

Intelligence amplification

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Intelligence amplification (**IA**) (also referred to as **cognitive augmentation** and **machine augmented intelligence**) refers to the effective use of information technology in augmenting human intelligence. The theory was developed in the 1950s and 1960s by cybernetics and early computer pioneers.

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Major Contributions

William Ross Ashby: *Intelligence Amplification*

The term *intelligence amplification* (IA) has enjoyed a wide currency since William Ross Ashby wrote of "amplifying intelligence" in his *Introduction to Cybernetics* (1956) and related ideas were explicitly proposed as an alternative to Artificial Intelligence by Hao Wang from the early days of automatic theorem provers.

.."problem solving" is largely, perhaps entirely, a matter of appropriate selection. Take, for instance, any popular book of problems and puzzles. Almost every one can be reduced to the form: out of a certain set, indicate one element. ... It is, in fact, difficult to think of a problem, either playful or serious, that does not ultimately require an appropriate selection as necessary and sufficient for its solution. It is also clear that many of the tests used for measuring "intelligence" are scored essentially according to the candidate's power of appropriate selection. ... Thus it is not impossible that what is commonly referred to as "intellectual power" may be equivalent to "power of appropriate selection". Indeed, if a talking Black Box were to show high power of appropriate selection in such matters — so that, when given difficult problems it persistently gave correct answers — we could hardly deny that it was showing the 'behavioral' equivalent of "high intelligence". If this is so, and as we know that power of selection can be amplified, it seems to follow that intellectual power, like physical power, can be amplified. Let no one say that it cannot be done, for the gene-patterns do it every time they form a brain that grows up to be something better than the gene-pattern could have specified in detail. What is new is that we can now do it synthetically, consciously, deliberately.

Ashby, W.R., *An Introduction to Cybernetics*, Chapman and Hall, London, UK, 1956. Reprinted, Methuen and Company, London, UK, 1964. PDF (<http://pespmc1.vub.ac.be/books/IntroCyb.pdf>)

Part of the series on
Cyborgs

Cyborgology

Bionics / Biomimicry
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 Brain-computer interface
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 Distributed cognition
 Genetic engineering
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Intelligence amplification

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Cognitive liberty
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 Cyborg feminism
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 Extropianism
 Morphological freedom
 Singularitarianism
 Transhumanism

J.C.R. Licklider: *Man-Computer Symbiosis*

"**Man-Computer Symbiosis**" is a key speculative paper published in 1960 by psychologist/computer scientist J.C.R. Licklider, which envisions that mutually-interdependent, "living together", tightly-coupled human brains and computing machines would prove to complement each other's strengths to a high degree:

"Man-computer symbiosis is a subclass of man-machine systems. There are many man-machine systems. At present, however, there are no man-computer symbioses. The purposes of this paper are to present the concept and, hopefully, to foster the development of man-computer symbiosis by analyzing some problems of interaction between men and computing machines, calling attention to applicable principles of man-machine engineering, and pointing out a few questions to which research answers are needed. The hope is that, in not too many years, human brains and computing machines will be coupled together very tightly, and that the resulting partnership will think as no human brain has ever thought and process data in a way not approached by the information-handling machines we know today."

Licklider, J.C.R., "Man-Computer Symbiosis", *IRE Transactions on Human Factors in Electronics*, vol. HFE-1, 4-11, Mar 1960. Eprint (<http://medg.lcs.mit.edu/people/psz/Licklider.html>)

In Licklider's vision, many of the pure artificial intelligence systems envisioned at the time by over-optimistic researchers would prove unnecessary. (This paper is also seen by some historians as marking the genesis of ideas about computer networks which later blossomed into the Internet).

Douglas Engelbart: *Augmenting Human Intellect*

Licklider's research was similar in spirit to his DARPA contemporary and protégé Douglas Engelbart; both had a view of how computers could be used that was both at odds with the then-prevalent views (which saw them as devices principally useful for computations), and key proponents of the way in which computers are now used (as generic adjuncts to humans).

Engelbart reasoned that the state of our current technology controls our ability to manipulate information, and that fact in turn will control our ability to develop new, improved technologies. He thus set himself to the revolutionary task of developing computer-based technologies for manipulating information directly, and also to improve individual and group processes for knowledge-work. Engelbart's philosophy and research agenda is most clearly and directly expressed in the 1962 research report which Engelbart refers to as his 'bible': *Augmenting Human Intellect: A Conceptual Framework*

(<http://www.bootstrap.org/augdocs/friedewald030402/augmentinghumanintellect/ahi62index.html>). The concept of network augmented intelligence is attributed to Engelbart based on this pioneering work.

"Increasing the capability of a man to approach a complex problem situation, to gain comprehension to suit his particular needs, and to derive solutions to problems. Increased capability in this respect is taken to mean a mixture of the following: more-rapid comprehension, better comprehension, the possibility of gaining a useful degree of comprehension in a situation that previously was too complex, speedier solutions, better solutions, and the possibility of finding solutions to problems that before seemed insolvable. And by complex situations we include the professional problems of diplomats, executives, social scientists, life scientists, physical scientists, attorneys, designers-- whether the problem situation exists for twenty minutes or twenty years. We do not speak of isolated clever tricks that help in particular situations. We refer to a way of life in an integrated domain where hunches, cut-and-try, intangibles, and the human feel for a situation usefully co-exist with powerful concepts, streamlined terminology and notation, sophisticated methods, and high-powered electronic aids."

Engelbart, D.C., "Augmenting Human Intellect: A Conceptual Framework", Summary Report AFOSR-3233, Stanford Research Institute, Menlo Park, CA, Oct 1962. Eprint (<http://www.bootstrap.org/augdocs/friedewald030402/augmentinghumanintellect/ahi62inde>)

Further reading

- Asaro, Peter (2008). "From Mechanisms of Adaptation to Intelligence Amplifiers: The Philosophy of W. Ross Ashby," in Michael Wheeler, Philip Husbands and Owen Holland (eds.) *The Mechanical Mind in History*, Cambridge, MA: MIT Press.
- Ashby, W.R., *Design for a Brain*, Chapman and Hall, London, UK, 1952. Second edition, Chapman and Hall, London, UK, 1966.
- Skagestad, Peter, "Thinking with Machines: Intelligence Augmentation, Evolutionary Epistemology, and Semiotic", *Journal of Social and Evolutionary Systems*, vol. 16, no. 2, pp. 157-180, 1993. Eprint (<http://www.cspeirce.com/menu/library/aboutcsp/skagesta/thinking.htm>)
- Smart Business Networks (or, Let's Create 'Life' from Inert Information) (http://papers.ssrn.com/sol3/papers.cfm?abstract_id=991163) on SSRN
- Waldrop, M. Mitchell, *The Dream Machine: J.C.R. Licklider and the Revolution That Made Computing Personal*, Viking Press, New York, NY, 2001. Licklider's biography, contains discussion of the importance of this paper.

See also

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| <ul style="list-style-type: none"> ■ Ashby, William Ross ■ Cybernetics ■ Brain-computer interface ■ Cyborg ■ Engelbart, Douglas ■ Human enhancement ■ Sensemaking | <ul style="list-style-type: none"> ■ Licklider, J.C.R. ■ Peirce, Charles Sanders ■ Symbiotic intelligence ■ Wisdom of crowds ■ Mechanization ■ Knowledge worker |
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External links

- Overview of Engelbart's framework at Fleabyte.org (<http://www.fleabyte.org/eic-3.html>)
- IT Conversations: Doug Engelbart - Large-Scale Collective IQ (<http://www.itconversations.com/shows/detail378.html>)
- Intelligence, Amplified (<http://blog.eturner.net/?p=6>)
- 7 December 1951, Ashby first wrote about the possibility to build an 'information amplifier'. (<http://www.rossashby.info/journal/page/3609.html>)
- 12 August 1953, Ashby mentioned an objection to his 'intelligence-amplifier'. (<http://www.rossashby.info/journal/page/4584.html>)

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