



Entangled cognitions

a complexivist perspective on AI and learning

Jon Dron, October 2026, presentation for “Artificial Intelligence and the Humanities: Critical Thinking in the Algorithmic Era”, IHU, Brazil

Me:

Associate Dean,
Learning &
Assessment,
Faculty of Science
and Technology

Full professor in the
School of
Computing and
Information
Systems

Edugeek

Tech geek

Technologist

(and once a full-
time musician)

Living in Vancouver



well, actually in the middle of nowhere

(-40°F = -40°C)

AU:

formed in 1970

(almost) fully online

about 40,000
students a year

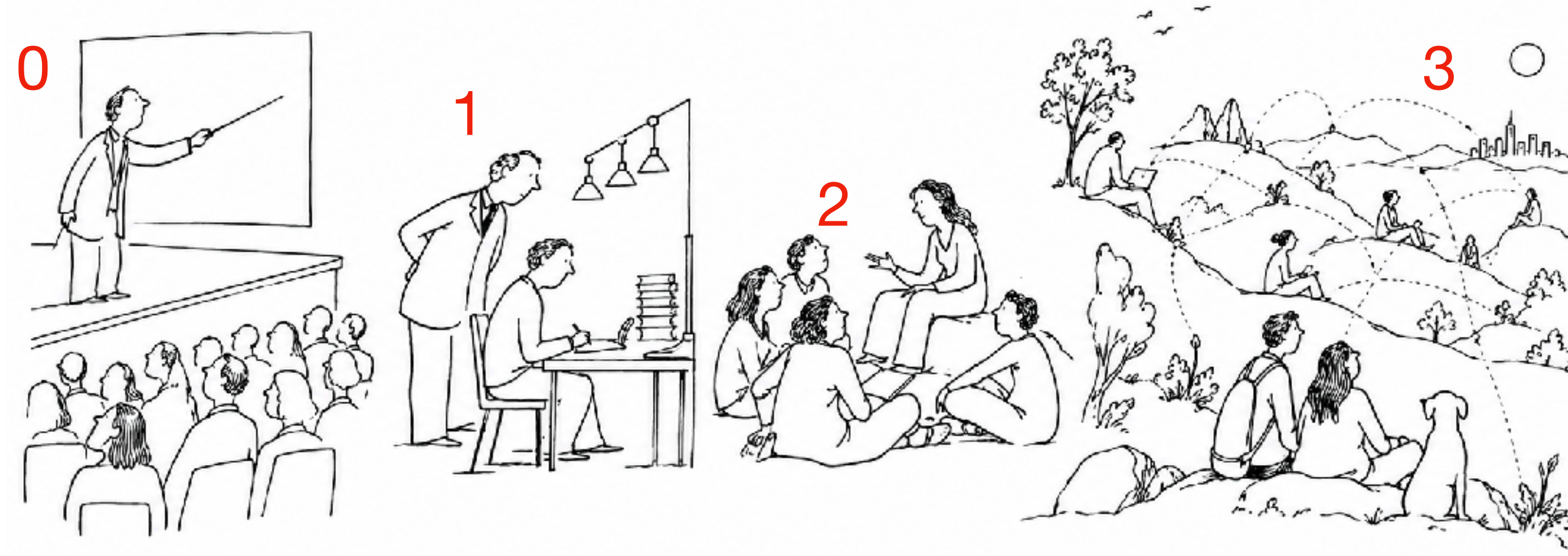
self-paced teaching
model (undergrad)

paced teaching
(graduate)

Northern Alberta

about 1000km from
my home

Three (or four) generations of (distance) pedagogy



	Generation	Pedagogical models	Focus	social form	Teacher metaphor	SAMR
0	Instructivist/folk-theoretic	information transmission, drill & test, etc	teaching	audience	Sage on the stage	substitution
1	Objectivist	behaviourism, cognitivism	teaching	individual	Controller, orchestrator	augmentation
2	Subjectivist	constructivism, social constructivism	learning	group	Guide on the side	modification
3	Complexivist	connectivism, rhizomatic learning, entangled learning, enactivism, landscapes of practice, etc	knowledge	net/set	Fellow traveller, role model	redefinition

**Each generation extends
but does not replace the last**



**All are and have always been
present in most intentional learning,
as it is experienced by a learner**

Objectivist and subjectivist pedagogies

	Objectivist	Subjectivist
Paradigm of	Teaching	Learning
Knowledge	Objective, independent of the knower; clearly defined objectives to reach	Constructed, individually and socially, from prior knowledge
Theory	Behaviourism, cognitivism, instructional design, etc	Cognitive (Piaget) and social (Dewey, Vygotsky) constructivism, communities of inquiry, etc
Teacher	Designer, transmitter and judge of instruction	Guide and facilitator, but still leads, controls and assesses the group
Learner	Follows designed paths to measurable outcomes	Active maker of meaning, through dialogue, inquiry and problem solving
Technique	Prescriptive, measurable, scalable	Situated, co-constructed, demanding of teacher skill

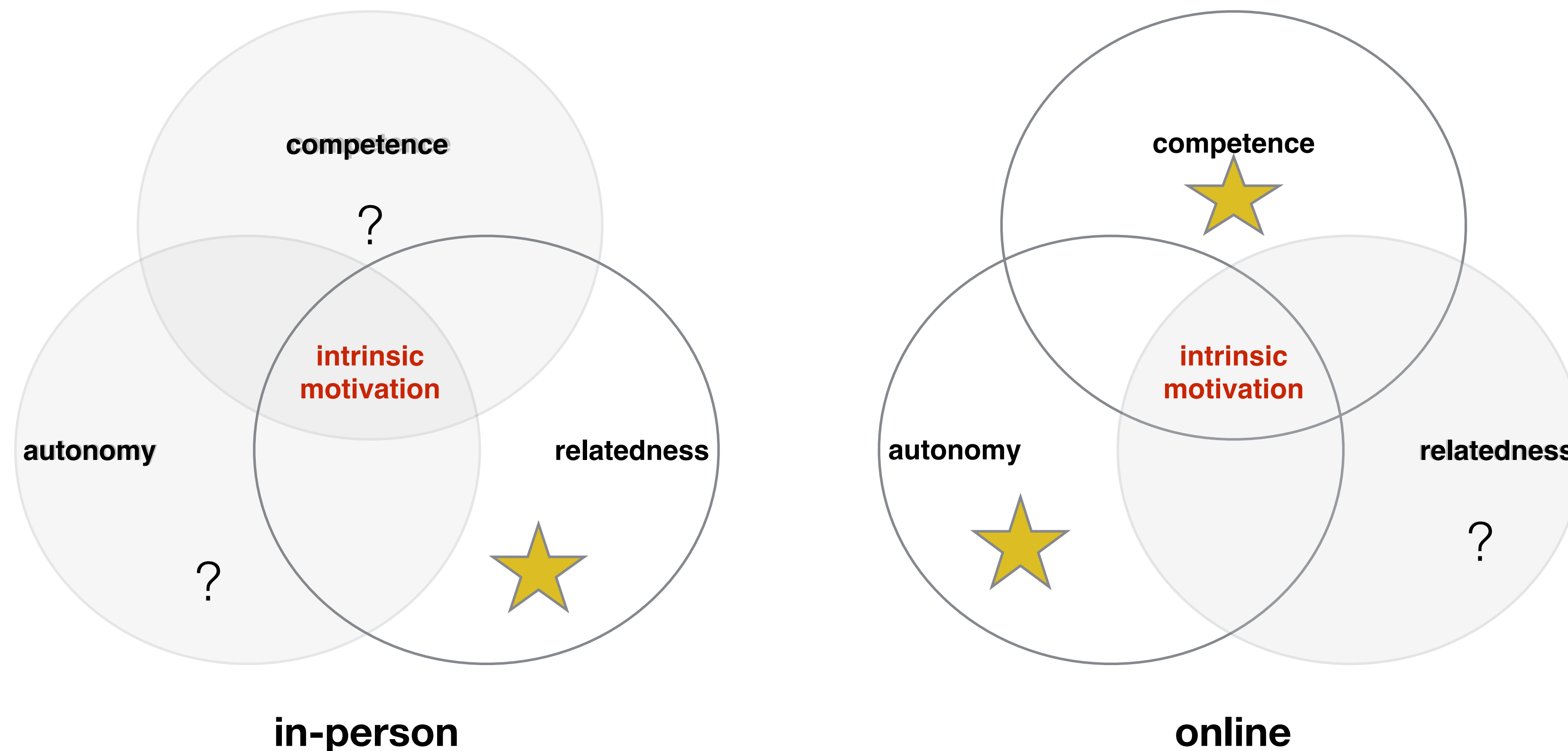
Complexivist pedagogies

Paradigm of	Knowing
Knowledge	distributed, situated, complex, emergent, in systems and networks, including intracranial and extracranial
Theory	Connectivism, Entanglement, Rhizomatic learning, Landscapes of practice, Enactivism, Cognitive apprenticeship, Extended cognition, Ecological constructivism, Networks of practice, Co-participation theory
Teacher	Everyone, everything, co-travellers, well-connected nodes, catalysts
Learning	complex, situated, connected, in the network
Technique	Diverse

Education: an ecosystem full of mutually exclusive goals



The first two generations are solutions to problems caused by how we educate



GenAI and the three generations

	Generation	AI threat to learning	AI threat to assessment	Typical AI role
0	Instructivist	very high	very high	replacement
1	Objectivist	high	very high	replacement
2	Subjectivist	medium	very high	augmentation
3	Complexivist	low	minimal	intrinsic

Not just about measurable learning outcomes



Complexivism - some common traits

Connectivism, Enactivism, Collective intelligence, Rhizomatic learning, Entangled learning, Ecological constructivism, Landscapes of practice, Situated cognition, etc, etc, etc

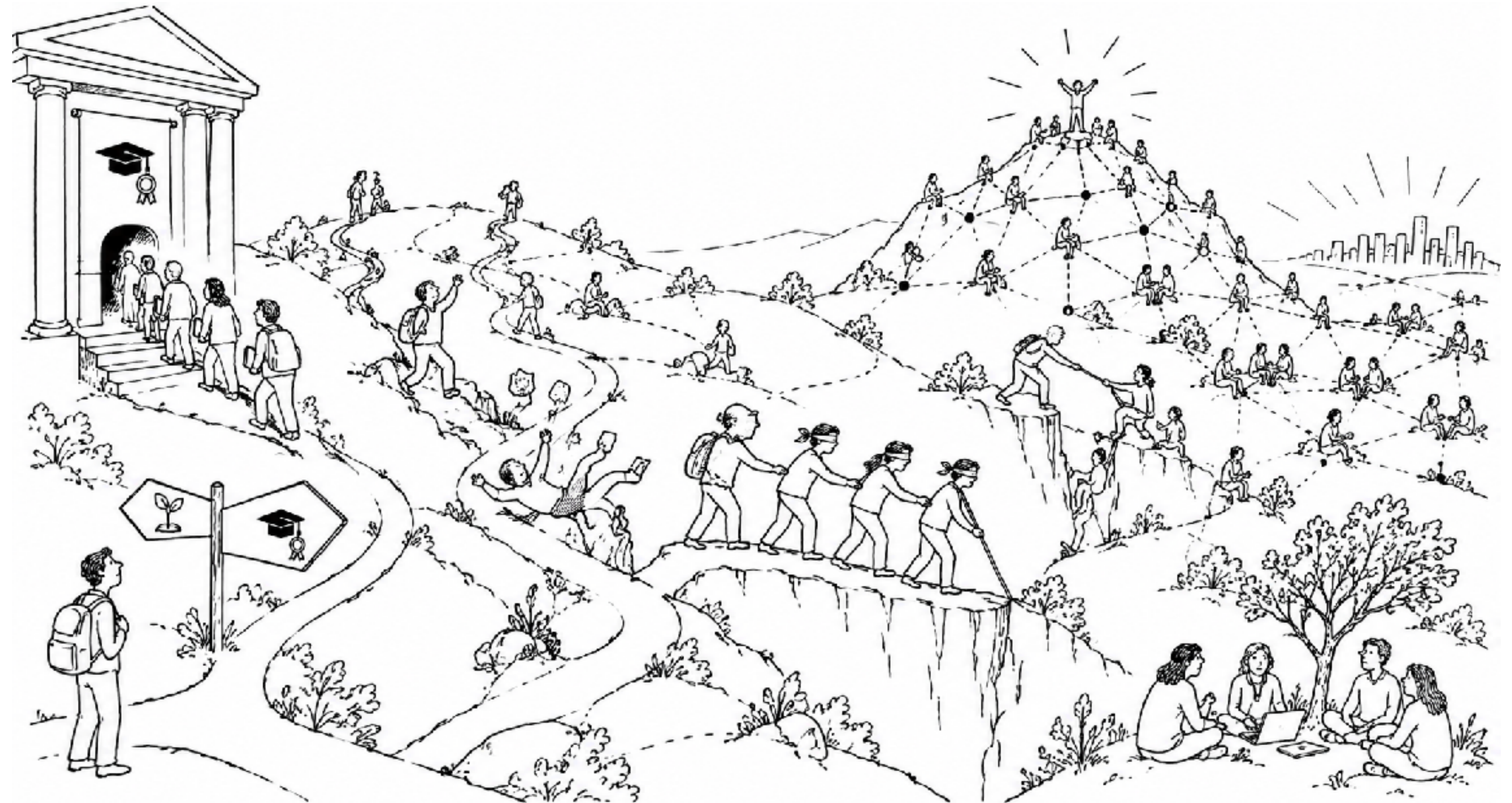


- Emergence and self-organization
- Relational ontology - networks and connections
- Learning as a property of systems, not just of individual minds
- Internet-native
- Situated in a unique social and personal context
- Authentic activities
- Distributed teaching role
- Social networks more than social groups
- Technologically constituted
- Multiple nested scales
- Co-evolution of learner and context
- Openness, fuzzy boundaries
- Entangled agents/actors/technologies
- Life-wide and life-long

However...

some issues with complexivist approaches

- for learning, not credentials
- unpredictability
- divergent outcomes
- sub-optimal paths
- blind-leading-the-blind
- sustaining networks
- the Matthew Effect
- better at scale
- anti-individualist



DREAM MACHINES

EVERYTHING IS DEEPLY INTERTWINGLED.



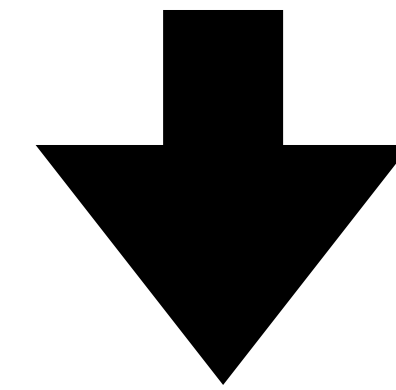
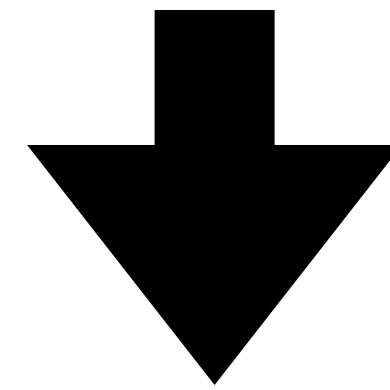
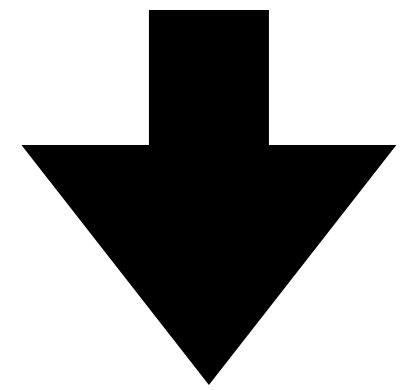
Entanglement/Intertwingularity

my own theory, in brief

W. Brian Arthur:

The orchestration of phenomena to our use

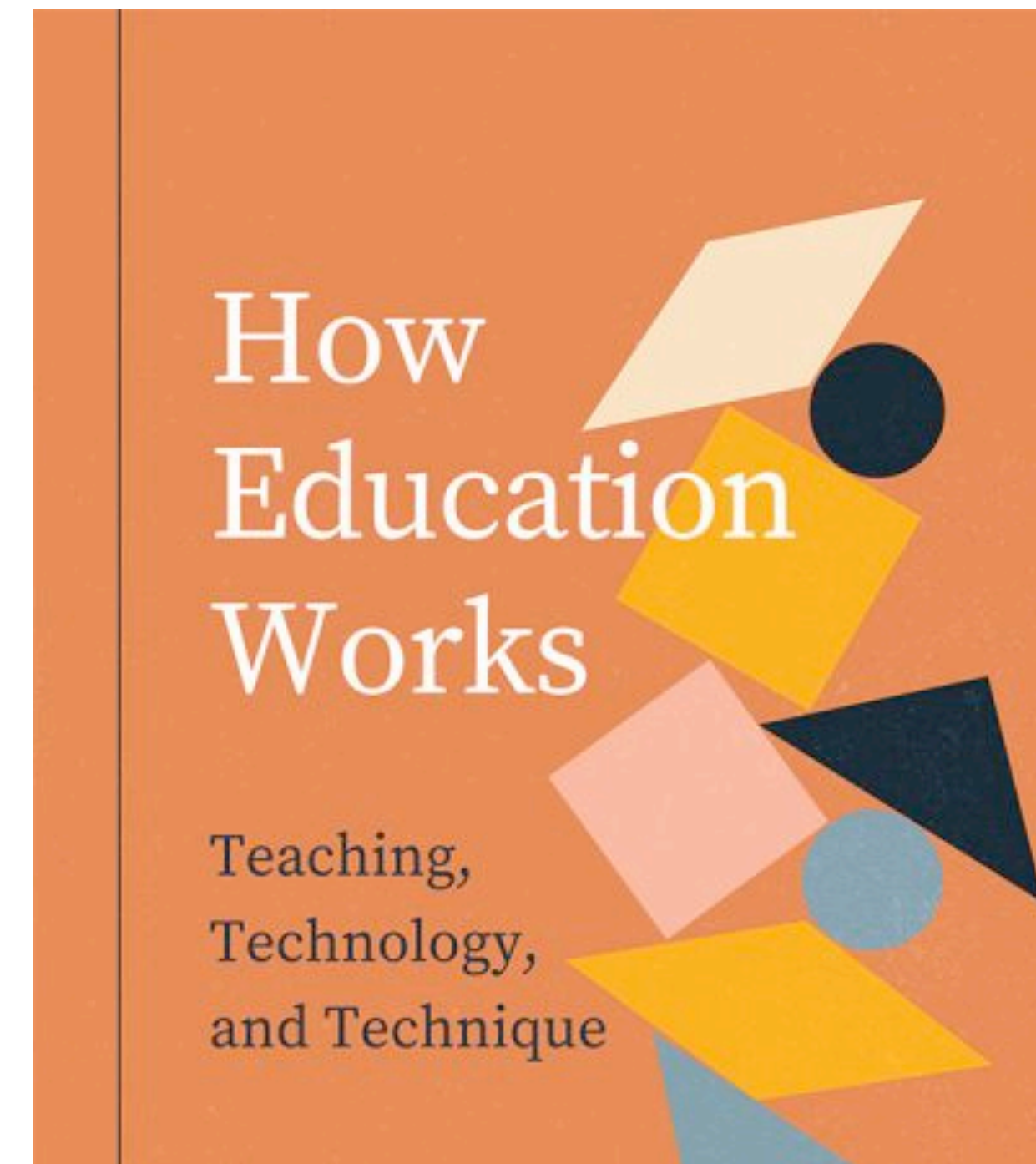
Arthur, W. B. (2009). *The Nature of Technology: What it is and how it evolves*. Free Press.



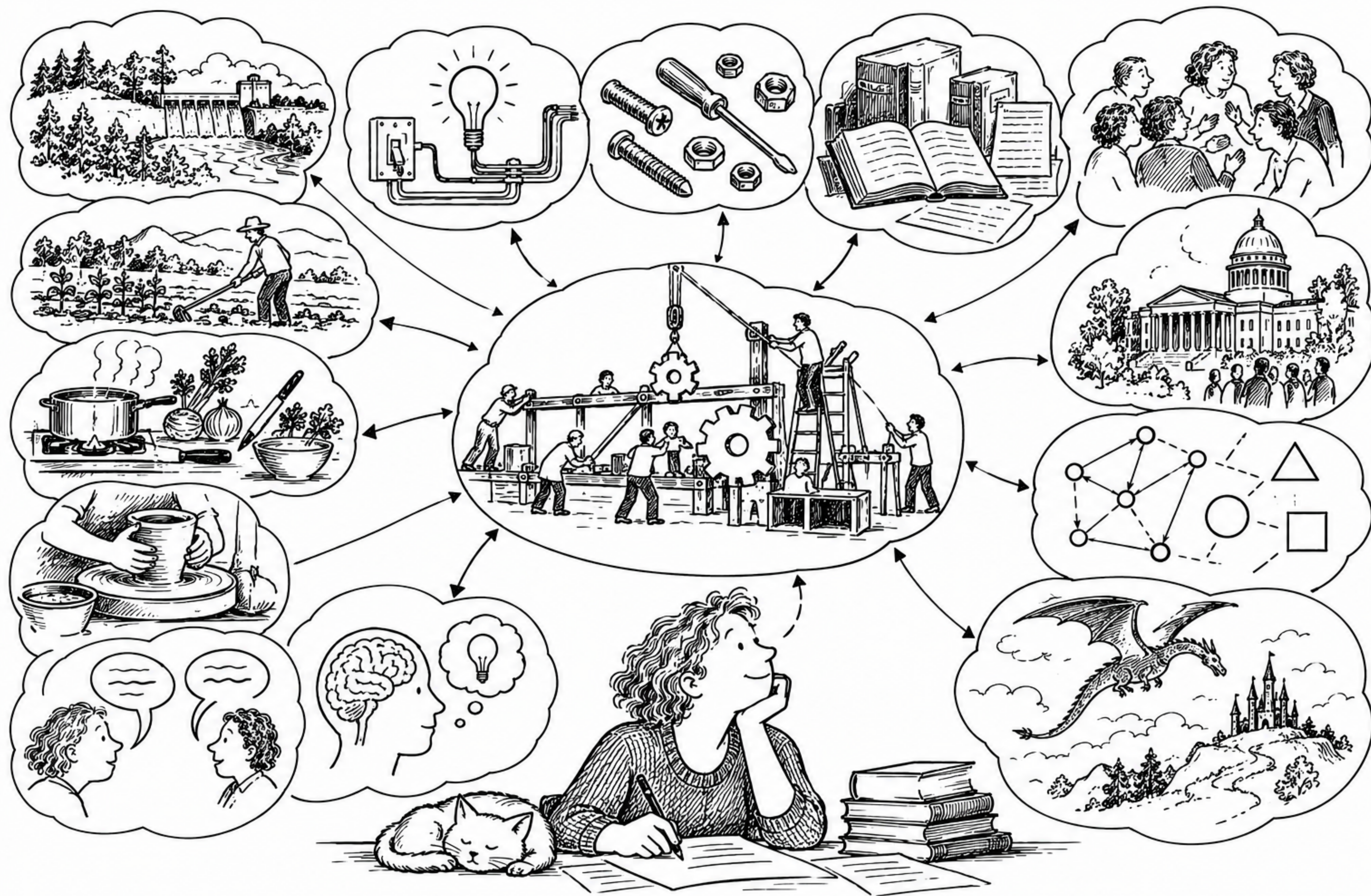
me:

organizing stuff to do stuff

“Technology”



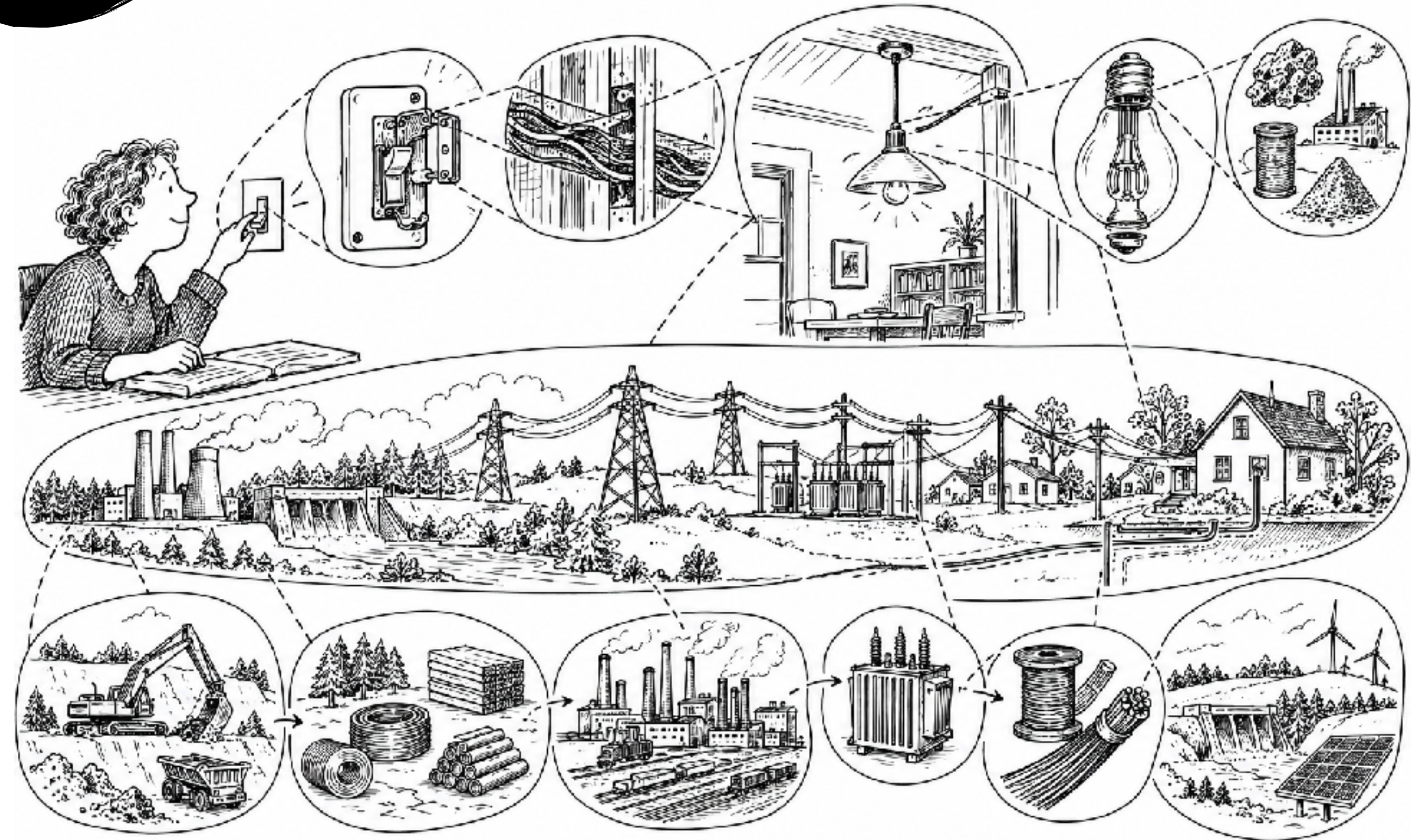
any
stuff

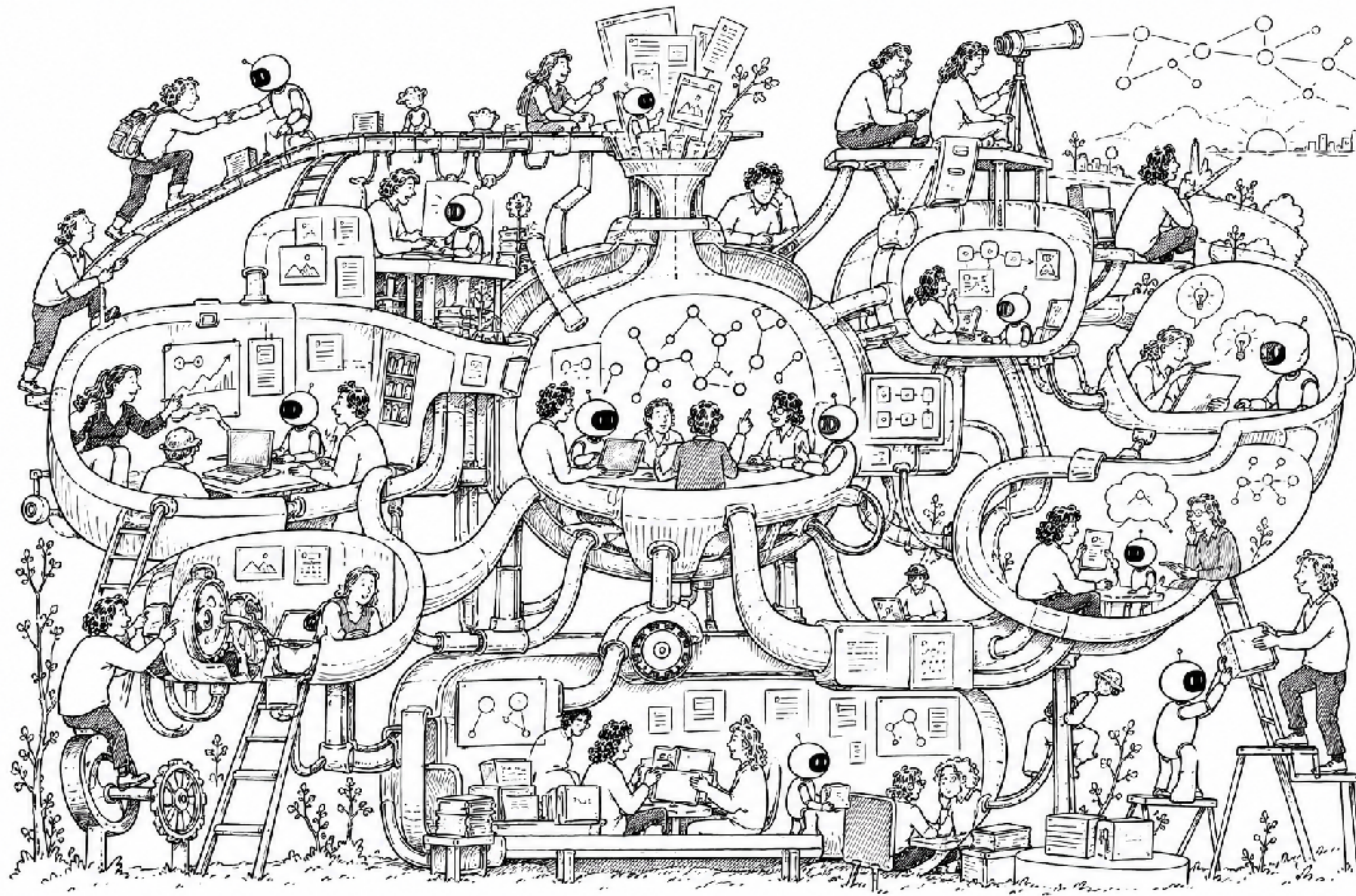


organizing stuff to do stuff



including (nearly
always) *other*
stuff organized
to do stuff





**We are participants in, not
just users of technologies**

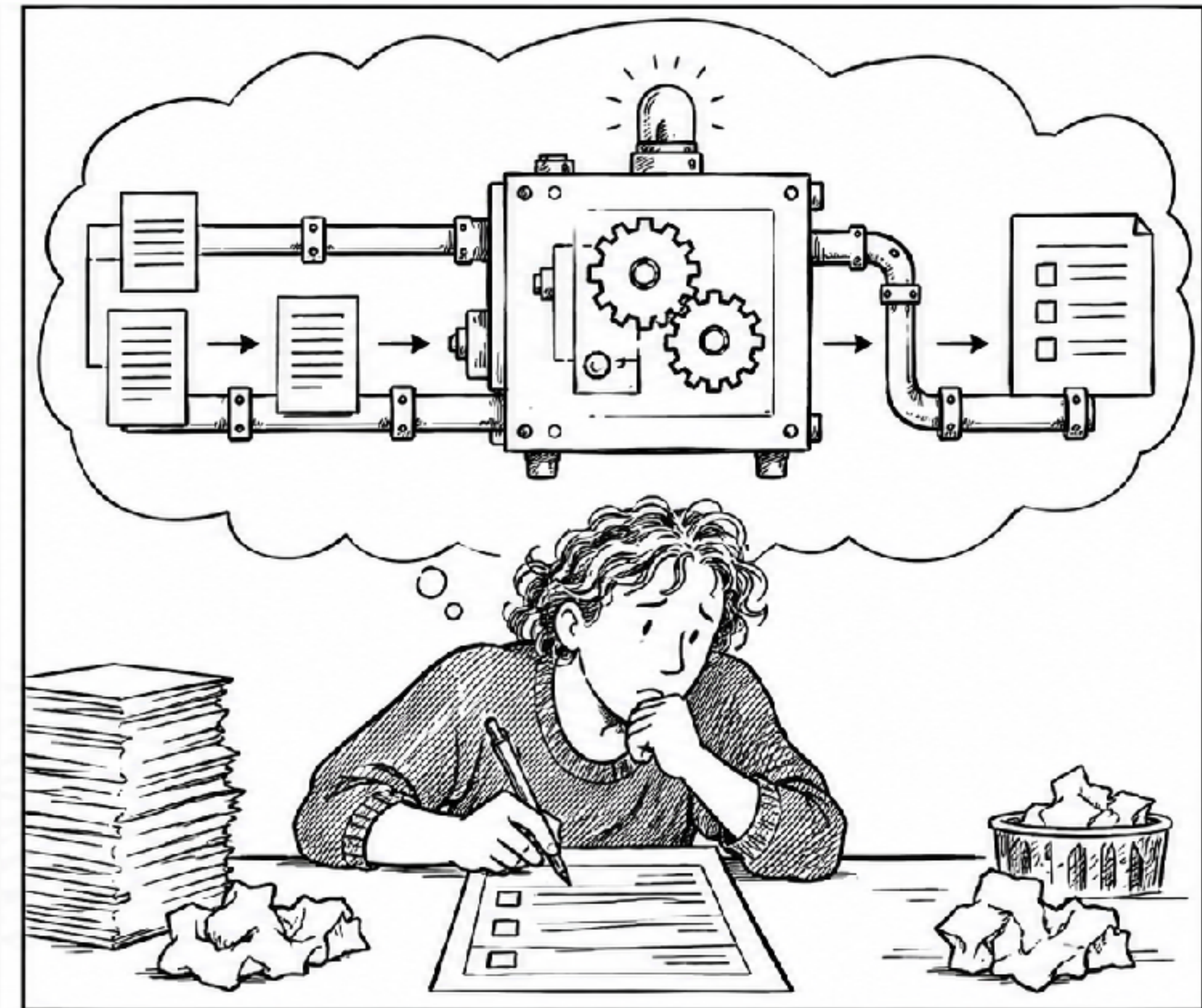
and they participate in
us



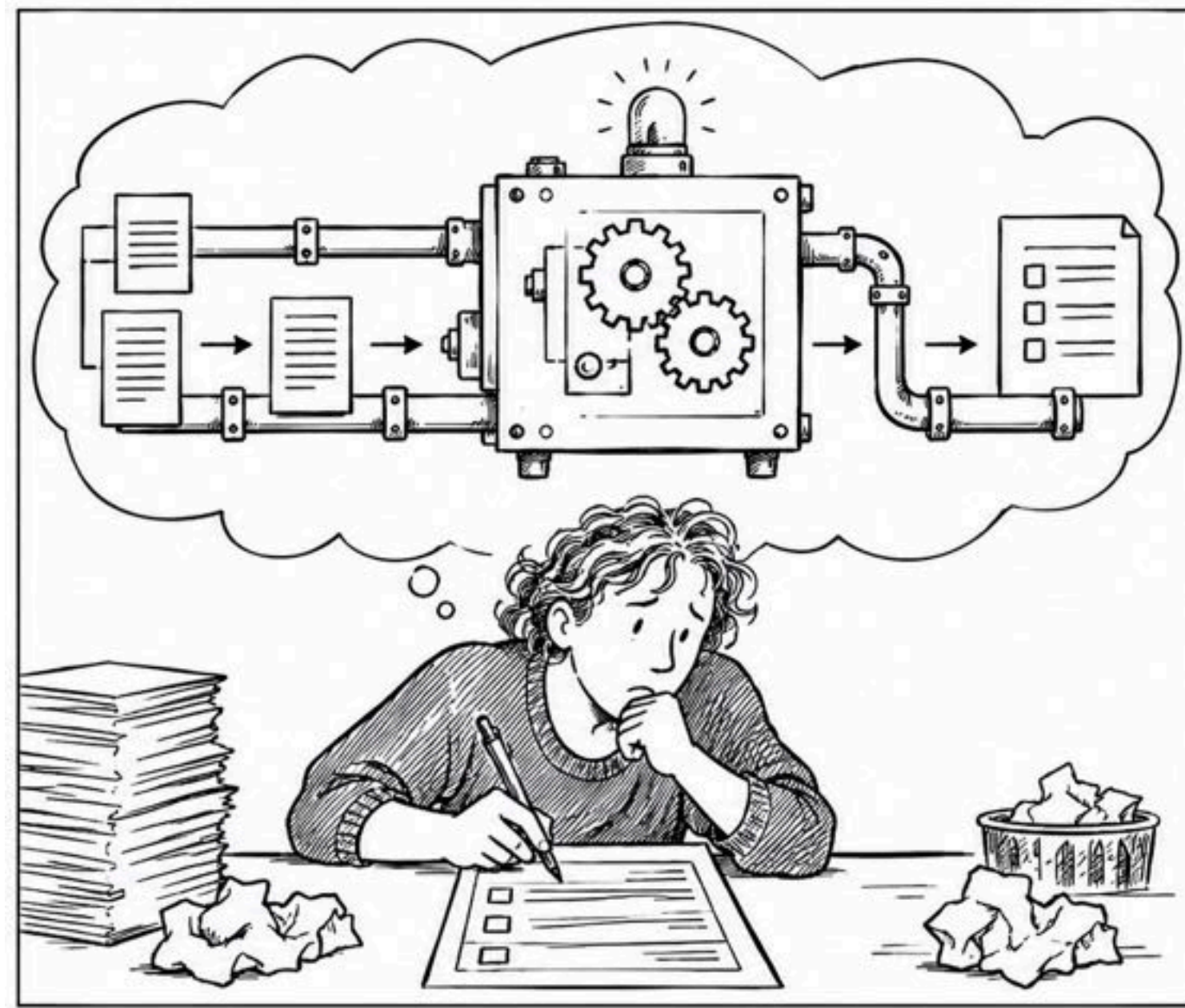


**We use technologies and each
use *is* a technology...
The technique.**

Soft technique/hard technique



We are part of the orchestration

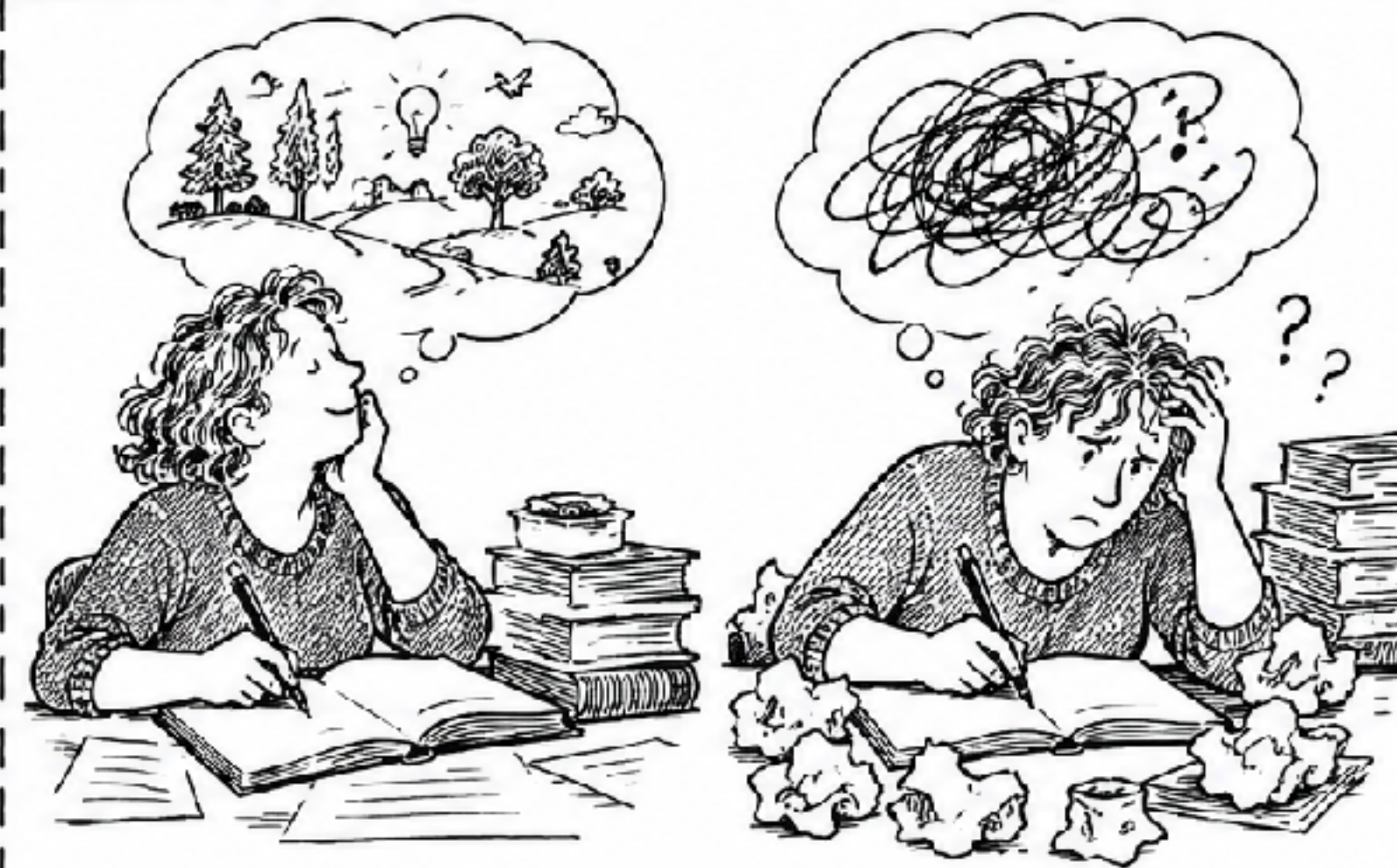


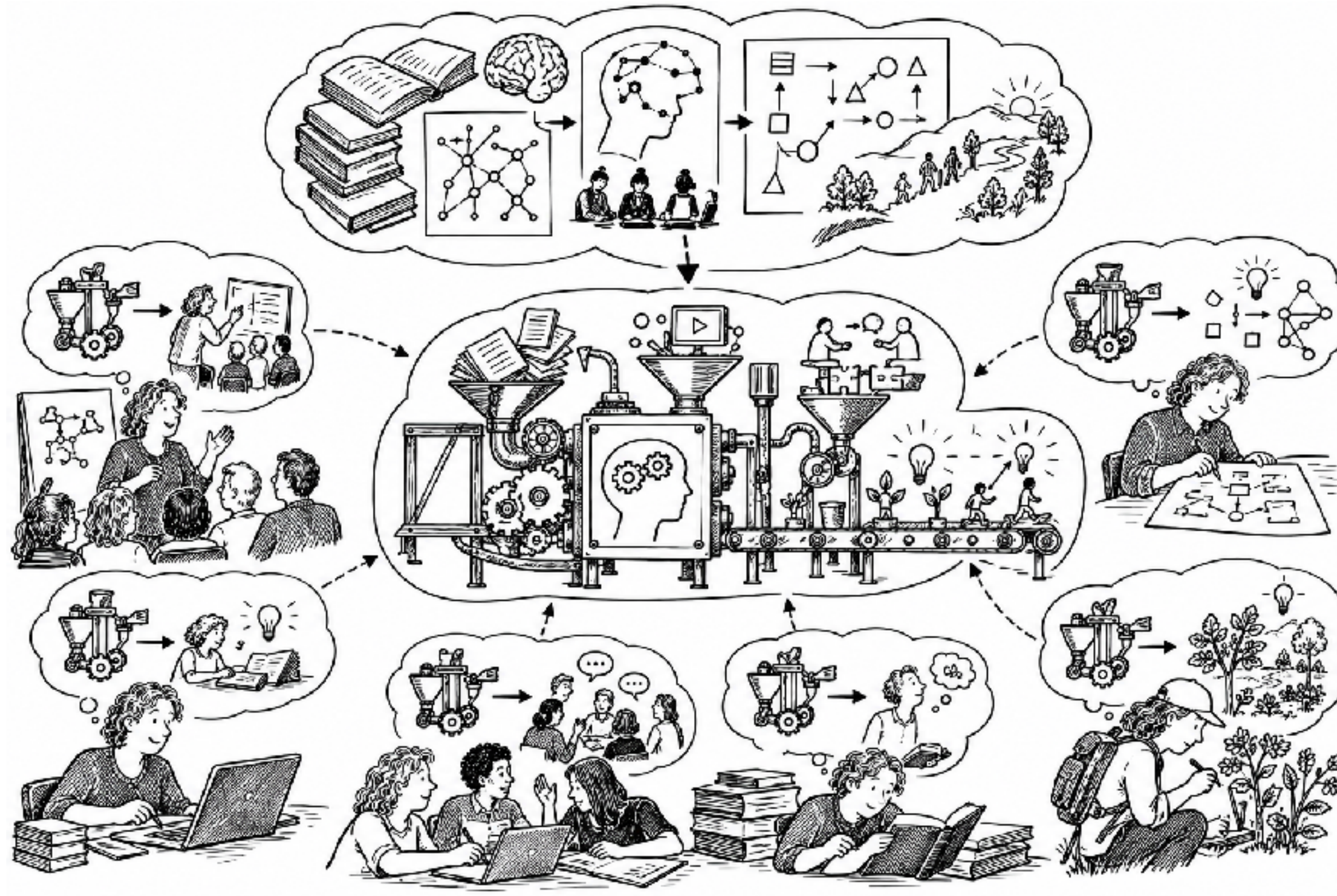
and/
or



we are the orchestrators

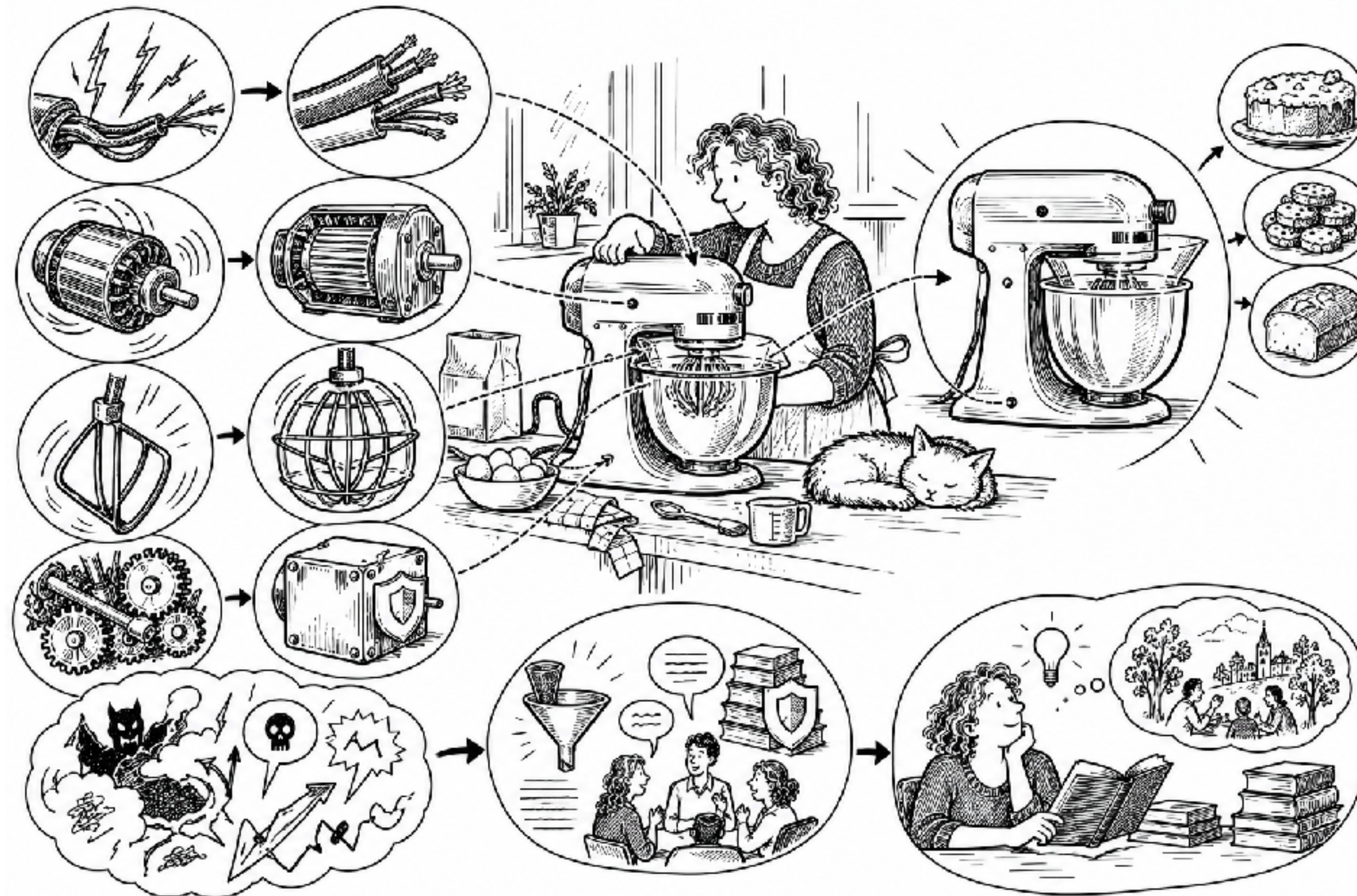
T'ain't
What You
Do (It's the
Way That
You Do It)





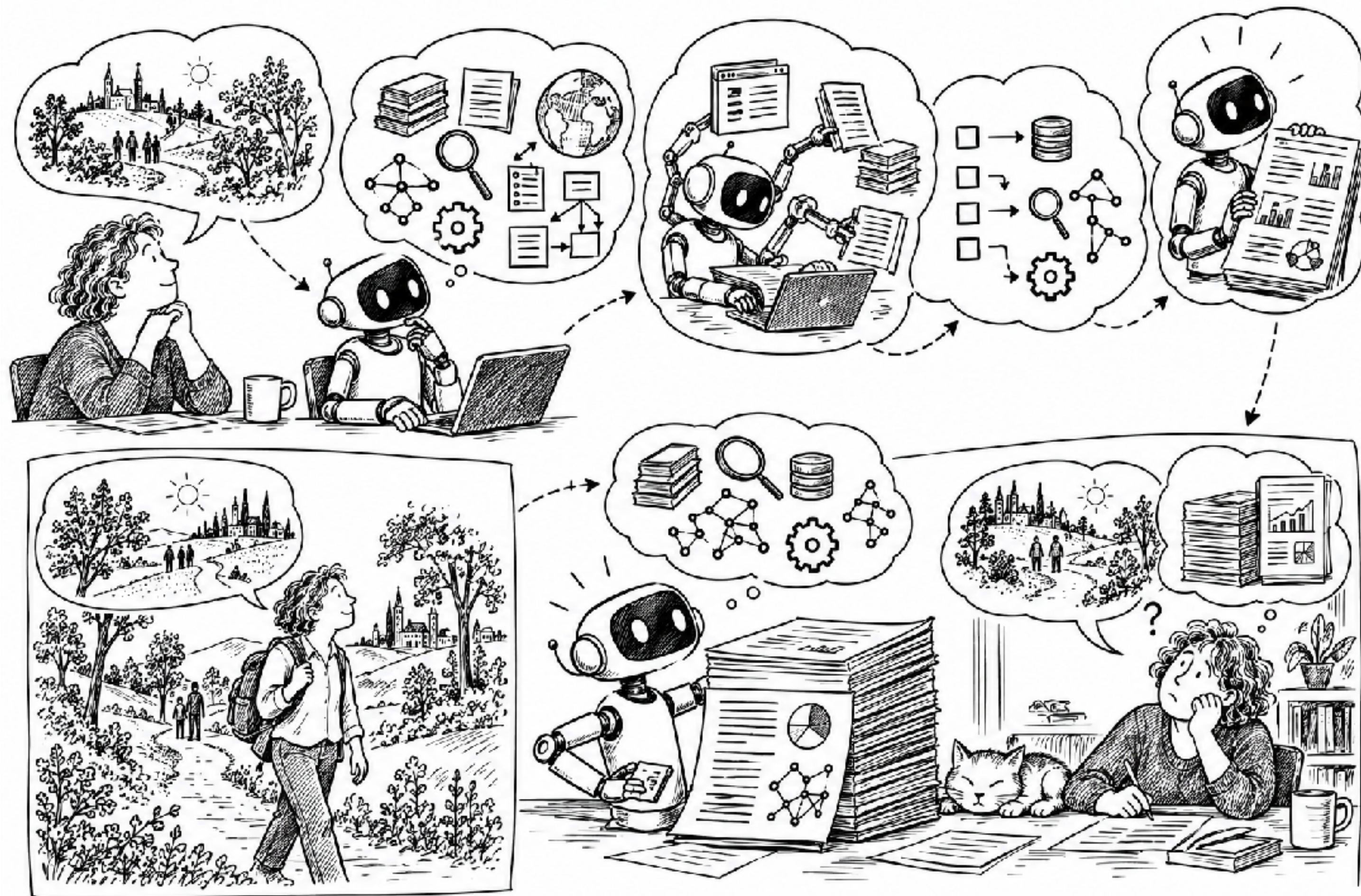
**Pedagogies
(pedagogical
methods) are
technologies, too**

What matters is the whole: what has been done and what we do with what has been done



And we are co-participants in the whole, each of us seeing a different whole from every other





And, unlike any prior technologies, genAIs can do all that too

GenAI

A tool user

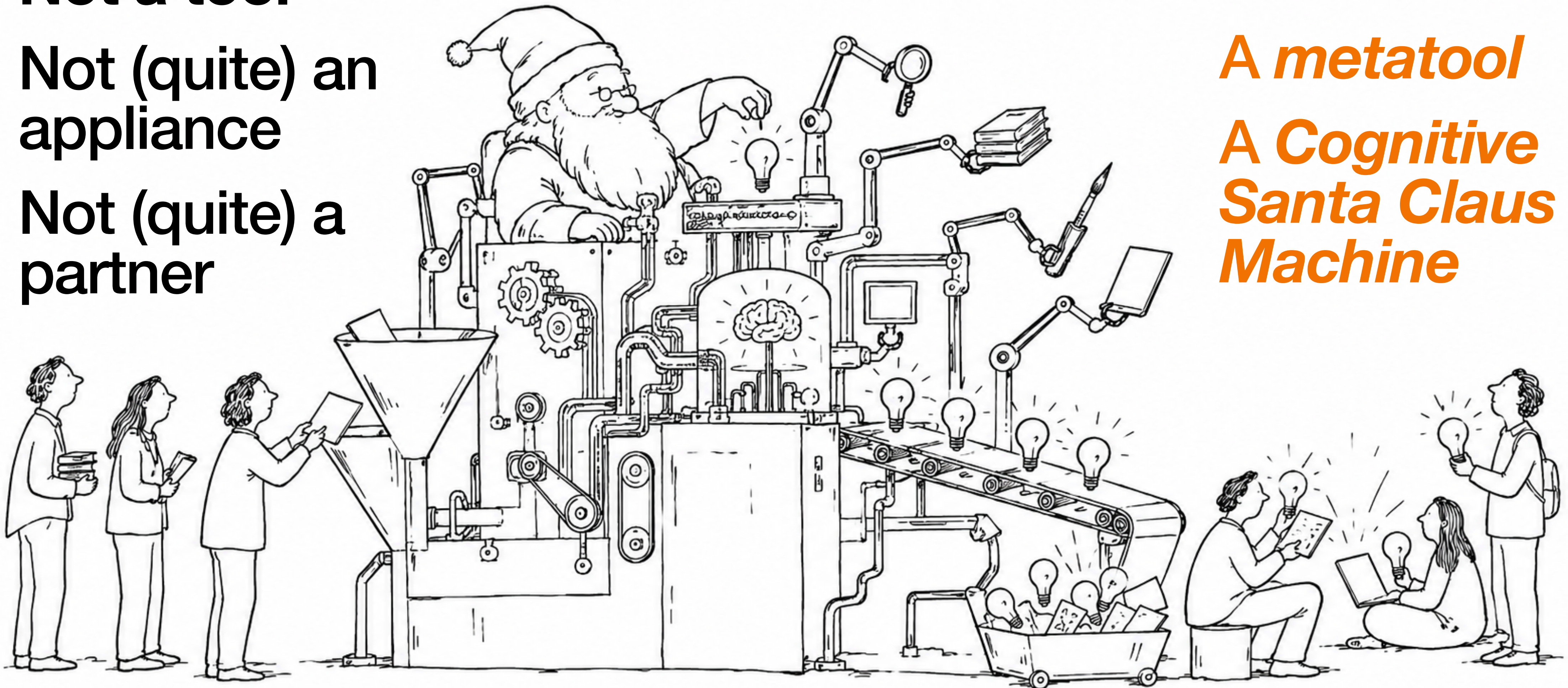
Not a tool

**Not (quite) an
appliance**

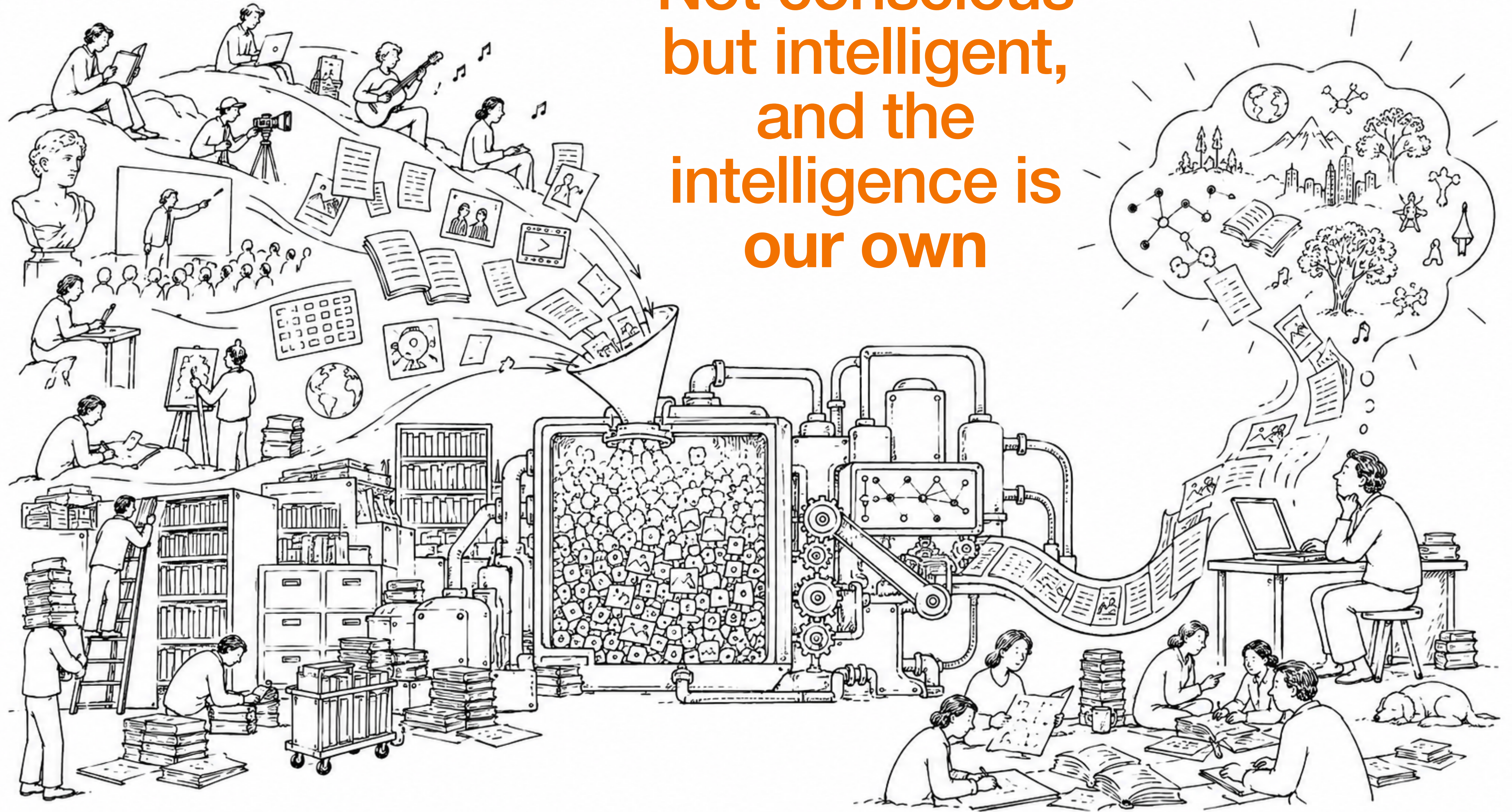
**Not (quite) a
partner**

A metatool

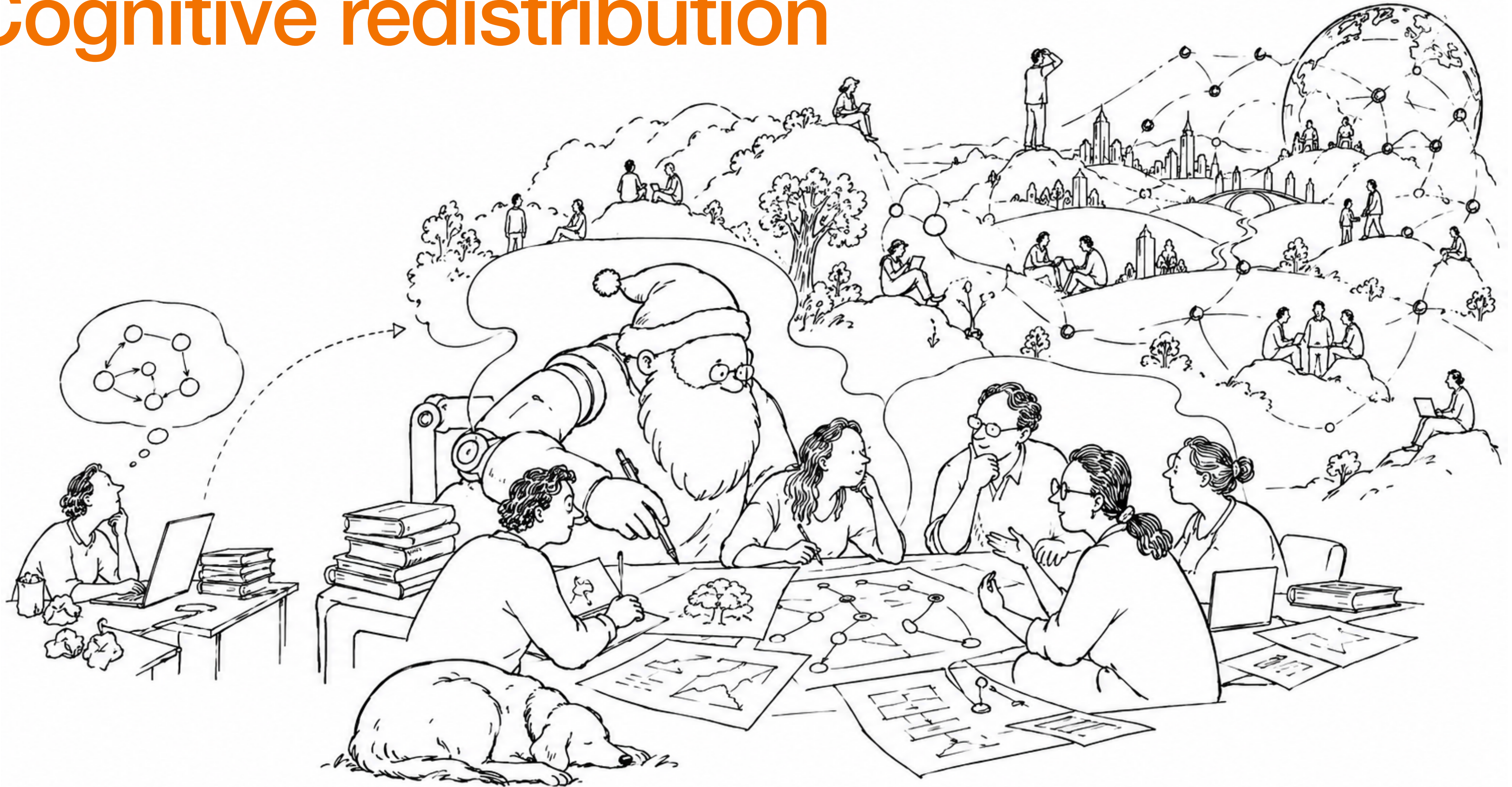
***A Cognitive
Santa Claus
Machine***



Not conscious
but intelligent,
and the
intelligence is
our own

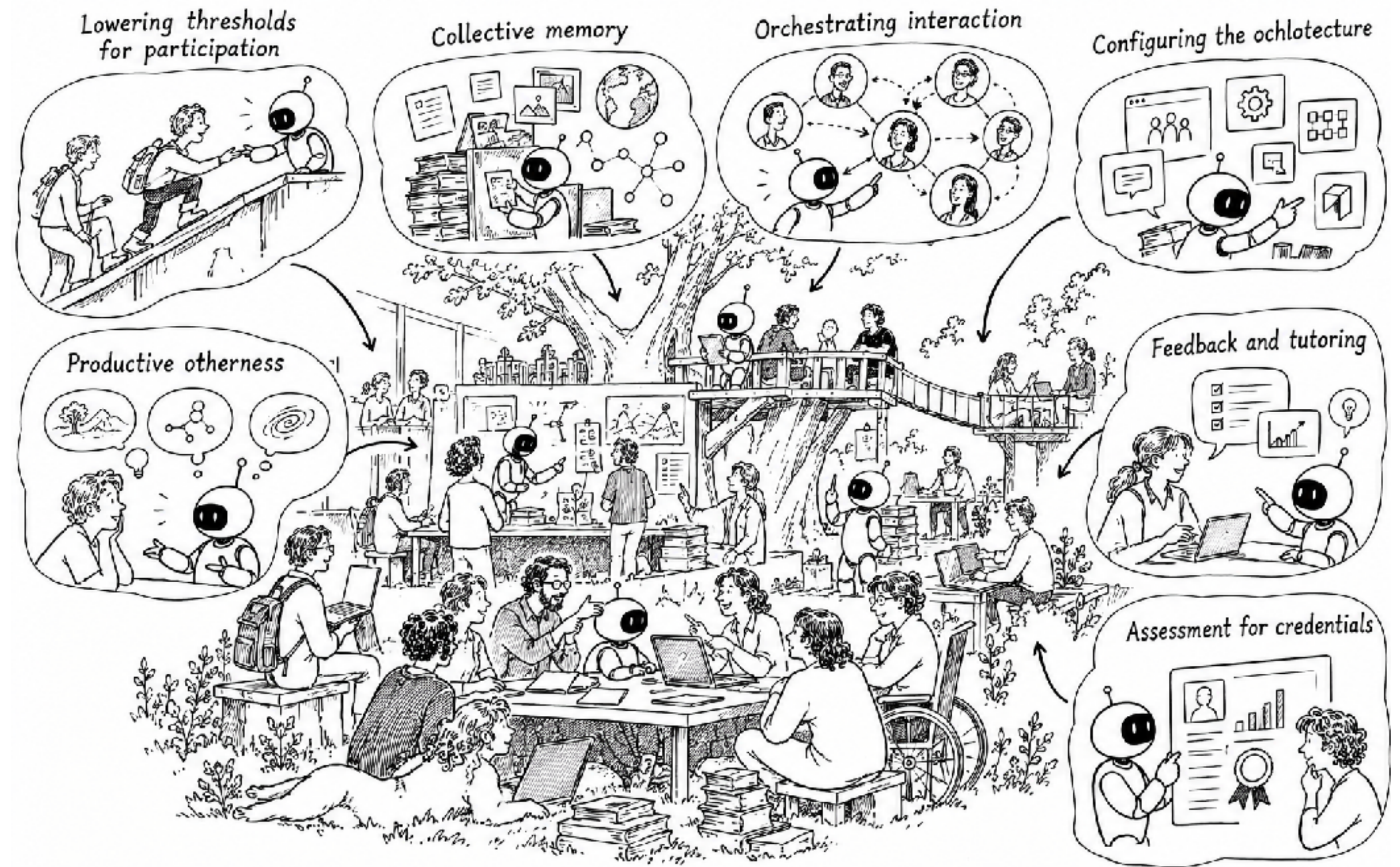


Not cognitive offloading: Cognitive redistribution



Some potential genAI supports

- lowering thresholds for participation
- collective memory
- orchestrating interaction
- managing the environment
- productive otherness
- feedback and tutoring
- assessment for credentials



but

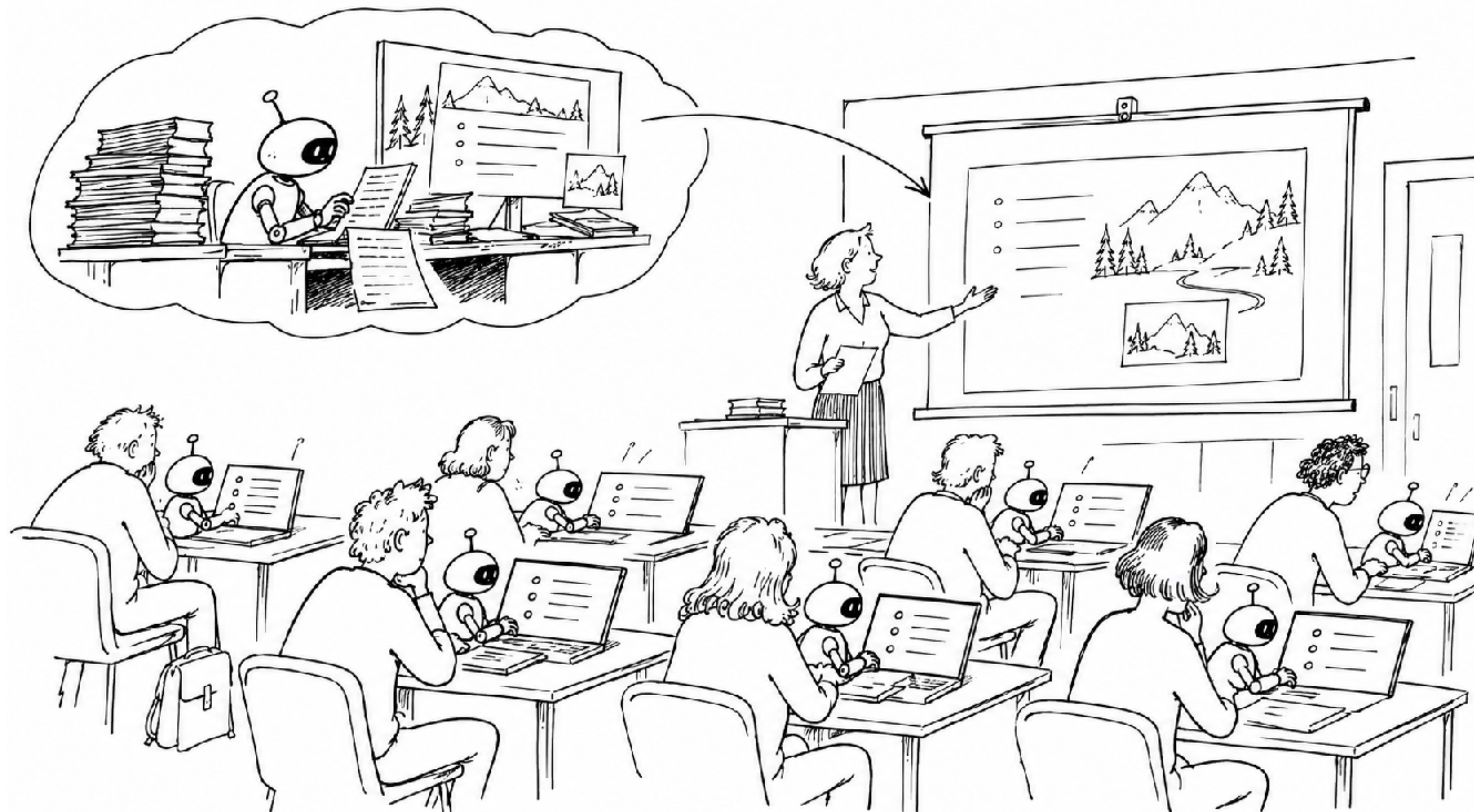
Degenerative AI



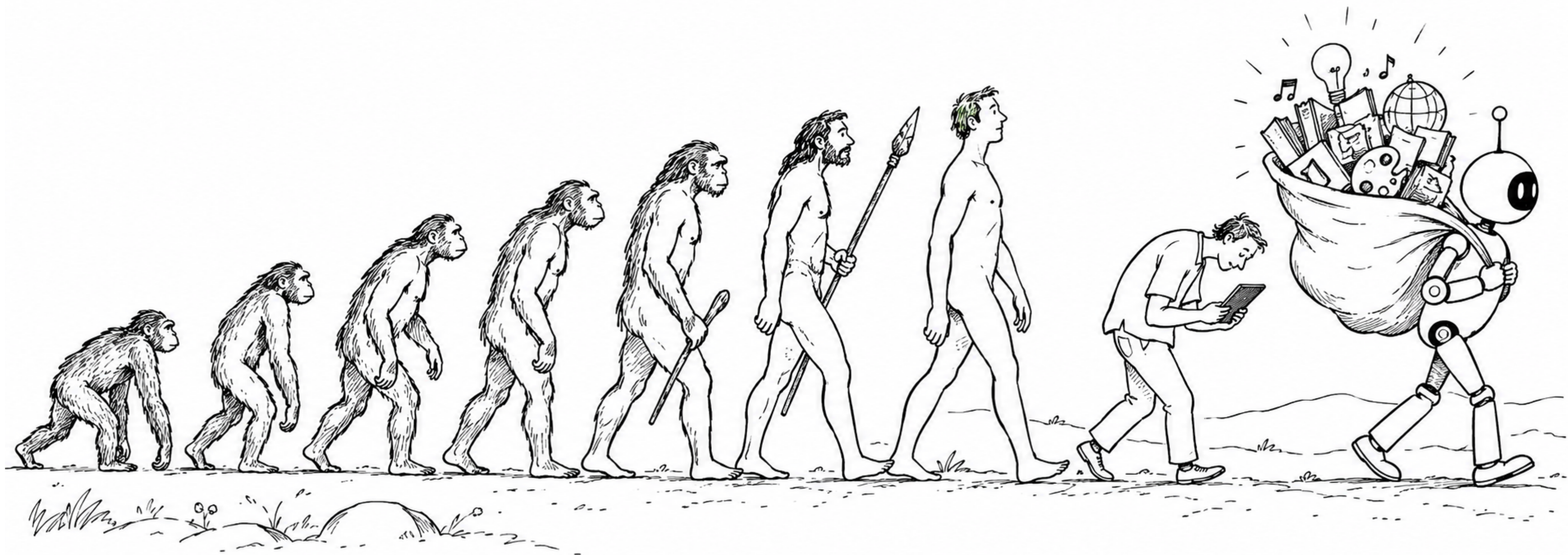
Degenerative AI



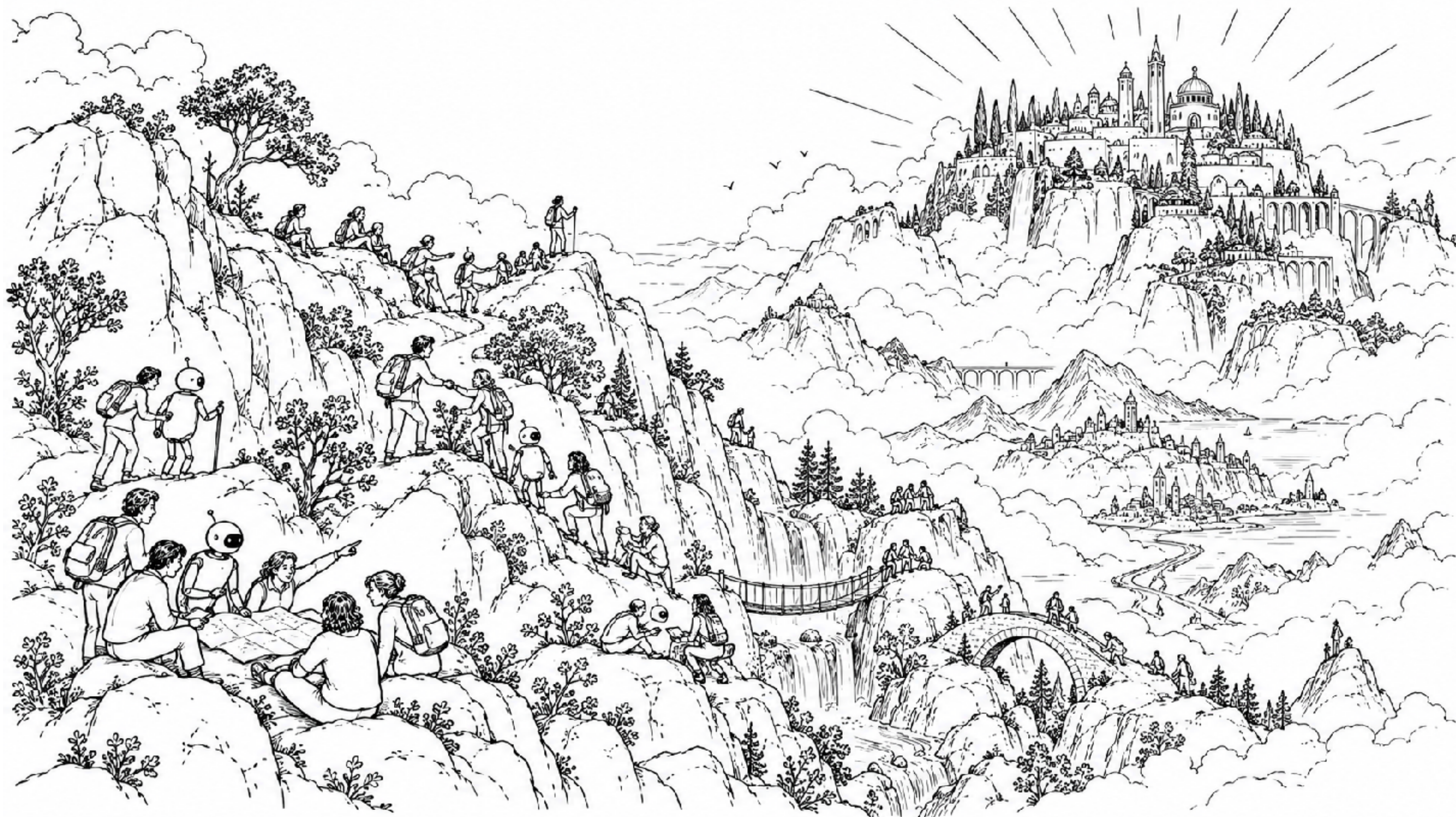
Degenerative AI



Degenerative AI



Regenerative AI



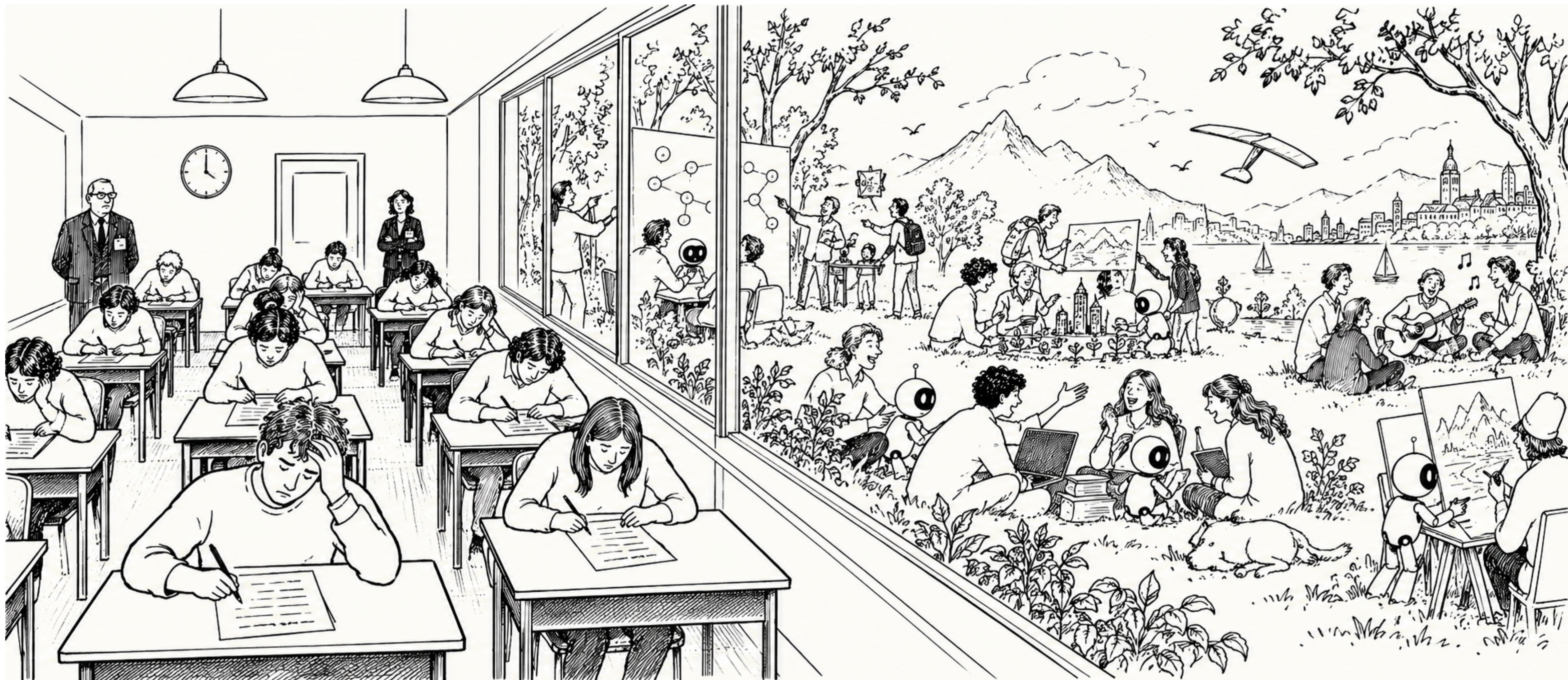
Regenerative AI



Regenerative AI



De/regenerative AI

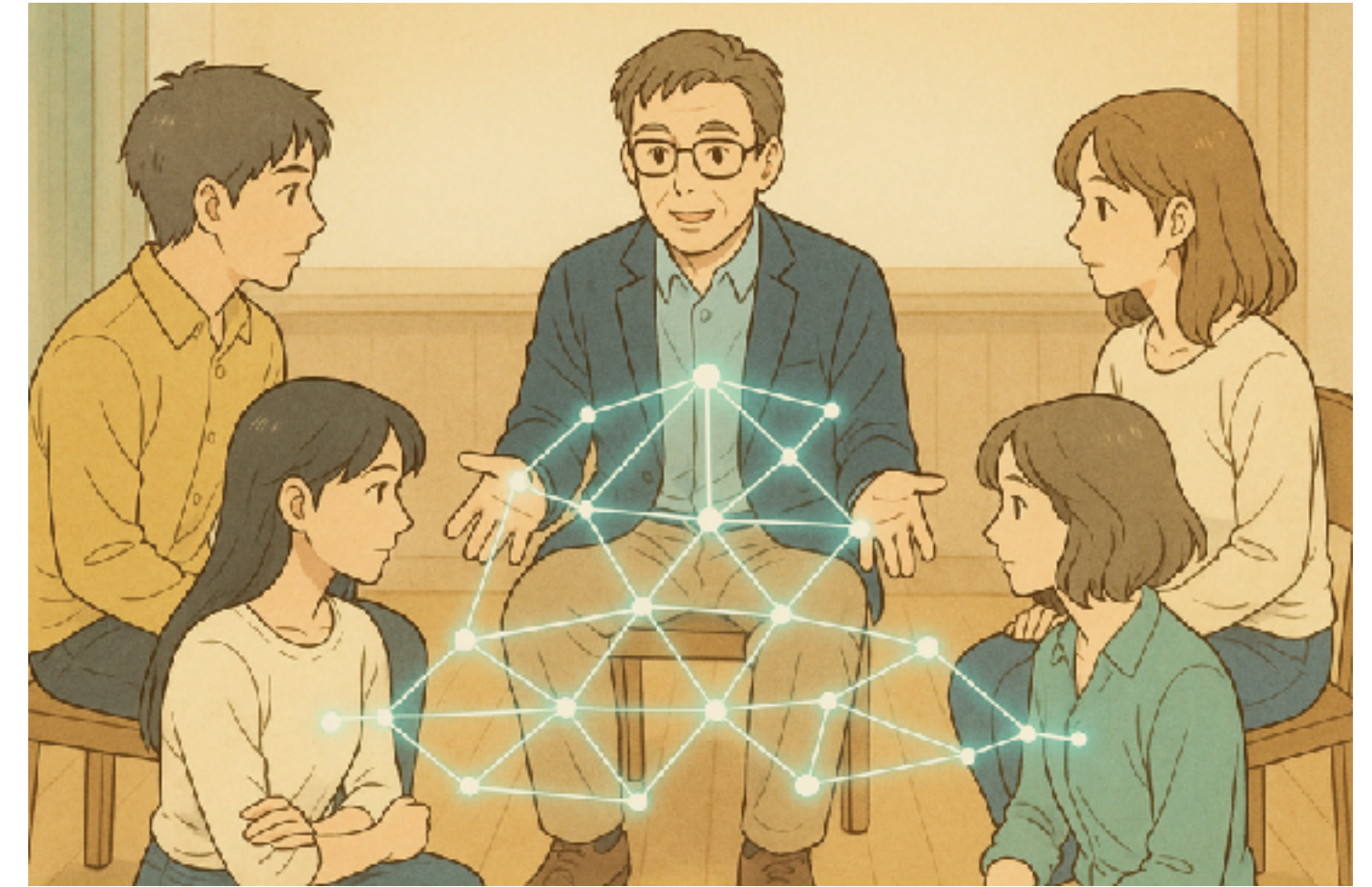


Regenerative roles

	Human Role (e.g.)	AI role (e.g.)
 Relationships	Interacting, role modelling, expressing, reacting.	Nurturing human relationships, discussion catalyzing/summarizing
 Values	Establishing values through actions, discussion, and structure.	<i>Staying out of this as much as possible!</i>
 Information	Helping learners to see the personal relevance, meaning, and value of what they are learning. Caring.	Helping learners to acquire the information. Providing the information.
 Feedback	Discussing and planning, making salient, challenging. Caring.	Analyzing objective strengths and weaknesses, helping with subgoals, offering support, explaining.
 Credentialling	Responsibility, qualitative evaluation.	Tracking progress, identifying unprespecified outcomes, discussion with human teachers.
 Organizing	Goal setting, reacting, responding.	Scheduling, adaptive delivery, supporting, reminding.
 Ways of being	Modelling, responding, interacting, reflecting.	<i>Staying out of this as much as possible!</i>

Coping in the world we actually inhabit...

As teachers
**Focus on the tacit,
the relational, the
social**

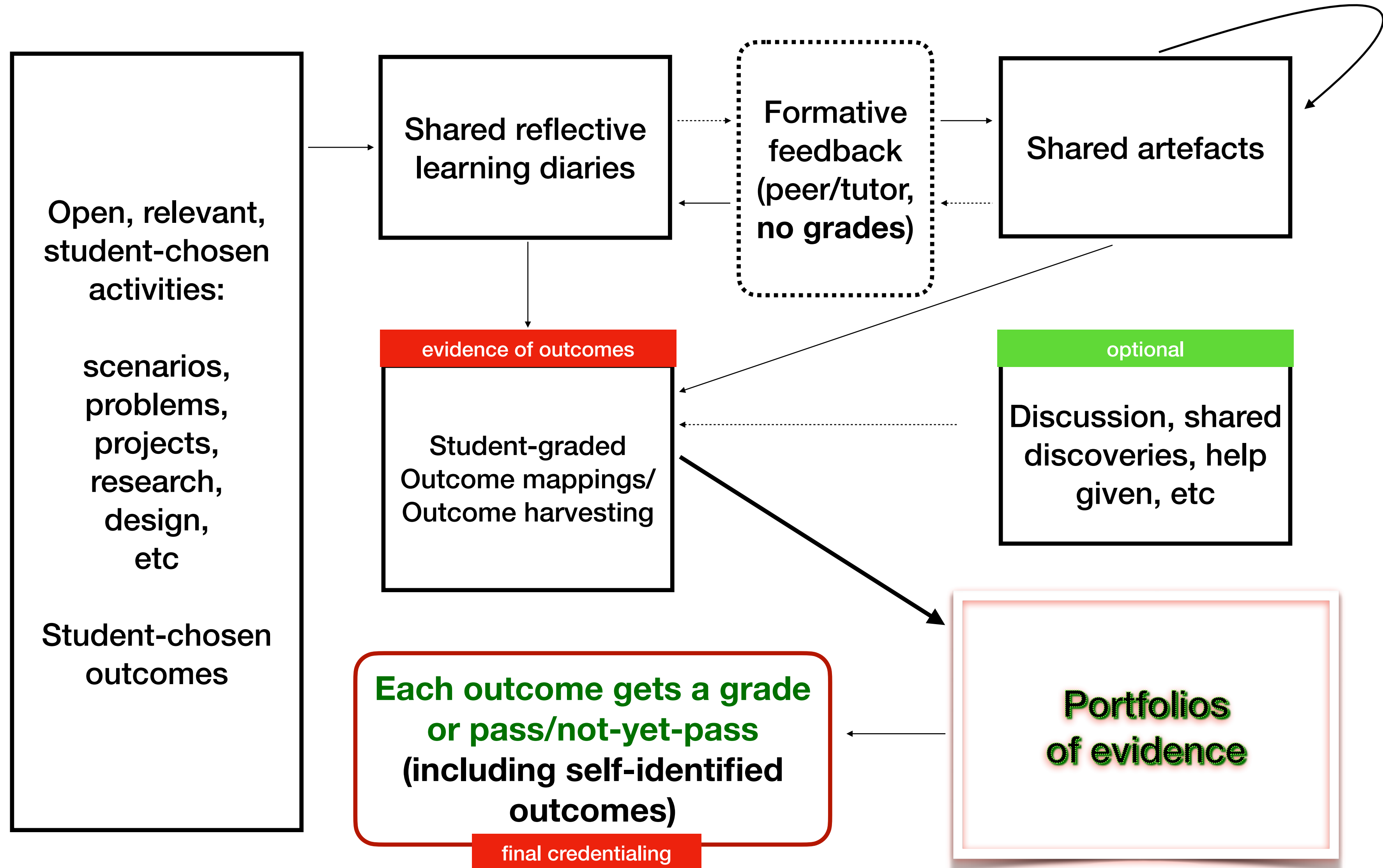


As learners
Focus on the choices.
**Don't let genAIs make choices that
would otherwise lead to learning**

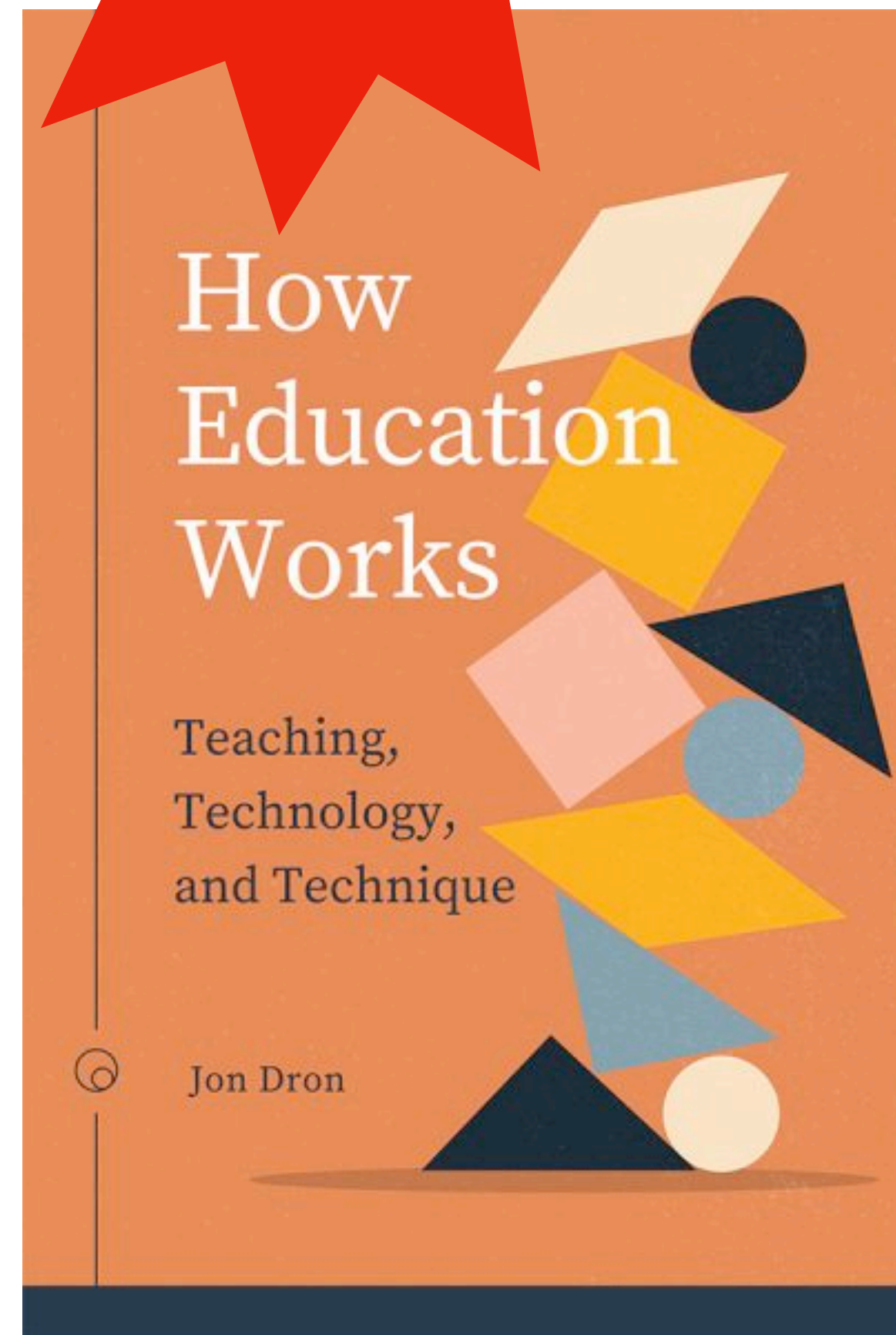


**Embrace
collective
cognition**

How I do assessment for credentials



Free to read and
download



<https://howeducationworks.ca>

Obrigado

✉ jond@athabascau.ca

🐦 [@jondron](https://twitter.com/jondron)

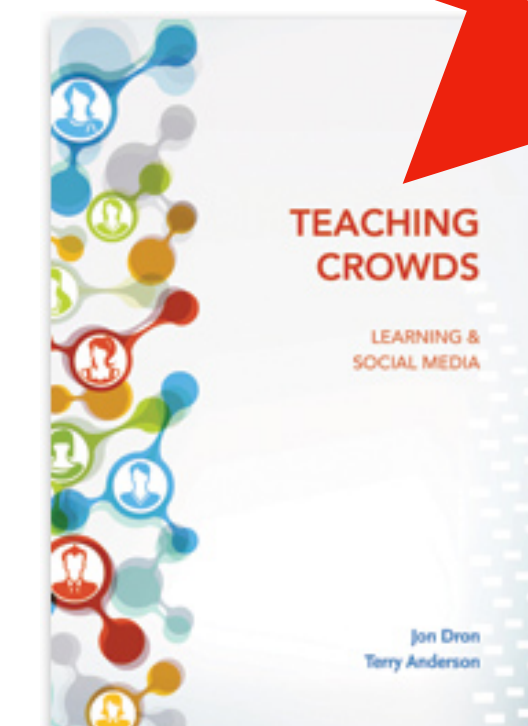
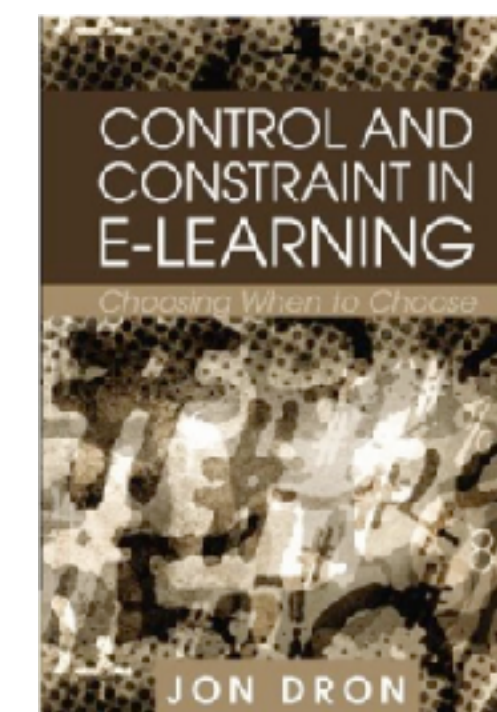
🌐 <https://jondron.ca/>

📡 [@jondron@mastodon.social](https://jondron@mastodon.social)



<https://jondron.ca/ai>

Free to
read and
download



Further reading

Dron, J. (2023). How education works: Teaching, technology, and technique. AU Press.

Dron, J. (2025). Cognitive Santa Claus Machines and the Tacit Curriculum. *AI Enhanced Learning*, 1(1), 181–188. <https://www.learntechlib.org/primary/p/226406/>

Dron, J. (2024). Learning: A technological perspective. *Journal of Open, Distance, and Digital Education*, 1(2), Article 2. <https://doi.org/10.25619/dpyg4687>

Model / theory	Reference
Core	
Complexivist paradigm	Dron, J., & Anderson, T. (2022). Pedagogical paradigms in open and distance education. In Handbook of Open, Distance and Digital Education. Springer. https://doi.org/10.1007/978-981-19-0351-9_9-1
Three generations / connectivist pedagogy	Anderson, T., & Dron, J. (2011). Three generations of distance education pedagogy. IRRODL, 12(3). https://doi.org/10.19173/irrodl.v12i3.890
Co-participation/Entangled learning	Dron, J. (2023). How education works: Teaching, technology, and technique. AU Press.
Entangled learning	Fawns, T. (2022). An entangled pedagogy: Looking beyond the pedagogy–technology dichotomy. Postdigital Science and Education, 4(3). https://doi.org/10.1007/s42438-022-00302-7
Connectivism	Siemens, G. (2005). Connectivism: A learning theory for the digital age. International Journal of Instructional Technology and Distance Learning, 2(1), 3–10.
Rhizomatic learning	Cormier, D. (2008). Rhizomatic education: Community as curriculum. Innovate: Journal of Online Education, 4(5).
Networks of practice	Wenger, E., Trayner, B., & de Laat, M. (2011). Promoting and assessing value creation in communities and networks: A conceptual framework (Rapport 18). Ruud de Moor Centrum, Open Universiteit.
Technology	Arthur, W. B. (2009). The nature of technology: What it is and how it evolves. Free Press.
Intertwingularity	Nelson, Ted. (1974). Computer Lib/Dream Machines. http://archive.org/details/computer-lib-dream-machines
Self-determination theory	Ryan, R. M., & Deci, E. L. (2017). Self-determination theory: Basic psychological needs in motivation, development, and wellness. Guilford Publications.
Other complexivist models and related readings	
Ecological constructivism	Barab, S. A., & Roth, W.-M. (2006). Curriculum-based ecosystems: Supporting knowing from an ecological perspective. Educational Researcher, 35(5), 3–13.
Extended cognition	Clark, A. (2008). Supersizing the mind: Embodiment, action, and cognitive extension. Oxford University Press.
Distributed cognition	Hutchins, E. (1995). Cognition in the wild. MIT Press.
Collective intelligence	Lévy, P. (1997). Collective intelligence: Mankind's emerging world in cyberspace. Plenum.
Distributed cognitive apprenticeship	Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. Educational Researcher, 18(1), 32–42. https://doi.org/10.3102/0013189X018001032
Heutagogy	Blaschke, L. M. (2012). Heutagogy and lifelong learning: A review of heutagogical practice and self-determined learning. IRRODL, 13(1), 56–71. https://doi.org/10.19173/irrodl.v13i1.1076
Enactivism (in education)	Davis, B., Sumara, D., & Kieren, T. (1996). Cognition, co-emergence, curriculum. Journal of Curriculum Studies, 28(2), 151–169.
Enactivism (foundational)	Varela, F., Thompson, E., & Rosch, E. (1991). The embodied mind. MIT Press.
Sociomaterial / ANT	Fenwick, T., Edwards, R., & Sawchuk, P. (2011). Emerging approaches to educational research: Tracing the sociomaterial. Routledge.
Knowledge building	Scardamalia, M., & Bereiter, C. (2006). Knowledge building: Theory, pedagogy, and technology. In R. K. Sawyer (Ed.), Cambridge handbook of the learning sciences (pp. 97–115). Cambridge University Press.
Collectives / stigmergic learning	Dron, J., & Anderson, T. (2014). Teaching crowds: Learning and social media. AU Press.
Networked learning	Goodyear, P., Banks, S., Hodgson, V., & McConnell, D. (Eds.) (2004). Advances in research on networked learning. Kluwer.
Learning ecologies	Barron, B. (2006). Interest and self-sustained learning as catalysts of development: A learning ecology perspective. Human Development, 49(4), 193–224.
Ecology of resources	Luckin, R. (2010). Re-designing learning contexts. Routledge.
Landscapes of practice	Wenger-Trayner, E., et al. (Eds.) (2015). Learning in landscapes of practice. Routledge.
Paragogy	Corneli, J., & Danoff, C. J. (2011). Paragogy. Proceedings of the 6th Open Knowledge Conference (CEUR Workshop Proceedings, Vol. 739).
Postdigital education	Jandrić, P., et al. (2018). Postdigital science and education. Educational Philosophy and Theory, 50(10), 893–899.
Dynamic systems	Thelen, E., & Smith, L. B. (1994). A dynamic systems approach to the development of cognition and action. MIT Press.
Ecological psychology	Gibson, J. J. (1979). The ecological approach to visual perception. Houghton Mifflin.
Ecology of mind	Bateson, G. (1972). Steps to an ecology of mind. Chandler.