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Augmented intelligence is an umbrella-term used in media theory, cognitive sciences, neurosciences, philosophy of mind, and political philosophy to cover the complex relation between human intelligence on one side, and mnemo-techniques and computational machines on the other—both understood to be an expansion (also to a social and political degree) of human cognitive faculties.

Main Synonyms

Synonyms include: augmented human intellect, machine augmented intelligence, and intelligence amplification. Specifically, extended mind, extended cognition, externalism, distributed cognition, and the social brain are concepts of cognitive sciences and philosophy of mind that do not necessarily involve technology (Clark and Chalmers 1998). Augmented reality, virtual reality, and teleoperation can be framed as a form of augmented intelligence, moreover, for their novel influence on cognition. Brain-computer interfaces directly record electromagnetic impulses of neural substrates to control, for instance, external devices like a robotic arm, and raise issues of the *exo-self* and *exo-body*. Augmented intelligence must be distinguished from artificial intelligence, which implies a complete autonomy of machine intelligence from human intelligence despite sharing a logical and technological ground; and from swarm intelligence, which describes decentralized and spontaneous forms of organization in animals, humans, and algorithmic bots (Beni and Wang 1989). In the field of neuropharmacology, nootropics refers to drugs that improve mental functions such as memory, motivation, and attention. Like artificial and augmented intelligence, the idea of collective intelligence also bred (especially in science fiction) a family of visionary terms that is not possible to summarize here (for example Stapledon 1930).

History: Engelbart and Bootstrapping

The relation between cognitive faculties, labor, and computation was already present in the pioneering work of Charles Babbage (1832). The "division of mental labor" was the managerial notion at the basis of his famous calculating engines, which aimed to improve industrial production. The concept of augmented intelligence itself was first introduced in cybernetics by Engelbart

(1962), who was influenced by the works of Bush (1945) on *the Memex*, Ashby (1956) on *intelligence amplification*, Licklider (1960) on *man-computer symbiosis*, and Ramo (1961) on *intellectronics*, among others. In his seminal paper, "Augmenting Human Intellect: A Conceptual Framework," Engelbart (1962) provides a definition of augmented intelligence specifically oriented to problem solving:

> By "augmenting human intellect" we mean 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 insoluble. 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. (1962, 1)

Engelbart was a pioneer of graphic user interfaces and network technologies, inventor of the computer mouse and founder of the Augmentation Research Center at Stanford University. The methodology called *bootstrapping* was the guiding principle of his research laboratory and aimed to establish a recursive improvement in the interaction between human intelligence and computer design (the term has also been adopted in the discourse on artificial intelligence to describe a hypothetical system which learns how to improve itself recursively, that is by observing itself learning; as yet such a system has not been successfully designed). Engelbart's vision was eminently political and progressive: Any form of augmentation of individual intelligence would immediately result in an augmentation of the collective and political intelligence of humankind. Despite the fact that Engelbart does not account for possible risks, social frictions, and cognitive traumas due to the introduction of augmented intelligence technologies, his combined technological and political definition can be useful to draw a conceptual map of augmented intelligence.

Conceptual Axes of Augmentation

The conceptual field of augmented intelligence can be illustrated along two main axes: a technological axis (that describes the degree of complexity from traditional mnemo-techniques to the most sophisticated knowledge machines) and a political axis (that describes the scale of intellectual augmentation from the individual to a social dimension).

– *Technological axis.* Any technique of external memory (such as the alphabet or numbers) has always represented an extension of human cognition.

McLuhan (1962) underlined how innovations such as the printing press and electronic media have caused a further expansion of our senses on a global scale, affecting cognitive organization and, therefore, social organization. According to McLuhan, it is possible to periodize the history of augmented intelligence in four epistemic periods according to the medium of cognitive augmentation: *sign* (alphabet, numbers, symbolic forms), *information* (radio, TV, communication networks), *algorithm* (data mining, computer modeling, simulation and forecasting), and *artificial intelligence* (expert systems and self-learning agents: as a hypothetical limit). The interaction between the human mind and techniques of augmentation is recursive (as Engelbart would register), since humankind has always continued improving upon them.

– *Political axis.* The political consequences of augmented intelligence are immediately manifested as soon as a large scale of interaction and computation is achieved. Indeed, Engelbart's project was conceived to help problem solving on a global scale of complexity: The collective scale cannot be severed by any definition of augmented intelligence. A vast tradition of thought has already underlined the collective intellect as an autonomous agent not necessarily embodied in technological apparatuses (Wolfe 2010). See the notions of: *general intellect* (Marx), *noosphere* (Teilhard de Chardin), *extra-cortical organization* (Vygotsky), *world brain* (Wells), *cultural capital* (Bourdieu), *mass intellectuality* (Virno), *collective intelligence* (Levy). Across this tradition, "the autonomy of the general intellect" (Virno 1996) has been proposed by autonomist Marxism as the novel political composition emerging out of post-Fordism. The project of such a *political singularity* mirrors perfectly the a-political model of *technological singularity*.

The combination (and antagonism) of the technological and political axes describes a trajectory toward augmented social intelligence. According to this definition, however, political conflicts, on one side, and the computational aporias, on the other, go unresolved. Deleuze and Guattari's notion of the machinic (1972, 1980)—also inspired by the idea of mechanology by Simondon (1958)—was a similar attempt to describe, in conjunction, the technological and political composition of society without falling either into fatalism or into utopianism. Among the notions of augmentation, moreover, it is worth recalling their concepts of machinic surplus value and code surplus value (Deleuze and Guattari 1972, 232–237).

Criticism and Limits

Any optimistic endorsement of new technologies for human augmentation regularly encounters different forms of criticism. "Artificial intelligence winters," for instance, are those periods of reduced funding and fall of institutional interest, also due to public skepticism. A first example of popular

criticism directed toward augmented intelligence in the modern age would be the Venetian editor Hieronimo Squarciafico. After working for years with Aldus Manuntius's pioneering press, he stated in an aphorism, an "abundance of books makes men less studious" (Lowry 1979: 31). The essay "The Question Concerning Technology" by Heidegger (1954) is considered a main reference for technological critique in continental philosophy. Heidegger influenced a specific tradition of technoskepticism: Stiegler (2010), for instance, has developed the idea that any external mnemo-technique produces a general *grammatization* and, therefore, a *proletarization* of the collective mind with a consequent loss of knowledge and *savoir-vivre*. Berardi (2009) has repeatedly remarked upon the de-erotization of the collective body produced by digital technologies and the regime of contemporary *semio-capitalism*. The physical and temporal limits of human cognition when interacting with a pervasive mediascape is generally addressed by the debate on the attention economy (Davenport and Beck 2001). The discipline of neuropedagogy has been acclaimed as a response to widespread techniques of cognitive enhancement and a pervasive mediascape (Metzinger 2009). Specifically dedicated to the impact of the Internet on quality of reading, learning, and memory, the controversial essay "Is Google Making Us Stupid?" by Carr is also relevant in this context. The thesis of the nefarious effect of digital technologies on the human brain has been contested by neuroscientists. Carr's political analysis, interestingly, aligns him with the continental philosophers just mentioned: "What Taylor did for the work of the hand, Google is doing for the work of the mind" (Carr 2008). A more consistent and less fatalistic critique of the relation between digital technologies and human knowledge addresses the primacy of sensation and embodiment (Hansen 2013) and the role of the "nonconscious" in distributed cognition (Hayes 2014). In neomaterialist philosophy, it is feminism, in particular, that has underlined how the extended or augmented mind is always embodied and situated (Braidotti, Grosz, Haraway).

Augmented Futures

Along the lineage of French technovitalism, yet turned into a neo-reactionary vision, Land (2011) has propagated the idea of capitalism itself as a form of alien and autonomous intelligence. The recent "Manifesto for an Accelerationist Politics" (Srnicek and Williams 2013) has responded to this fatalist scenario by proposing to challenge such a level of complexity and abstraction: The idea is to repurpose capitalism's infrastructures of computation (usually controlled by corporations and oligopolies) to augment collective political intelligence. The Cybersyn project sponsored by the Chilean government in 1971 set out to control the national economy via a supercomputer; this is usually mentioned as a first rudimentary example of such *revolutionary cybernetics* (Dyer-Witheford 2013). More recently, Negarestani (2014) has advocated for a functional

linearity between the philosophy of reason, the political project of social intelligence, and the design of the next computational machine, where the logical distinction between augmented intelligence and artificial intelligence would no longer make any sense. The definition of augmented intelligence, however, will always be bound to an empirical foundation that is useful to sound out the consistency of any political or technological dream to come.

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