Ghazza Abderrazzak, *al-Usus al-Mafāhīmiyya wa-l-Tiqaniyya lil-Dhakāʾ al-Iṣṭināʿī wa-Taṭawwuruh: Min Namādhij al-Ḥawsabiyya ilā al-Taʿallum al-Ālī* [*The Conceptual and Technical Foundations of Artificial Intelligence and Its Evolution: From Computational Models to Machine Learning*] (Doha/Beirut: ACRPS, 2024), pp. 448.

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From *The Gutenberg Galaxy: The Making of Typographic Man*[1] to *The Global Village: Transformations in World Life and Media in the 21st Century* (co-authored with Bruce R. Powers), Marshall McLuhan's work has inspired numerous theories seeking to make sense of the information age. Technological discoveries have repeatedly reshaped humanity's cultural and behavioural characteristics. Gutenberg's invention of the printing press in the 1440s reveals the significant role books played in shaping the concept of the individual and fostering nation-building.[2] As a medium of communication, books helped create the conditions for leaving the "Gutenberg Galaxy" and entering that of Guglielmo Marconi, inventor of the wireless telegraph system and radio. Whereas print enhanced visual perception and made it the primary sense for communication, "digital media" emerged, as McLuhan foresaw, by engaging multiple senses at once and enabling communication on the scale of the "global village".[3] With the advent of the internet, the defining features of a digital society began to take shape, along with virtual spaces in which digital and human activities intersect.

With the emergence of AI, communication, interaction, and connection have evolved beyond simple exchange toward the creation of machines, robots, and software capable of independent decision- making and idea generation. This has led to "new breakthroughs previously unknown to humankind", as Ghazza Abderrazzak, emphasizes in *The Conceptual and Technical Foundations of Artificial Intelligence and its Evolution: From Computational Models to Machine Learning*. These breakthroughs concern new aspects of the relationship between humans and machines, which now extends far beyond mere use, encompassing data collection, accurate disease diagnosis, language learning, new professions, the decline of others, content creation, e-commerce, and even psychological counselling. It also gives rise to troubling challenges such as cybercrime, privacy violations, plagiarism, cyber violence, internet addiction, and exacerbated unemployment, as intelligent machines perform physical and cognitive tasks far beyond human capabilities. Moreover, AI risks widening inequality, threatening privacy, and distorting digital justice.[4]

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[1] Marshall McLuhan, *The Gutenberg Galaxy: The Making of Typographic Man* (Toronto: University of Toronto Press, 1962).

[2] Richard Cavell & Marshall McLuhan, "L'histoire du livre," in: Carole Gerson & Jacques Michon, *Histoire du livre et de l'imprimé au Canada*, vol. 3: *de 1918 à 1980* (Montréal: Presses de l'Université de Montréal, 2007), pp. 91-93.

[3] Marshall McLuhan & Bruce R. Powers, *The Global Village: Transformations in World Life and Media in the 21st Century* (New York: Oxford University Press, 1989).

[4] Khatri Elayachi, "Dirāsa Nafsiyya wa-Ijtimāʿiyya lil-Huwiyya Dākhil al-Shabakāt al-Ijtimāʿiyya: Namūdhaj al-Mawqiʿ al-Ijtimāʿī al-'Facebook'," *Majallat al-ʿUlum al-Ijtimaiyya*, vol. 5 (2018), p. 221.

Abderrazzak's book adopts a linear approach, within a chronological historical framework, to trace the scientific and technological development of what has come to be known as Artificial Intelligence (AI). With intellectual caution, he examines the precursors of modern AI, including regression functions, lambda calculus, and Turing machines.[5] He traces this trajectory before and after the emergence of AI as an academic field in 1956, situating it alongside the revolution in the cognitive sciences, including cognitive psychology, informatics, linguistics, neuroscience, philosophy of mind, and anthropology. He follows the development of AI through two distinct paradigms: symbolic computation, which defines AI as "computation using symbols through explicit formal rules"; and neural associationism, linking AI to "cognition and behaviour, which arise from the interaction of different computational units that are interconnected and governed by learning rules".[6]

The first paradigm is grounded in mathematical logic and based on mechanistic, sequential, and logical principles. The second is rooted in a neural-associationist background, modelling itself on how the brain works and drawing upon dynamic, random, and complex factors. While the symbolic computational approach has faced setbacks in speech processing, image processing, and machine translation, neural associationism has made its mark in these fields by demonstrating the capacities of its cognitive systems in novel and remarkable ways. It has revealed cognitive abilities that appear as manifestations of holistic states emerging from complex, dynamic processes.[7]

Abderrazzak's work comprises six main sections and 22 chapters. The book lays out AI's underlying concepts, tracing its evolution from symbolic computation to machine learning, achieved through the processing of big data. The volume focuses on the foundations of AI, simplifying their content and translating them into Arabic – a significant contribution given that the core literature of computer science and related fields originates largely from Western publishing houses. It describes the mosaic of AI's development, showing how machines process information and explaining the principles underlying their operation (exploration and solution algorithms, knowledge representation systems, and software) in a clear and accessible manner. The author examines the fundamental hypotheses, their underlying assumptions, and the ways in which they have been verified. These hypotheses stem primarily from the possibility of "describing any mental activity with sufficient accuracy to be imitated by a machine".[8] Within symbolic computing, they gave rise to the idea of Artificial General Intelligence (AGI). Yet given the difficulty of achieving AGI, the concept of "expert systems" took its place, leading to the conclusion that "intelligence is first and foremost the application of knowledge rather than a matter of calculation or reasoning".[9]

The author asks: What is knowledge itself? Which kinds of knowledge do we want to represent? What is its nature or logical value?[10] How were machines developed to structure thought – machines that write, read, and simulate human activities expressed in a particular language?[11] How can mathematical and logical issues be addressed, and how can algorithmic procedures solve intractable problems such as the decidability?[12] Can human intelligence be simulated digitally? Is it possible to create computational and symbolic AI?[13] What are the implications of the profound revolution brought about by cybernetics, which "reduced everything to concepts devoid of intellectual content", foremost among them automated control,

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[5] Ghazza Abderrazzak, *al-Usus al-Mafāhīmiyya wa-l-Tīqaniyya lil-Dhakāʾ al-Iṣṭināʿī wa-Taṭawwuruh: Min Namādhij al-Ḥawsabiyya ilā al-Taʿallum al-Ālī* (Doha/Beirut: ACRPS, 2024), p. 41.

[6] Ibid., p. 22.

[7] Ibid., p. 421.

[8] Ibid., p. 29.

[9] Ibid., p. 31.

[10] Ibid., p. 23.

[11] Ibid., p. 29.

[12] Ibid., p. 27.

[13] Ibid., p. 119.

information processing, behavioural regulation through feedback, and the search for balance between the systems and its environments through the simultaneous study of the brain, mind, and the machine?[14] How do we build knowledge representations that a machine can use?[15] How can common-sense knowledge be represented? What is the difference between the web and the internet? How has the internet changed our relationship with knowledge?[16]

The book also examines statistical machine learning, along with related concepts such as hypothesis spaces, representation languages, rules of inference, the exploration of possibility, the nature of these rules, and how their effectiveness develops according to available data.[17] The author considers forms of deep machine learning networks and algorithms capable of simulating the behaviour of the human brain.[18]

Abderrazzak analyses the mathematical relationships and logical matrices at play in Machine Learning (ML), a branch of AI concerned with algorithms that enable computer systems to learn and train themselves using vast amounts of data, and to make decisions without direct human intervention. His account of AI's development focuses on the contributions of its founding researchers, including David Hilbert, Alan Turing, Kurt Gödel, Alonzo Church, Claude Shannon, and John von Neumann. He presents their key mathematical, logical, and intellectual achievements, along with their original writings and landmark scientific papers, without discussing the funding sources and research grants that have propelled AI's ongoing progress.

The book details concepts that have evolved alongside scientific and technological advances in AI: from knowledge-based systems to expert systems; from Web 2.0 to the Semantic Web or Web 3.0; and from large mainframe computers to microcomputers. The author also addresses the difficulties in AI's evolution, especially the challenges encountered in computational implementation, such as natural language encoding and machine translation.[19] He further explores alternatives within problem-solving process, an approach that remains central to the book's cognitive framework.

Abderrazzak points out that these remarkable developments in AI continue to shake traditional certainties about knowledge and reality, challenging many beliefs and overturning the symbolic, logical, and existential conceptual framework through which the mind has been understood. This may either complicate our understanding of the brain-body-environment triad in relation to the real world, or deepen our perception of the dimensions inherent in all things.[20]

A more fundamental question follows: why are human qualities attributed to inanimate machines that lack consciousness? In the case of AI, anthropomorphization – the attribution of human qualities to non-human, physical, or animal entities – is a method to which humans resort when faced with psychological, social, and cultural problems that are hard to solve. It thus becomes a crucial tool for understanding non-human behaviours, including those of highly intelligent robots.[21]

One facet of this idea appears in several of the author references. He mentions globalized entities supported by AI, such as YouTube, Facebook, and X, which have bolstered the collaborative web and transcended narrow concepts of software and technology. They have become a comprehensive system for producing data and reshaping relationships, contributing to the creation of virtual, communities, fulfilling

[14] Ibid., p. 155.
[15] Ibid., p. 244.
[16] Ibid., p. 361.
[17] Ibid., p. 404.
[18] Ibid., p. 415.
[19] Ibid., p. 225.
[20] Ibid., p. 422.
[21] Ameet Deshpande et al., "Anthropomorphization of AI: Opportunities and Risks," *Arxiv*, 24/5/2023, accessed on 10/12/2024, at: https://acr.ps/1L9GPt2

human expectations, and forming spaces for psychological, social, and intellectual projection. Users embraced them with unparalleled eagerness; in the author's words, they offered "a welcome occasion that met a long-standing demand among web users".[22]

In his conclusion, Abderrazzak presents a provocative philosophical scenario conceived by Greg Egan in 1990: what if a device implanted in the human brain could replicate all brain activity perfectly, rendering the brain itself unnecessary, so that after a few years, the person could remove their biological brain and function perfectly with the replica? Known in Egan's work as "the jewel", such a device would mimic the brain's structure, cell by cell and link by link. Once the individual reached adulthood, they could transfer their neural activity to the jewel and achieve immortality.[23] Abderrazzak uses this story to explain the theoretical background of neuroconnectionism, which regards the brain as a black box to be imitated rather than opened.[24] He then distinguishes this background from the premises of symbolic computation.

Despite the number and significance of the issues raised by AI, its momentum, and the complexity of its challenges are the result of a multitude of accumulated features, applications, and forms of immersion in the technological age. Abderrazzak's book clarifies some of these developments through a clear academic and scientific approach. Its intellectual commitment is limited to tracing the development of AI from its earliest beginnings to the present day, without delving into its impact on science, the dilemmas and obstacles it has presented, its impact on humanity, the threats and crises it may pose, or its environmental impact.

The author explores the cognitive framework that underpins AI's representation of knowledge and its processing of big data, which forms the foundation of deep machine learning. Such learning is freed from the cognitive constraints that limit human thought, enabling AI to develop algorithms that predict, implement ideas, or perform tasks once considered pure fantasy – developments that few could have imagined becoming reality. This opens up a field of research requiring human, scientific, and ethical efforts to control a technology whose reach and influence continue to expand, to the point that it threatens humanity's psychological, social, security, and intellectual stability.

This detailed, linear reading of AI's evolution from symbolic computing to deep machine learning – structured through scientific, epistemological, and historical questions – differs sharply from the socio-historical readings exemplified by Matteo Pasquinelli's *The Eye of the Master*.[25] Pasquinelli refutes the notion that AI can mimic the human mind or its neural structures, asserting instead that there is a close relationship between social forms and algorithmic constructs, since the latter are series of sequential steps designed to achieve desired outcomes.

Such steps are not limited to mathematics. The Babylonians used them to define legal principles, predict the future, determine medical treatments, and select foods. In this light, the goals of AI appear to extend little beyond the blind automation of work – replacing humans with machines – and control. AI is thus not a neutral tool, but a reflection of the socio-economic environment in which it was produced, and at the same time, a force that contributes to that environment's enhancement and reproduction.

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[22] Abderrazzak, p. 364.

[23] Ibid., p. 424.

[24] Ibid., p. 425.

[25] Matteo Pasquinelli, *The Eye of the Master: A Social History of Artificial Intelligence* (London: Verso Books, 2023).