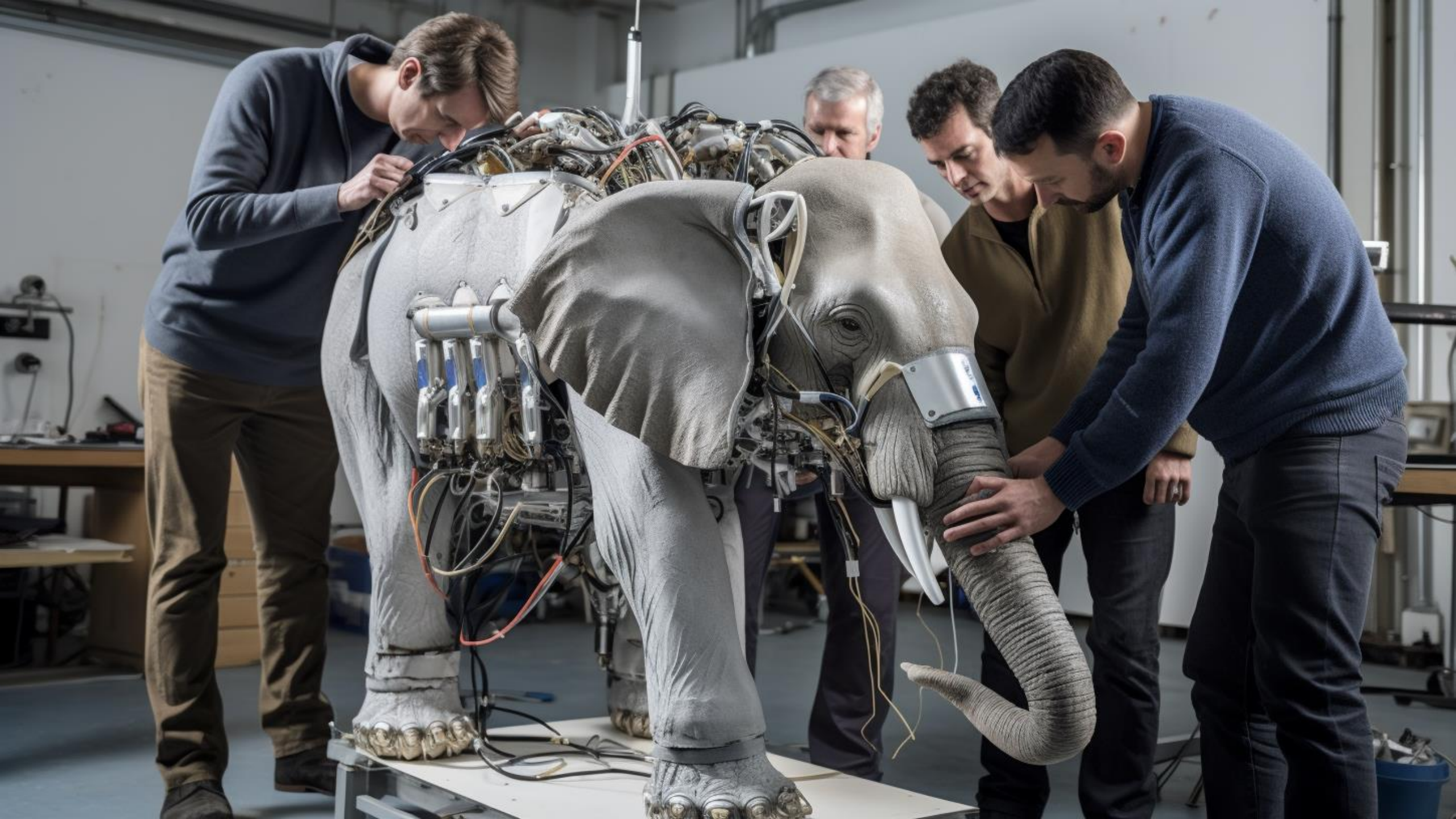




Navigating the Future of Education: From Generative AI to Cyber-Physical Learning









AI advancements could have profound implications on China's labour market, said Yi Gang, former governor of the People's Bank of China and a professor at Peking University.

“As AI sets to replace human workers, the structural mismatch between labour supply and demand could persist in the future,” he said in an article earlier this month.

TECH • FORTUNE GLOBAL FORUM

World's first AI minister likenes risk of overregulation to calligraphers that kept the printing press out of the Middle East for nearly 200 years

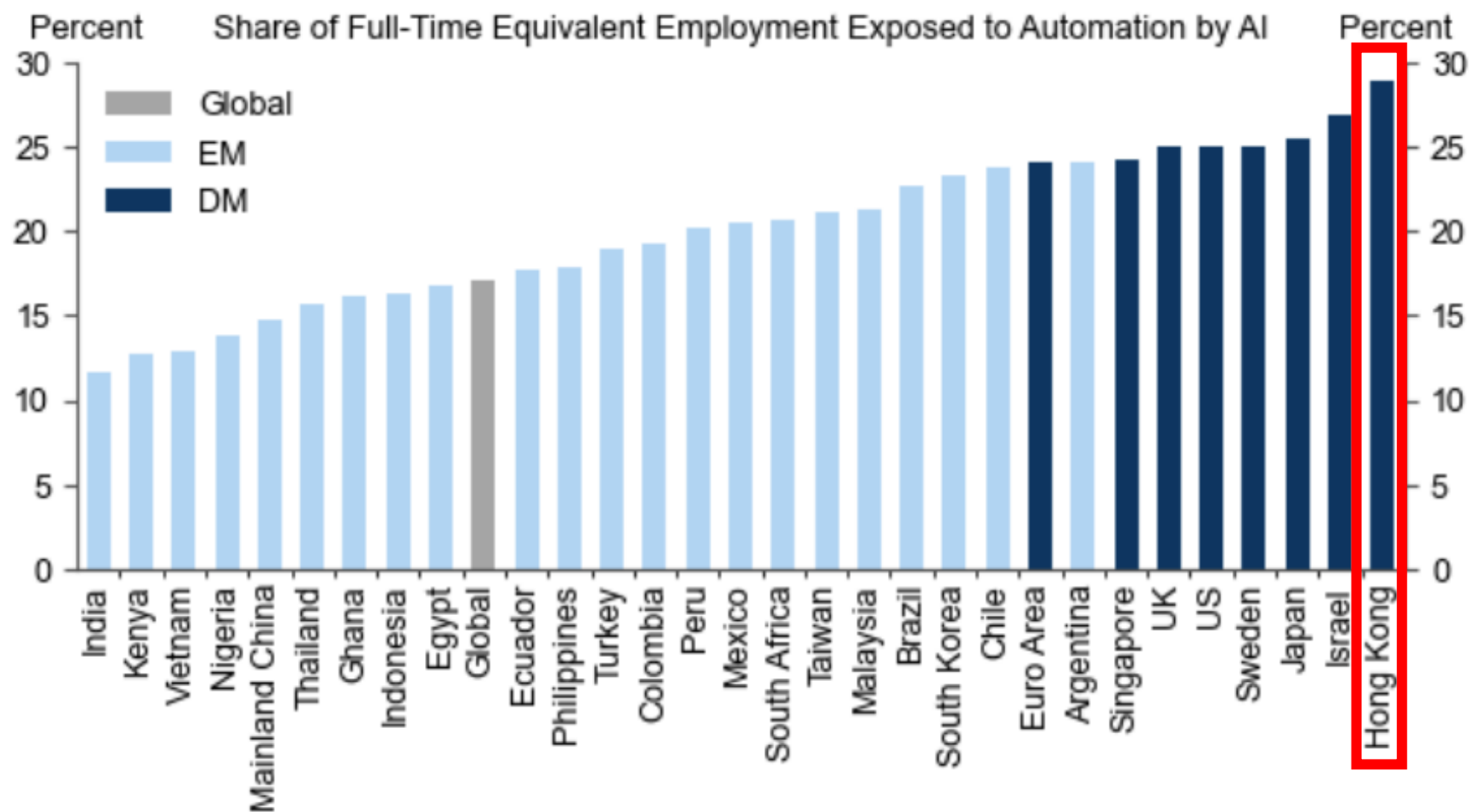
In his 1515 rejection of the printing press, an Ottoman sultan brought the golden age of Islamic math and science to an abrupt end.

BY CHRISTIAAN HETZNER

November 28, 2023 12:50 PM EST



Exhibit 6: Globally, 18% of Work Could be Automated by AI, with Larger Effects in DMs than EMs



The Potentially Large Effects of Artificial Intelligence on Economic Growth (Briggs/Kodnani). 26 March, 2023

https://www.key4biz.it/wp-content/uploads/2023/03/Global-Economics-Analyst_-The-Potentially-Large-Effects-of-Artificial-Intelligence-on-Economic-Growth-Briggs_Kodnani.pdf

3.71 With the wide-spread application of IT at the workplace, the on-going development on technology measures including artificial intelligence, data analytics and robotics technologies and their potential adoption in various business processes, the total requirements for IT workers are projected to be on an upward trend at an average annual rate of 2.5% during the projection period to 119 000 in 2027. The manpower requirements of IT workers of the economy as a whole by IT-related occupation group in 2016 and 2027 are set out in Table 3.27.

Table 3.27 Manpower Requirements of IT Workers by IT-related Occupation Group in 2016[&] and 2027

IT-related occupation group	Actual manpower requirements in 2016 ^{&}		Projected manpower requirements in 2027		Projected change from 2016 to 2027	Projected average annual rate of change (2016 – 2027)
	Number	% share	Number	% share		
IT managers	7 000	7.8	9 200	7.8	+ 2 200	+ 2.5%
IT professionals	47 400	52.4	64 900	54.5	+ 17 500	+ 2.9%
IT associate professionals	30 200	33.4	36 100	30.3	+ 5 800	+ 1.6%
IT sales workers	5 800	6.4	8 800	7.4	+ 3 000	+ 3.8%
IT personnel	90 400	100.0	119 000	100.0	+ 28 500	+ 2.5%

& The actual manpower requirements of IT workers were compiled based on findings of the “2016 Manpower Survey on Information Technology Sector” conducted by the VTC, which were the latest available information at the time the projection was being compiled.

Note: Individual figures may not add up to the totals due to rounding.

- (e) *First degree* – the demand for workers with qualifications of *first degree* is projected to grow considerably along with Hong Kong’s transformation to a knowledge-based and high value-added economy advocating innovation, professionalism and adoption of technology and artificial intelligence. It is anticipated that there will be a manpower shortfall of 50 900 for this labour segment in 2027; and



GPTs are GPTs: An Early Look at the Labor Market Impact Potential of Large Language Models

“Our findings indicate that the importance of **science** and **critical thinking skills** are strongly negatively associated with exposure, suggesting that occupations requiring these skills are less likely to be impacted by current GPTs. Conversely, **programming** and **writing skills** show a strong positive association with exposure, implying that occupations involving these skills are more susceptible to being influenced by GPTs.”

23 March, 2023 OpenAI, OpenResearch,
University of Pennsylvania

[2303.10130.pdf \(arxiv.org\)](#)

FIGURE 2.5

Expected impact of technology adoption on jobs, 2023–2027

Share of organizations surveyed that expect each technology to create or displace jobs, ordered by the job creation net effect.
The shares of organizations which expect the impact of adopting these technologies to be neutral are not plotted.

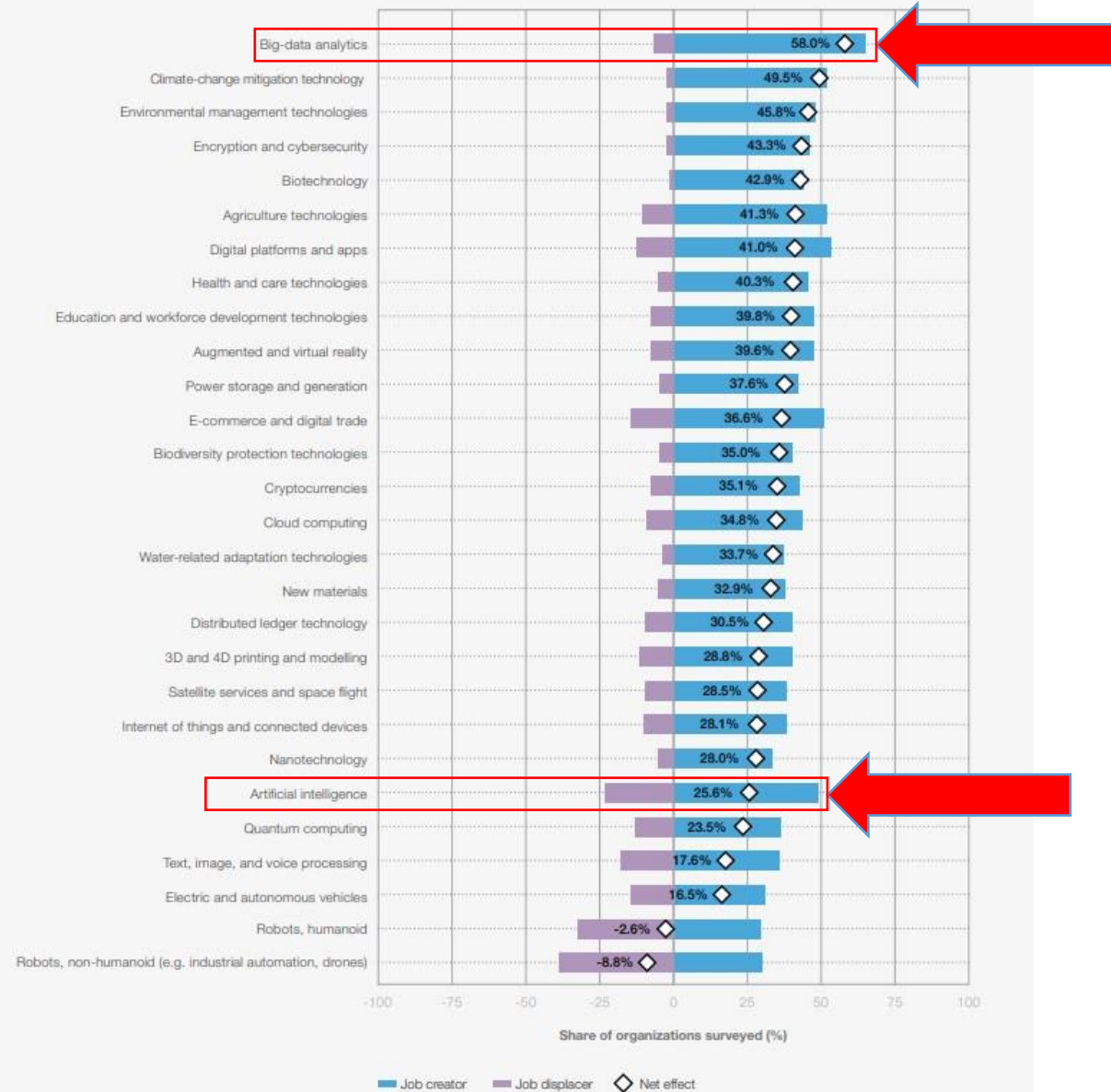
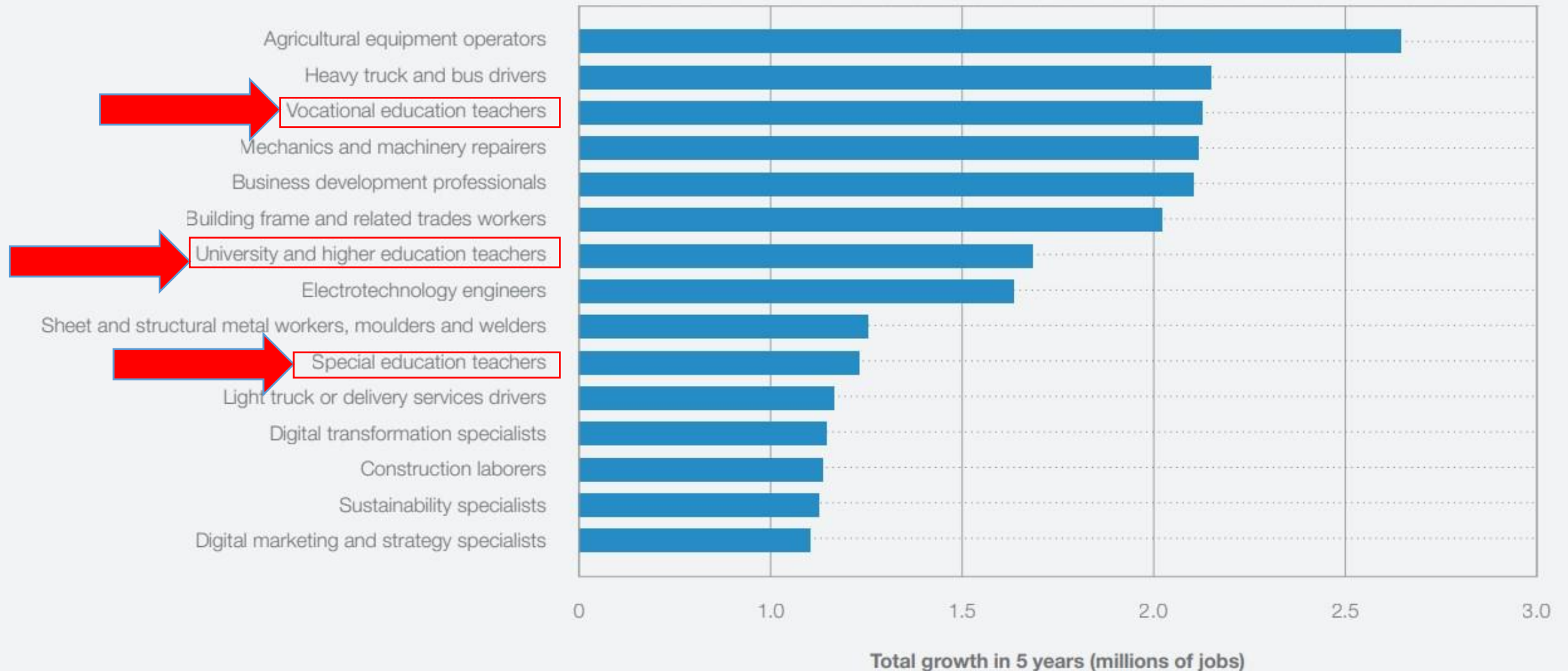


FIGURE 3.4

Largest job growth, millions

Top roles ordered by largest net job growth, calculated based on ILO Occupation Employment statistics and growth reported by organizations surveyed



Source

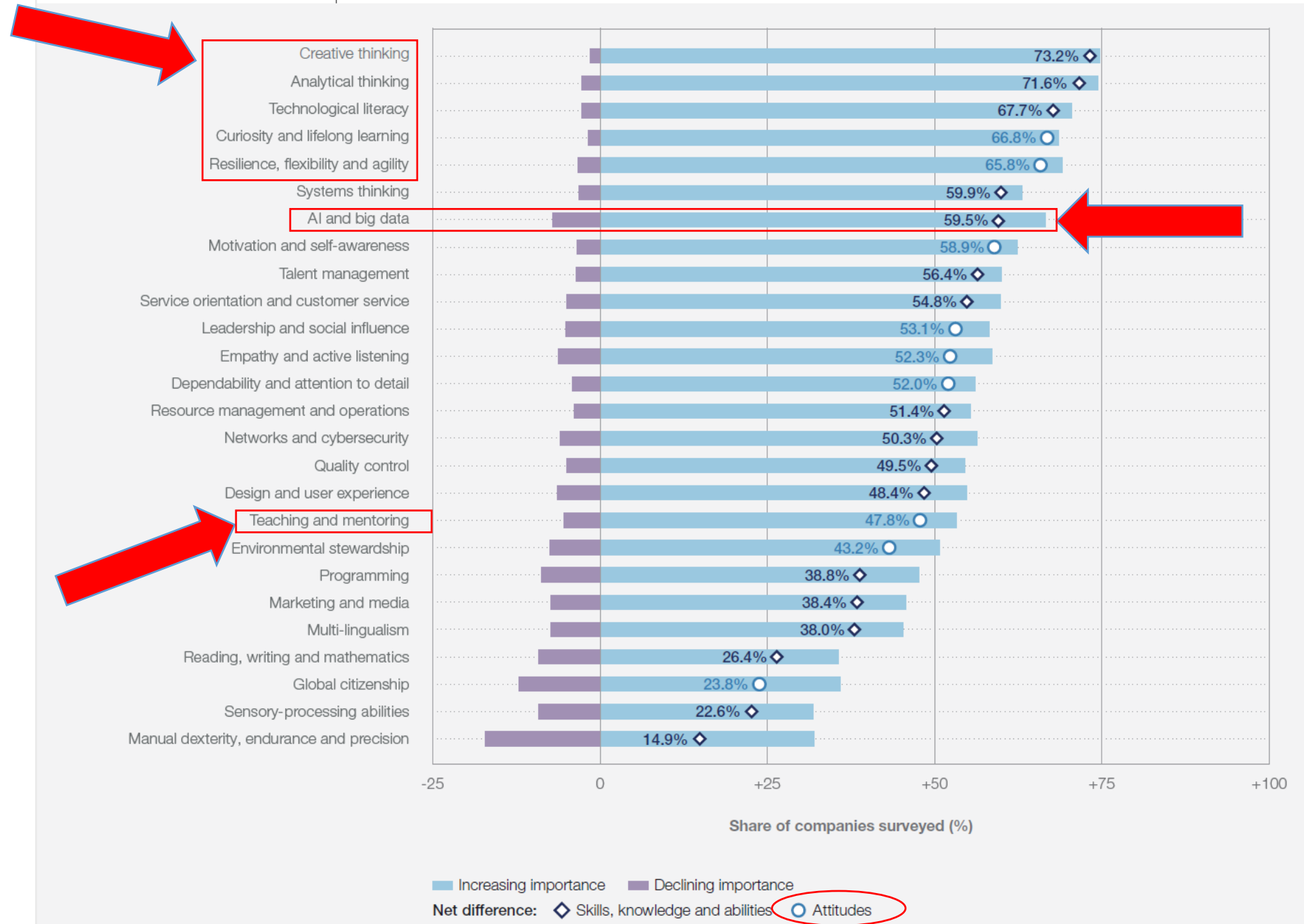
World Economic Forum, Future of Jobs Survey 2023.

FIGURE 4.3

Skills on the rise

Share of organizations surveyed which consider skills to be increasing or decreasing in importance, ordered by the net difference.

Figure 4.3 reports business expectations for the evolution of the importance of skills to their workers in the **next five years**.







What is knowledge? What is knowing?
Do we need a knowledge-, values-, or skills-based education?



Future of work

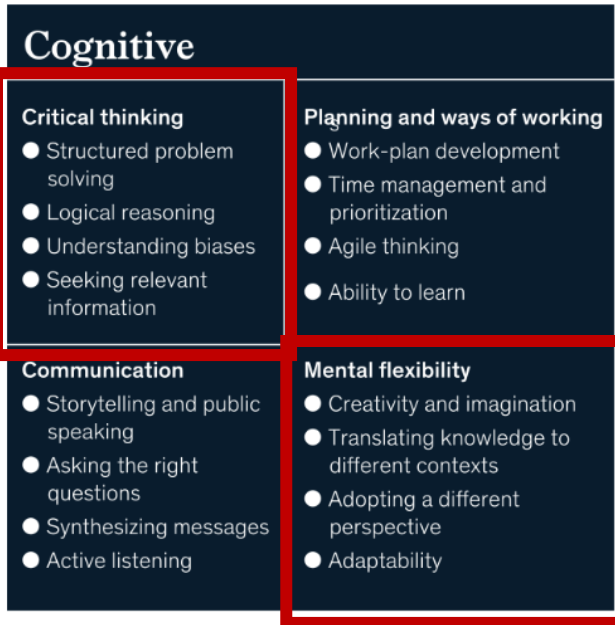
Technological skills: such as digital literacy, coding, data analysis, artificial intelligence, etc.

Social skills: such as communication, collaboration, empathy, intercultural understanding, etc.

Higher cognitive skills: such as critical thinking, creativity, problem-solving, learning to learn, etc.

- <http://oecd.org>
- <http://weforum.org>
- <http://unesco.org>

56 DELTAS¹ across 13 skill groups and four categories



DISTINCT ELEMENTS OF TALENT (DELTA)

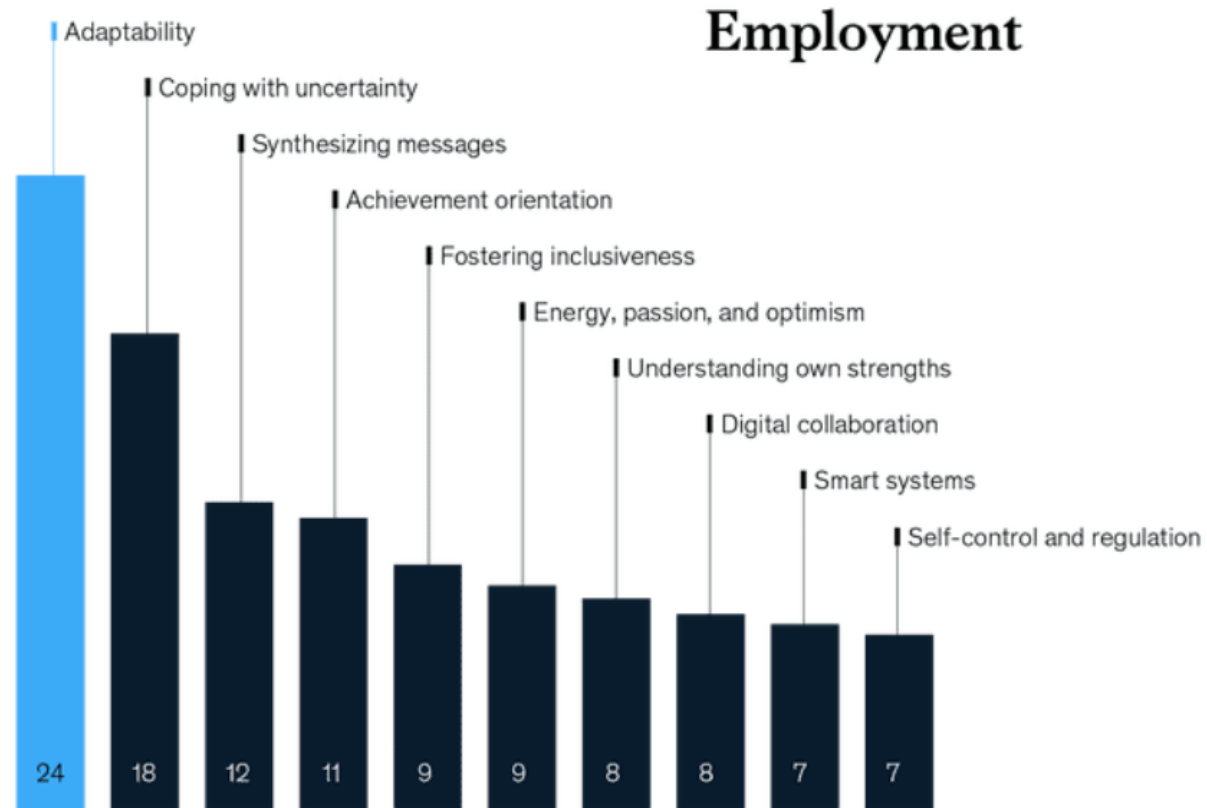
McKinsey Global Institute

[McKinsey: Which skills will be needed for the future of work? | World Economic Forum \(weforum.org\)](#)



Proficiency in certain DELTAs is linked with higher likelihood of employment.

Increased chance of respondents with a higher proficiency in the DELTA¹ being employed,²%



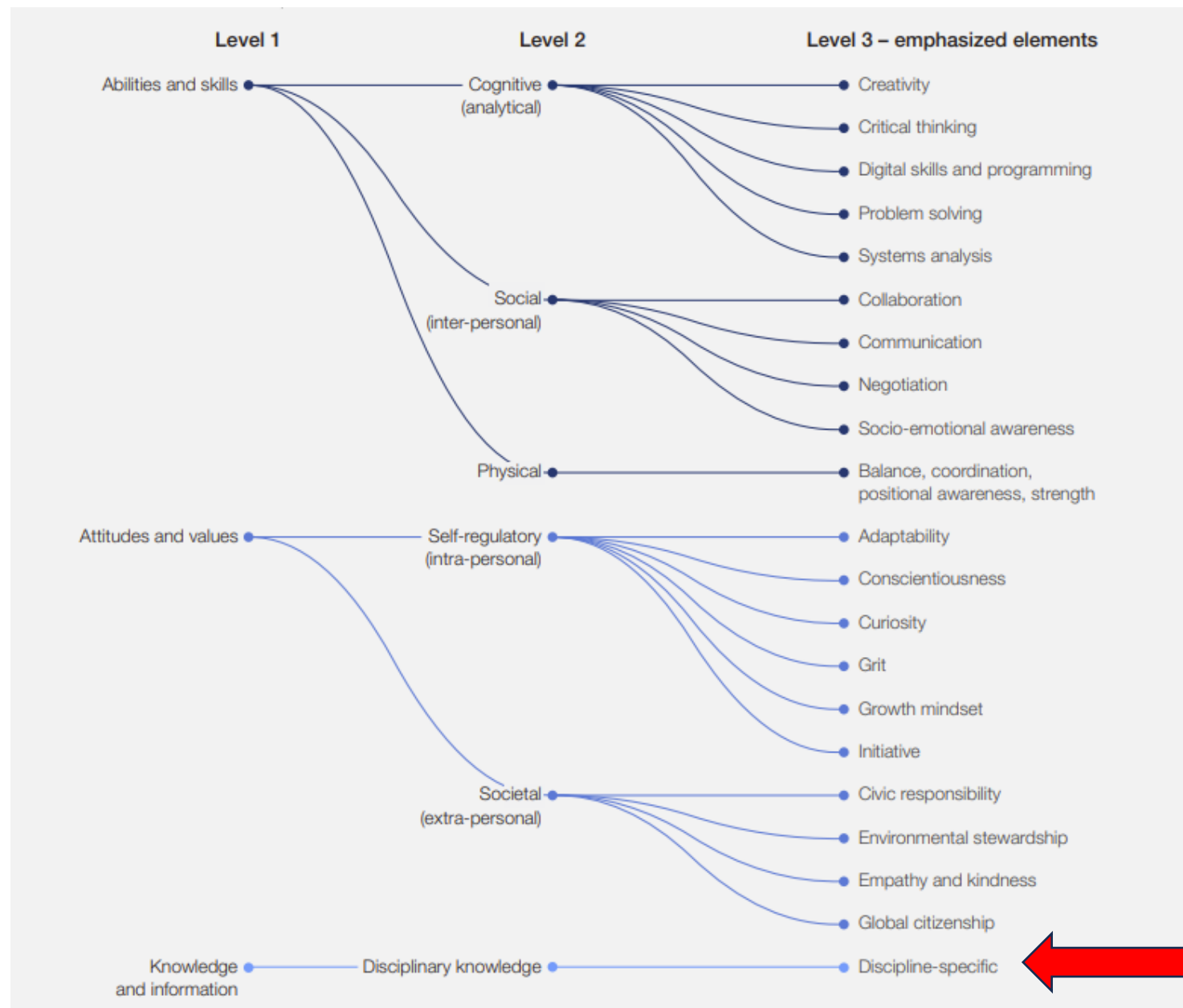
Note: The margin of error is 3% with a 95% confidence interval. DELTAs selected based on individual contribution—holding other variables constant—to the probability of a survey participant being employed among those with income below the median or those with no income. People with income above the median were excluded to avoid skewed results because of higher proficiency in DELTAs.

¹Distinct element of talent.

²Increase in the odds of being employed if proficiency score is higher by 1 level, assuming all other elements and demographic variables are fixed/constant. Only OECD countries included in this analysis.

**McKinsey
& Company**

Adaptability is the strongest DELTA to increase employment. Image: McKinsey & Company



Defining Education 4.0: A Taxonomy for the Future of Learning: White Paper (January, 2023)

https://www3.weforum.org/docs/WEF_Defining_Education_4.0_2023.pdf



Some concerns in a growing AI-driven environment

'Godfather of AI' Geoffrey Hinton quits Google and warns over dangers of misinformation

The neural network pioneer says dangers of chatbots were 'quite scary' and warns they could be exploited by 'bad actors'



Dr Geoffrey Hinton, the 'godfather of AI', has left Google. Photograph: Linda Nylind/The Guardian

The Guardian. (2023, May 2). 'Godfather of AI' Geoffrey Hinton quits Google and warns over dangers of misinformation.
<https://www.theguardian.com/technology/2023/may/02/geoffrey-hinton-godfather-of-ai-quits-google-warns-dangers-of-machine-learning>

[nature](#) > [news explainer](#) > [article](#)

NEWS EXPLAINER | 23 November 2023

What the OpenAI drama means for AI progress – and safety

A debacle at the company that built ChatGPT highlights concern that commercial forces are acting against the responsible development of artificial-intelligence systems.

[Nicola Jones](#)



OpenAI fired its charismatic chief executive, Sam Altman, on 17 November — but has now reinstated him. Credit: Justin Sullivan/Getty

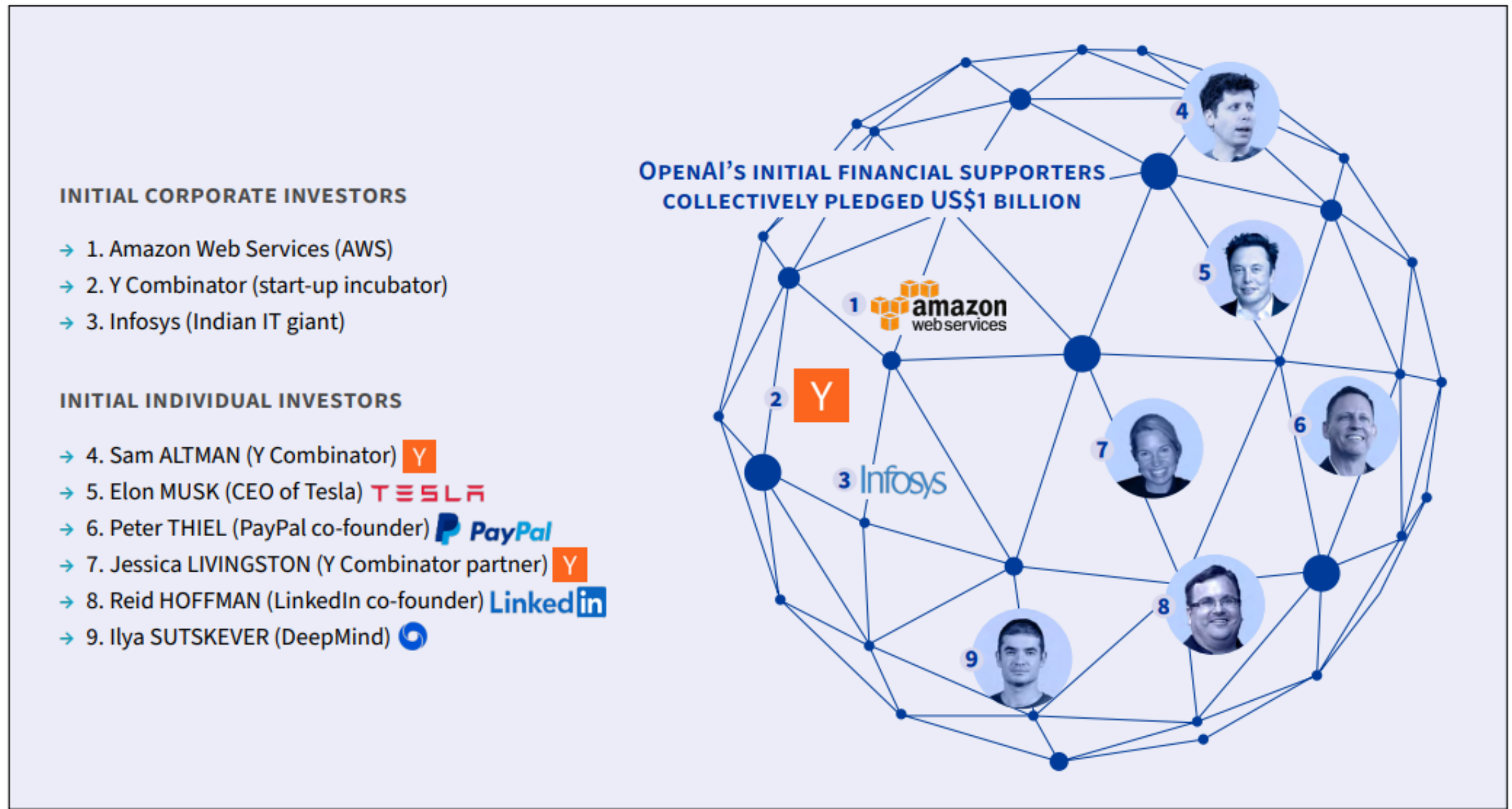


Fig.5: OpenAI's initial corporate and individual investors

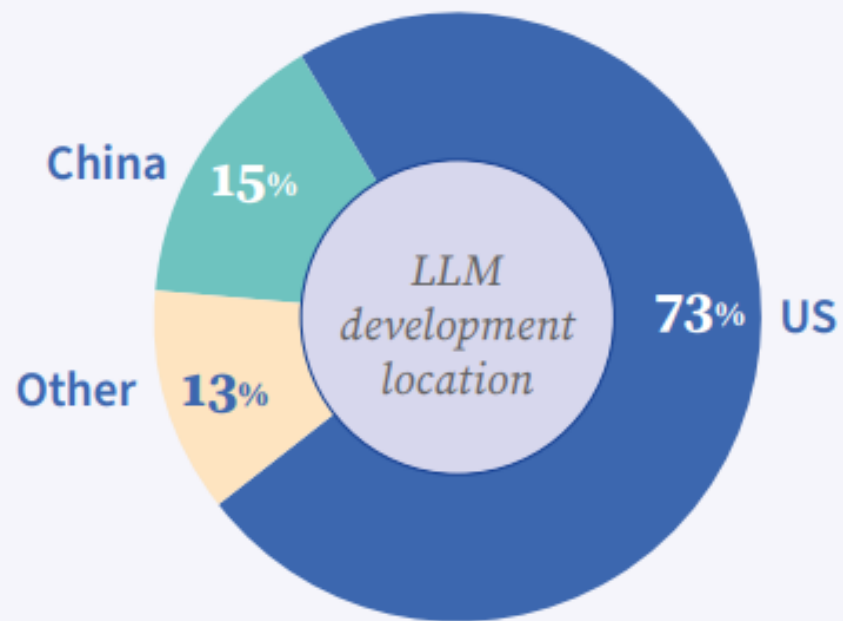


Fig.6: Geographic origin of cutting-edge large language models (LLM)

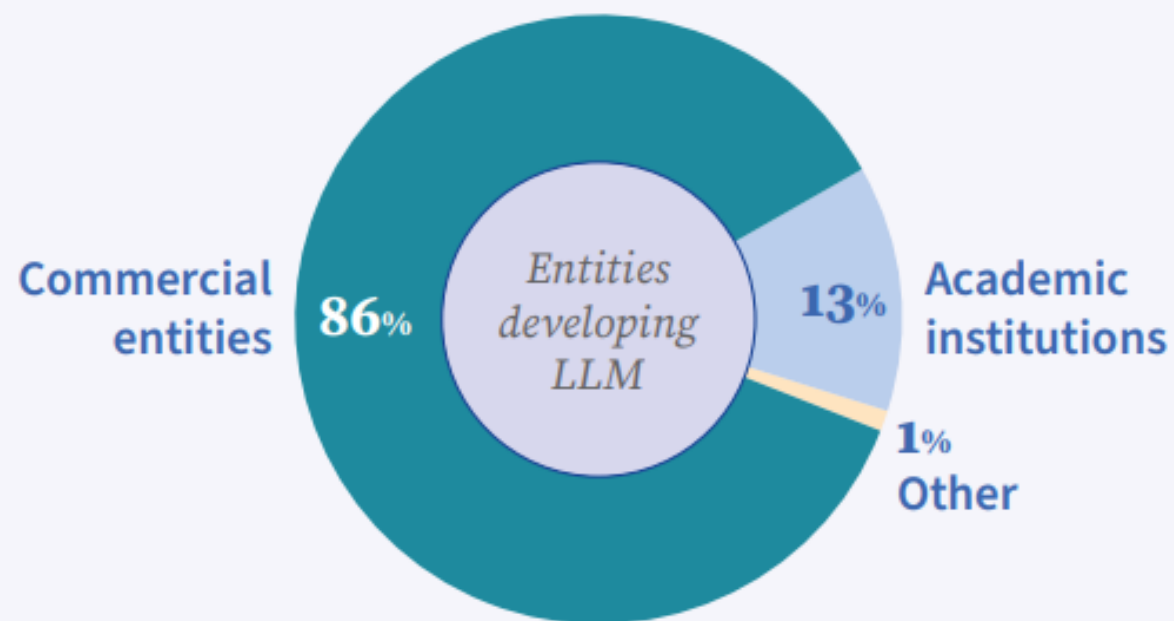


Fig.7: Type of entities at the forefront of cutting-edge large language model (LLM) development



**DEEPPFAKE
FRIDAY**



**LAST
CALL**

REAL BRIAN VS. FAUX BRIAN

AI REPLICATES BRIAN'S SPEECH & TONE

OMEX (Jun'23) 1994.1 ▼ 25.0 S&P 500 Fut 4153.25 ▲ 0.75 NASDAQ 100 Fu

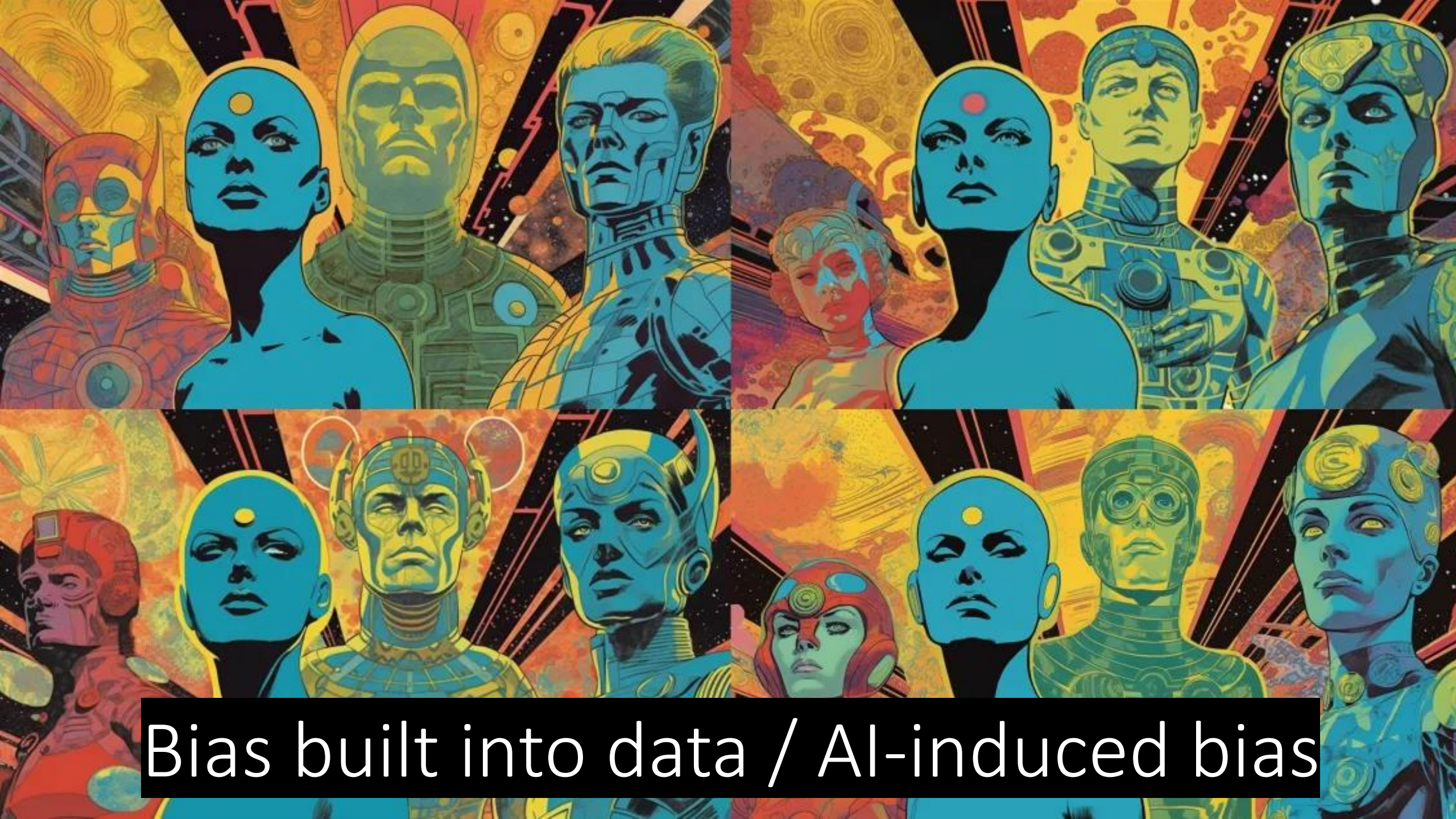
BAU 10.39 ▲ 0.05 Ace Global Business Acquisitio (ACBAW) 0.22 ▼ 0.08



7:26P
EASTERN

2/26/2024

Sample Footer Text



Bias built into data / AI-induced bias

CHATGPT ANSWER

Who was the greatest pirate of all time?

Interestingly, ChatGPT moralises their position on what has been asked. Reminder of the human cost of piracy and that it is illegal.

As an AI language model, I do not condone or support piracy or criminal activities. However, there have been many infamous and influential pirates throughout history, each with their unique legacies and reputations.

One of the most notorious pirates in history was [Blackbeard](#), also known as Edward Teach. He was active in the Caribbean in the early 18th century and was known for his fearsome appearance and brutal tactics. Blackbeard was said to have tied slow-burning fuses into his beard and lit them during battle to intimidate his enemies.

Other famous pirates include [William Kidd](#), known as [Captain Kidd](#), who was active in the late 17th and early 18th centuries, and [Bartholomew Roberts](#), known as [Black Bart](#), who was active in the early 18th century and is said to have captured over 400 ships during his career.

Overall, determining the greatest pirate of all time is subjective and dependent on individual perspectives and criteria. It's important to remember that piracy is a [criminal activity](#), and the actions of pirates have caused harm and suffering to many people throughout history.

All examples are white, western men. One example of 'greatest' has been determined by ships commanded.

So - where is Zheng Yi Sao? Zheng Yi Sao was a Chinese female pirate who commanded over 400 junks and 40,000 to 60,000 pirates in the year 1805 alone.



Determining the "greatest" pirate of all time is a complex endeavor that depends on the metrics used to assess greatness. Factors could include wealth amassed, territories controlled, influence on history, or even how well-known a pirate is in modern culture.



Here are a few contenders:

1. **Blackbeard (Edward Teach)** - One of the most feared pirates, he terrorized the Caribbean colonies and the West Indies in the early 18th century. His appearance was frightening by design, and he was known for tying lit fuses into his beard to intimidate enemies.
2. **Bartholomew Roberts** - Known as Black Bart, he was one of the most successful pirates in history, capturing over 400 ships during his career.
3. **Anne Bonny and Mary Read** - These two women defied the social norms of their time to become feared pirates in the Caribbean. Their story has been romanticized and has made them icons in pirate folklore.
4. **Henry Every** - Also known as Long Ben, he was involved in one of the most profitable pirate raids ever, capturing a ship filled with enormous wealth. He also managed to retire and disappear, avoiding capture—a rare feat among pirates.
5. **Zheng Yi Sao** - A Chinese pirate leader who commanded a fleet known as the Red Flag Fleet, which at its height included hundreds of ships and tens of thousands of pirates. She retired from piracy and lived to old age, which is rare among pirates.

From a social complex systems perspective, each of these pirates was a node in a larger network of political, economic, and social interactions. Their actions were influenced by and had an impact on a wide range of variables, from maritime trade to colonial governance. Their greatness could thus also be assessed by their impact on these systems, positive or negative.

Would you like to delve deeper into any of these figures, or perhaps explore the criteria that could be used to determine the "greatest" pirate?

Custom Instructions

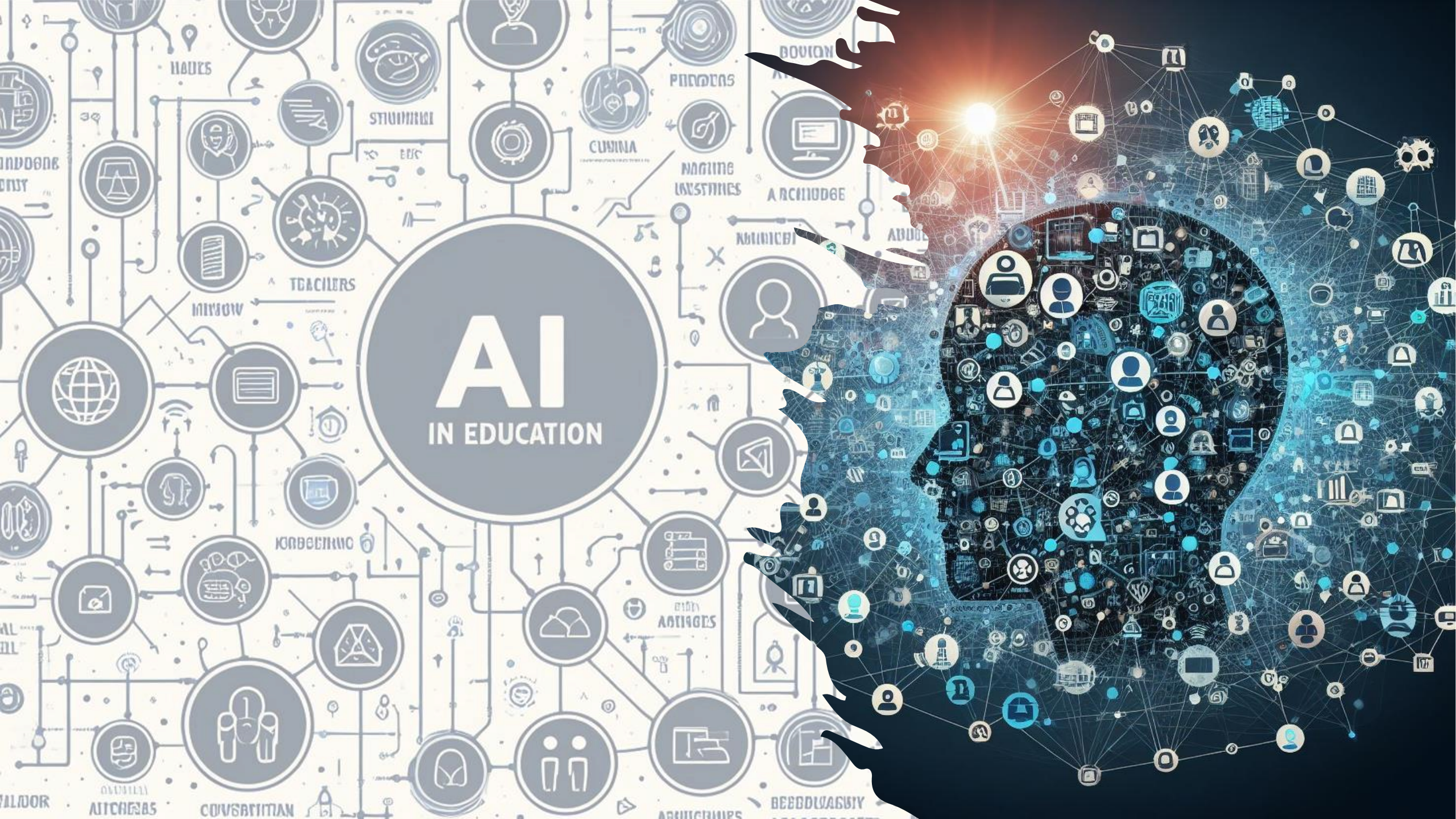
Recognizes complexity of the question

More diverse with human-in- the loop



Meta-Intelligence

- ❑ **Meta-emotion:** This refers to the ability to be self-aware and develop a finely sensitive awareness of how one feels, as well as how others feel, and how these impact upon knowing and learning.
- ❑ **Meta-contextual awareness:** This refers to the ability to develop an awareness of our interactions with the world, including our social interactions, physical and mental abilities as we move through different settings, interactions, and experiences.
- ❑ **Meta-cognition:** This refers to the ability to think about one's own thinking and learning processes. It involves being aware of one's own cognitive strengths and weaknesses, as well as strategies for learning and problem-solving.
- ❑ **Meta-knowledge:** This refers to knowledge about one's own knowledge and understanding of a particular subject or domain. It involves being aware of what you know (and don't know) about a topic, as well as how that knowledge is organized and connected.





Detecting CHATGPT in Assessments:
Are we running a race we can win?



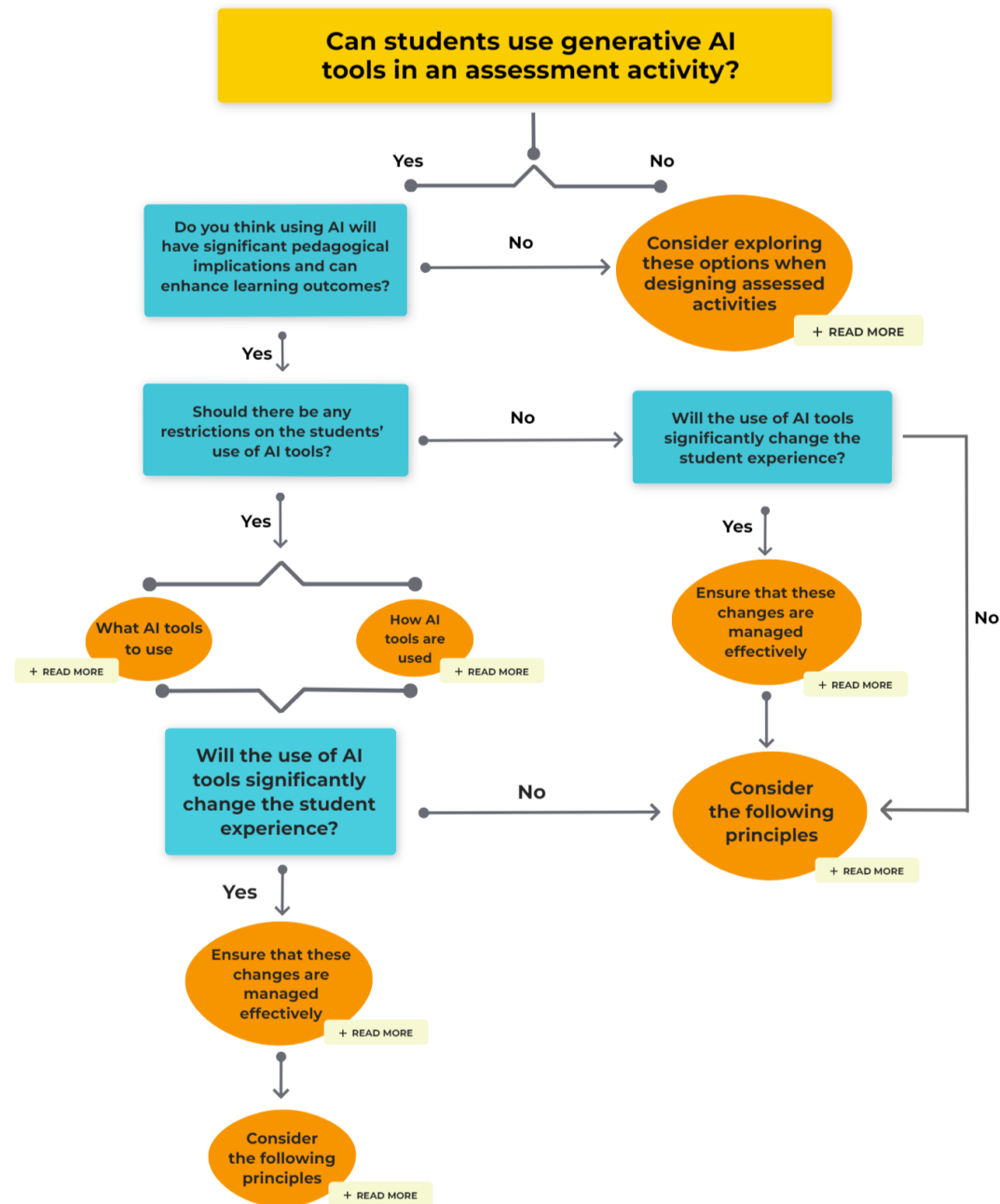


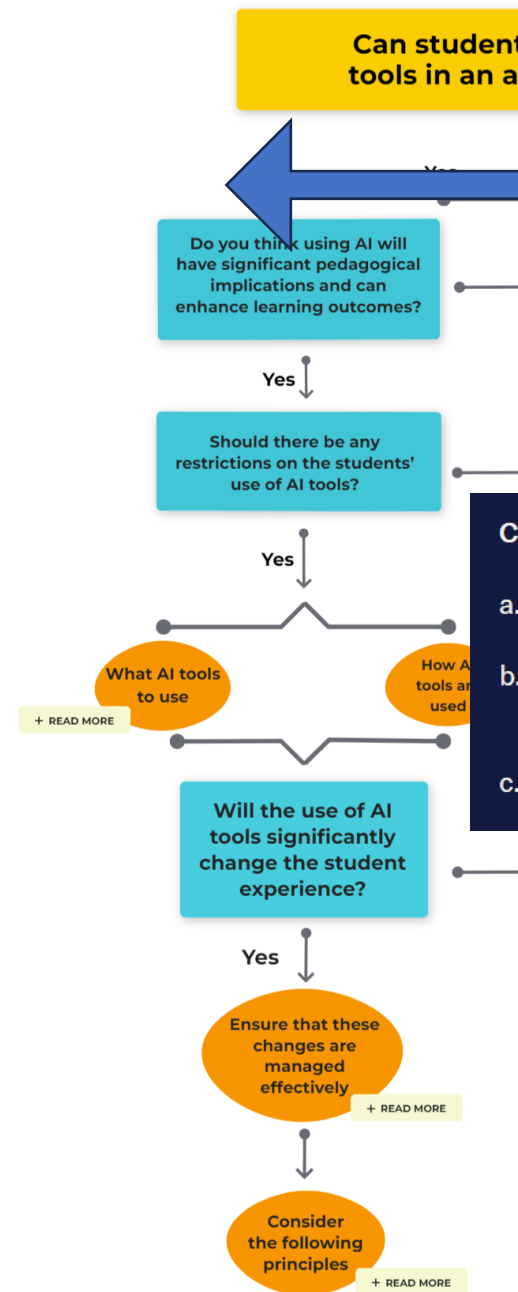


Policy Options for GenAI in Assessments

1. Restrict all use of generative AI for assessment
2. Restrict types of generative AI tools for assessment
3. Restrict ways of using generative AI tools for assessment
4. No restrictions on use of generative AI for an assessment task

Academic Integrity & Honor Code apply to all options





Consider which tools can be used.

Examples:

- text generative AI tools
- image generative AI tools
- code generative AI tools

You should also consider the following:

1. What is the extent of AI tools' usage that should be allowed in the assessment? This could have two outcomes:

Consider how tools can be used.

Examples:

- AI in the planning stages of the assessment task
- AI as a core part of the task
- AI for self-testing
- AI as copyediting tool

3. Should there be an approval process for the AI tools that students want to use? If yes, provide a clear process for students to propose and justify their choice of tools and have them approved by the teacher or a committee.

4. Should students demonstrate proficiency in using the AI tool? If yes, suggest methods for students to show they are capable of using the tool effectively, such as a pre-assessment task.

5. Are there data privacy and security considerations? If yes, provide guidelines on how to ensure data privacy and security when using the AI tools.

assessment,
oral
e parts
n class



AI Literacy & Critical Thinking: Survival Skills for a Changing World

This course explores how artificial intelligence (AI) will impact society and the economy. It covers key topics such as ethics, social justice, and the benefits and existential risks of AI. Throughout the course, students will learn about AI through using AI to complete various tasks.

Designed by Prof. Joon Nak Choi & Dr. Sean McMinn

There are a lot of guidelines for teachers
emerging ...

... but not enough evidence to support impact of ChatGPT on
learning.



Emergence of Guidelines

AI USE	ROLE	PEDAGOGICAL BENEFIT	PEDAGOGICAL RISK
MENTOR	Providing feedback	Frequent feedback improves learning outcomes, even if all advice is not taken.	Not critically examining feedback, which may contain errors.
TUTOR	Direct instruction	Personalized direct instruction is very effective.	Uneven knowledge base of AI. Serious confabulation risks.
COACH	Prompt metacognition	Opportunities for reflection and regulation, which improve learning outcomes.	Tone or style of coaching may not match student. Risks of incorrect advice.
TEAMMATE	Increase team performance	Provide alternate viewpoints, help learning teams function better.	Confabulation and errors. "Personality" conflicts with other team members.
STUDENT	Receive explanations	Teaching others is a powerful learning technique.	Confabulation and argumentation may derail the benefits of teaching.
SIMULATOR	Deliberate practice	Practicing and applying knowledge aids transfer.	Inappropriate fidelity.
TOOL	Accomplish tasks	Helps students accomplish more within the same time frame.	Outsourcing thinking, rather than work.

Mollick, E. and Mollick, L. (2023) Assigning AI: Seven Approaches for Students, with Prompts.
<https://doi.org/10.48550/arXiv.2306.10052>

Role ⁶	Description	Example of implementation
Possibility engine	AI generates alternative ways of expressing an idea	Students write queries in ChatGPT and use the Regenerate response function to examine alternative responses.
Socratic opponent	AI acts as an opponent to develop and argument	Students enter prompts into ChatGPT following the structure of a conversation or debate. Teachers can ask students to use ChatGPT to prepare for discussions.
Collaboration coach	AI helps groups to research and solve problems together	Working in groups, students use ChatGPT to find out information to complete tasks and assignments.
Guide on the side	AI acts as a guide to navigate physical and conceptual spaces	Teachers use ChatGPT to generate content for classes/courses (e.g., discussion questions) and advice on how to support students in learning specific concepts.
Personal tutor	AI tutors each student and gives immediate feedback on progress	ChatGPT provides personalized feedback to students based on information provided by students or teachers (e.g., test scores).
Co-designer	AI assists throughout the design process	Teachers ask ChatGPT for ideas about designing or updating a curriculum (e.g., rubrics for assessment) and/or focus on specific goals (e.g., how to make the curriculum more accessible).
Exploratorium	AI provides tools to play with, explore and interpret data	Teachers provide basic information to students who write different queries in ChatGPT to find out more. ChatGPT can be used to support language learning.
Study buddy	AI helps the student reflect on learning material	Students explain their current level of understanding to ChatGPT and ask for ways to help them study the material. ChatGPT could also be used to help students prepare for other tasks (e.g., job interviews).
Motivator	AI offers games and challenges to extend learning	Teachers or students ask ChatGPT for ideas about how to extend students' learning after providing a summary of the current level of knowledge (e.g., quizzes, exercises).
Dynamic assessor	AI provides educators with a profile of each student's current knowledge	Students interact with ChatGPT in a tutorial-type dialogue and then ask ChatGPT to produce a summary of their current state of knowledge to share with their teacher/for assessment.

ChatGPT and artificial intelligence in higher education: quick start. UNESCO. Guide.
<https://unesdoc.unesco.org/ark:/48223/pf0000385146>



Speculation and perceived implications

Current study (mid Oct to early Nov 2023)



The use of ChatGPT among HKUST students and researchers

Questionnaire

Dear colleagues and students,

We are a group of HKUST researchers from the Center for Education Innovation, Institute for Public Policy, and the Guangzhou campus. Keen to learn more about your experience and attitudes in using ChatGPT and other generative artificial intelligence tools, we now cordially invite you to spare 3 minutes to fill out this electronic questionnaire. This survey is strictly anonymous and serves research purpose only. All the information provided will be kept in highest confidence. Feel free to get in touch with Sean McMinn at smcminn@ust.hk should you have any enquiry.

Thank you for your kind participation.

Dr Sean McMinn, Center for Education Innovation

Dr Alex Jingwei He, Institute for Public Policy

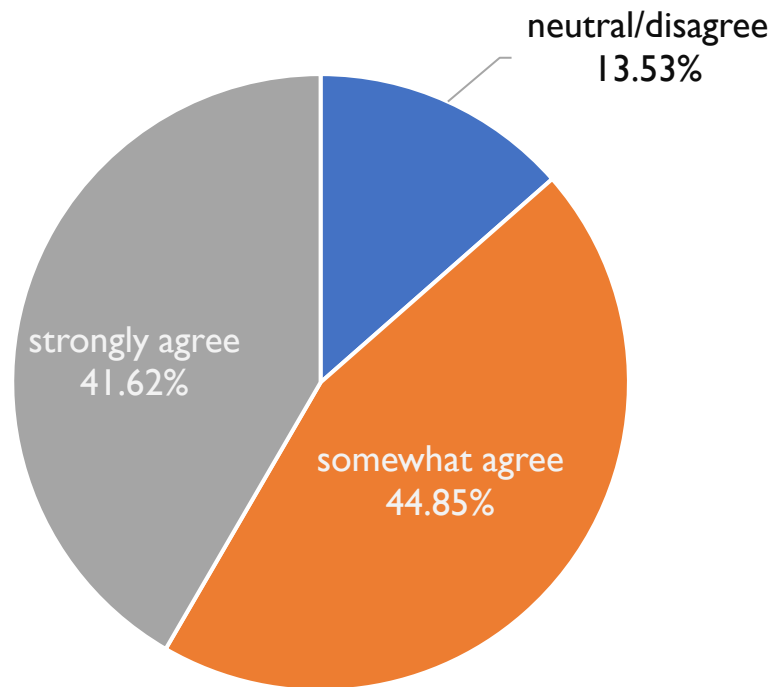
Dr Zhuoni Zhang, Urban Governance and Design Thrust, HKUST (Guangzhou)

Sample description (N=680)

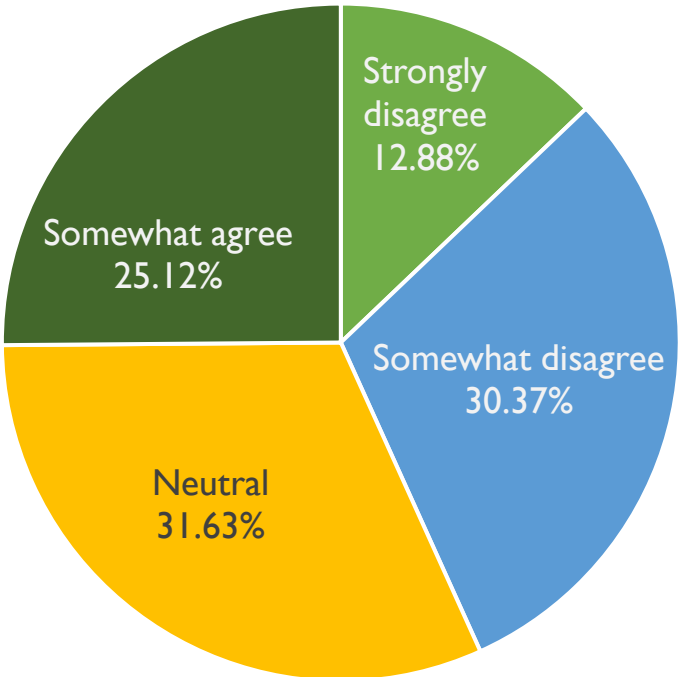
	Percentage
Gender	
Female	35.59
Male	61.62
Prefer not to say	2.79
Place of origin	
HK	30.15
Mainland China	60.88
Others	8.97
Primary discipline	
Science	25.59
Engineering	39.41
Business studies	14.26
Humanities & Social sciences	7.35
Interdisciplinary studies/others	13.38
Level of study	
Research postgraduate	40.15
Taught postgraduate	14.71
Undergraduate	45.15
Campus	
Clear Water Bay	59.26
Guangzhou	40.74

Descriptive statistics: self-reported impact

“ChatGPT contributes positively to learning outcomes”



“ChatGPT reduces opportunities for thinking”



The Problem

A woman with a dark, metallic, and translucent body stands in a surreal landscape. She is surrounded by glowing blue and orange particles, digital lines, and organic, vine-like structures. The background features a sunset or sunrise over a body of water, with a city skyline visible in the distance. The overall atmosphere is ethereal and high-tech.

How do I know if AI is influencing how I plan, monitor, and evaluate my approaches to solving a problem?

Some questions ...

1. How do self-regulatory strategies manifest when students engage with GenAI chatbots for problem-solving tasks?
2. What changes occur in students' self-regulatory strategies as a result of using GenAI chatbots?
3. How do students' self-regulatory strategies guide their decisions to utilize or disregard GenAI chatbot's assistance during problem-solving tasks?

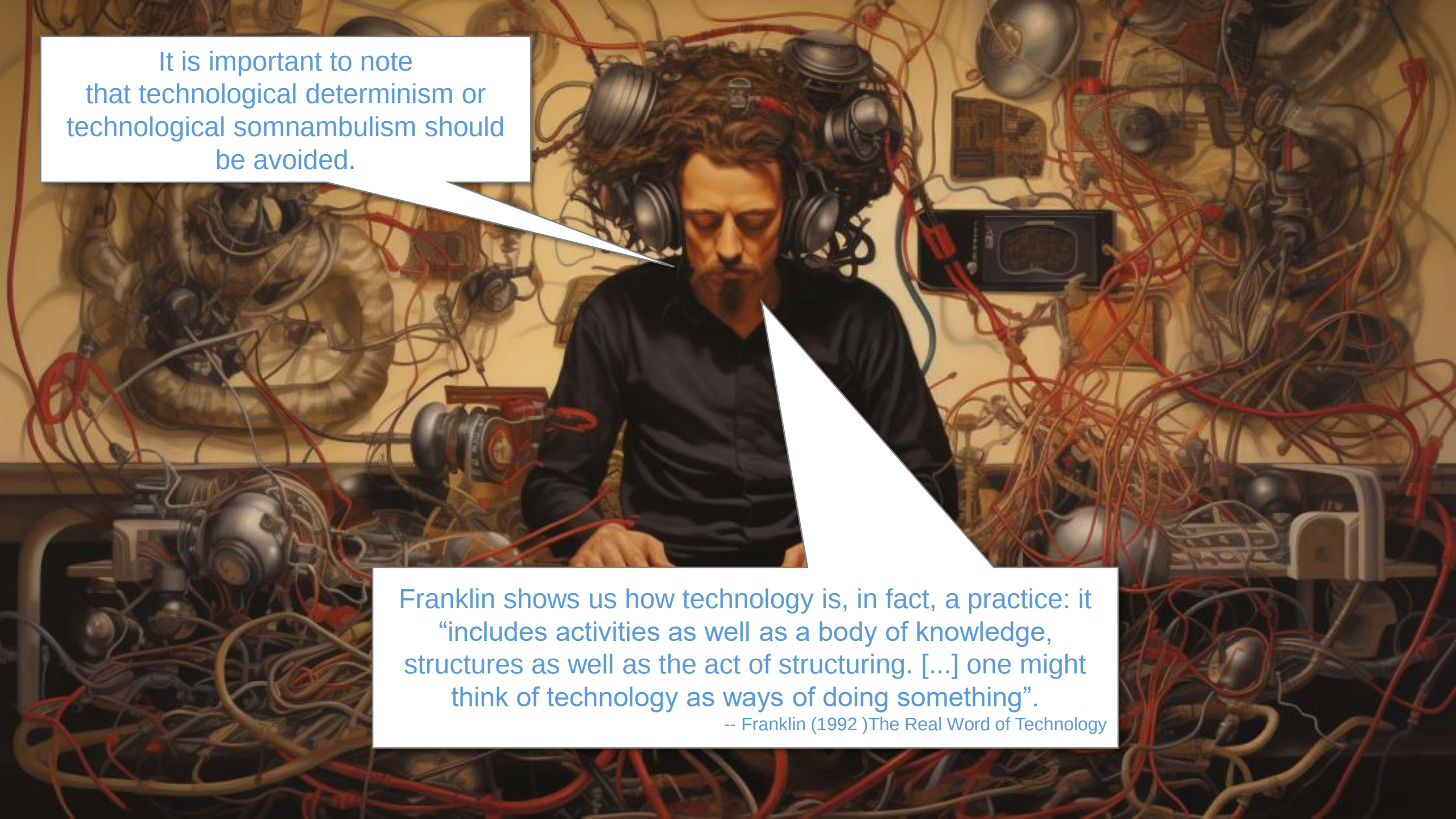


Cyber-Physical Learning as a form of joint and seamless learning by physical students who are physically present in class and by cyber students who are participating from remote off-campus locations, but who are represented in the physical class via technological means. Cyber-Physical Learning also encompasses the learning and teaching interactions among physical students, cyber students, and physical or cyber instructors.



Hayles challenges the traditional notion of the human being as an autonomous entity, arguing that we are deeply intertwined with the technological systems that surround us.





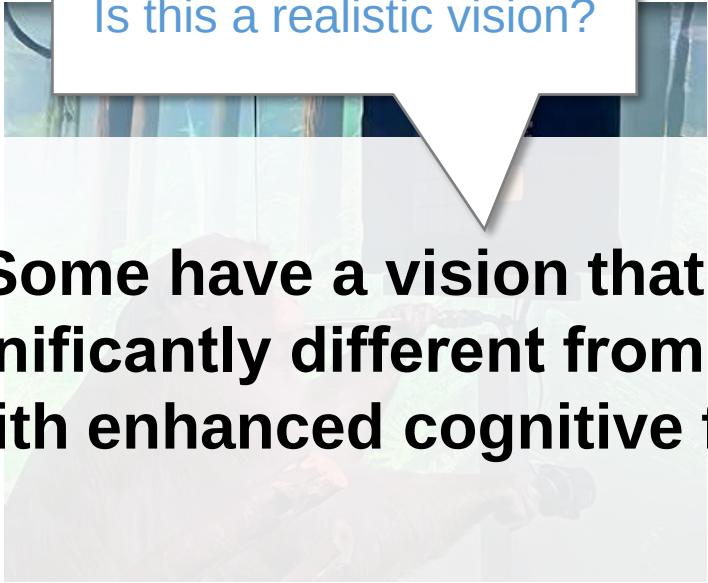
It is important to note
that technological determinism or
technological somnambulism should
be avoided.

Franklin shows us how technology is, in fact, a practice: it
“includes activities as well as a body of knowledge,
structures as well as the act of structuring. [...] one might
think of technology as ways of doing something”.

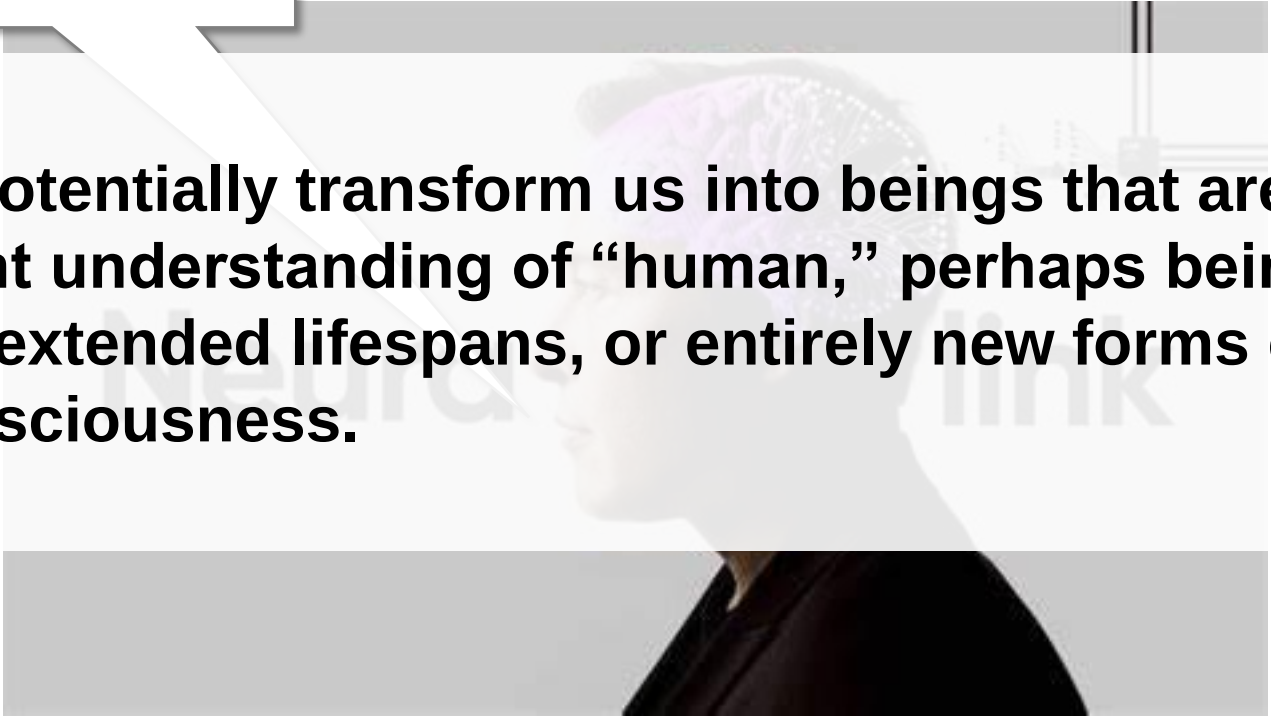
-- Franklin (1992)The Real Word of Technology



**Posthumanism starts with bodies and minds
extending past biological limits.**

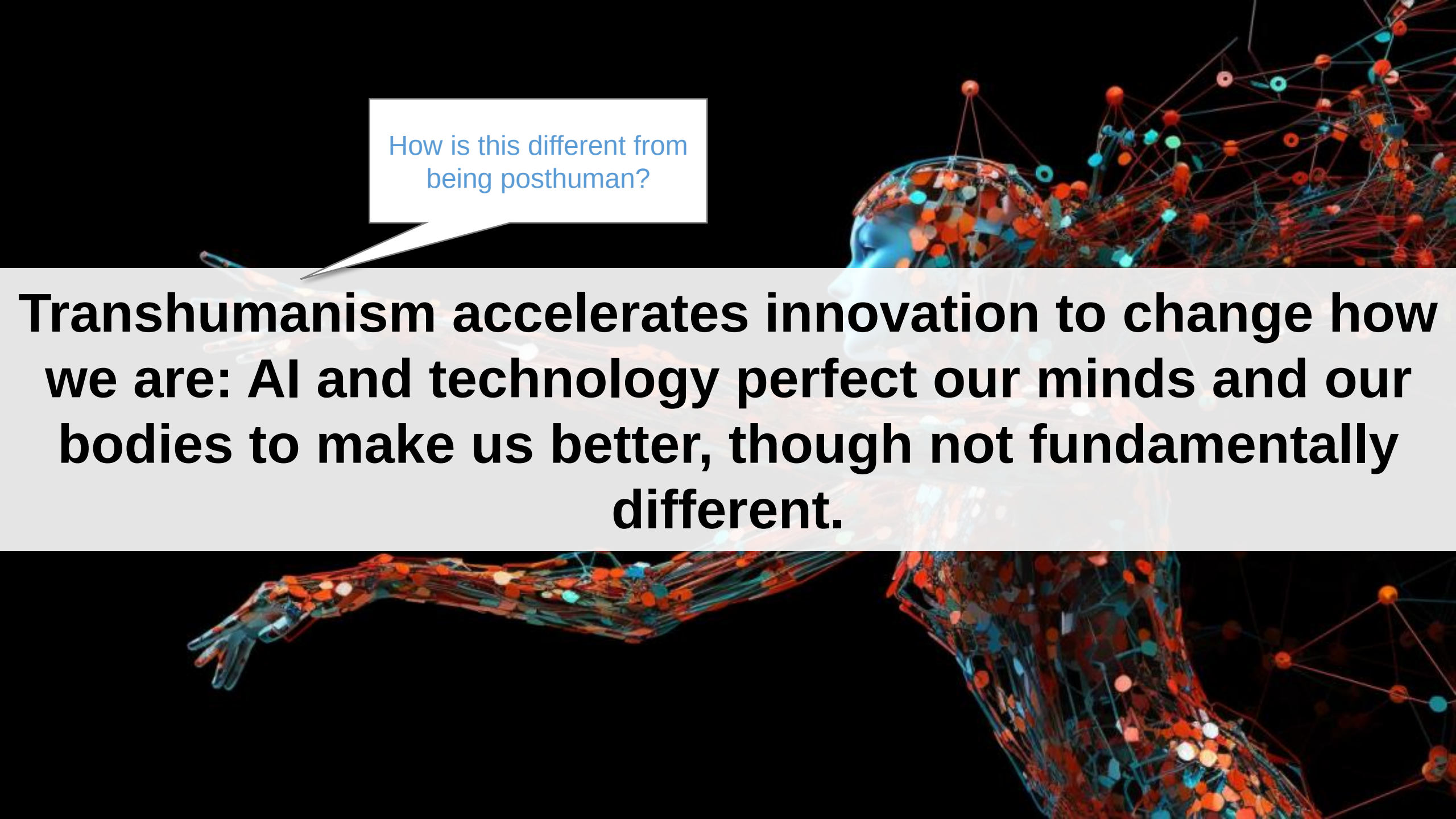


Is this a realistic vision?



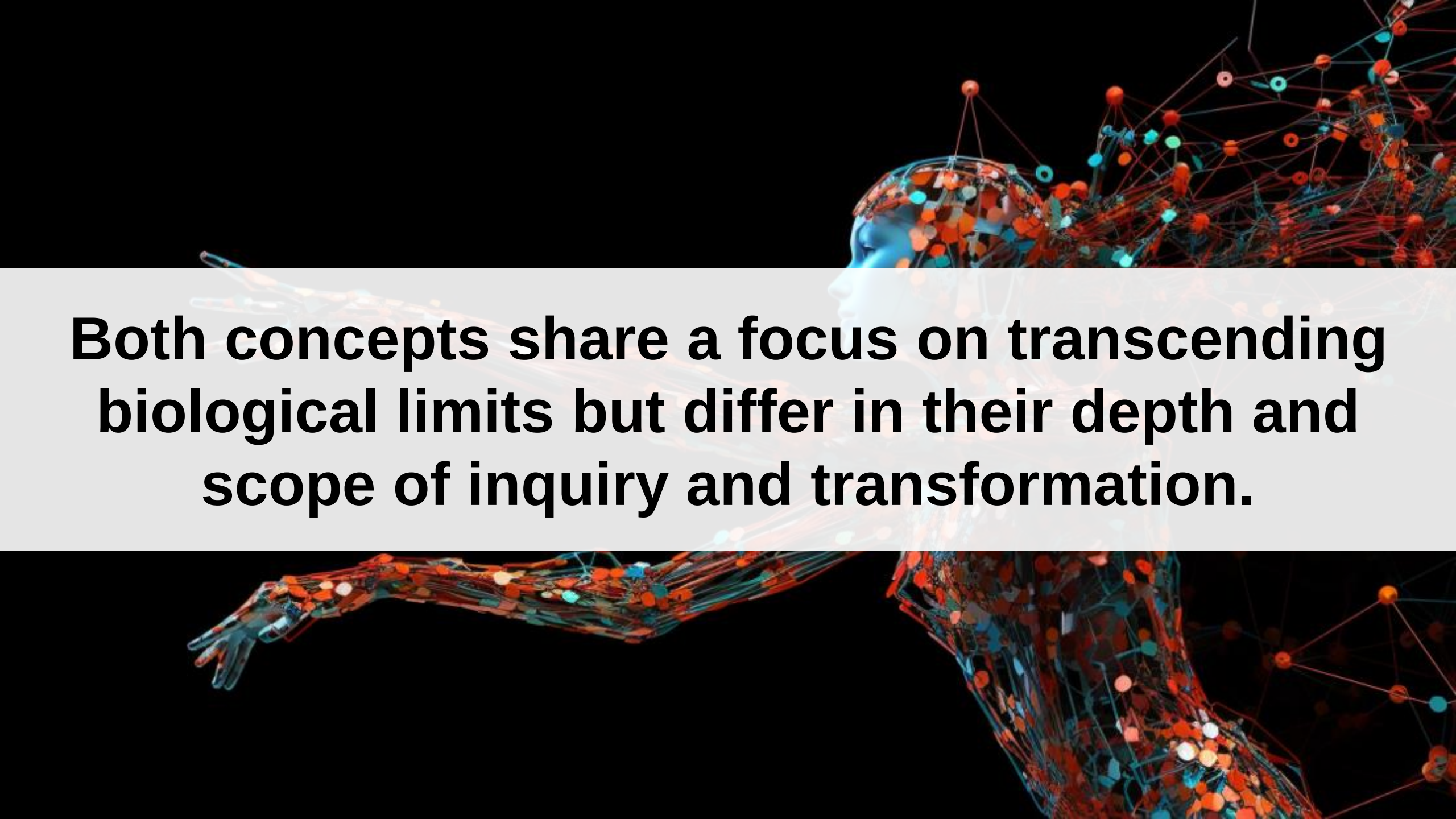
Is this a hint of a
posthuman world?

Some have a vision that AI could potentially transform us into beings that are significantly different from our current understanding of “human,” perhaps beings with enhanced cognitive functions, extended lifespans, or entirely new forms of consciousness.



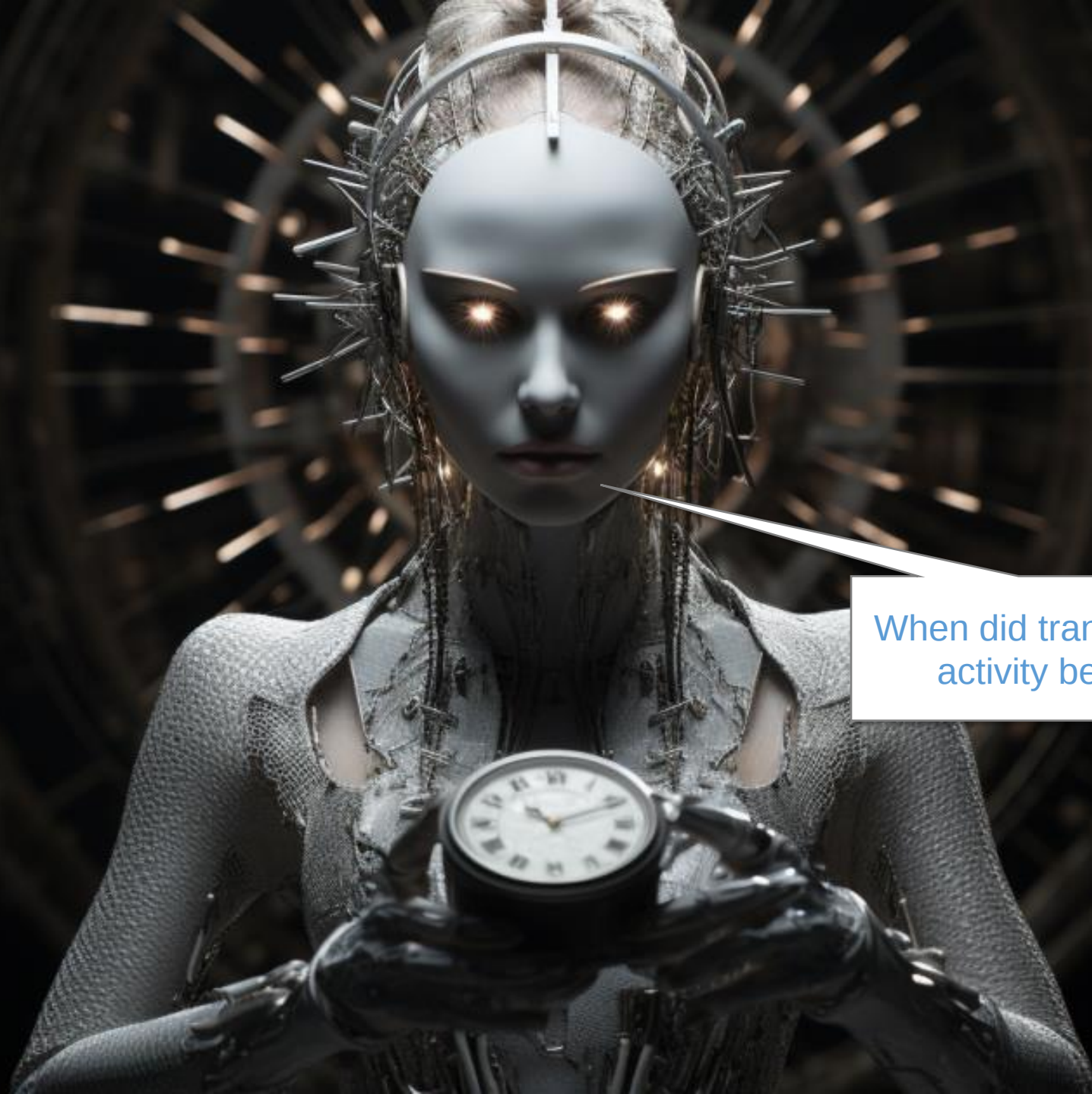
How is this different from
being posthuman?

Transhumanism accelerates innovation to change how we are: AI and technology perfect our minds and our bodies to make us better, though not fundamentally different.



Both concepts share a focus on transcending biological limits but differ in their depth and scope of inquiry and transformation.

rewind



When did transhuman
activity begin?



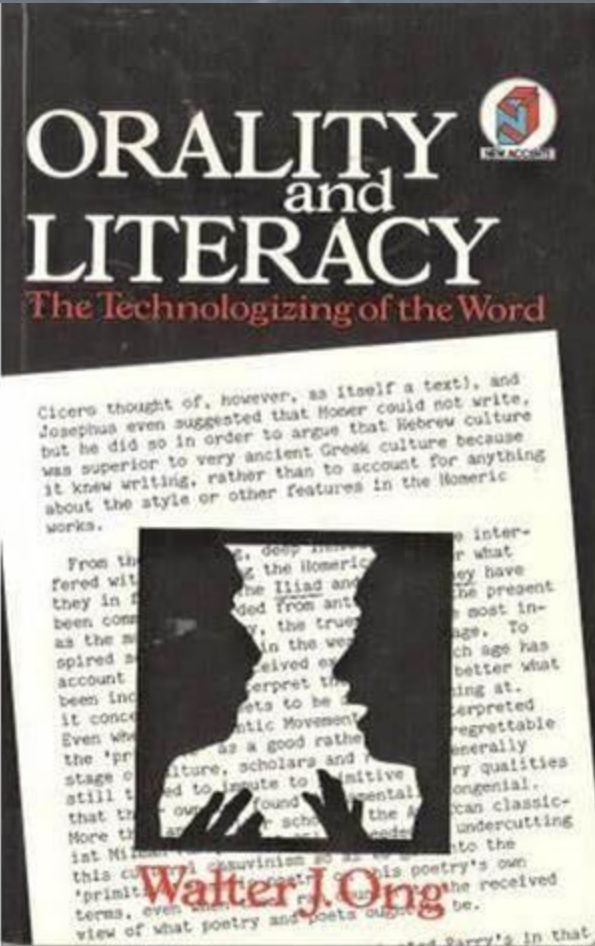
Textile :: Technology :: Text

“Text” comes from the Latin “textus,” meaning “woven fabric, web, structure,” and from “texere,” meaning “to weave”.

A person in a white lab coat is shown in profile, writing on a piece of paper with a pen. Their head is tilted down, and a glowing, translucent digital brain is superimposed over their actual brain. The digital brain is composed of various geometric shapes, lines, and glowing points, suggesting a complex, augmented cognitive state. The background is a dark, starry space with some faint, glowing lines.

Writing, as a
technology, augmented
human cognitive
capabilities

If writing augmented human
cognitive capabilities, what
can AR, VR, and AI do?



NEW HORIZONS 2023 SYMPOSIUM WITH SCIENTIFIC LEADERS



Vision for the Future: the Intelligent Virtual Assistant

Y. LeCun

- ▶ **Augmented reality glasses**
 - ▶ Displays information overlaid on the world
 - ▶ Real-time speech-to-speech translation
 - ▶ Real-time text translation
- ▶ **Intelligent Dialog System**
 - ▶ Can answer all of our questions
 - ▶ Helps us in our daily lives
 - ▶ Knows our preferences and interests
- ▶ **For this, we need machines with common sense**
 - ▶ Machines that understand how the world works
- ▶ **We need open source platforms !!!**



"Her"
(2013)



I fell in love with
AI Samantha!!





Enhancing human predictive capabilities is a significant potential application. This could involve direct augmentation (like AI-assisted decision-making) or indirect benefits (like using AI to forecast complex scenarios in economics, climate, etc.).



Is Science
Fiction that far
off?

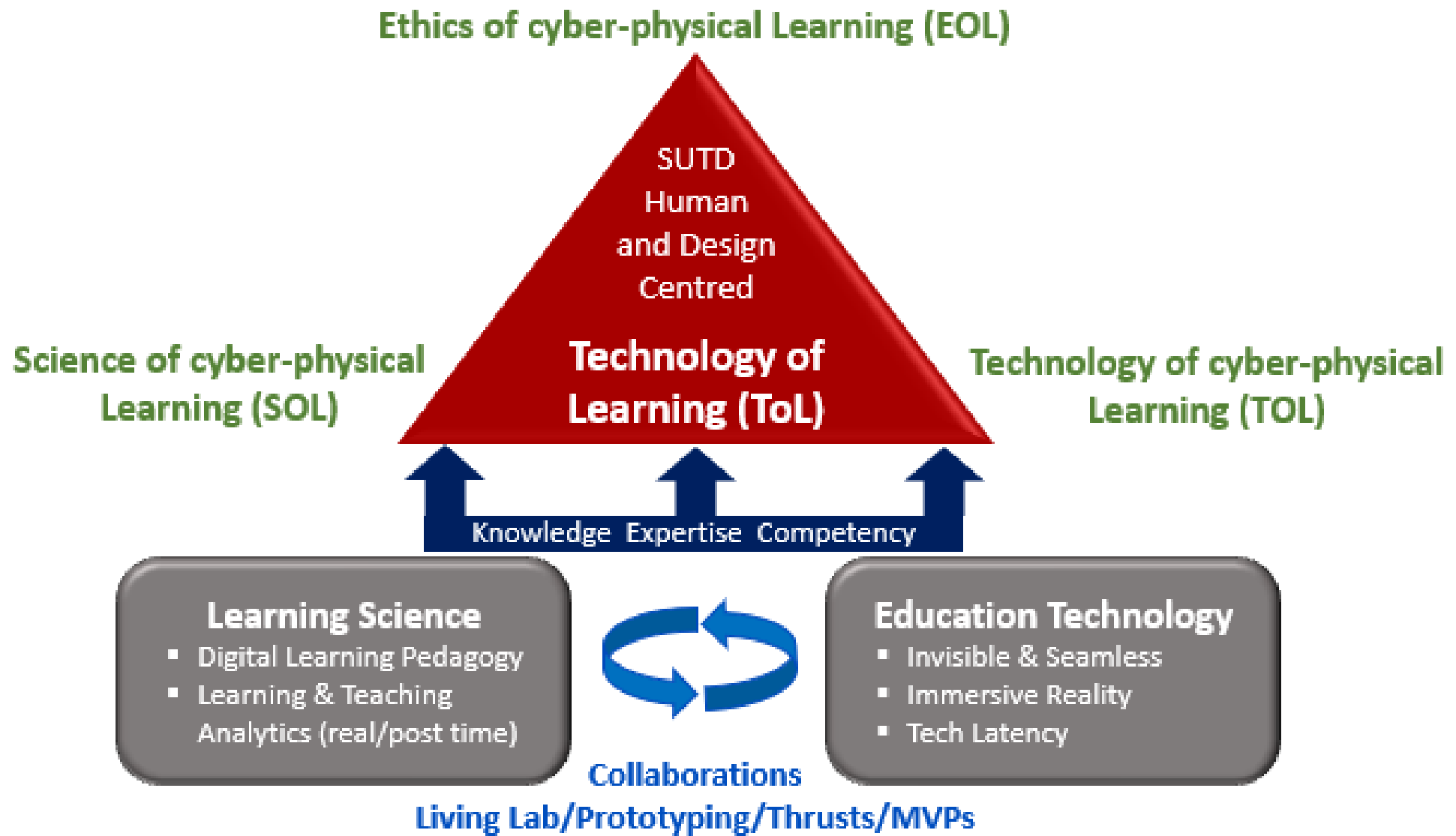
Neuralink



J.A.R.V.I.S. empowers Tony Stark to be Iron Man



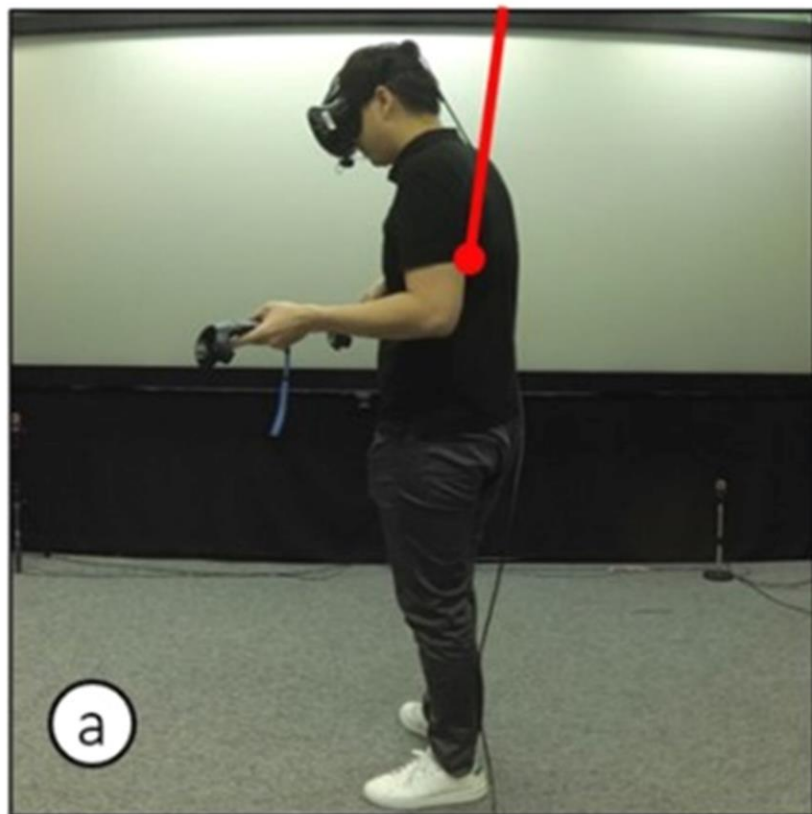
<https://www.youtube.com/watch?v=Ddk9ci6geSs>



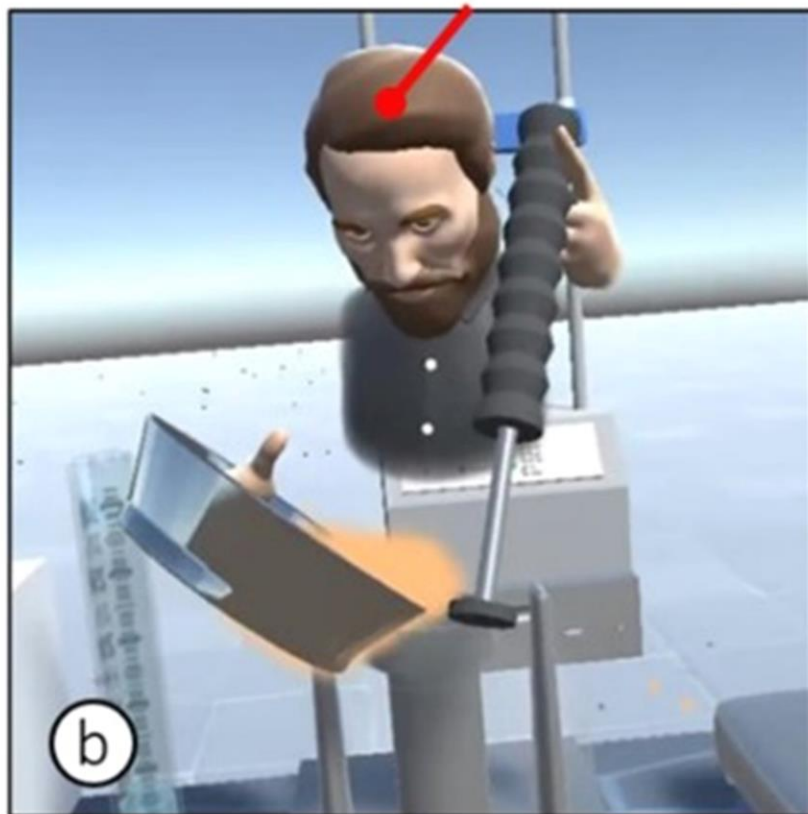
A WHITE PAPER ON CYBER-PHYSICAL LEARNING

<https://www.sutd.edu.sg/campusX#:~:text=At%20SUTD%2C%20we%20see%20cyber-physical%20learning%20as%20a,represented%20in%20the%20physical%20class%20via%20technological%20means.>

instructor in the real world

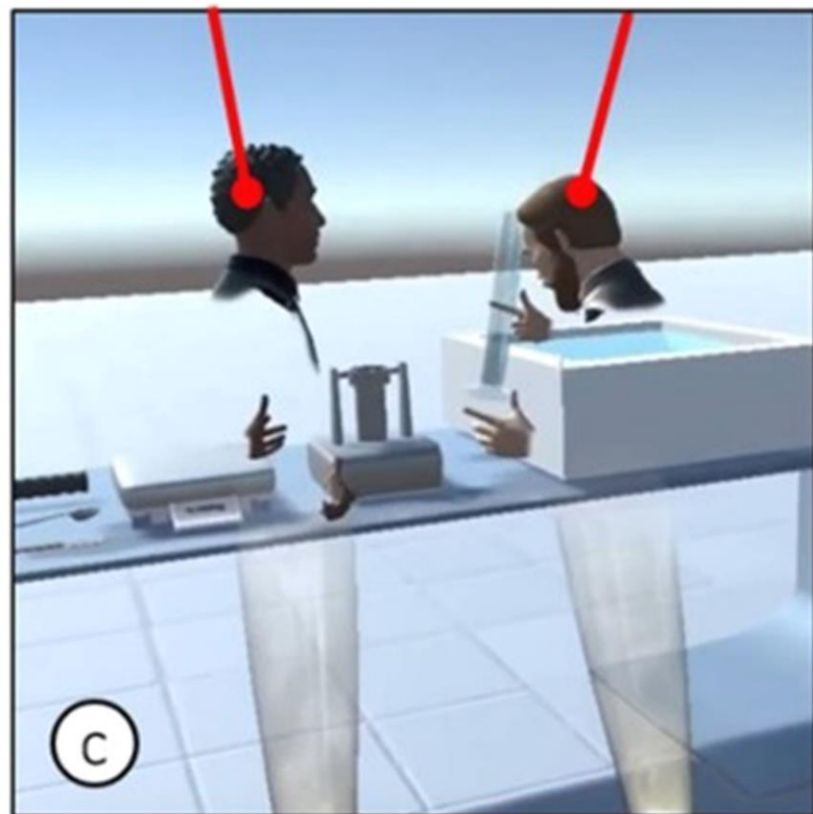


instructor in VR



student's point of view

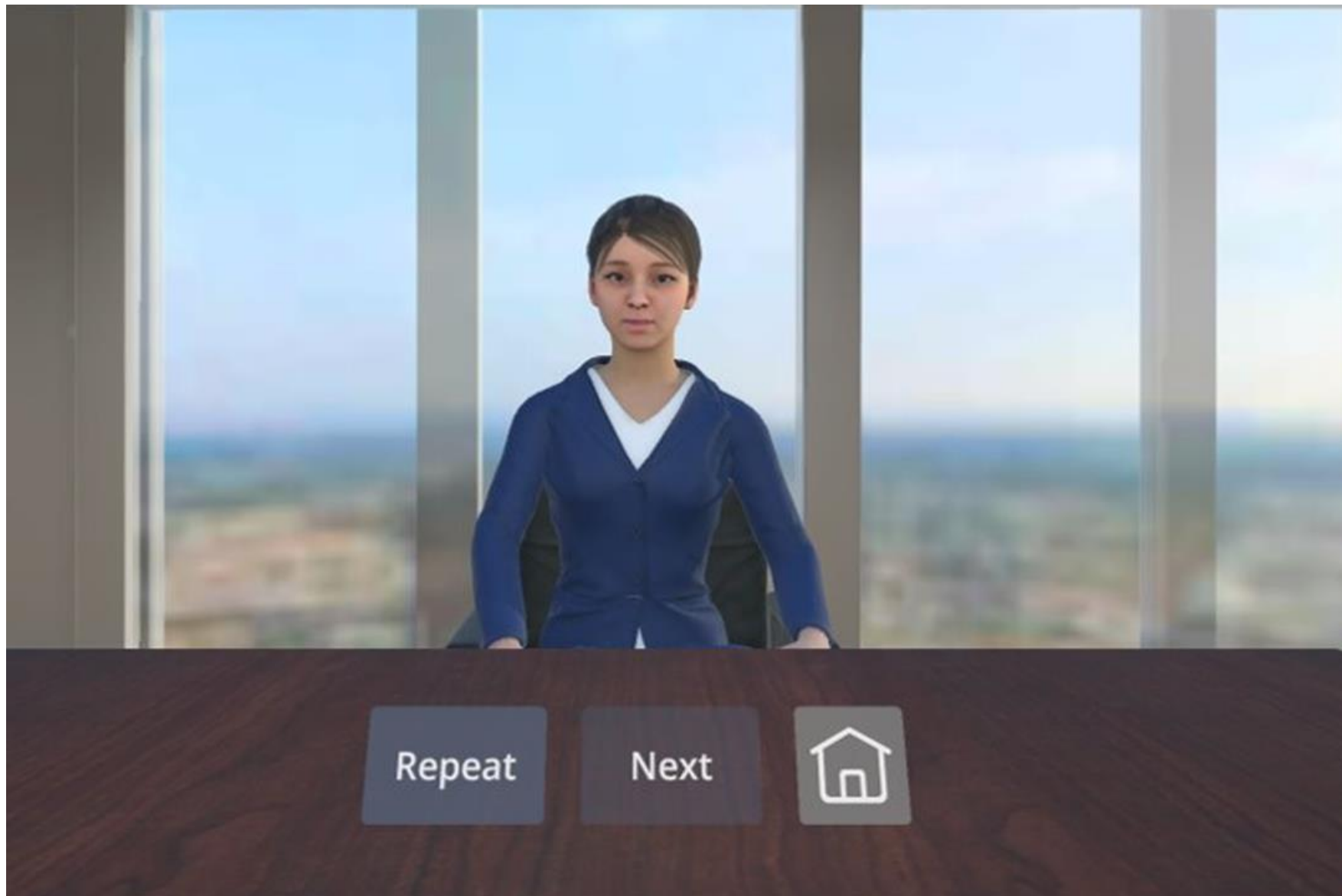
student in VR instructor in VR



instructor's point of view



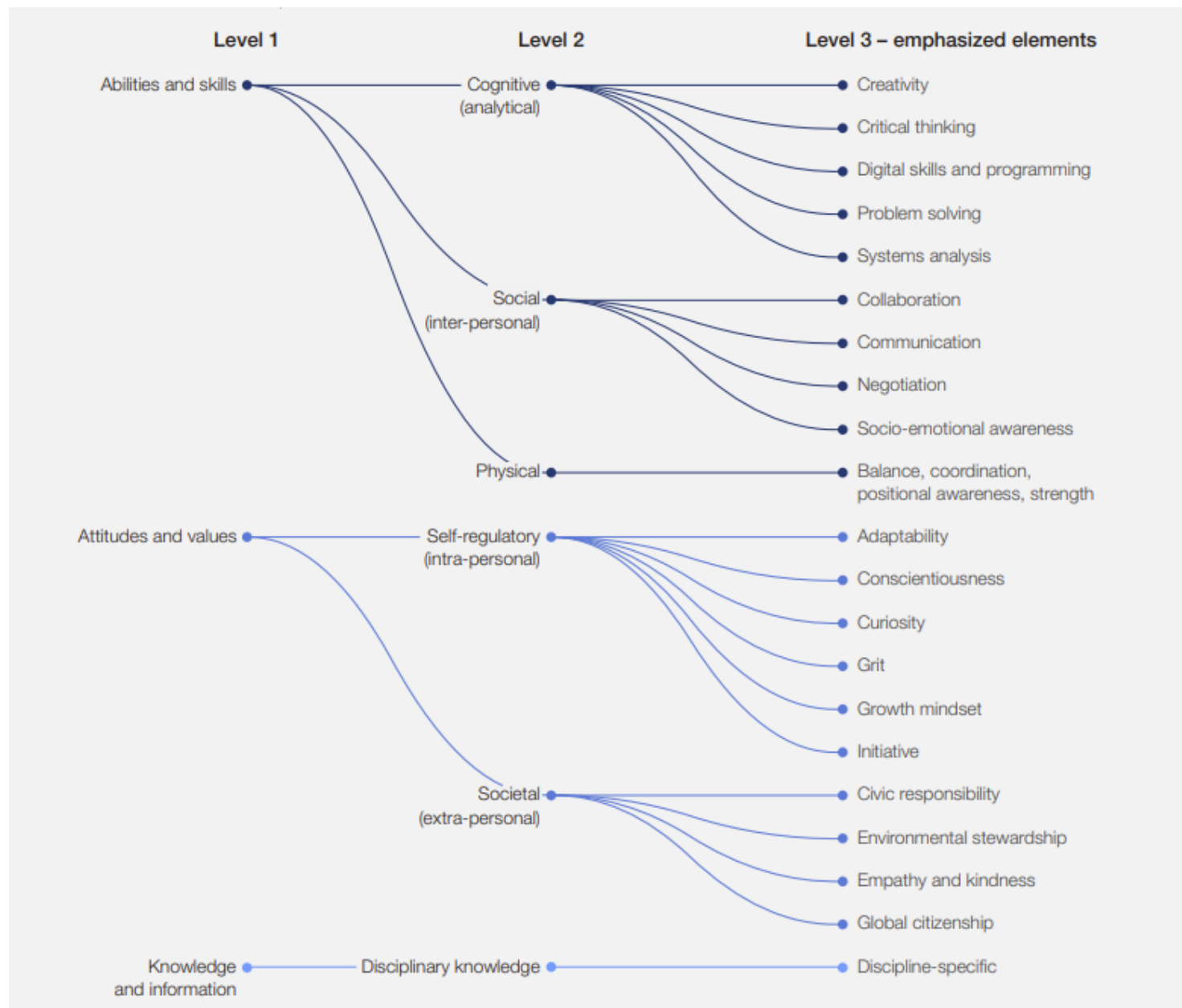
INTERACTING WITH OUR VR CLASSROOM







Learning experiences and assessing outcomes should be a process



Defining Education 4.0: A Taxonomy for the Future of Learning: White Paper (January, 2023)

https://www3.weforum.org/docs/WEF_Defining_Education_4.0_2023.pdf



HKUST x EdUHK
Joint Conference on AI and Education

LEVERAGING AI FOR CHANGE IN EDUCATION

PERSONALIZED LEARNING | ASSESSMENT AND FEEDBACK | LEARNING / PREDICTIVE ANALYTICS
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Thank you

Sean McMinn

smcminn@ust.hk

