Intelligence, the elusive concept and general capability still not found in machines

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“Together with sensors and learning management systems, Artificial Intelligence (AI) can give teachers a real sense of how different students learn differently, where students get interested and where they get bored, where they advance and where they get stuck. Technology can help adapt learning to different student needs and give learners greater ownership over what they learn, how they learn, where they learn and when they learn. [...] And of course, AI is helping assessment and exams make big leaps, whether these are assessments through simulations, hands-on assessments in vocational settings, or machine-learning algorithms scoring essays.”

Andreas Schleicher, Director, OECD Directorate for Education and Skills, commenting the OECD Digital Education Outlook 2021
https://oecduteday.com/how-radically-reimagine-teaching-learning-digital-technology/

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The reality of AI in education is looking very different...
Cheating allegations engulf Dartmouth medical school

By Laura Krantz  Globe Staff, Updated April 15, 2021, 6:52 p.m.

The e-mail accused her — and, she later learned, more than a dozen other students — of cheating by accessing online course materials while taking a test on a different software platform. The school said that it had electronic evidence of misconduct, and that she was invited to make a brief statement defending herself at a tribunal to be held over Zoom in a week.

A couple of months later...

Victory! Dartmouth Ends Unfounded Cheating Investigation After Students, Rights Groups Speak Out

DEEPLINKS BLOG

BY JASON KELLEY
JUNE 10, 2021

https://www.eff.org/deeplinks/2021/06/dartmouth-ends-misguided-investigation-after-students-rights-groups-speak-out
Online proctoring, one among many!

- **Highly intrusive surveillance machinery**: Corporations’ interests-driven
- **Lack of AI literacy**: educational institutions buy everything they are told
- Psychology, Sociology, Education experts **not involved**
- Identifies “suspicious” behaviours; “detects” fraud ⇒ **Inaccurate**; no extensive research comparing to human experience
- Privacy (data use and sharing **without students or parents’ consent**)
- **No opt-out**: no alternative examination mechanisms
- **Zero transparency**; **blurry or no** accountability; **no** explainability
- **Discrimination** (e.g. students with special conditions), etc.
Philosophy & Technology
https://doi.org/10.1007/s13347-021-00476-1

RESEARCH ARTICLE

Good Proctor or “Big Brother”? Ethics of Online Exam Supervision Technologies

Simon Coghlan\textsuperscript{1,2} · Tim Miller\textsuperscript{1,2} · Jeannie Paterson\textsuperscript{2,3}

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The future of AI in education is bright, but we need to pay careful attention to how, for what, and for whom AI is used.
“The long-term dream of AI is to build machines that have the full range of capabilities for intelligent actions that people have—to build machines that are self-aware, conscious and autonomous in the same way that people like you and me are. [...] The reality of AI for the foreseeable future is very different to the grand dream.” (Wooldridge, 2020)

A (very) brief history of the scientific study of (machine) intelligence

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The scientific study of intelligence originated in the 1870s ... 

... about 150 years ago.

Long tradition in Psychology and related fields.
First scientific definition of intelligence?

“The intelligent being, animal or man, supplies its wants, preserves its life, improves its condition, only by the exact accordance of its present prevision and the near or even distant future” (Taine 1875).

Hippolyte Adolphe Taine
(April 21, 1828 – March 5, 1893)

Research in AI started in the 1950s ... 

“stimulated by the invention of modern computers. This inspired a flood of new ideas about how machines could do what only minds had done previously” (Minsky 1985)

“Intelligence is] the ability to solve hard problems” (Minsky 1985).

“Artificial Intelligence is . . . the study of the computations that make it possible to perceive, reason, and act” (Winston 1992).

Evolution of *perceive*, *reason*, and *act*(*)

A collection of 70+ definitions of intelligence.

Both of human and machine intelligence.

No consensus, however.

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No consensus definition

“There is very great disagreement concerning the concept of intelligence” (Journal editors 1921).

“[A] substantial disagreement on a single definition still abounds” (Detterman 1986).

“It is a testimony to the immaturity of our field that the question of what we mean when we talk about intelligence still doesn’t have a satisfying answer” (Chollet 2019)

Why?

- Still no consensus definition(s) of (A)I
- Very polarized concept
- Interdisciplinarity, different contexts and applications
- Misleading news and hype around AI damaging the field
- Need to know the boundaries of the discourse

“**The lack of specificity allows journalists, entrepreneurs, and marketing departments to say virtually anything they want.**” (Lipton, 2018)

“*[T]he public knowledge and understanding on AI [...] is suffering from a lack of transparency as to capabilities and thus impacts of AI.*” (Nemitz, 2018)

“*[A] lack of clarity in terms of definitions and objectives seems to have plagued the [AI] field right back to its origins in the 1950s. This makes tracing [its] evolution... a difficult task.*” (AI in the UK, 2018, p. 156)
AGISI Survey on defining (machine) intelligence

Prof. Dr. Dagmar Monett, HWR Berlin & AGISI.org
AGISI Survey *Defining (machine) Intelligence*

24.7.2017—25.7.2019

57+ 184+

567 responses

9x2 definitions of (human/machine) intelligence to agree upon

Academia (*N*=452, 79.7%)
Industry (*N*=116, 20.5%)

Researchers (*N*=435, 76.7%)
Educators (*N*=197, 34.7%)
Developers, Engineers (*N*=90, 15.9%)

4,128 opinions
343 new, suggested definitions

*Results as per closing the survey*

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Findings: Cognitive biases undermine consensus on defining (machine) intelligence
E.g.: Respondents tended to place too much importance on some words and overlooked others.

Focalism - The tendency to place too much importance on one aspect of an event (Kahneman et al., 2006)
Most commented and second less accepted definition of machine intelligence

“Intelligence is concerned mainly with rational action. Ideally, an intelligent agent takes the best possible action in a situation.”

(Russell & Norvig, 2010)
What is AI actually, where are we now, and what is missing?
On wishful mnemonics


(h/t Melanie Mitchell)
“[P]eople may have no idea, or only a largely incorrect idea, of the reasoning processes that caused them to behave in a particular way.”

“[P]eople can be quite mistaken about their reasoning processes, even about the most routine matters.”

“Reasoning is not language. Whatever the merits of the competence/performance distinction in linguistics, there’s no compelling reason to import it into inductive reasoning.”

Artifictional intelligence, the one “available through the newspapers, books and films.”

“No computer will be fluent in a natural language, pass a severe Turing Test and have full human-like intelligence unless it is fully embedded in normal human society. No computer will be fully embedded in human society as a result of incremental progress based on current techniques” (Collins 2018).

“Neither deep learning nor other forms of second-wave AI, nor any proposals yet advanced for third-wave, will lead to genuine intelligence.”

“The myth is not that true AI is possible. As to that, the future of AI is a scientific unknown. The myth of artificial intelligence is that its arrival is inevitable, and only a matter of time—that we have already embarked on the path that will lead to human-level AI, and then superintelligence. *We have not.*”

“Success on narrow applications get us not one step closer to general intelligence. The inferences that systems require for general intelligence [...] cannot be programmed, learned, or engineered with our current knowledge of AI. [...] No algorithm exists for general intelligence.”

Current AI is nowhere near:
- Orientation toward that which is represented (and not merely its representation)
- Distinguish appearance from reality
- Commitment, taking care about the difference
- Embracing actuality, possibility, impossibility
- Self-awareness

“Many forms of work are shrouded in the term ‘artificial intelligence,’ hiding the fact that people are often performing rote tasks to shore up the impression that machines can do the work.”

“[M]any underpaid workers are required to help build, maintain, and test AI systems. [...] The technical AI research community relies on cheap, crowd-sourced labor for many tasks that can’t be done by machines.”

What AI is

“AI is neither artificial not 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.”

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