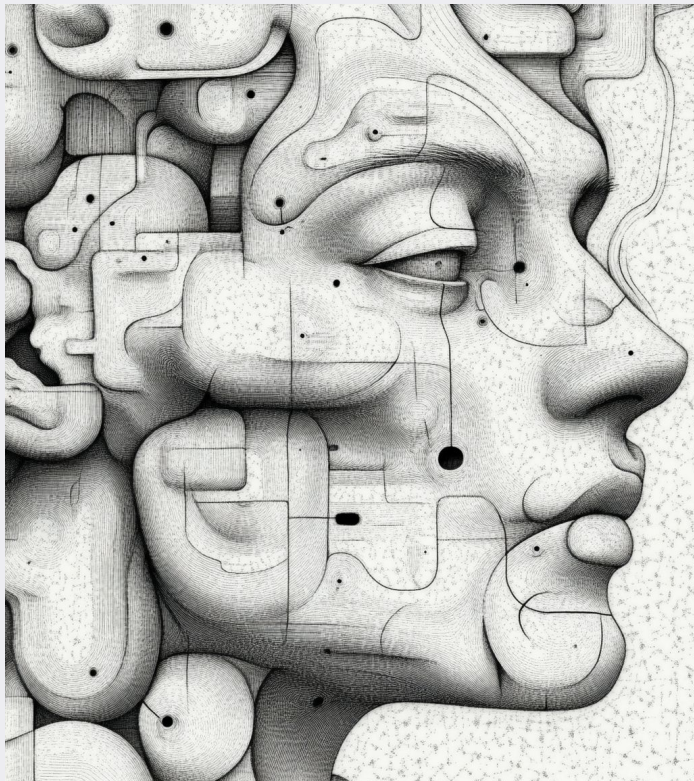# Generative AI for Education
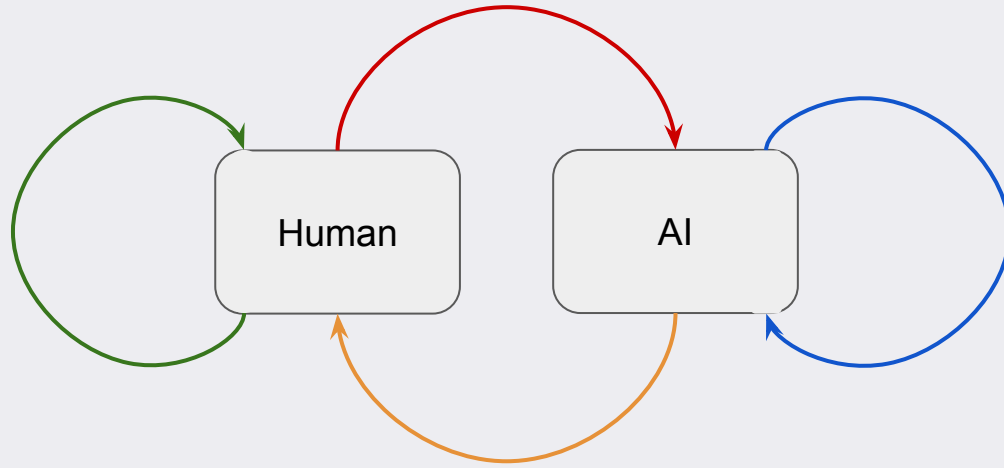
Cybernetics

Artificial Intelligence

Artificial Intelligence involves….

"*how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves*" (McCarthy et al., 1955)

An Era of Symbiotic (or Sympoetic* or Co-intelligent**) Pedagogy?
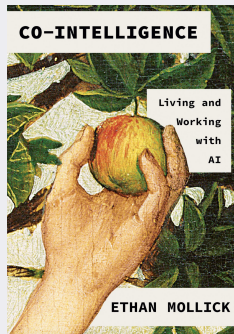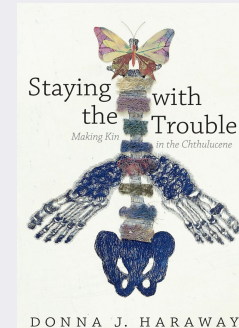

Human-to-Human

Human-to-AI (e.g. GPT)
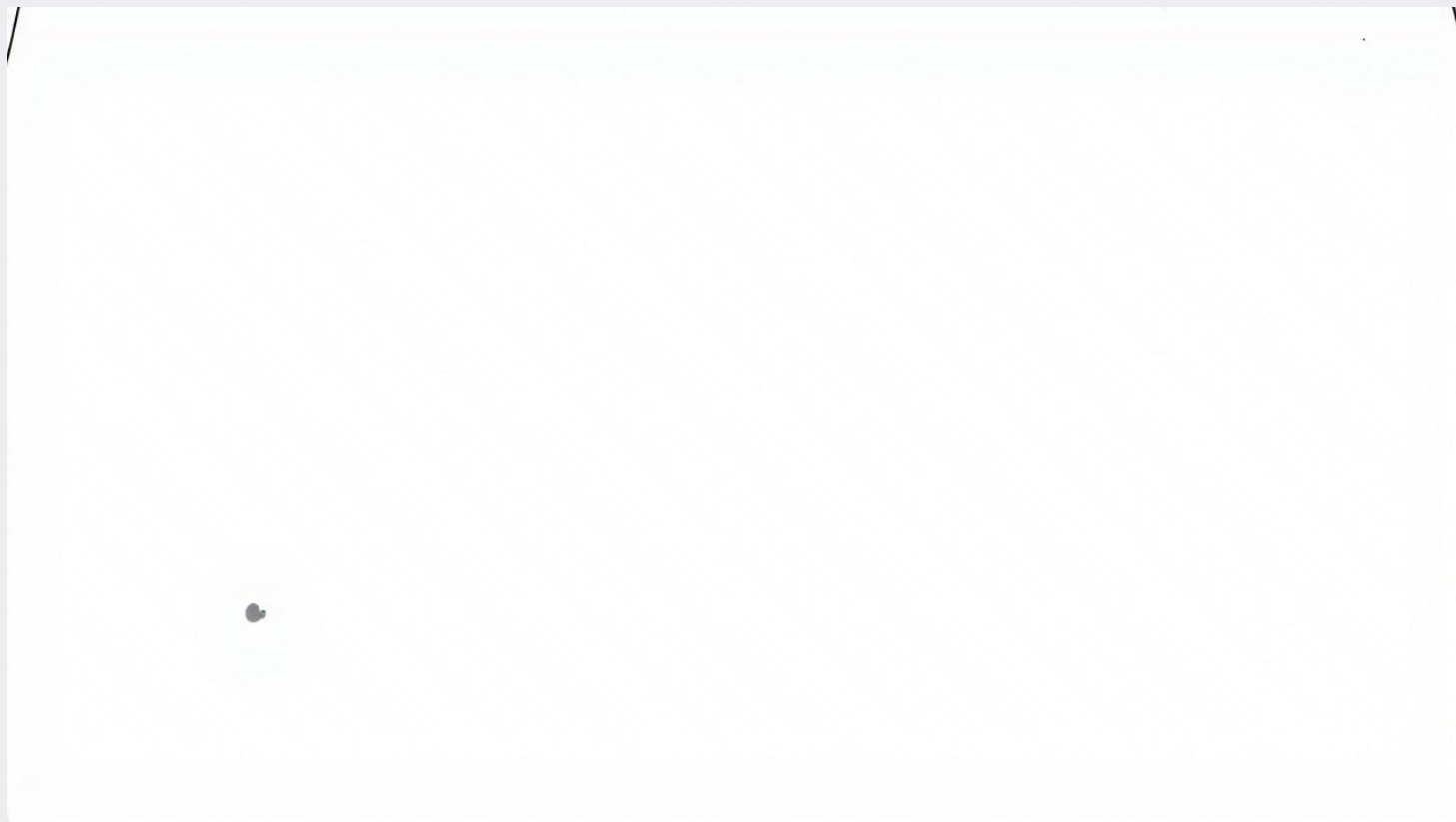
AI-to-AI (e.g. DeepSeek R1-Zero)

AI to Human

* Donna Haraway (2106) *Staying with the Trouble*

** Ethan Mollick (2024) *Co-intelligence*

Qwen2.5-Max, "tabula rasa, b&w", 16:9

AI as IT?
Or something
else?

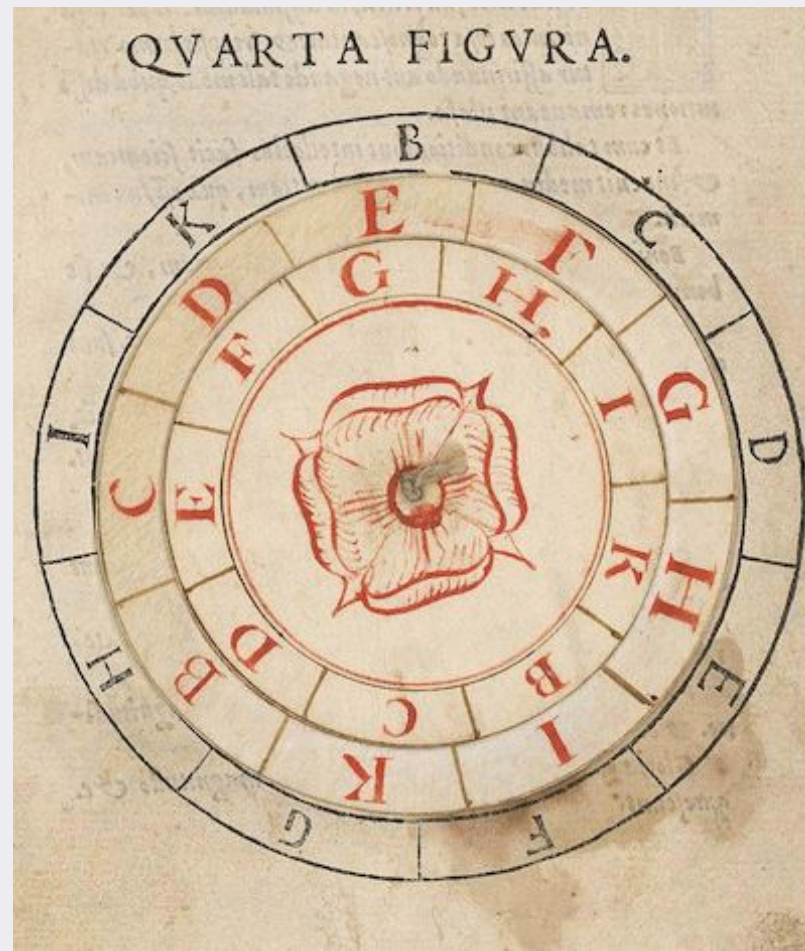"In a lot of ways, the IT department of every company is going to be the HR department of AI agents in the future," said Huang during the keynote.
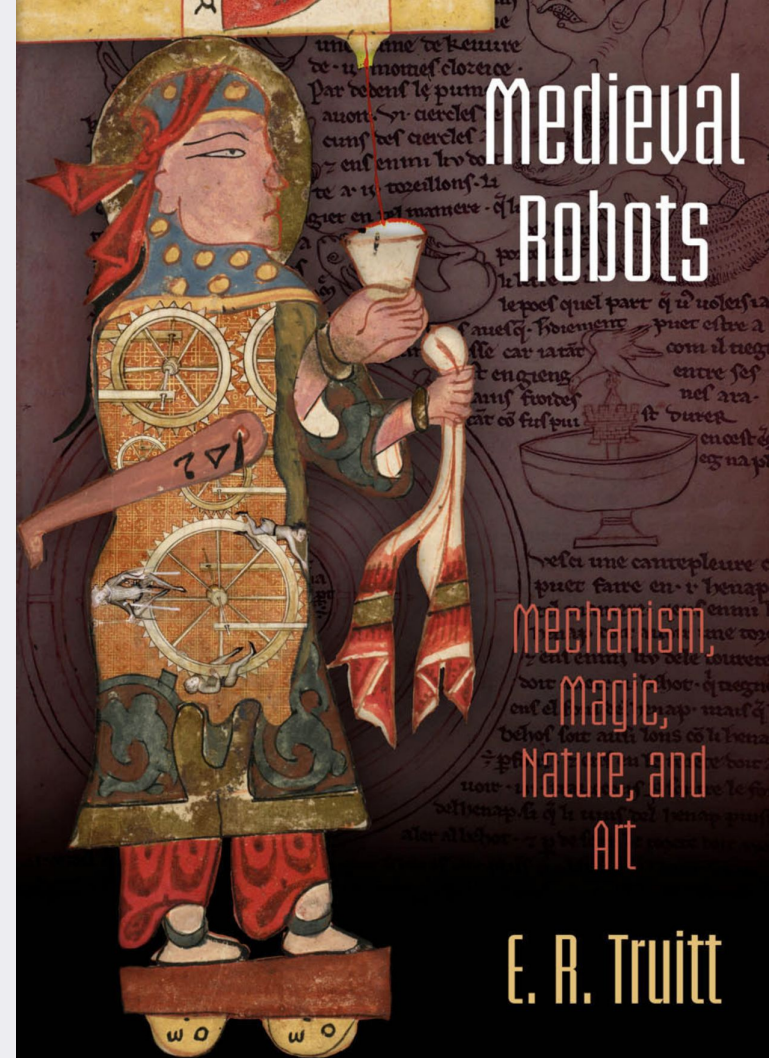
Yahoo Finance, 2025

Proto-Computing in the 8th –13th Centuries

QVARTA FIGVRA.

Side-note for the historically minded…

Truitt, E. R. (2015). *Medieval robots: Mechanism, magic, nature, and art*. University of Pennsylvania Press.

Graphical Representation of an Integral

$f(x) = x^2$

$\int_a^b f(x)dx$

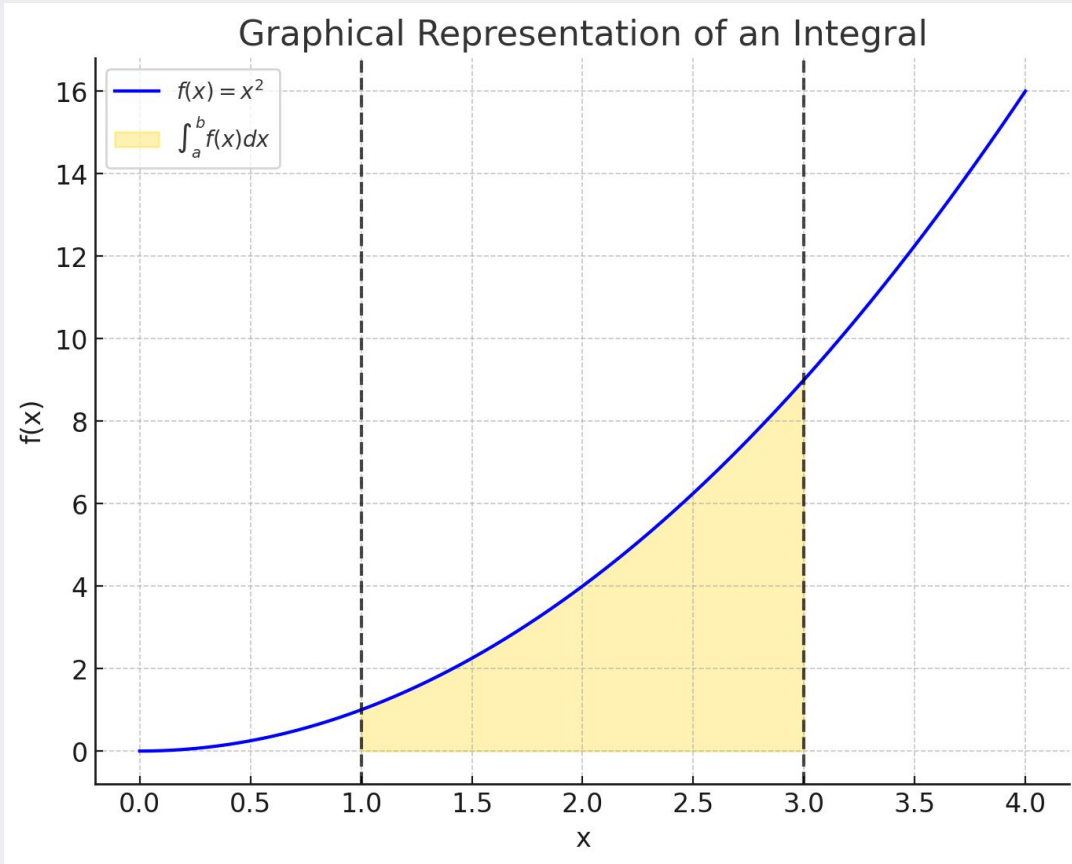Give me a graphical depiction of integral calculus

Graphical Representatio...

Here is a graphical representation of an integral. The blue curve represents the function $f(x) = x^2$, and the shaded gold area represents the definite integral $\int_a^b f(x)dx$, which calculates the area under the curve between $x = 1$ and $x = 3$. Let me know if you'd like a different function or visualization! 😊

'If AI systems are seen as more reliable or rational than any human expert, able to take the "best possible action," then it suggests that they should be trusted to make high-stakes decisions in health, education, and criminal justice. When specific algorithmic techniques are the sole focus, it suggests that only continual technical progress matters, with no consideration of the computational cost of those approaches and their far-reaching impacts on a planet under strain.

In contrast, in this book I argue that AI is **neither artificial nor intelligent**. Rather, artificial intelligence is both embodied and material, made from natural resources, fuel, human labor, infrastructures, logistics, histories, and classifications. AI systems are not autonomous, rational, or able to discern anything without extensive, computationally intensive training with large datasets or predefined rules and rewards. In fact, artificial intelligence as we know it depends entirely on a much wider set of political and social structures….

At a fundamental level, AI is **technical and social practices, institutions and infrastructures, politics and culture**. Computational reason and embodied work are deeply interlinked: AI systems both reflect and produce social relations and understandings of the world.'

Crawford, Kate. (2021). *Atlas of AI: Power, Politics, and the Planetary Costs of Artificial Intelligence* (p. 8). Yale University Press.

ÉMILE,
OU
DE L'ÉDUCATION.

Par J. J. ROUSSEAU,
Citoyen de Genève.

Sanabilibus ægrotamus malis ; ipsaque nos in rectum natura genitos, si emendari velimus, juvat.
Sen : de irâ. L. II. c. 13.

TOME PREMIER.

A LA HAYE,
Chez JEAN NÉAULME, Libraire.

M. DCC. LXII.
Avec Privilége de Nosseign. les Etats de Hollande & de Westfrise.

17th/18th Century
 – final days of feudalism
 – computation as *rational (human)*

18th/19th Century
 – first days of industrial capitalism
 – computation as *mechanical (machine)*

"The hand-mill gives you society with the feudal lord; the steam-mill society with the industrial capitalist." (Marx, 1847)

17th / 18th Centuries - Dawn of Modernity

Renaissance -> Enlightenment

Rationality

Mathematics (Descartes, Leibniz, Newton)

Science (Bacon, Newton)

Philosophy (Descartes, Spinoza, Leibniz)

The Birth of the (political) Subject (Luther, Calvin > Descartes, Rousseau)

"Calculemus!" (Let us Calculate - Leibniz) - but see Nietzsche's reaction…

Proto-Industrialization / Globalization / Colonization

Machines: Steam Engine / Jacquard Loom.

19th / early 20th - Modernity Proper

England as the Factory of the World: High precision mass mechanization

The Horror of the machine - Romanticism, Frankenstein, the rise of the Gothic genre

1820s - Luddism, English Socialism

1830s/40s - Babbage, Lovelace, Engels, Marx (Marx cited Babbage - Marxism is partly a response to technology, and the "General Intellect" also looks like AI)

Comte: Positivist sociology (society can be scientific)

Darwin: Man is not the centre of things… (but evolution leads an orientation towards history - perfectable or degenerative)

Ricouer: "Hermeneutics of Suspicion" (Marx, Nietzsche, Freud) - beyond Descartes: forces of ideology / will to power / unconscious desire…

Fordism / Taylorism

mid 20th - early 21st - Post/Late Modernity

Politics and economics: false "sciences" (2 world wars, Great Depression)

Paradox: Computation arises out of negative mathematics, 1930s (Godel, Church, Turing): what computation **cannot** do

First computers in 2nd world war: differencing engines (Leibniz, Babbage – ChatGPT) - do calculus sums for missile trajectories (gravity, acceleration)

Post-war 1950s: AI, but also cybernetics, information theory (Shannon), the Turing test, game theory (Nash, von Neumann) - back to "calculemus"?

Markets as perfect computers: neoliberalism as epistemology.

Post-fordism, immaterial / flexibilized / cognitive labor,

Counter-narratives: Cultural Marxism, existentialism, poststructuralism, "ends" talk (End of Man - Foucault; end of History - Fukuyama; end of the grand narrative - Lyotard)

Post-Enlightenment disenchantment

AI Winter / Spring / glorious Summer? Transhumanism, return to Enlightenment, or enshittification (Doctorow)

Looking ahead…

What **fundamentals** makes for AI / Machine Learning / Deep Learning / Neural network?

- Calculus (17th century – Leibniz, Newton)
- Probability [think "stochastic parrots"] (18th/19th century – Euler, Gauss, Laplanche Fourier)
- Linear algebra (19th century – James John Sylvester)
- Markov Models (very early 20th century – Andrej Markov)

And a bold proposition…

- All the **mathematics** for AI in 2025 was developed by the end of the 19th century (with applications, like Markov models, in 1906/1913)
- Are the last 125 years just **hardware**, **networks** & **data** (see LeCun 2021 - who doesn't (quite) say this)?
- Is our sense of **modernity** just the long shadow cast by the Enlightenment (17th / 18th century)?