalio

Robust Jobs

Policy analysts
Statisticians
Physicists
Economists
Lab managers
Human resource
OH&S advisers
Financial brokers
Solicitors
Technical writers
Actuaries
Detectives
Psychologists
Market researchers
Journalists
School teachers
Programmers
Software engineers
Web developers
DB administrators
Web designers

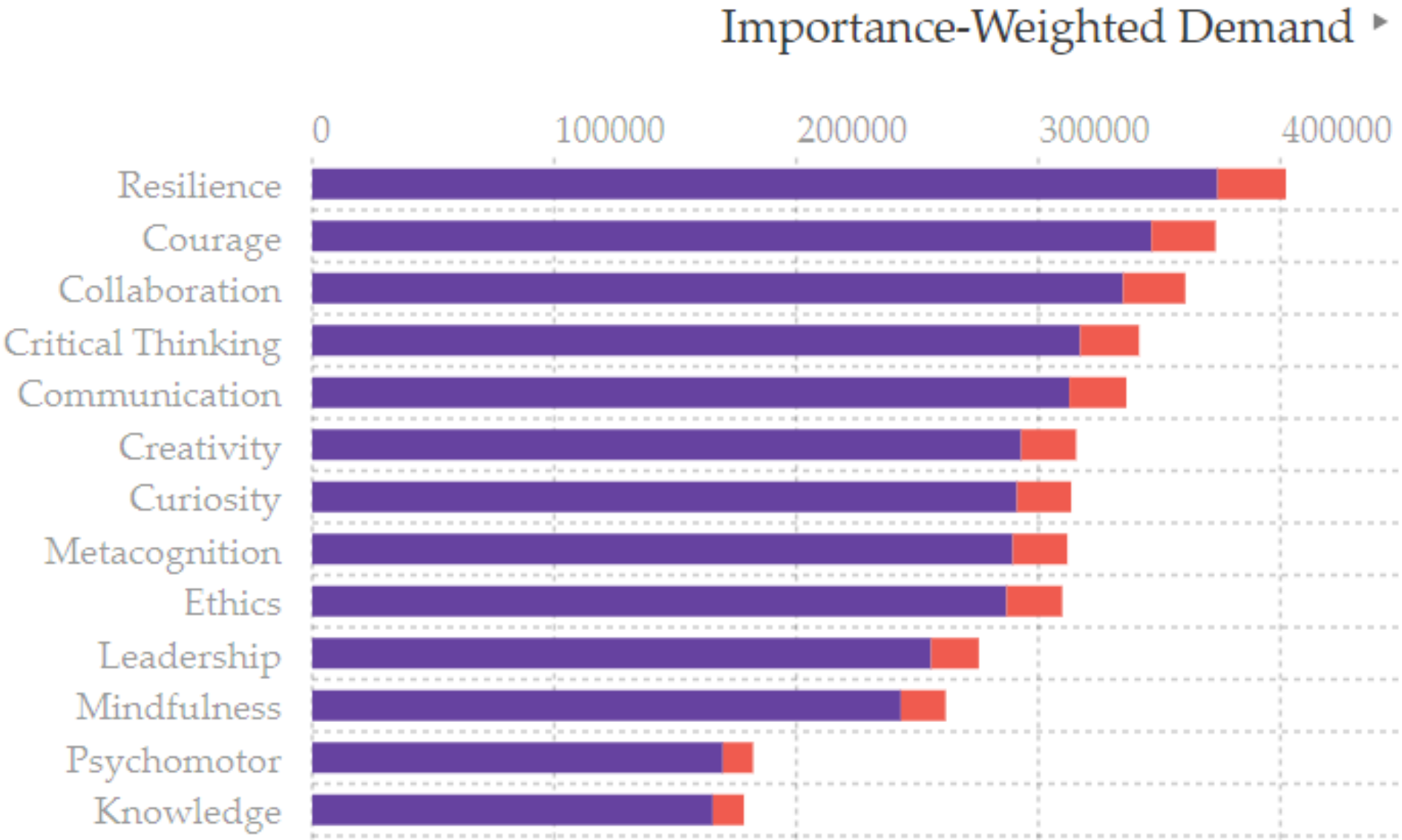
General practitioners
Nurses
Podiatrists
Dental technicians
Pharmacists
Veterinarians
Radiographers
Physiotherapists
Tour guides
Beauty therapists
Make-up artists
Community workers
Massage therapists
Cardiac technicians
Childcare workers
Special Ed teachers
Fitness instructors
Psychiatrists
Paramedics
Surgeons
Social workers

Emergence of New Jobs

Job	Pay level
App developer	*High*
Driverless car engineer	*High*
Cloud computing specialist	*High*
Big data analyst/data scientist	*High*
Social media manager	Medium
Sustainability manager	Medium
YouTube content creators	Medium
Millennial generational expert	Medium
Drone operators	Medium
Uber driver	Low

Source: World Economic Forum “Future of Jobs”

Occupations needs



Source: US O*NET and Bureau of Labor Statistics

The Power of Exponential Technologies

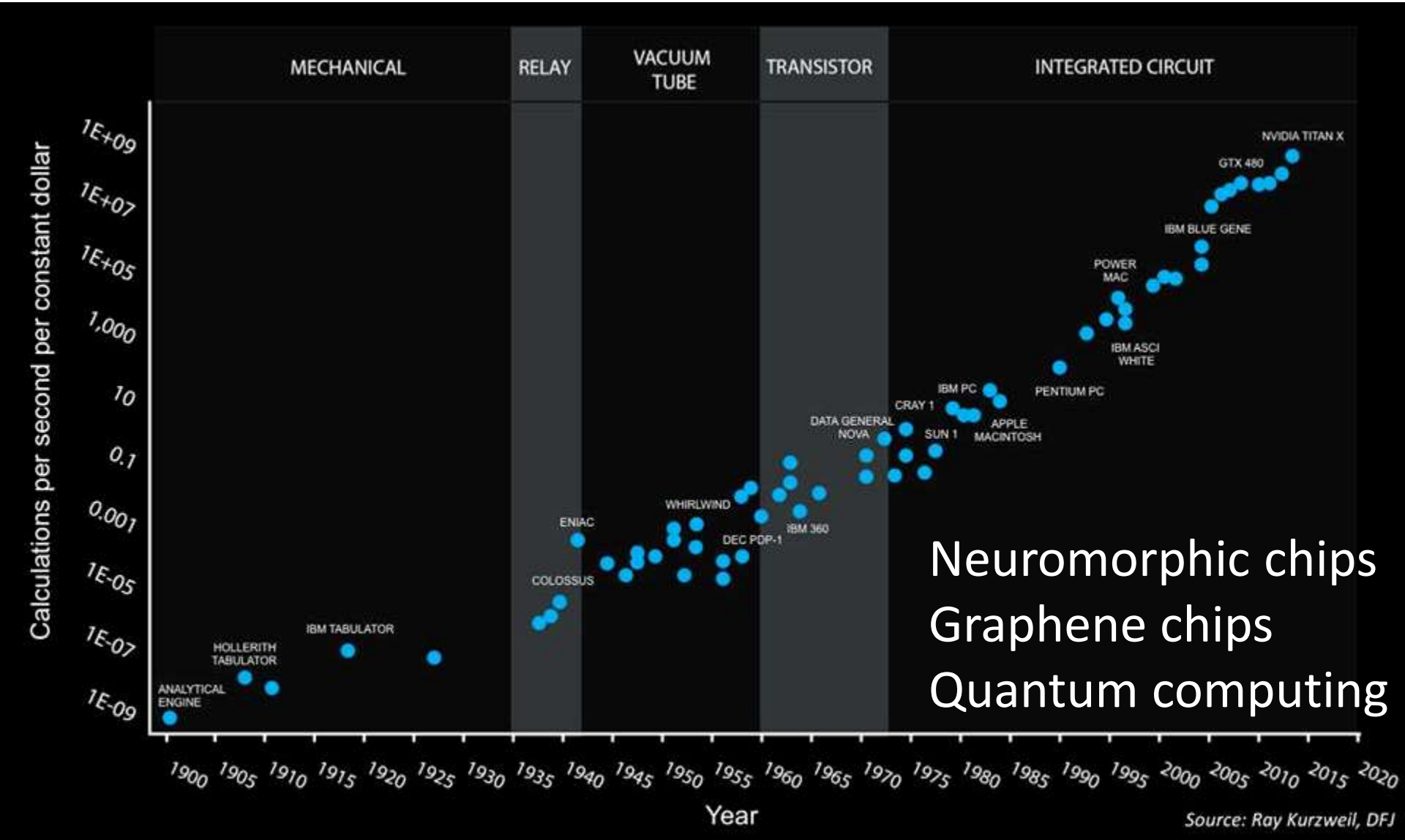
Million-fold improvement in 25 years

Neural Nets:

1988: 3 layers

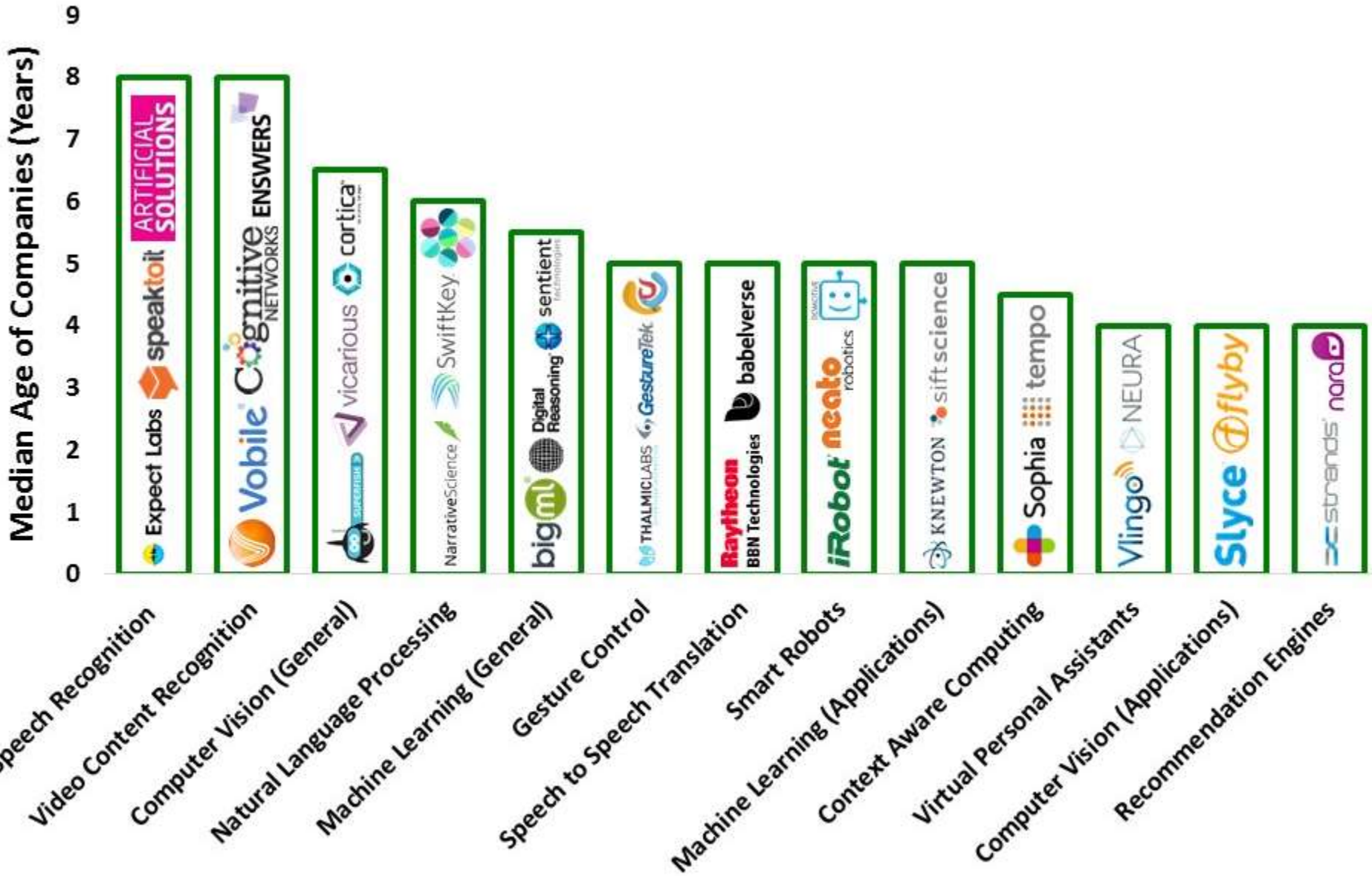
2018: 50+ layers

On the road to ExoBrain



Neuromorphic chips
Graphene chips
Quantum computing

Artificial Intelligence applied everywhere



Cartoon to reality in six years

Magically schedule meetings

That's us. That's all we think about.

https://x.ai/about/

Artistic Style Transfer

X

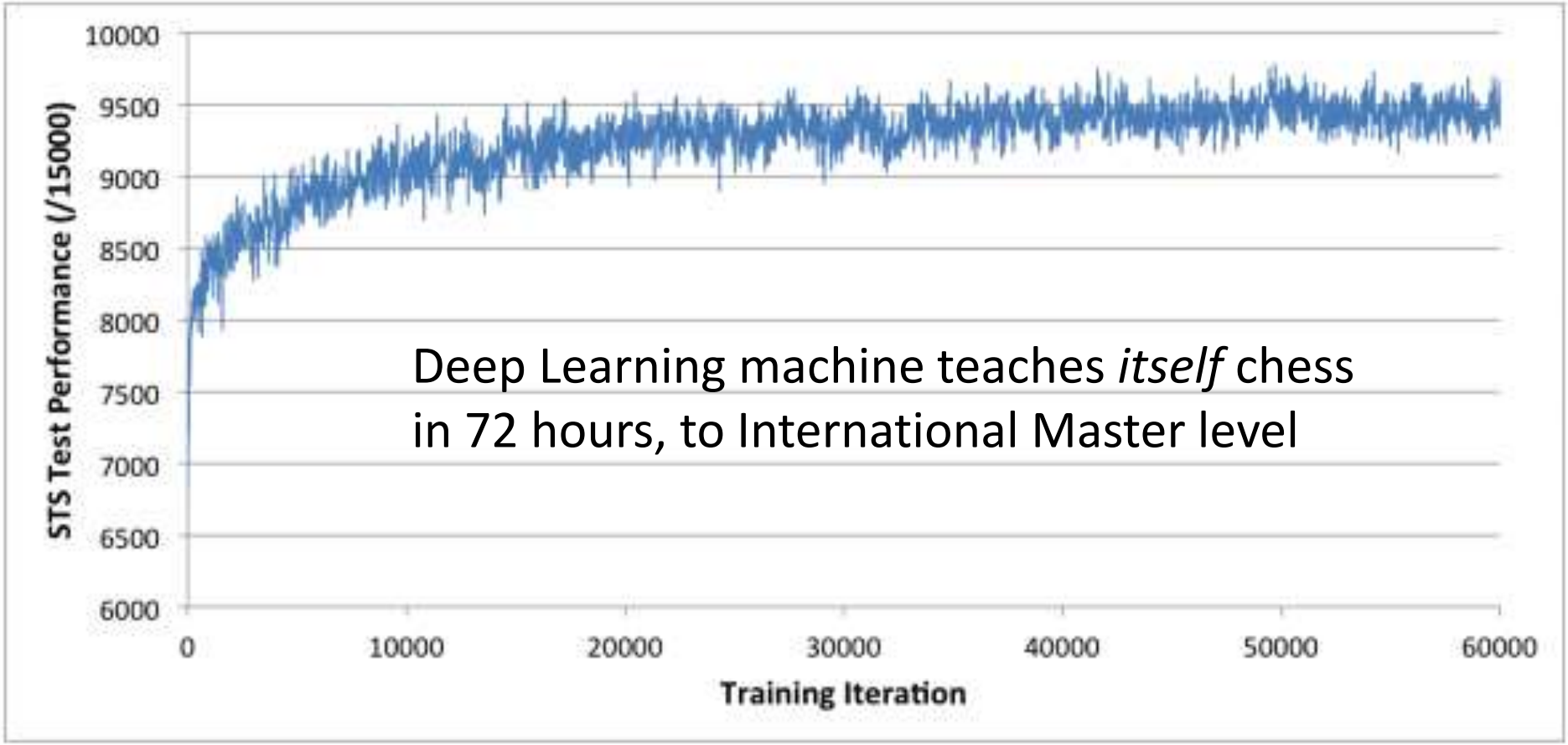
=

X

=

Learn by itself/from each other

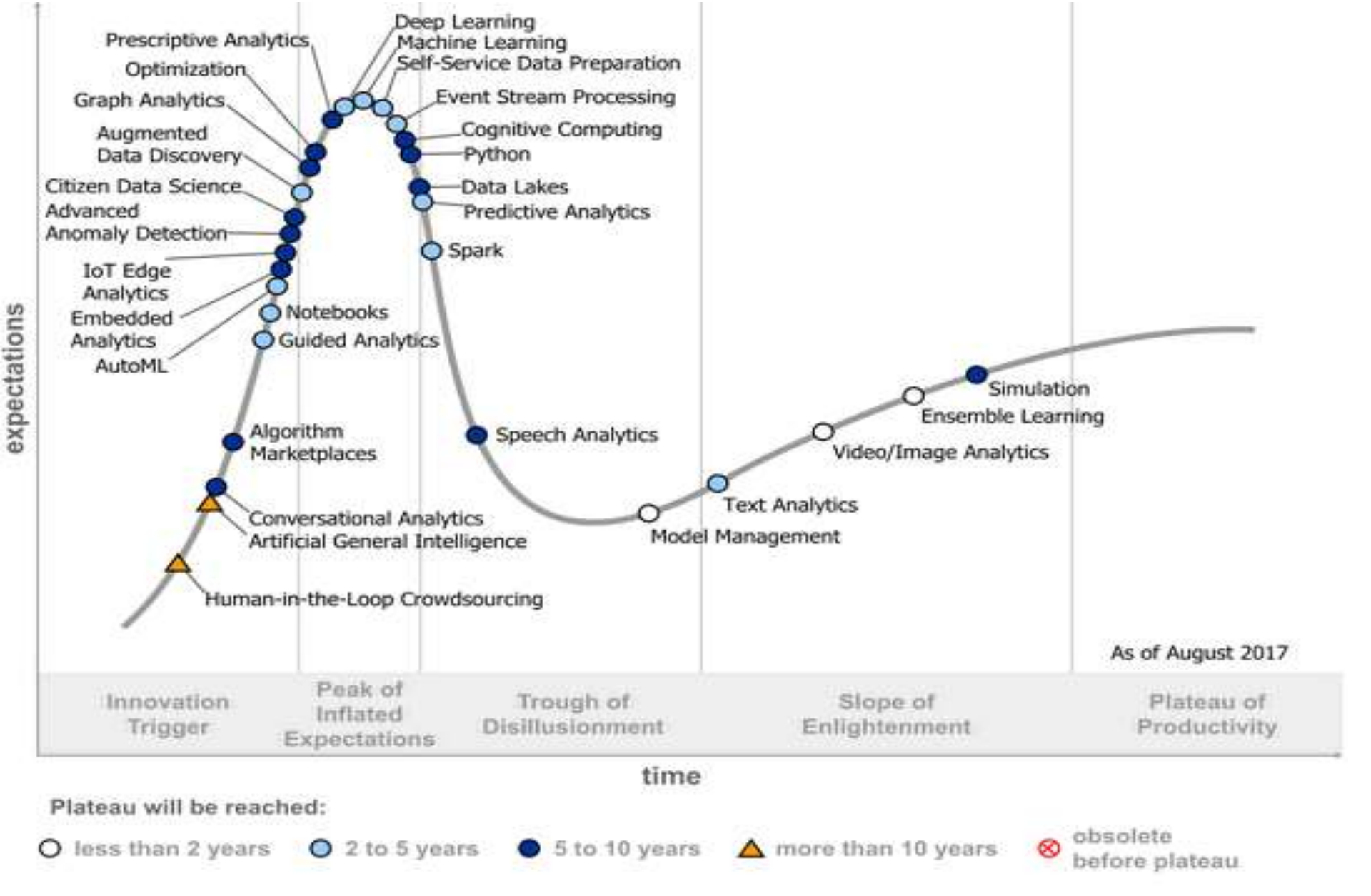
→ *Hyperbolic Progression*



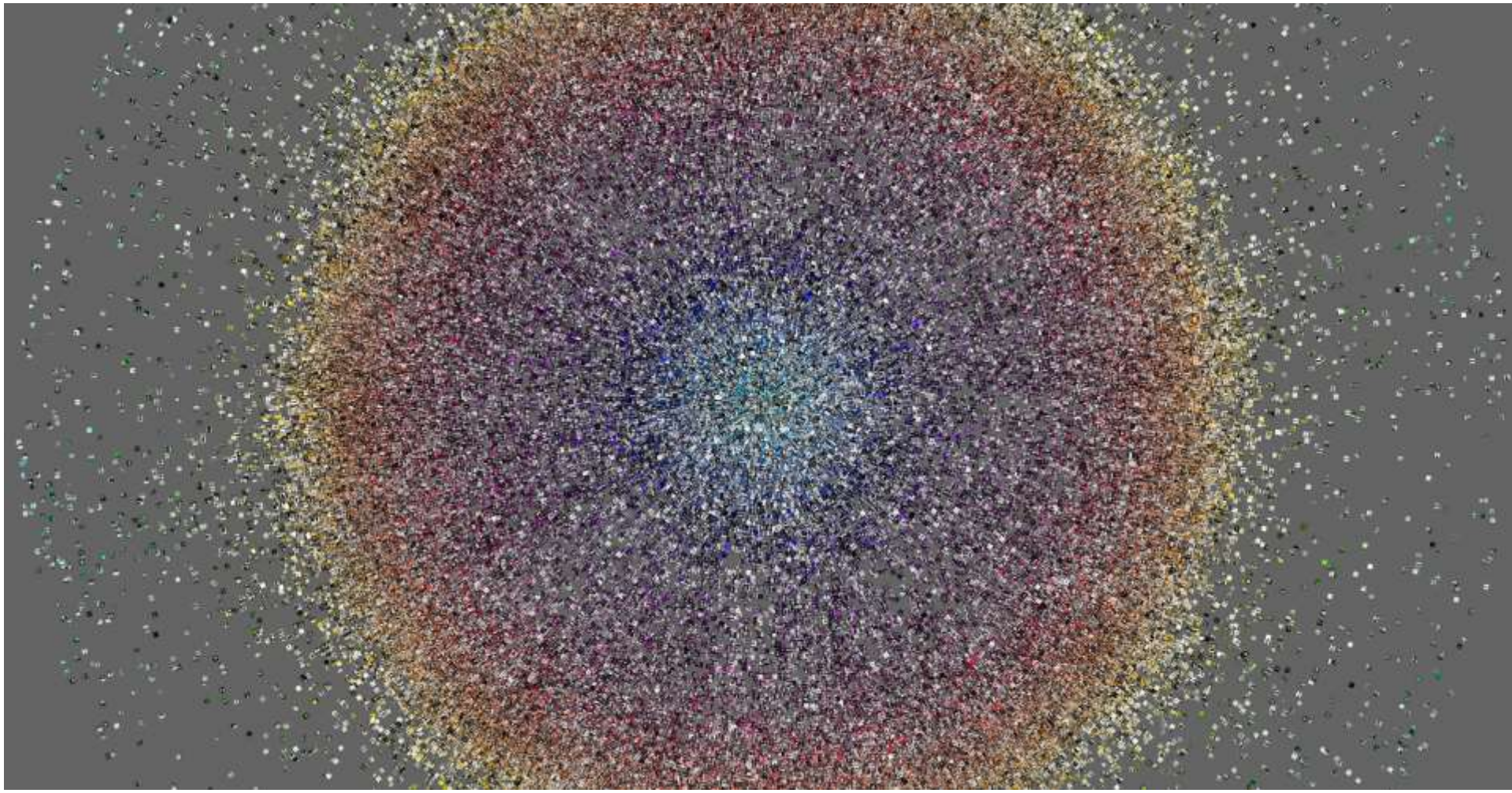
And Rubik's cube:

https://www.youtube.com/watch?v=jm-ihc7CASY

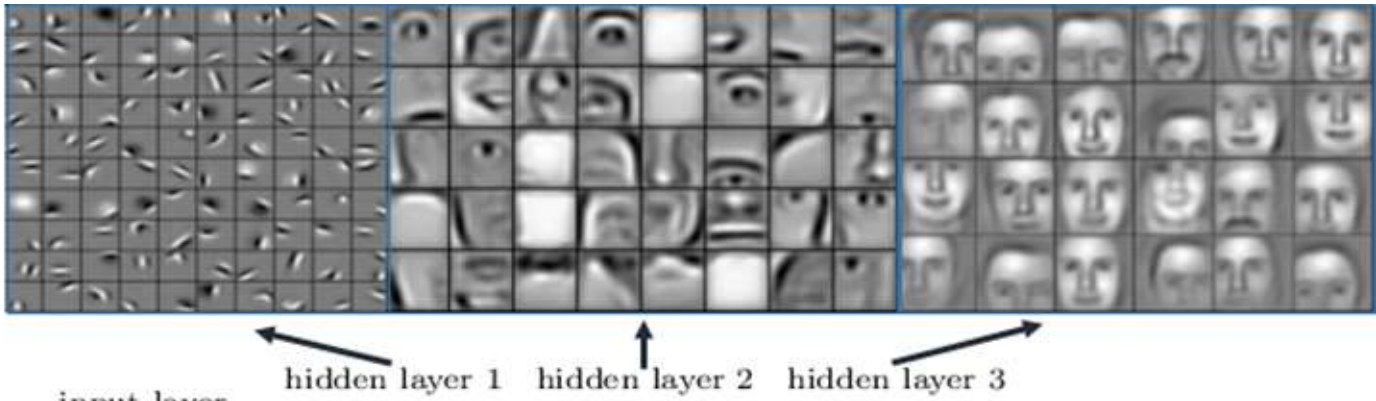
Hype Cycle

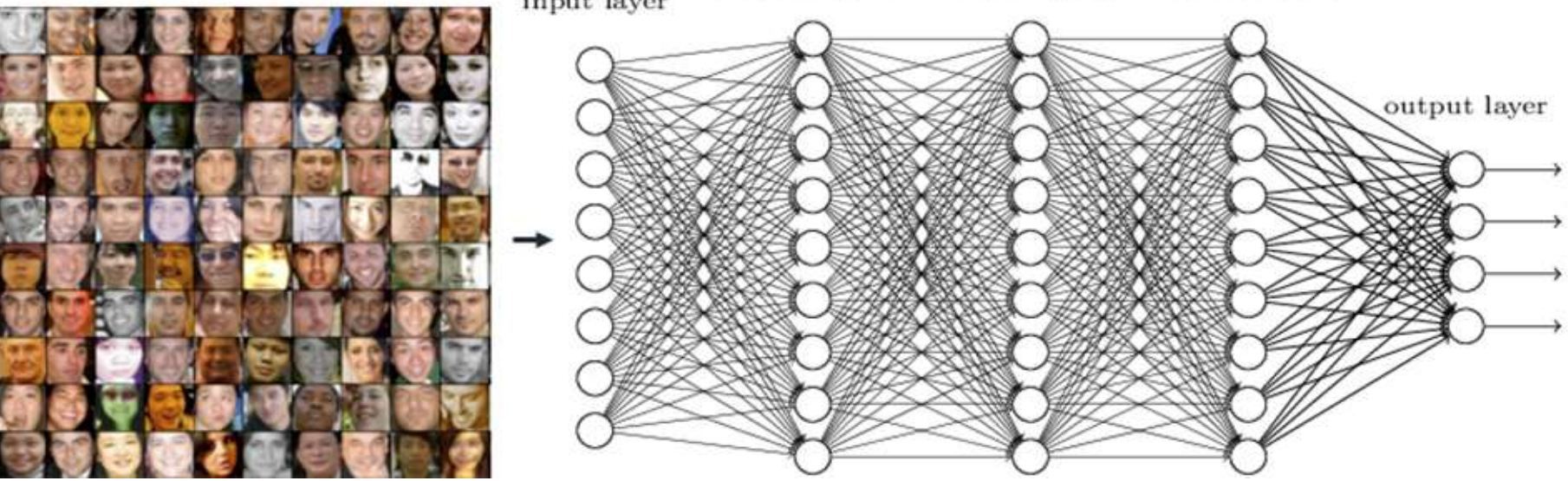


Greedy – need lots of data



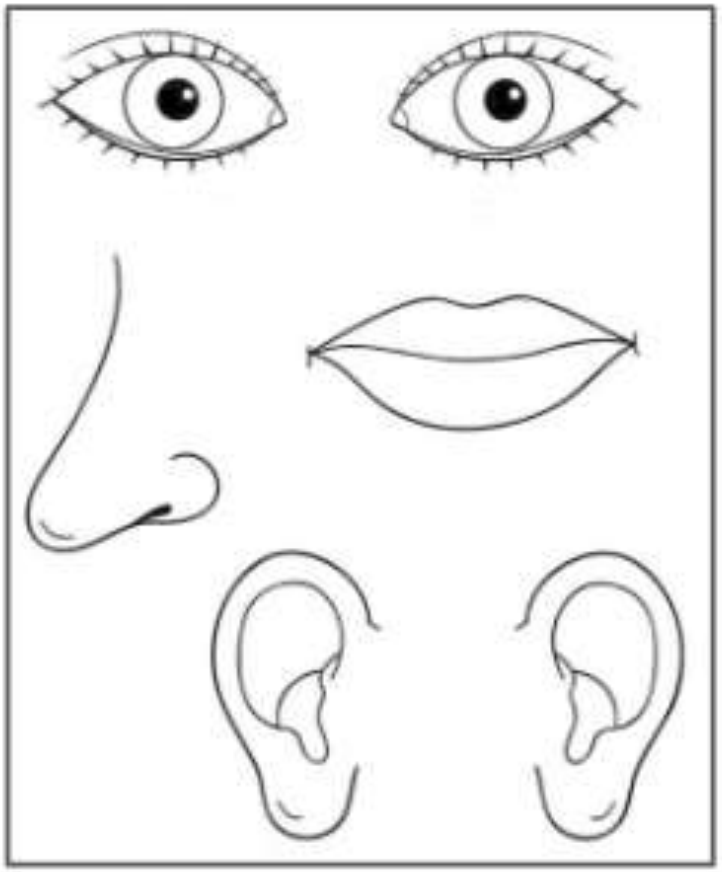
Opaque: converges how??

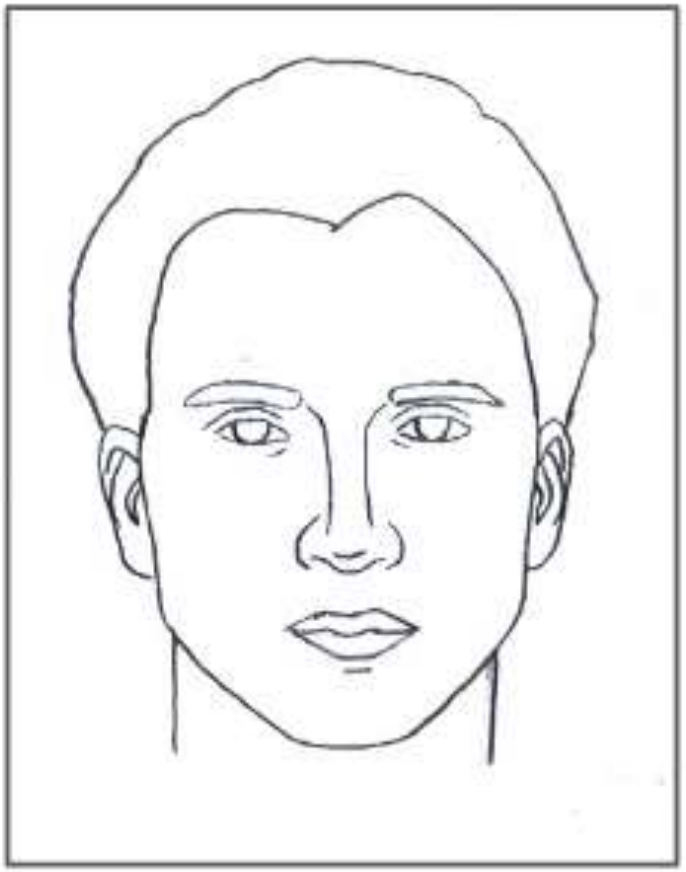




50 layers not just 3!

Brittle



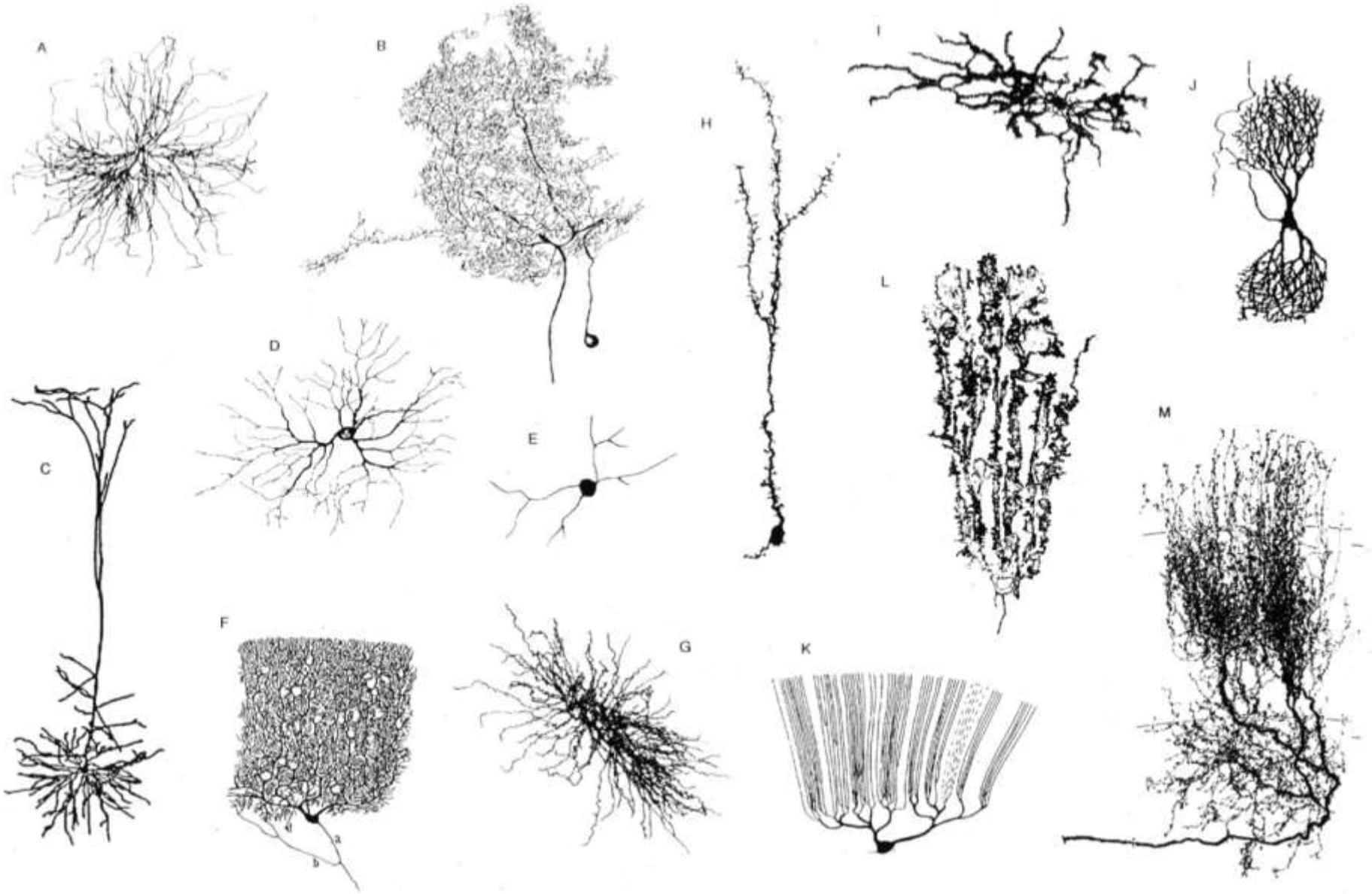


Brittle: Dogs Everywhere!

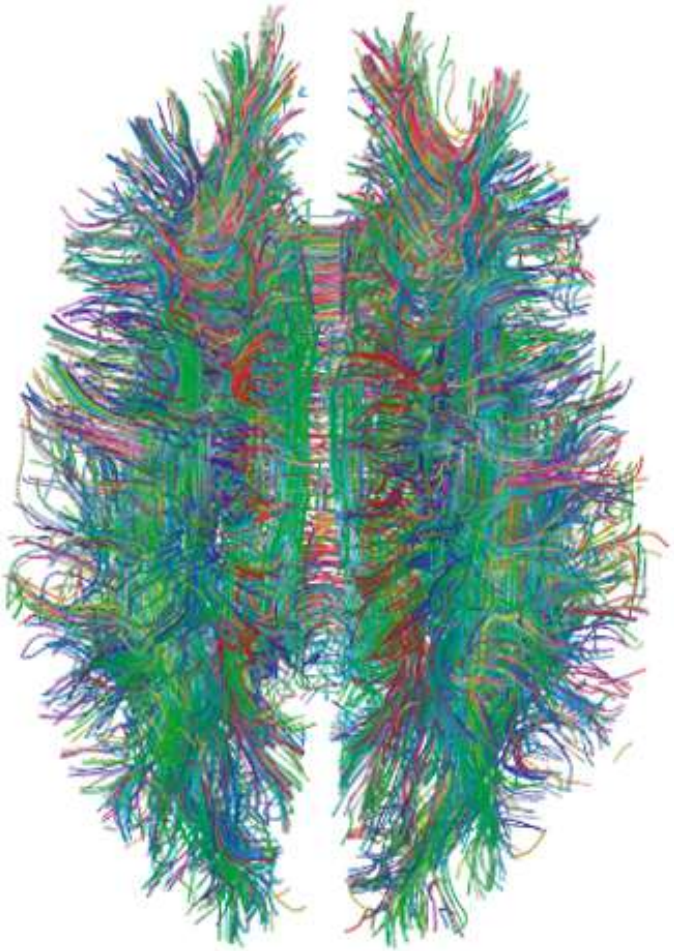
Brittle: formatted vs real-life

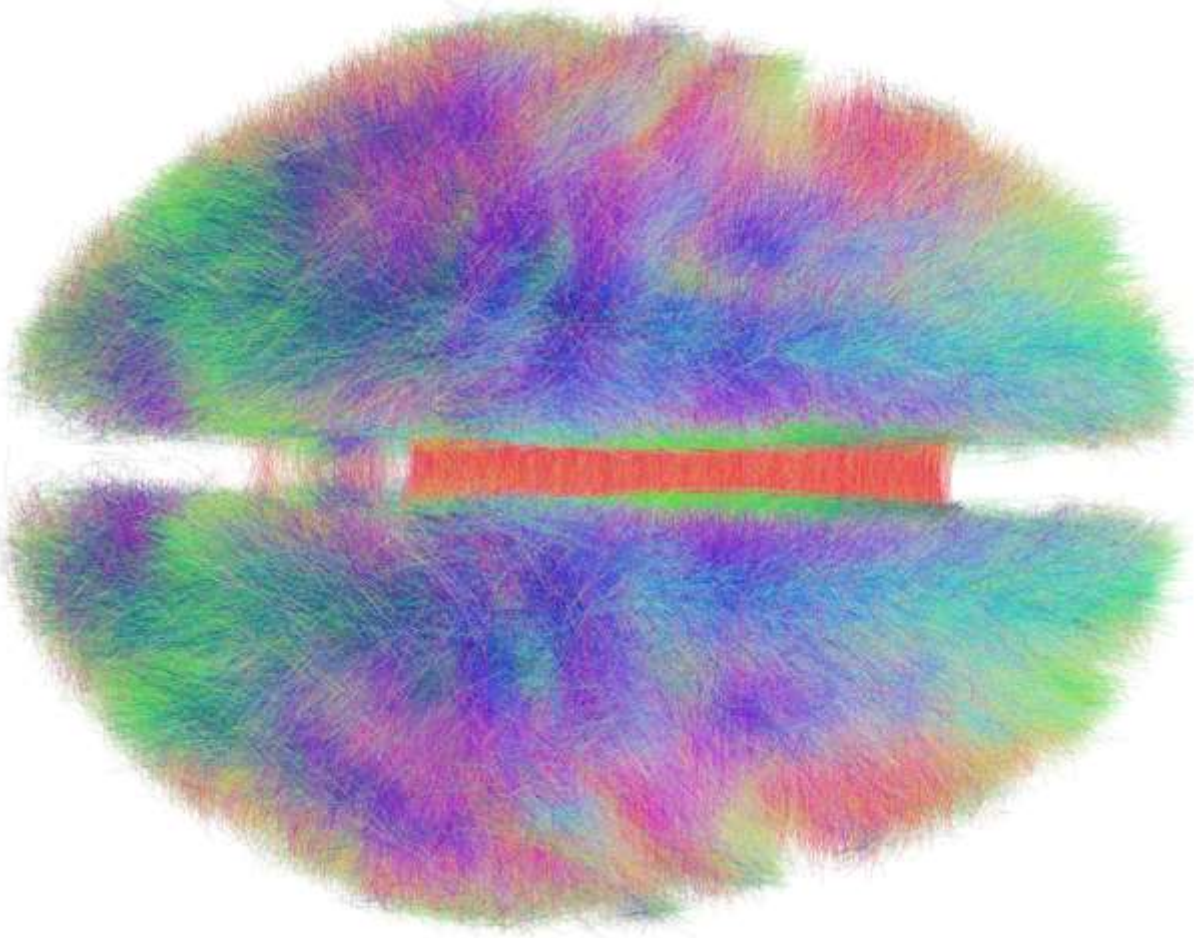
Shallow – low transfer

Just in the hippocampus...

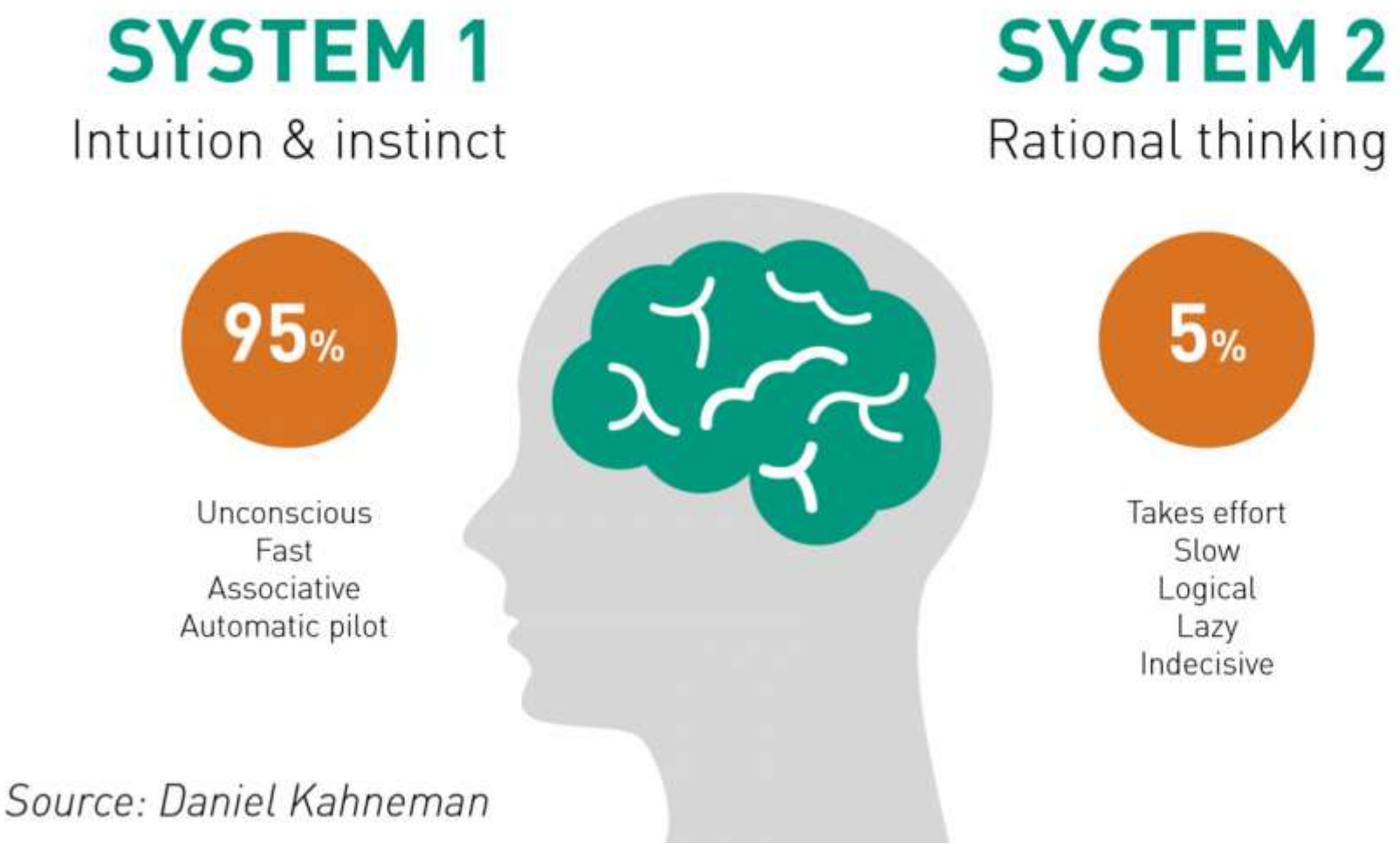


The Connectome





Humans are complex



Cognitive Domain and Algorithms

CREATING Synthesizing
EVALUATING
ANALYZING
APPLYING
UNDERSTANDING
REMEMBERING

The Painting Fool

Invention Machine

Post Olympics @wpolympicsbot · 6m
Medal Leaderboard

IBM Watson

Lex Machina
IP litigation data and analytics

Google Translate

Skype Translate

DRAGON NATURALLYSPEAKING

Google facebook

Source: Bloom/Anderson

Affective Domain and Algorithms

INTERNALIZING
ORGANIZING
VALUING
RESPONDING
RECEIVING

Broad Listening
For Deep Understanding

affectiva

Intelligent Agent

Siri

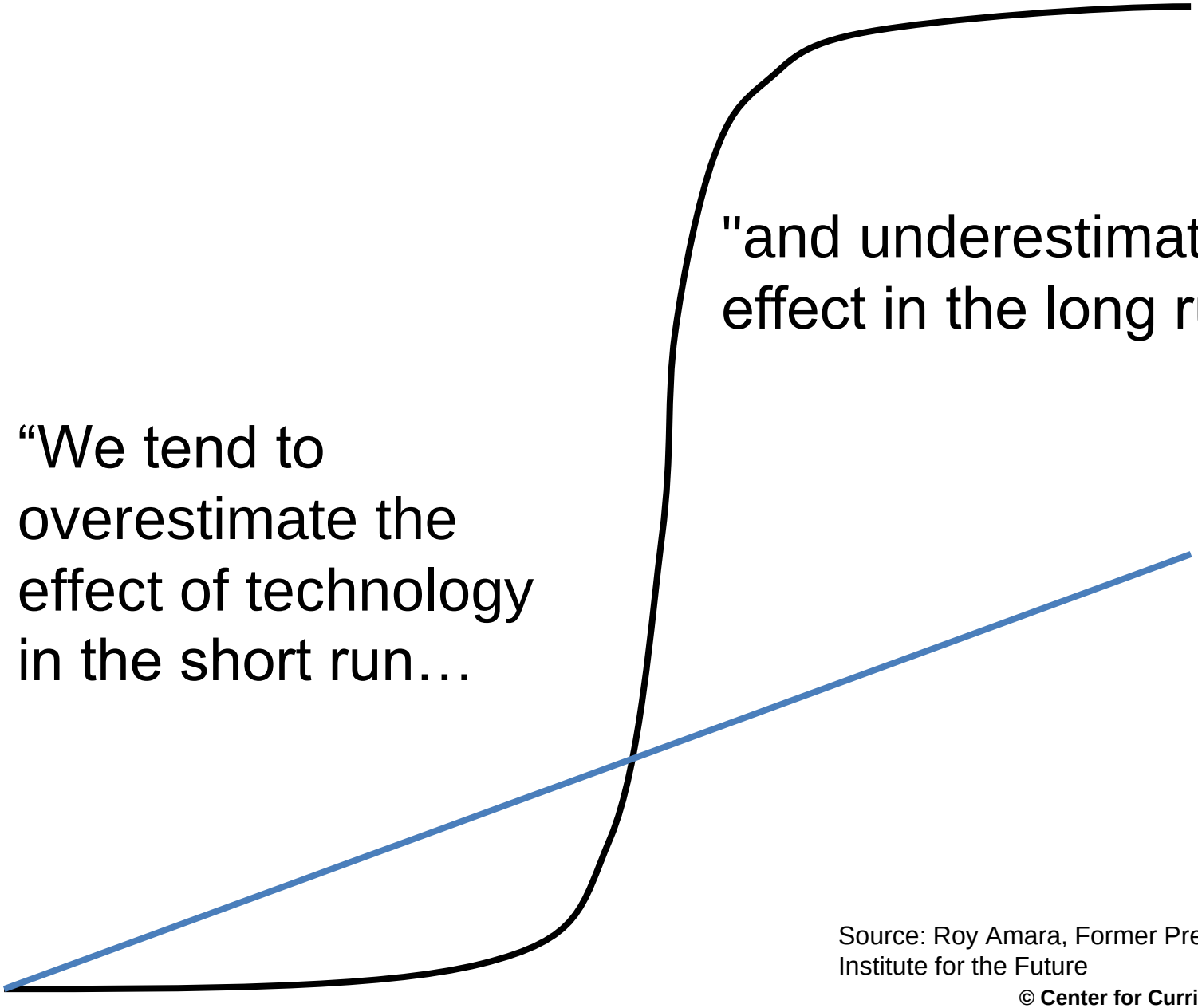
Source: Krathwohl, Bloom, Masia

Psychomotor Domain and Algorithms

ORIGINATION
ADAPTATION
COMPLEX OVERT RESPONSE
MECHANISM
GUIDED RESPONSE
SET
PERCEPTION

Source: Simpson

Reality Check

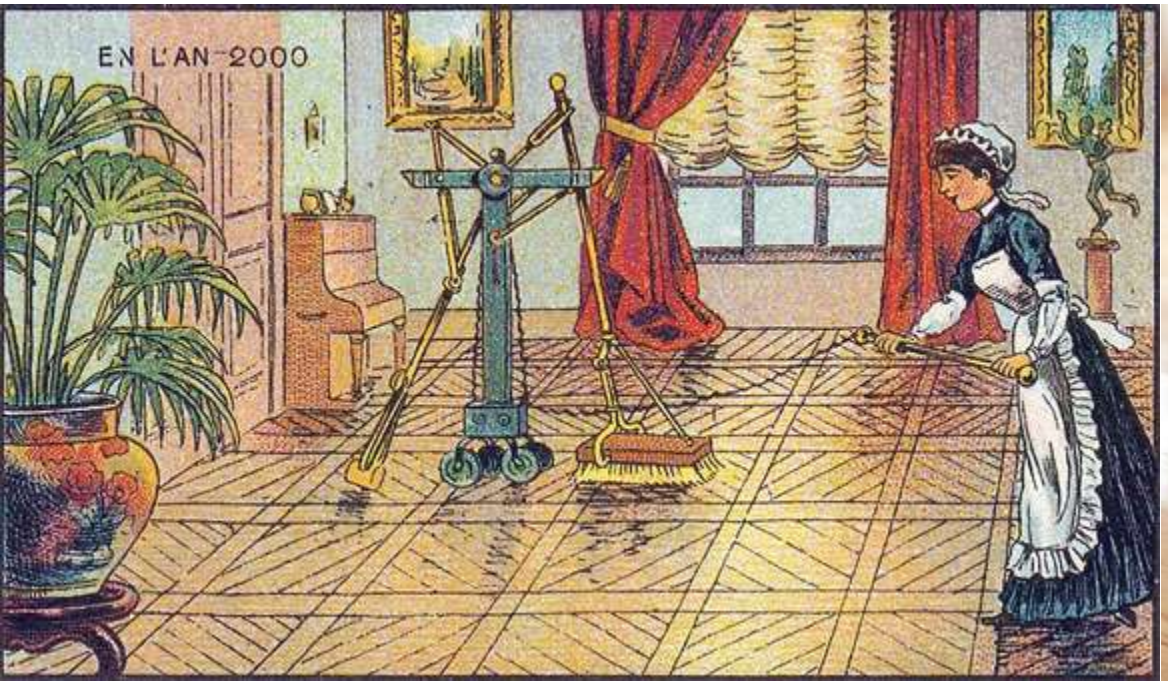


"and underestimate the effect in the long run.“

“We tend to overestimate the effect of technology in the short run…

Source: Roy Amara, Former President, Institute for the Future

Our Limited Imagination

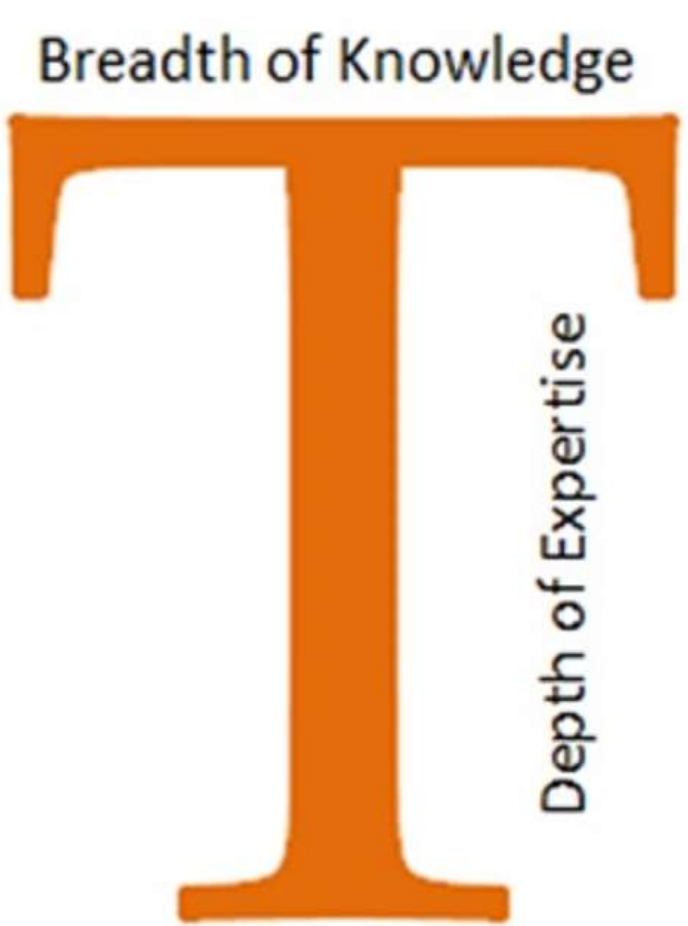


Source: Jean-Marc Côté, 1899

What will we/our children need to be successful in an A.I. world?

21st Century → Versatility

Renaissance Humans Needed



Relevance is a choice

© Charles Fadel Occupation (below)	Algebra	Applied Maths	Calculus	Discrete Mathematics	Foundations	Geometry	Numbers & Operations	Statistics & Probability	Topology & Recreational
Taxonomy & Ontology: Wolfram Research →	Matrices, Operations, Vectors etc	Complex systems, Control, Game theory, etc	Analysis, Transforms, Polynomials, etc	Automata, Graphs, Computational maths etc	Sets, Logic etc	Curves, Dimensions, Transformations, Trigonometry, etc	Arithmetic operations, Fractions, Sequences, etc	Distributions, Analysis, Estimation, etc	Knots, Figures, Folding, Spaces, etc
Agriculture						X	X	X	
Architecture		X				X	X	X	X
Astronomy/Cosmology	X	X	X	X		X	X	X	X
Biology, Botany, Zoology		X		X			X	X	
Biotechnology, Genetics	X	X	X	X		X	X	X	X
Business		X					X	X	
Cinematography/Photography						X	X		X
Civil engineering	X	X	X	X		X	X	X	X
Communication		X					X	X	
Computer science	X	X	X	X	X	X	X	X	X
Craftsmanship						X	X		X
Dance						X	X		X
Design						X	X		X
Drawing						X	X		X
Economics & Finance	X	X	X	X		X	X	X	
Education	X	X	X			X	X	X	
Electrical engineering	X	X	X	X		X	X	X	
Environmental science	X	X	X	X		X	X	X	
Ethics							X		
Geography/Geology	X	X	X	X		X	X	X	X
Health							X	X	
History/Archeology	X	X		X			X	X	
Journalism	X	X					X	X	
Languages/Linguistics	X	X		X			X	X	
Law		X					X	X	
Materials Science/Nanotechnology	X	X	X	X		X	X	X	X
Mechanical engineering, Robotics	X	X	X	X		X	X	X	X
Medicine/Pharmacy/Veterinary		X					X	X	
Music	X						X	X	
Painting						X	X		
Philosophy		X			X		X	X	
Physics	X	X	X	X	X	X	X	X	X
Poetry/Prose							X		
Psychology/Sociology/Anthropology	X	X		X			X	X	
Sculpture						X	X		X
Sewing/Knitting/Tapestry						X	X		X
Spirituality/Religions							X		
Theater/Acting							X		X

Introduce Modern Disciplines

Tech & Engineering

Entrepreneurship

Social Sciences

and more…

Develop Skills

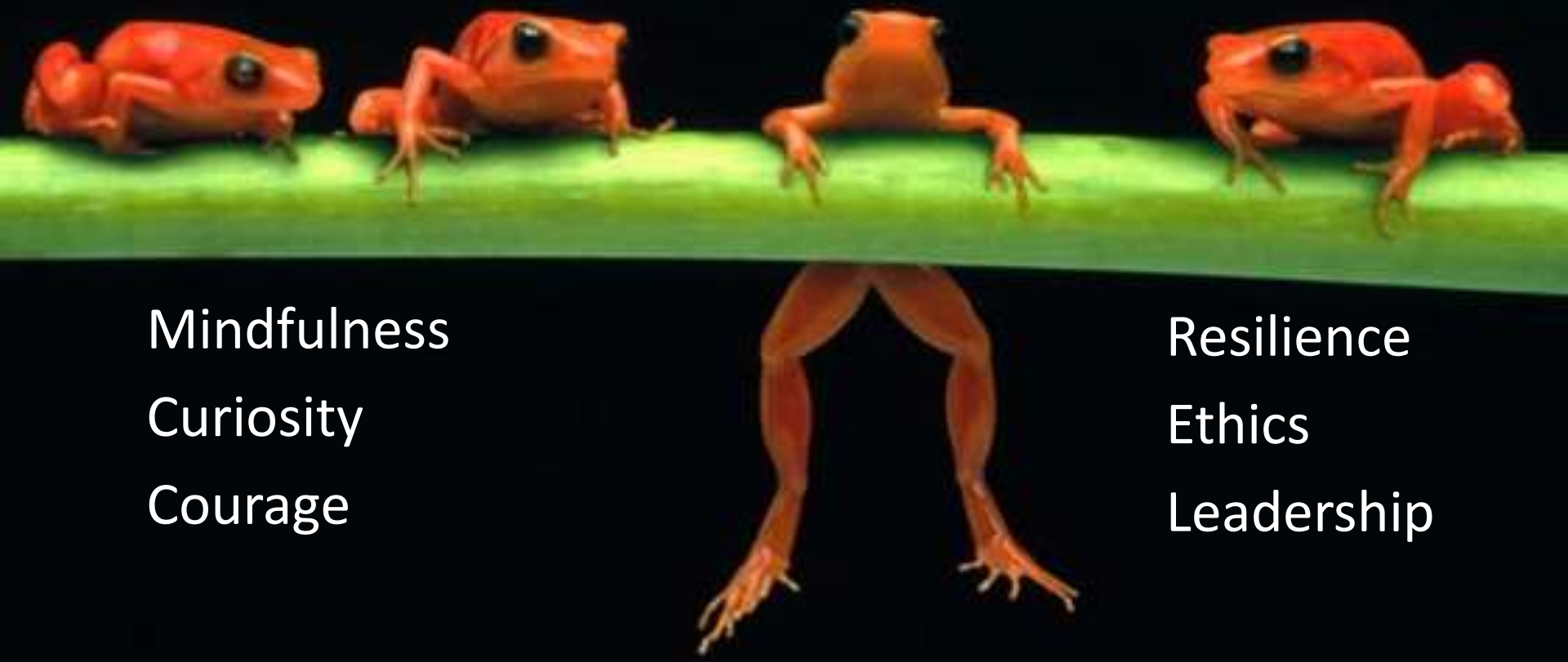
Creativity

Critical Thinking

Communication

Collaboration

Build Character



Mindfulness

Curiosity

Courage

Resilience

Ethics

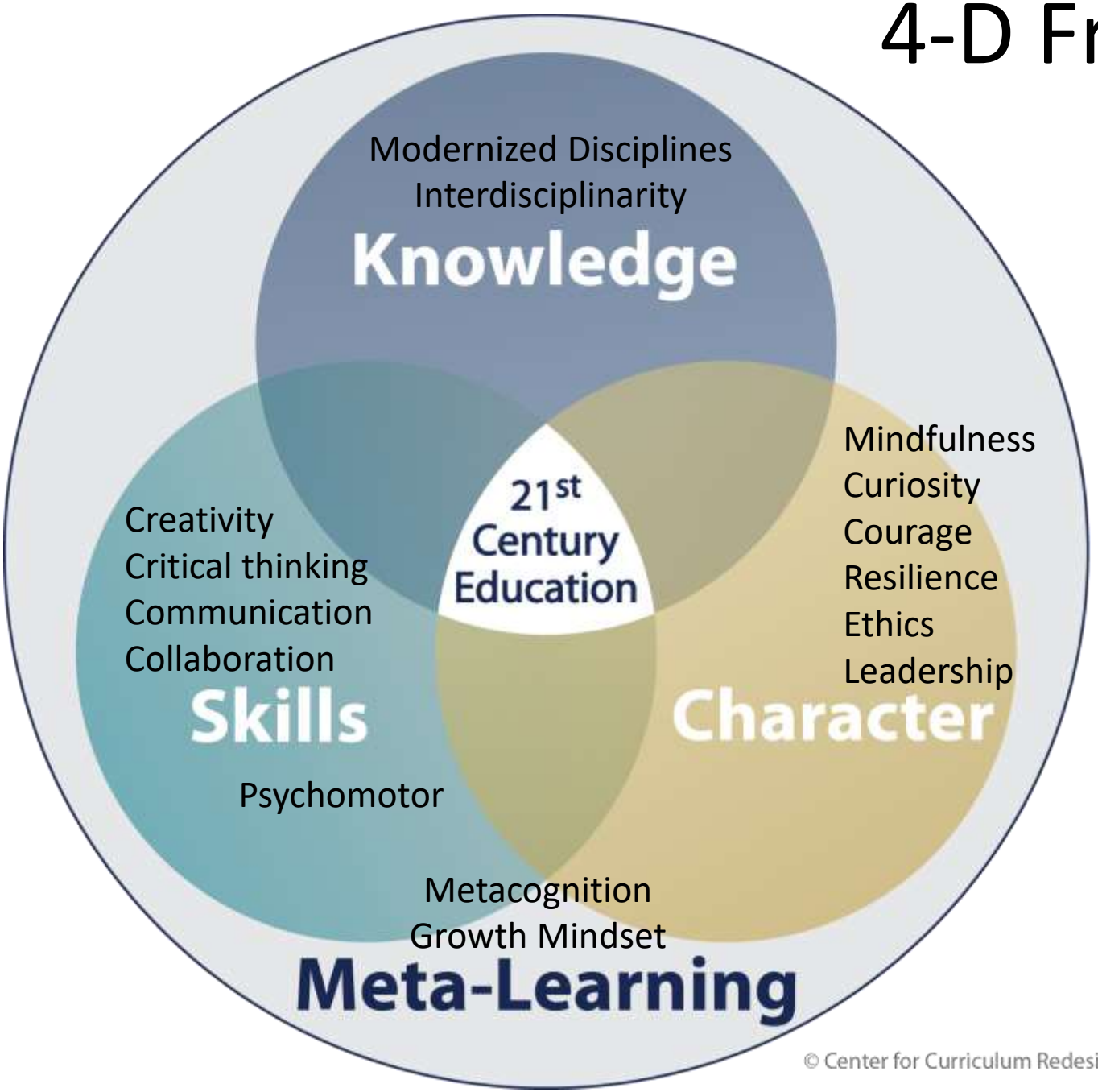
Leadership

Train Meta-Learning ("learning how to learn")

Metacognition

Growth Mindset

4-D Framework



Matrix between Knowledge & other Dimensions

© 2014 Center for Curriculum Redesign – All Rights Reserved		Skills				Character						Meta-Learning	
		Creativity	Critical thinking	Communication	Collaboration	Mindfulness	Curiosity	Courage	Resilience	Ethics	Leadership	Growth	Metacognition
Themes - embedded throughout Global literacy Environmental Literacy Etc.	Traditional Knowledge (Interdisciplinary)												
	Mathematics												
	Science												
	Language												
	Etc.												
	Modern Knowledge (Interdisciplinary)												
	Robotics												
	Entrepreneurship												
	Wellness												
	Etc.												

Competencies are expressed through Knowledge domain

Deliberately, comprehensively, systematically, demonstrably

"A very thoughtful treatment of the competencies our students need to thrive in today's/tomorrow's world.

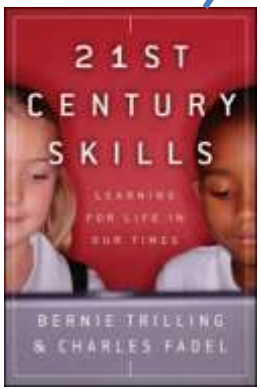
Carol Dweck

Stanford University

"Educators worldwide need to rapidly operationalize these dimensions"

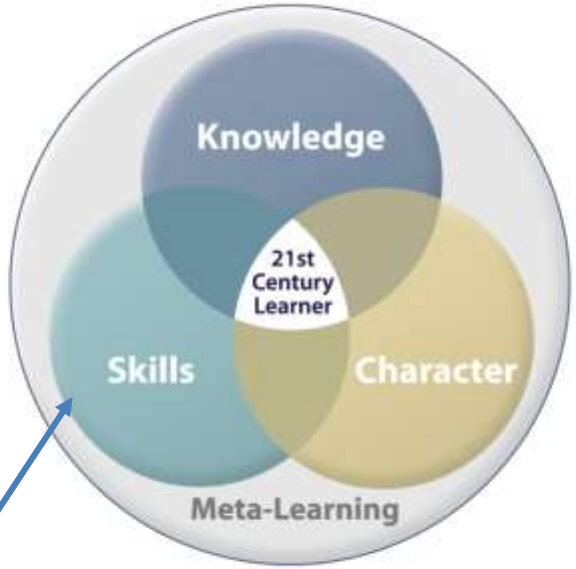
Todd Rose

Harvard University



From the authors* of best-seller *21st Century Skills*

CHARLES FADEL*, MAYA BIALIK, AND BERNIE TRILLING*



FOUR-DIMENSIONAL EDUCATION

THE COMPETENCIES LEARNERS NEED TO SUCCEED

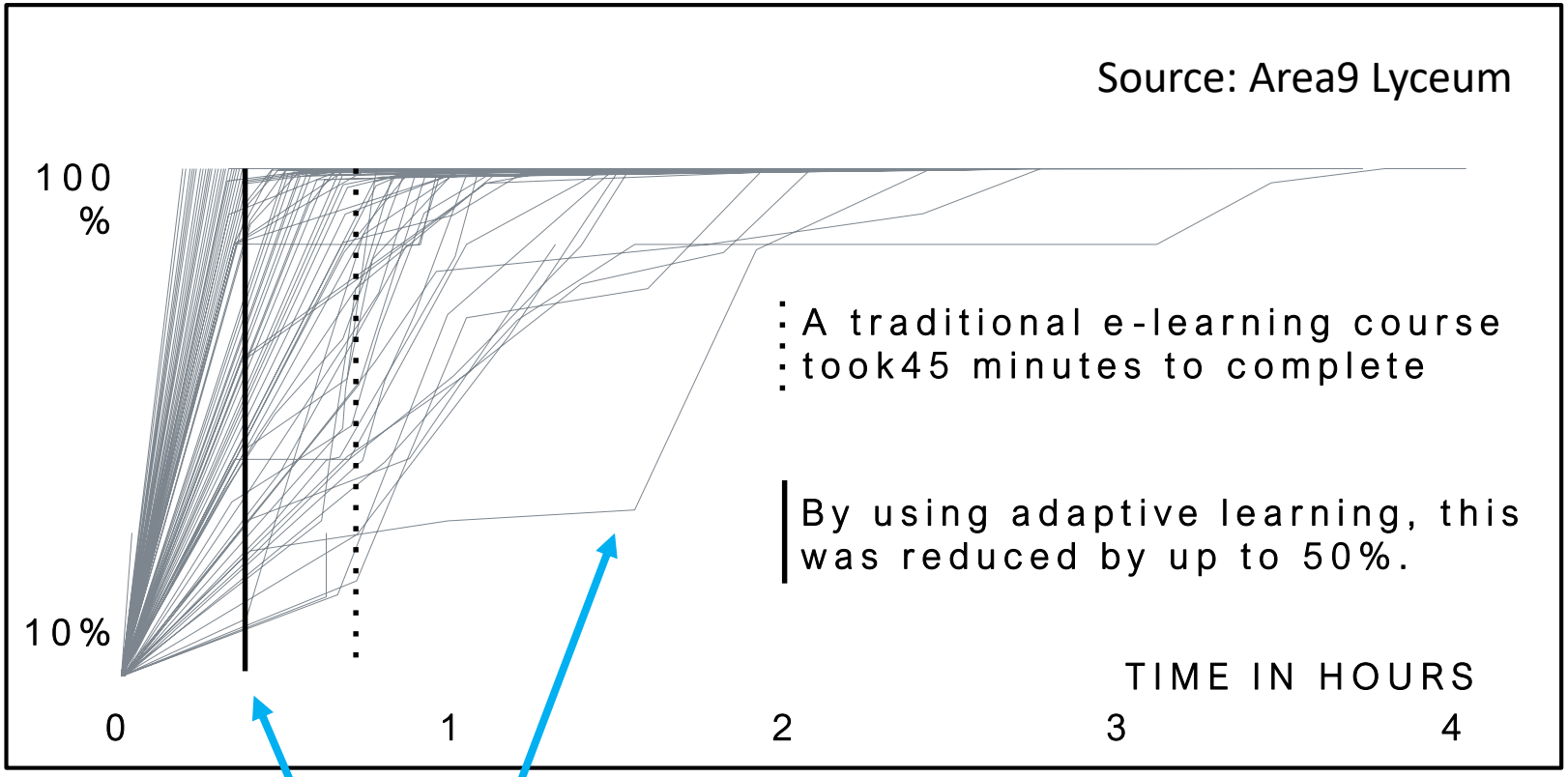
Prologue by **Andreas Schleicher, OECD**

Download: http://bit.ly/4DEdu

HOW – Personalized Learning

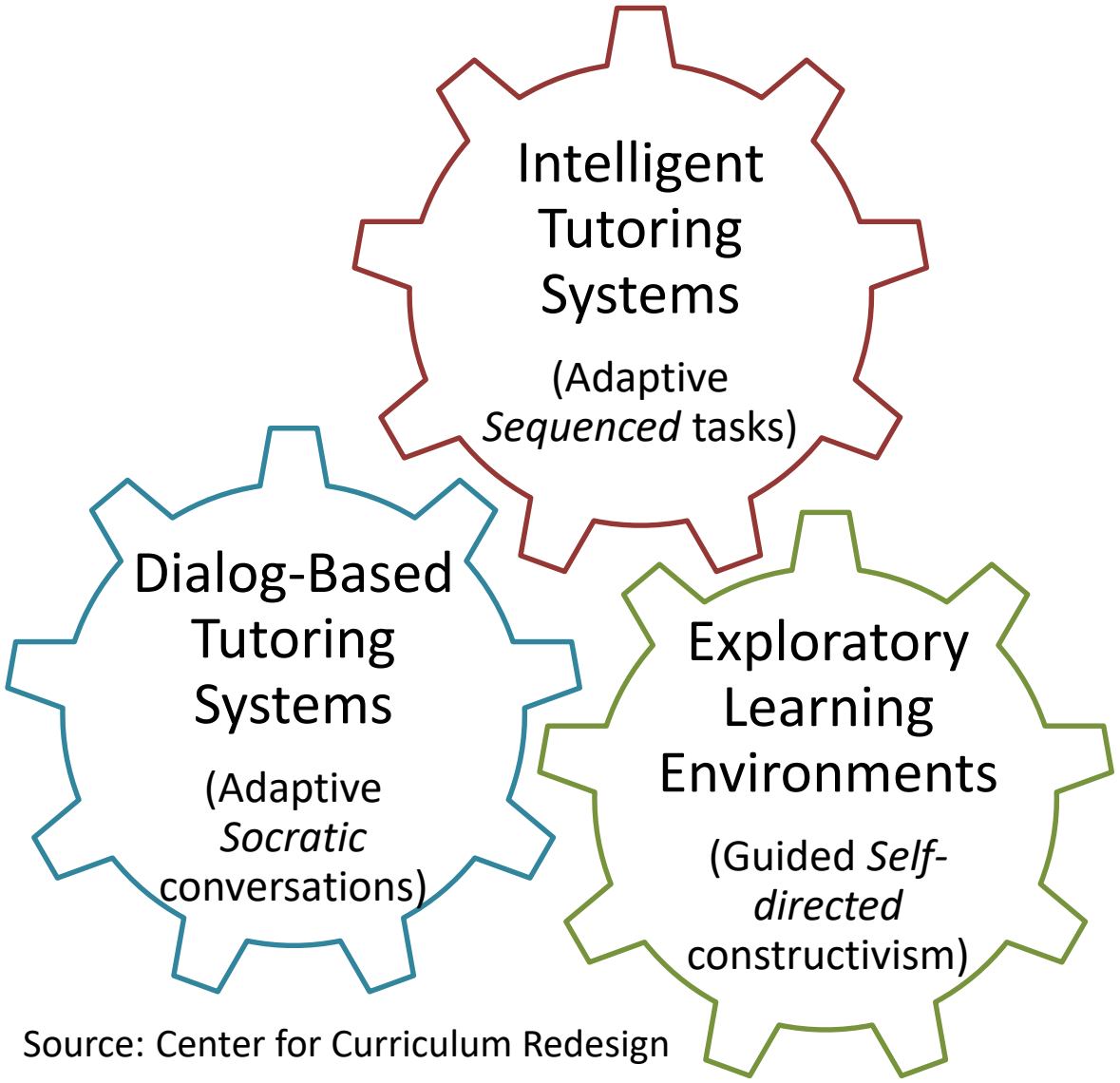
Unique development of each student

Adaptive Learning's Promises



- Self-pacing
- Learning time reduction

Major Types of Student-facing AI in Edu



Source: Center for Curriculum Redesign

Potential applications within major classes,

as well as standalone:

- Automatic essay feedback
- Language learning
- Chatbots
- AR/VR
- Learning network orchestrators
- Collaborative learning
- Student forum monitoring
- Continuous assessments
- AI learning companions

Metaphor

Superpowers = not human

Technology as capacity-multiplier

"This brilliantly reflective and forward-looking book helps the education community in navigating the storm… a daring intellectual undertaking!

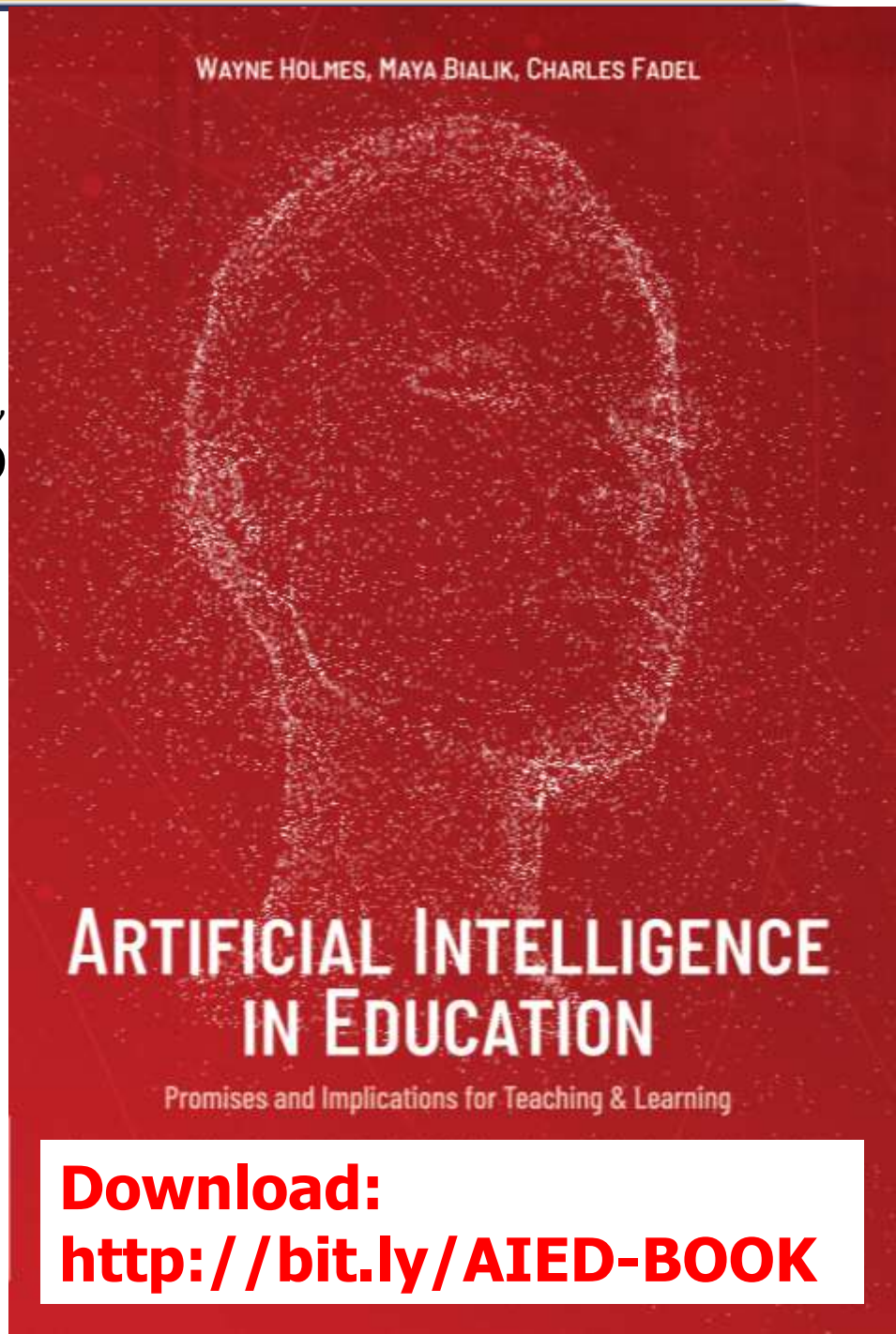
—Dirk Vandamme, **OECD**

"An invaluable resource for those concerned with the future of education."

—**Tony Wagner**, best-selling author
"Global Achievement Gap" & *"Creating Innovators"*

"A must-read for anyone seeking to go beyond the hype of AI towards appropriate, precise, and empowering uses of these tools for learning."

—Maria Langworthy, **Microsoft**



Download: http://bit.ly/AIED-BOOK

Learning WITH the Machines

Deep Learning (A.I.) + “Deeper Learning” (H.I.)

= Augmented Intelligence

Thank You!

"***What*** should students learn for the 21st century?"

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