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Fire, seeds, and algorithms: contextualizing artificial intelligence in human evolutionary history

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Technology, society and cognition

The history of the *Homo* genus has been marked by major innovations that were not only technological but also social and cognitive. Long after *Homo habilis* began producing stone tools around 2.6–2.9 million years ago in East Africa (see the contribution by Riel-Salvatore in this forum), the domestication of fire and the Neolithic transition stand out as two of the most significant developments.

Today, artificial intelligence (AI) represents a new phase of change that is redefining how we think and how our social and economic systems operate. Its ability to permeate nearly every sphere of society and to function as a platform for further advances makes AI an unprecedentedly powerful driver of change (Brynjolfsson and McAfee 2014). In this sense, AI can be seen as part of the long continuum of transformative human achievements.

Despite the very different temporal scales involved, it is still meaningful to explore possible analogies with the two major turning points mentioned above. In this brief essay, I critically examine two such parallels by comparing the technological, cognitive, and social dynamics that accompanied the adoption of fire and the Neolithic transition, on the one hand, with those emerging around artificial intelligence, on the other.

AI and fire: extending human capacities

The domestication of fire was the result of a long and gradual process. Robust evidence for its regular and sustained use appears between 1 million and 800,000 years ago, most notably in the intentional burning of plant and bone material at Wonderwerk Cave in South Africa (Berna et al. 2012). True domestication—understood as the habitual integration of fire into daily activities and the cultural transmission of the skills required to maintain it—appears more clearly between roughly 400,000 and 300,000 years ago at sites such as Qesem Cave in Israel and Bolomor Cave in Spain (Barkai and Gopher 2013; Peris et al. 2012). Crucially, this timeline has been recently reinforced by findings from Barnham (UK), which provide the earliest direct evidence of fire-making dating back to 400,000 years ago (Davis et al. 2025). As a matter of fact, this technological milestone occurred long before the systemic co-dependence between humans and their environment that would later define the Neolithic domestications (see below).

The control of fire allowed the cooking of food, directly improving digestibility and energy absorption, and thus supporting the development of the human brain. It also altered the circadian rhythm of activities, providing light and heat that made social and cognitive life possible beyond the limits of natural daylight. Beyond its practical functions, fire acquired a symbolic and cultural dimension: it brought individuals together around a shared space of light and warmth, fostering storytelling and the transmission of knowledge (Wiessner 2014).

In this way, fire helped create a shared cognitive environment that can be seen as an early form of extended and distributed thinking, similar to what Clark and Chalmers (1998) describe. Its ability to change the way humans

perceived and interacted with their surroundings makes it one of the first examples of what McLuhan (1964) called an extension of the body and mind. Together, these perspectives show that fire was not just a tool, but a transformative force that reshaped human biology, the environment, and social life.

The conceptual roots of AI date back to the 1940s and 1950s, while its recognition as an autonomous research field is generally traced to 1955 (McCarthy et al. 1955; Russell and Norvig 2021). AI has followed an extremely rapid trajectory of development, concentrated within a few decades: its large-scale diffusion and its significant socio-technical impact can be located from the second decade of the twenty-first century onward, with the rise of deep learning systems and, more recently, generative AI (LeCun et al. 2015; Goodfellow et al. 2014)

Despite the great temporal distance between these two major innovations, a form of conceptual continuity emerges: like fire, artificial intelligence also represents an extension of human capacities. While fire functioned primarily as a tool that endowed humans with new physical abilities—such as cooking, protection, and illumination—AI instead acts in a direct and particularly incisive way on mental capacities. Through machine learning algorithms, predictive systems, and decision-support tools, AI extends our ability to process information, recognize complex patterns, and make decisions in contexts characterized by multiple variables (Russell and Norvig 2021), making available levels of computation, abstraction, and computational creativity that were previously unattainable.

From an anthropological perspective, both technologies emerge from a process through which humans externalize bodily and mental functions, creating tools that become an integral part of their technical, cognitive and social environment. Fire, as an early and primarily physical extension of human bodily capacities, and AI, as a prolongation of intellectual functions, represent two stages in a process of mutual transformation between human beings and technologies. This bidirectional relationship was first theorized by André Leroi-Gourhan (1964) through the notion of technogenèse, which describes how artifacts—initially stone tools and later increasingly complex technical systems—reorganize cognitive and social life while being simultaneously structured by the human practices that generate and use them.

AI and the Neolithic: reshaping the lifeways

The Neolithic transition—beginning in the Near East roughly between 11,000 and 9,000 years ago—represented a protracted and complex shift from hunter-gatherer societies to settled agricultural communities, remodeling economic, social, and symbolic structures (Bellwood 2005). The introduction of plant cultivation and animal domestication made the production of food surpluses possible, eventually leading to labor specialization and the development of more complex religious and political institutions. These changes, however, also gave rise to new inequalities and shifts in power, which varied across local contexts (Cauvin 2000). The Neolithic was not simply an economic transformation but a fundamental change in ways of living: it altered how humans inhabited space, perceived time, and constructed collective meaning.

Similarly, artificial intelligence (AI) can be seen as a force of profound social and cultural change. It now operates as a technology of cognitive mediation, reconfiguring how knowledge is produced, shared, and applied. Through automation, massive data processing, and predictive analytics, AI is altering the landscapes of education, work, and social interaction (Brynjolfsson and McAfee 2014; Susskind 2020). Just as the plow or the wheel in the Neolithic established new material infrastructures, AI algorithms create new cognitive infrastructures, modifying not only the tools of production but also the very ways humans think and relate to one another (Harari 2014; Floridi 2023).

While the agricultural revolution made it possible to build stable communities and

complex hierarchical systems, AI appears to foster the emergence of new *socio-technical forms* of collective intelligence and distributed decision-making. The aggregation of information and the ability to perform real-time analysis pave the way for unprecedented forms of cooperation, in which the boundary between human agency and machine-mediated action becomes increasingly porous (Floridi 2023; but see Rainey and Hochberg 2025 for a more extreme scenario). In this sense, AI can be interpreted as a new phase of human-technology interaction: a cognitive revolution that, somewhat like the Neolithic, but in a more direct way, affects knowledge processes and recasts cultural practices and their social dynamics. In both cases, the change is neither episodic nor isolated, but cumulative and structural.

The Neolithic revolution transformed human life over the course of millennia, reconfiguring material practices, social relations, and symbolic representations, with highly diverse effects depending on historical, geographical, and cultural contexts. AI, by contrast, produces its effects on a much shorter timescale. In addition to this extremely compressed temporal dynamic, the coding and circulation of digital tools tend to limit the diversity of impacts when compared with complex and contingent historical processes. Nevertheless, variability remains substantial, shaped by cultural, social, economic, and institutional contexts; by the intended purposes of use (educational, productive, communicative, or persuasive); and by the modes of implementation (centralized or distributed, open or proprietary), as well as by the available data and metadata.

Another analogy worth considering concerns the issue of social disparities. While the Neolithic transition generated forms of inequality based on land ownership and agricultural surplus—forms that deepened over the course of human economic history until they became systematic and structural—the advent of AI is creating new and profound cognitive and economic divides, whose consequences we are not yet fully able to assess. The concentration of computational power (hardware), advanced algorithms, and proprietary data in the hands of a few large corporations is producing unprecedented power asymmetries between a small class of AI creators and managers and a much larger majority of users. This may result in growing inequality in access to knowledge and productivity, introducing a new factor of social differentiation and division.

In sum, artificial intelligence—like the Neolithic revolution—does not merely introduce new techniques; it alters the very conditions of possibility for human life. It not only reworks social practices, forms of cooperation, and systems of meaning, but also introduces new inequalities or amplifies existing ones. If agriculture made sedentary civilization possible, AI may contribute to the emergence of an interconnected cognitive civilization in which intelligence—natural, artificial, and hybrid—becomes the focal point of new ways of living, thinking, and organizing society. Given its speed and impact, this shift inevitably brings with it both opportunities and risks that we are only beginning to understand.

Conclusions

Seen through the lens of the past, AI appears as a phenomenon that fits within the same co-evolutionary dynamics between technology, mind, and society—understood, in the case of AI, in a broad, non-biological sense—that have marked the history of the Homo genus and its sole surviving species, *Homo sapiens*. Its specificity lies in the opening of a new phase in which the hybridization of natural and artificial intelligence takes on a decisive role in shaping our future.

The analogies between fire and the Neolithic transition, on the one hand, and artificial intelligence, on the other, show that AI is not merely a technical challenge. Their comparison provides interpretive keys that reveal how AI fits into a long trajectory of change in which technology does not simply support human action, but actively contributes to reorganizing forms of sociality, structures of perception, and how human beings inhabit the world.

However, it is also useful to consider the limits of the analogies discussed above. First, the extreme speed with which AI—particularly generative AI—produces its effects creates a profound misalignment between the pace of technological progress and the slower rhythms of cognitive, social, and institutional change. Our ability to adapt ethical frameworks, legal systems, labor structures, and educational models is strained by the speed at which AI renders skills obsolete, generates new forms of disinformation, and challenges fundamental concepts such as authorship and work. This exposes societies to unprecedented risks of growing inequalities that may lead to social fractures and crises of institutional legitimacy—problems that are difficult to regulate within a constantly shifting landscape.

Second, the analogy with the extension of human capacities loses some of its relevance when AI begins to substitute or heavily constrain effective human decision-making capacity through automated decision-making systems—for instance, through algorithms that decide or create—raising issues of autonomy, delegation, and dependency that neither the Neolithic transition nor the discovery of fire posed so directly. Finally, the fundamental resource of AI is data, controlled by global platforms. The analogy with Neolithic inequalities becomes weaker when power is no longer linked to the physical possession of resources (land or animals), but rather to the asymmetry between those who control data and tools and those who, while contributing (often unknowingly) to their production, have no real control over them.

But even more than these three limitations of the analogies, the greatest gap concerns AI's autonomous capacity of self-sustained algorithmic optimization (although within goal structures, datasets, and performance metrics initially defined by human designers): thanks to data, machine learning, and continuous feedback, systems can independently improve their performance and adapt to new situations, consolidating competitive advantages and producing rapid and unpredictable effects— for example, on economic choices, information, and, more broadly, decision-making processes. Even a partial loss of human oversight over AI could exacerbate disparities in access to knowledge and employment, while generating social tensions that are difficult to manage. This arises both from the challenge of anticipating and regulating the consequences of AI use and from the further concentration of power among actors who can advance its development more rapidly due to superior access to resources and data.

Ultimately, AI should be understood as an anthropological phenomenon of epochal significance—not only capable of redefining the boundaries of human experience, but also compelling us to explore areas that until now were considered purely theoretical or unlikely. In any case, the opportunities and risks it brings constitute an unprecedented challenge, forcing us to rethink how we relate to the world and will coexist in the era of hybrid intelligence.

Author's note

For the preparation of this essay, artificial intelligence models (GPT-4, Gemini) were used as tools to support writing, stylistic refinement, and the exploration of possible conceptual organizations. AI contributed to the production of preliminary drafts and the formulation of writing suggestions, but the final structure of the text, interpretive choices, critical analysis of sources, and the definition of its intellectual content were carried out exclusively by the author.

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