

## CONSIDERATIONS ON THE HISTORY AND SOCIOLOGY OF THE INFORMATION SOCIETY

### CONSIDERAÇÕES SOBRE A HISTÓRIA E A SOCIOLOGIA DA SOCIEDADE DA INFORMAÇÃO

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#### Abstract

This study explores the historical and sociological foundations of the information society through an interdisciplinary framework combining the sociology of knowledge, philosophy of science, and the history of computing. Building on Edgar Morin's seven essential forms of knowledge, the study argues that contemporary education must shift from mere information transmission to cultivating epistemic awareness, rational knowledge production, Earth identity, ethical responsibility, and the capacity to confront uncertainty. The first section examines the philosophical foundations of the sociology of knowledge through Karl Mannheim's theory of existential determination, as well as the Enlightenment's rational ideal and its critique by the Frankfurt School. Habermas's reconstruction of rationality through knowledge-constitutive interests is presented as a critical pathway for emancipatory knowledge. The second section analyzes scientific production as a sociological process via Kuhn's paradigm theory, Bourdieu's field analysis, and Burke's social history of knowledge. The third section outlines the historical evolution of computation from mechanical devices to modern digital infrastructures, emphasizing sociotechnical transformation. Finally, the integration of artificial intelligence into healthcare is evaluated through ethical and regulatory challenges such as algorithmic bias, transparency, accountability, and privacy. The study concludes that the ultimate test of the information society is not knowledge production itself, but the ability to

#### Resumo

*Este estudo explora os fundamentos históricos e sociológicos da sociedade da informação por meio de uma estrutura interdisciplinar que combina a sociologia do conhecimento, a filosofia da ciência e a história da computação. Com base nas sete formas essenciais de conhecimento de Edgar Morin, o estudo argumenta que a educação contemporânea deve mudar da mera transmissão de informações para o cultivo da consciência epistêmica, da produção racional de conhecimento, da identidade terrestre, da responsabilidade ética e da capacidade de enfrentar a incerteza.*

*A primeira seção examina os fundamentos filosóficos da sociologia do conhecimento por meio da teoria da determinação existencial de Karl Mannheim, bem como o ideal racional do Iluminismo e sua crítica pela Escola de Frankfurt. A reconstrução da racionalidade por Habermas por meio de interesses constitutivos do conhecimento é apresentada como um caminho crítico para o conhecimento emancipatório. A segunda seção analisa a produção científica como um processo sociológico por meio da teoria dos paradigmas de Kuhn, da análise de campo de Bourdieu e da história social do conhecimento de Burke. A terceira seção descreve a evolução histórica da computação, desde dispositivos mecânicos até infraestruturas digitais modernas, enfatizando a transformação sociotécnica. Por fim, a integração da inteligência artificial à saúde é avaliada por meio de desafios éticos e regulatórios, como viés algorítmico,*



remain human through ethical and critical engagement with knowledge.

**Keywords:** Information Society. Sociology of Knowledge. Edgar Morin. Mannheim. Frankfurt School. Habermas. Kuhn. Bourdieu. Digital Transformation. Artificial Intelligence Ethics. Healthcare AI.

*transparência, responsabilidade e privacidade. O estudo conclui que o teste definitivo da sociedade da informação não é a produção de conhecimento em si, mas a capacidade de permanecer humano por meio do envolvimento ético e crítico com o conhecimento.*

**Palavras-chave:** *Sociedade da Informação. Sociologia do Conhecimento. Edgar Morin. Mannheim. Escola de Frankfurt. Habermas. Kuhn. Bourdieu. Transformação Digital. Ética da Inteligência Artificial. IA na Saúde.*

## 1 INTRODUCTION

One of the most renowned French sociologists and thinkers of our time, **Edgar Morin**, states in his work *Seven Complex Lessons in Education for the Future*—written at UNESCO’s request—that now, as we have entered the 2020s and move into the mid-2020s, it is no longer sufficient to teach young people merely “information” as was done in earlier periods. Rather, it has become necessary to teach them first and foremost the fundamental principles of **knowing, learning, and understanding**.

In general, these seven essential forms of knowledge—often not taught because they are unknown or forgotten, yet far more necessary than ordinary everyday information—are as follows:

1. Teaching how to escape the blindness and illusion inherent in knowing;
2. Teaching how to produce rationally grounded knowledge;
3. Teaching young people to become aware of the human condition;
4. Teaching Earth identity;
5. Teaching how to confront uncertainties;
6. Teaching understanding;
7. Teaching the ethics of the human species.

In fact, these seven principles already exist within our ancient cultural tradition; yet it is **Edgar Morin** who systematized them and transformed them into a foundational text. Now, by attempting to understand these seven principles more closely, let us make a deep and thorough entry into our subject.

It is striking that education—whose primary goal has often been considered the transmission of knowledge—has entirely overlooked the task of teaching the nature of the human capacity to know. Yet *knowing about knowing* should be regarded as a fundamental necessity that continuously prepares the human mind against the possibility of error and illusion. The aim here is to equip each mind in its struggle to become a conscious being, granting it an intellectual power of defense. Therefore, it is imperative that studies concerning the mental and cultural dimensions of human cognition—its processes and forms, and the psychological or cultural tendencies that may lead it into error or illusion—be incorporated into and developed within education.

The second fundamental problem concerns **teaching how to produce rationally grounded knowledge**. Unfortunately, the necessity of developing a type of knowledge capable of grasping global and fundamental problems—and, additionally, positioning local and partial knowledge within that broader framework—has not been sufficiently understood. When knowledge is rigidly compartmentalized into disciplines, the relationship between the part and the whole is often severed, and meaningful interpretation becomes difficult. Hence, rather than forms of knowledge that focus solely on fragments, we need an understanding of knowledge that can address each phenomenon within its context, complexity, and wholeness.

The human mind's tendency to position knowledge within an overall unity must be cultivated. In a complex world, it is essential to teach methods that enable us to comprehend reciprocal relationships and interactions between parts and wholes. Such a pedagogical approach has the potential to radically transform both our modes of thinking and our processes of producing knowledge.

The third problem concerns **making young people aware of the human condition**. Human beings are multi-layered entities with physical, biological, psychological, social, and historical dimensions. However, due to its disciplinary fragmentation, the modern educational system divides this unity into parts, thereby making it almost impossible to provide a coherent answer to the question of what the human being is. Yet every individual, regardless of origin, must be conscious both of their unique identity and of the shared identity they possess in common with all humanity.

According to Morin, only once this consciousness is developed will the human being understand itself as an “Earthling,” recognize that it lives on a shared planet with a

shared human identity, and act accordingly. Therefore, the **human condition** must become one of the core subjects of every educational system.

The notion of teaching young people awareness of the human condition finds expression in Yunus Emre's words:

“Whatever you wish for yourself, wish the same for another.”

Likewise, Mevlânâ (Rumi) expresses the same principle by saying:

“Even if people's eye colors differ, the color of their tears is the same.”

In other words, according to this perspective, all created human beings are obliged to be treated equally inasmuch as they are created as human beings. Since “an Arab has no superiority over a non-Arab, nor a non-Arab over an Arab,” true superiority reveals itself in morality and humane behavior. And this can occur only through genuine awareness of the human condition. What Edgar Morin articulates in this century was already declared years and even centuries ago by Mevlânâ and Yunus.

The fourth—and perhaps most critical—problem is the necessity of **teaching Earth identity**. The fact that the human species now shares a common destiny on a global scale is largely ignored by educational systems. Yet understanding the dynamics of the global age and recognizing Earth identity should be among the fundamental subjects of contemporary education.

In this context, the historical trajectory of globalization—beginning in the sixteenth century with intercontinental interaction—must be taught; and the ways in which different regions of the world entered into relations of interdependence must be clearly demonstrated. Moreover, the processes of exploitation, oppression, and injustice that have shaken humanity deeply and that still continue must be addressed without concealment.

The series of global crises that marked the twentieth century has clearly revealed that all humans now share a common fate in the face of questions of life and death. Education should develop this consciousness of shared destiny and emphasize that humanity's future means either collective salvation or collective collapse.

At this point, it is appropriate to expand the discussion with examples from Islamic and Turkish history. During the reign of Sultan Süleyman the Magnificent, grain

warehouses were infested with ants. When this happened, Sultan Süleyman wrote to the scholar Zembilli Ali Cemali Efendi and asked:

“If ants have surrounded the granary, is there any harm in crushing the ant?”

Zembilli Ali Efendi replied with a letter:

“When you stand before the Divine Court tomorrow, the ant will demand its right from Süleyman.”

From a civilization that cared about even the rights of an ant, we have evidently arrived at a society in which over three hundred women are killed each year due to domestic violence—without adequately teaching the human condition and Earth identity. Thus, young people must be taught upon which foundations knowledge should first be established. Perhaps the most essential of these seven necessary forms of knowledge is teaching Earth identity, because we all live in the homeland of the world and will one day depart from it. Therefore, in order to leave behind a meaningful life story, we must first be taught that we are human beings, that there is only one livable place, namely the Earth, and that we must not use the world, humanity, and all the possibilities God has granted us in a contemptuous or exploitative manner. In this sense, we believe it is highly appropriate to explain the foundations of the sociology of knowledge through Edgar Morin.

To be “an Earthling” also means learning and teaching how to develop the ability to confront numerous uncertainties. This is precisely Morin’s fifth principle. While the sciences have given humanity great certainties, they have also revealed the existence of vast zones of uncertainty. Hence education must include teaching uncertainties encountered in the physical sciences, in biological evolution, and within historical processes.

Instruction must be structured in such a way as to enable encounters with the accidental, the unpredictable, and uncertain situations, while also teaching how to reorganize available knowledge during action and develop new strategies. Humanity’s abandonment of deterministic approaches that presume the future of history to be causally predetermined, and its study instead of the unexpected events and major ruptures of our century, show that we must accept that the essence of the future is unknown.

For this reason, education must prepare the mind “to expect the unexpected.” Everyone who assumes responsibility for teaching should be able to grasp the uncertainties of the world in which they live and should even stand at the forefront of these uncertainties to contribute to the effort to make sense of the future.

Teaching understanding is the most effective way of teaching how to live together in this world. Morin’s sixth principle, “teaching understanding,” emphasizes that although communication is both an instrument and an aim, educational systems have largely neglected the development of understanding. Yet our planet has entered an age in which mutual understanding is required in every respect.

It is clear that understanding must be taught at every educational stage and at every age; this, however, first requires a reform of the mind. Developing mutual understanding both in close relationships and among strangers is of vital importance in order to elevate human relations beyond the level of “barbaric incomprehension.”

According to Morin, reaching this point requires not only addressing superficial symptoms of racism and xenophobia, but also a deep investigative approach that examines their roots. Only in this way can the mental capacity of individuals to understand the world and one another be strengthened.

To learn understanding also means developing empathic thinking. In other words, the issue again converges on wishing for others what one wishes for oneself, and learning to be happy not only with one’s own happiness but also with the happiness of others. Learning to understand is a crucial and key point.

The question of learning and teaching by which moral principles one should live constitutes the final stage of the intellectual quest. According to Morin’s seventh principle, “the ethics of the human species,” education must orient itself toward an ethical understanding that addresses the human condition simultaneously along the axis of individual–species–society. Such an ethics necessitates a system—namely democracy—in which the individual regulates society and society regulates the individual.

Ethics must be shaped by the realization that the human being is at once a social being and biologically a member of a species. Thus, every development that is truly “human” must simultaneously include the strengthening of individual autonomy, the healthy establishment of social belonging, and the development of consciousness of belonging to the human species.

According to Morin, the two fundamental ethical and political imperatives of the new millennium arise precisely from here: to protect human freedom as an individual, and to position the individual within the shared destiny of the human family. Education is the most powerful instrument to nurture this consciousness.

Thus, after understanding and explaining upon which principles the information society should be built in today's world where we live at the stage of the information society, it will be appropriate to reflect upon and discuss the **Philosophical Foundations of the Sociology of Knowledge and the Dialectic of Reason**.

## **2 PART I: THE PHILOSOPHICAL FOUNDATIONS OF THE SOCIOLOGY OF KNOWLEDGE AND THE DIALECTIC OF REASON**

### **2.1 Introduction: knowledge, society, and the modern journey of reason**

One of the most fundamental problems of modern social sciences is not so much how knowledge is possible, but under what historical and social conditions knowledge becomes “valid.” The idea that knowledge is not merely a mental activity or an abstract process operating through pure logical formulas, but is produced within a specific social position, historical context, and cultural conditions constitutes the backbone of the sociology of knowledge, which became institutionalized especially in the first half of the twentieth century. In this regard, Karl Mannheim's works granted the discipline a foundational content by addressing the relationship between knowledge and social existence both theoretically and methodologically. <sup>1</sup> (Mannheim, 1936)

On the other hand, although the modern ideal of reason carried the promise of emancipation originating in the Enlightenment, it entered a serious crisis through the experiences of wars, totalitarian regimes, and mass manipulation in the twentieth century. The Frankfurt School reveals the dialectic of reason by showing how the Enlightenment's emancipatory idea of reason transformed into instrumental rationality that produces domination. <sup>2</sup> (Horkheimer & Adorno, 2002) Habermas, while continuing this critique, opposes a total rejection of Enlightenment; he argues that the critical capacity of reason can be reconstructed. <sup>3</sup> (Habermas, 1971)

The aim of this chapter is: (1) to explain Mannheim's existential determination thesis, the ideology–utopia distinction, and the concept of relationism with their philosophical foundations; (2) to examine the Enlightenment's ideal of reason and the Frankfurt School's critique; and (3) within the framework of Habermas's approach of knowledge-constitutive interests, to discuss knowledge together with its emancipatory potential.

### 3 KARL MANNHEIM AND THE EXISTENTIAL DETERMINATION OF KNOWLEDGE

#### 3.1 Biography and intellectual development: a sociologist within history

Karl Mannheim (1893–1947), alongside Max Scheler, holds a special place among the founders of the sociology of knowledge. The first condition for understanding Mannheim's thought is to evaluate his intellectual production not only through philosophical arguments but also through the historical ruptures of his life. For Mannheim's theory of knowledge is, in a sense, an epistemological reflection of historical upheavals. <sup>4</sup> (Kettler, 1984)

Born in Budapest, Mannheim began his education in philosophy and attended Georg Simmel's lectures in Berlin and Henri Bergson's in Paris. Simmel's question "How is society possible?" provided a strong starting point for Mannheim's reflection on the social framework of knowledge. <sup>5</sup> (Simmel, 1971)

Mannheim's activity as a sociologist can be divided into two periods:

#### **First period (Germany / Weimar era – until 1933):**

This period was shaped within an intellectual atmosphere that directly witnessed ideological conflicts in modern Europe. Major theories such as Marxism, liberalism, and conservatism were reinterpreted politically and intellectually; the Bolshevik Revolution led to the hardening of ideologies across Europe. Mannheim's *Ideology and Utopia*, published in 1929, was an epistemological echo of this crisis period. <sup>6</sup> (Mannheim, 1936)

#### **Second period (England – after 1933):**

After being dismissed from the university by the Nazi regime in 1933, Mannheim moved to England, where he adopted a more pragmatic approach in fields such as social planning

and the sociology of education. Although the sharpness of his theory in this period has been debated, it can be seen that he positioned the sociology of knowledge not as a “truth machine” but as a method of reflection organizing intellectual orientations in modern society. <sup>7</sup> (Mannheim, 1940)

In Mannheim’s thought, Dilthey’s historicism, Windelband’s approach to cultural sciences, Weber’s interpretive sociology, Marx’s critique of ideology, and Husserl’s phenomenology left notable influences. <sup>8</sup> (Merton, 1968)

### **3.2 The basic structure of the sociology of knowledge: discipline as theory and method**

For Mannheim, the sociology of knowledge is a discipline that examines the relationship between thought and society; yet it is not merely a descriptive field. He conceives the sociology of knowledge as both:

1. a theory explaining the relationship between knowledge and society;
2. a method showing how this relationship can be investigated. <sup>9</sup> (Mannheim, 1936)

This approach requires knowledge to be treated not merely through the binary of “true–false,” but through the question: “Under what conditions does a regime of truth emerge, and how?” Thus, Mannheim calls us to think the epistemological status of knowledge together with the dynamics of social existence.

### **3.3 Existential boundedness (Seinsgebundenheit): the ontological link of knowledge**

At the center of Mannheim’s sociology of knowledge lies the thesis of existential boundedness (Seinsgebundenheit). This thesis argues that not only the form of knowledge but also its content and claim to validity are constituted in relation to social existence. <sup>10</sup> (Mannheim, 1936)

In this framework, knowledge is not determined solely by “pure reason” or by “the nature of objects.” The process of knowing is shaped by human biological capacity, social conditions, class position, generational belonging, and cultural codes. Therefore, Mannheim poses a serious challenge to modern epistemology’s conception of “timeless reason.”

Existential boundedness is not a simple deterministic causality. Mannheim refers instead to concepts such as elective affinity or compatibility to express the relationship between thought and social position, rather than a “mechanical chain of cause and effect.”<sup>11</sup> (Kettler, Meja & Stehr, 1984)

### 3.4 The Concept of perspective: the viewpoint character of knowledge

One of Mannheim’s strongest contributions is his explanation of the perspectival character of knowledge. Perspective is not merely a “formal difference”; it also includes a substantial and value-laden orientation.<sup>12</sup> (Mannheim, 1936)

Individuals do not think merely as products of their singular psychologies; the interests, experiences, and historical positions of the group to which they belong determine the categories of knowledge. Therefore, for Mannheim, thought is influenced by social processes and individuals share the collective viewpoints of their groups.

For example, the concept of “freedom” may be used with different meanings by different class and status groups in the same historical period. This shows that even concepts do not possess neutral contents independent of existential position.<sup>13</sup> (Berger & Luckmann, 1966)

### 3.5 Ideology and utopia: the political and historical dimension of knowledge

A central focus of Mannheim’s sociology of knowledge is the concept of ideology. His analysis expands Marx’s critique of ideology, because he understands ideology not only as the thought of the opponent but also as the fact that one’s own thought is shaped by social conditions.<sup>14</sup> (Marx & Engels, 1970)

#### 3.5.1 *Three levels of ideology*

(1) **Particular ideology:** a psychological level claiming that part of the opponent’s thinking contains distortion.

(2) **Total ideology:** an ideology operating at the group level and shaping the thinking style of an age.

(3) **General ideology:** the claim that every form of thought (except the natural sciences) contains ideological implications. <sup>15</sup> (Mannheim, 1936)

This third level brings Mannheim's thought close to the risk of "pan-ideologism," that is, a plane where everything is ideological. Mannheim was aware of this and confronted the critique of absolute relativism.

### 3.5.2 *The concept of utopia*

Utopia stands at the opposite pole of ideology: while ideology legitimizes the existing order, utopia refers to forms of thought aiming to transcend the status quo. Utopia often emerges in the imaginative world of the oppressed or marginalized and may have a transformative (even destructive) effect on the social order. <sup>16</sup> (Mannheim, 1936)

## 3.6 **Relationism: an attempt to escape relativism**

To the extent that Mannheim emphasizes the social determination of knowledge, the major critique directed at him is this: If every knowledge claim is socially determined, then Mannheim's own claim must also be determined. How, then, can Mannheim defend the truth of his thesis? <sup>17</sup> (Aron, 1970)

To overcome this deadlock, Mannheim proposes the concept of **relationism** rather than relativism. Relationism does not mean the total devaluation of knowledge or that everything is equally relative; rather, it means accepting that knowledge always gains meaning within a situational context. <sup>18</sup> (Mannheim, 1936)

This signifies not the epistemological impossibility of truth, but that truth is constructed contextually in plural forms.

## 3.7 **Hermeneutics, self-reflexivity, and the problem of objectivity**

Mannheim's methodological understanding strengthens hermeneutic approaches in the cultural sciences. He argues that cultural objects can be approached in two ways:

- **Meaning from within:** the immanent world of meaning of the object;

- **Explanation from without:** the conditions of the object's social-existential determination.

This distinction requires social sciences to operate with methods different from those of the natural sciences. <sup>19</sup> (Dilthey, 1989)

Mannheim also analyzes cultural objects not only through expressed meaning but also through a background meaning that carries historical spirit, by using the concept of documentary meaning. <sup>20</sup> (Mannheim, 1952)

Self-reflexivity refers to the idea that the researcher must recognize their own historical position. The researcher must interrogate their own criteria of truth in relation to what they observe. <sup>21</sup> (Gadamer, 2004)

Objectivity is thus defined not as “a single truth,” but as a new form of objectivity constructed through the bringing together of different perspectives. <sup>22</sup> (Mannheim, 1936)

### **3.8 The free-floating intelligentsia (Freischwebende Intelligenz)**

One of the most controversial elements of Mannheim's theory is the concept of the “free-floating intelligentsia.” This concept rests on the hope that intellectuals relatively independent from class interests could synthesize different perspectives and develop a more comprehensive viewpoint. <sup>23</sup> (Kettler, Meja & Stehr, 1984)

However, many critics have regarded this view as a “utopia of neutrality.” Mannheim's intellectuals, in some interpretations, risk becoming a modern version of the Marxist “pure proletariat myth” or the Hegelian idea of “absolute spirit.”<sup>24</sup> (Aron, 1970)

## **4 PART II: SOCIOLOGICAL MECHANISMS OF SCIENCE AND KNOWLEDGE PRODUCTION**

### **4.1 Thomas S. Kuhn and The Structure of Scientific Revolutions**

Thomas S. Kuhn's *The Structure of Scientific Revolutions* created a transformative effect not only in the history and philosophy of science but also in the sociology of science, profoundly challenging the basic assumptions regarding the manner of progress in modern science (Kuhn, 1962/2012). According to Kuhn, the history of science is not,

as often assumed, a continuous and linear accumulation process. Rather, scientific knowledge progresses through leaps marked by radical ruptures and revolutionary transformations. This approach makes it possible to evaluate science not merely as a technical process of advancement but also as a social process shaped by the shared assumptions, norms, and orientations of the scientific community.

## 4.2 Paradigm and normal science

At the center of Kuhn's conception of science lies the concept of a paradigm, which refers to the totality of beliefs, values, methods, techniques, and exemplar problem-solving practices shared by a scientific community (Kuhn, 1962/2012). A paradigm is not only a theoretical framework; it is also a guiding principle that determines how scientists see the world, which questions they consider meaningful, and which methods they accept as "scientific."

Kuhn emphasizes two basic meanings of paradigm:

1. **Disciplinary matrix:** the symbolic generalizations, metaphysical assumptions, and values shared by a scientific community.
2. **Exemplars:** concrete examples of problem-solving internalized during training, often without being verbally articulated. (Kuhn, 1962/2012)

Kuhn explains much of scientific activity through the concept of **normal science**, which is based on one or more past scientific achievements forming a paradigm and directs scientists toward "puzzle-solving" within a specific research tradition (Kuhn, 1962/2012). The aim of normal science is not to create a new paradigm, but to expand the scope of the existing one, strengthen its coherence, and increase its applicability to specific problems.

## 4.3 Anomalies, crisis, and revolution

For Kuhn, scientific novelty often emerges when inconsistencies become visible between the expectations imposed by the paradigm and the facts presented by nature. These inconsistencies are called anomalies (Kuhn, 1962/2012). In the short-term

anomalies can be resolved within normal science; however, anomalies that persist over long periods lead to the sense that the paradigm is inadequate, producing a crisis stage.

During periods of crisis, the shared rules of the scientific community loosen, normal science routines break down, and new theoretical searches gain strength (Kuhn, 1962/2012). This process ultimately results in a scientific revolution: the old paradigm is abandoned and a new paradigm incompatible with it becomes the new standard of the field. Kuhn compares scientific revolutions to political revolutions: in both cases, not only a technical change occurs, but a new order is established in terms of values, legitimacy sources, and authority relations.

#### **4.4 Incommensurability and paradigm change**

One of Kuhn's most debated contributions is the concept of incommensurability. Rival paradigms not only propose different theories; they also see, classify, and interpret nature differently. Therefore, a complete "logical comparison" between paradigms is not possible (Kuhn, 1962/2012). Hence paradigm conflicts can often become a "dialogue of the deaf." Paradigm change is not a result determined solely by evidence; it is a collective process involving persuasion, transformation within the scientific community, and a shift in orientation.

Kuhn has at times been criticized for portraying science as a subjective and irrational activity and thus falling into "relativism." Yet Kuhn accepts that science advances; he merely argues that this progress should not be understood as a movement toward a single, unchanging, absolute truth, but as a process of transformation and adaptation similar to biological evolution (Kuhn, 1962/2012).

### **5 PART III: THE HISTORICAL JOURNEY OF COMPUTATION AND DIGITAL TRANSFORMATION**

#### **5.1 From mechanical computation to the electronic revolution**

The computer, one of the most decisive technological inventions of the modern age, is not the product of a single inventor; rather, it is the result of a historical process

shaped by the contributions of thousands of scientists, engineers, and thinkers across different periods and social contexts. Therefore, the history of the computer must be regarded not merely as a technical narrative of progress but as a sociotechnical transformation intertwined with knowledge production, social needs, and institutional structures (Ceruzzi, 2012).

It is possible to examine the main outline of computer history in two major periods:

- the era of mechanical computation extending into the pre-twentieth century,
- the electronic computer revolution emerging in the twentieth century.

## 6.2 The era of mechanical computation

Mechanical computation tools represent early examples of humanity's relationship with quantitative knowledge and form the conceptual foundations of modern computers.

The abacus is one of the oldest known computation devices. Thought to have emerged around 4,500 years ago in the Sumerian civilization, it was developed especially in China and widely used in Asia from around 1500 BCE onward. It remained effective in trade and accounting until the seventeenth century (Ifrah, 2000).

The Pascaline was developed in 1642 by the French mathematician Blaise Pascal and is considered one of the first examples of modern mechanical calculators. Pascal designed this machine to assist his father in tax calculations; it could perform addition and subtraction up to eight digits. Yet high production cost and technical difficulties limited its widespread use (Pascal, 1642/1995).

Wilhelm Schickard and Gottfried Wilhelm Leibniz are two critical figures in the history of mechanical computation. Although Schickard designed a mechanical calculator in 1624, this invention remained unknown for a long time. Leibniz developed the Leibniz Wheel in 1672, more advanced than Pascal's machine, and formulated the binary number system in 1689, laying the foundations for modern computer logic (Leibniz, 1689/1989).

One of the greatest leaps in computation history occurred with Charles Babbage. Babbage developed designs for the Difference Engine in 1822 and the Analytical Engine in 1833. The Analytical Engine included fundamental components of modern computers

such as input, output, memory, and a central processing unit, and was planned to operate with steam power (Babbage, 1837/1989).

During this process, Ada Lovelace foresaw that the Analytical Engine could perform not only numerical calculations but also symbolic operations, and she wrote programs for the machine using punched cards. For this contribution, Lovelace is historically considered the first computer programmer (Lovelace, 1843/1983).

By the end of the century, Herman Hollerith developed a punched-card tabulating machine used in the 1890 U.S. census. This invention initiated the era of semi-automated data processing, and Hollerith's company became IBM (International Business Machines) in 1924, turning into a central actor in the history of computing (Ceruzzi, 2012).

## 5.2 Electronic computers and generations

The emergence of modern computers became possible through rapid developments in electronic technologies in the twentieth century. In particular, quantum physics and semiconductor technologies created a revolutionary increase in computational capacity (Ceruzzi, 2012).

**First Generation Computers (1940s–1958)** were machines operating with vacuum tubes, extremely large, expensive, and energy-intensive. Konrad Zuse's Z3 (1941) is considered the first programmable digital computer. Colossus (1943) was used in England for code-breaking; ENIAC (1945) was the first general-purpose electronic computer. EDVAC was the first computer to implement the stored-program principle (Von Neumann architecture) (Von Neumann, 1945/1993).

**Second Generation (1958–1964)** emerged with transistors replacing vacuum tubes, producing smaller, more reliable, and energy-efficient systems. Nevertheless computers were still large and costly (e.g., IBM 650).

**Third Generation (1965–1971)** saw computers become significantly smaller and cheaper through the use of integrated circuits (ICs), and access expanded beyond institutions. Inter-computer communication became possible in this generation.

**Fourth Generation (1972–present)** began with the development of microprocessors. Intel 4004 (1971) combined the central processing unit into a single

chip. Moore's Law predicted that processing power would double every 18–24 months (Moore, 1965). Altair 8800 was the first mass-produced personal computer; Apple I and II were pioneering models that popularized individual computer use.

### 5.3 The digital age and future perspectives

Fourth-generation computers have become inseparable from daily life with the spread of the internet. Today laptops, tablets, and smartphones function essentially as pocket computers.

Looking toward the future, quantum computers are expected to have the potential to exceed the computational limits of classical computers far beyond current capacities. These systems are expected to integrate with advanced AI applications capable of learning and making decisions (Nielsen & Chuang, 2010).

## 6 PART IV: THE INTEGRATION OF ARTIFICIAL INTELLIGENCE INTO HEALTHCARE AND ETHICAL ISSUES

### 6.1 The historical development of artificial intelligence and its applications in healthcare

Artificial intelligence (AI), in its modern sense, became an independent discipline in the mid-twentieth century, within the context of advances in computation theory, the emergence of electronic computers, and attempts to mathematically model cognitive processes (Russell & Norvig, 2021). The institutional birth of the field is associated with the **Dartmouth Conference** held in 1956. John McCarthy, one of the organizers, framed AI as a distinct academic research domain by defining the concept of “artificial intelligence” as “the science and engineering of making intelligent machines” (McCarthy *et al.*, 1955/2006).

## 6.2 The evolution of AI: from symbolic systems to deep learning

The development of artificial intelligence can be examined in three main phases. The first stage is **symbolic AI**, which gained prominence from the 1950s onward. The goal in this period was to develop systems that imitate human reasoning through logic rules, symbols, and programmed inference mechanisms (Russell & Norvig, 2021).

The second stage—especially prominent in the 1980s—was the era of **expert systems**. Expert systems aimed to provide decision support by simulating domain expertise through rules and knowledge bases. However, due to limitations such as scalability and context adaptation, these systems remained constrained (Shortliffe & Cimino, 2014).

The third and currently dominant stage is the rise of **machine learning**, particularly **deep learning–based models**. This approach relies on algorithms learning patterns from large datasets rather than being explicitly programmed. Deep learning, inspired by the layered structure of neural networks in the human brain, has significantly improved performance in areas such as image processing, natural language processing, and speech recognition (Goodfellow *et al.*, 2016).

## 6.3 The transformative potential of AI in healthcare

Artificial intelligence produces applications that transform human life across a wide spectrum—from scientific research and engineering to healthcare services. In healthcare, the impact of AI has become visible particularly in enhancing diagnostic accuracy, strengthening personalized medicine, improving operational processes, and expanding access to health services (Topol, 2019).

This transformation should be understood not merely as technological advancement, but also as a **sociotechnical rupture** that restructures the institutional functioning of healthcare, the physician–patient relationship, and the epistemological foundations of medical decision-making (Topol, 2019; Shortliffe & Cimino, 2014).

### 6.3.1 Primary application areas

- (i) **Medical Image Analysis and Diagnosis:** AI-based image processing systems provide decision support for radiologists by detecting abnormalities in data obtained through imaging methods such as X-rays, CT scans, and MRI. These systems can improve early diagnosis likelihood, especially in certain cancer types or microscopic anomalies (Topol, 2019).
- (ii) **Personalized Treatment (Precision Medicine):** AI contributes to developing individualized treatment recommendations by simultaneously analyzing genetic data, lifestyle factors, clinical history, and environmental conditions. This supports personalized medicine beyond standard treatment protocols (Topol, 2019).
- (iii) **Predictive Analytics:** AI systems operating on large-scale medical datasets can produce models predicting the risk of disease emergence, thereby strengthening preventive health strategies (Shortliffe & Cimino, 2014).
- (iv) **Operational Efficiency and Administrative Automation:** In areas such as appointment scheduling, patient registration management, insurance claims, and workflow arrangement, AI can reduce administrative burdens for healthcare workers, enabling more time for clinical care (Topol, 2019).
- (v) **Remote Healthcare and Telemedicine:** AI-supported telehealth applications may reduce inequalities through remote monitoring and consultation services, particularly in regions where access to healthcare is limited (Topol, 2019).

## 6.4 AI in healthcare: ethical and technical challenges

The widespread use of AI in healthcare raises not only technical efficiency concerns but also critical ethical and regulatory questions. Therefore, the integration of AI systems into clinical practice should be evaluated within the framework of core medical ethics principles: beneficence, non-maleficence, justice, and autonomy (WHO, 2021).

#### *6.4.1 Algorithmic Bias and the problem of justice*

AI systems reflect the characteristics of the datasets on which they are trained. If these datasets are incomplete, imbalanced, or structured in ways that reproduce historical inequalities, biases may be transferred into model outputs. This may reproduce existing forms of discrimination in healthcare (Obermeyer *et al.*, 2019).

#### *6.4.2 The Problem of transparency and the “Black Box”*

Although deep learning models may offer high accuracy, it is often difficult to explain their decision-making mechanisms. This creates trust issues in clinical contexts and makes it harder to audit incorrect decisions. Hence, **Explainable AI** approaches are of critical importance in clinical applications (WHO, 2021).

#### *6.4.3 Legal liability and accountability*

As AI systems become included in autonomous decision-making processes, liability in cases of medical error becomes complex: Is responsibility held by the programmer, the hospital, the physician, or the device itself? This field lies at the core of contemporary ethical and legal debates (WHO, 2021).

#### *6.4.4 Privacy, security, and data protection*

Health data is among the most sensitive forms of data regarding privacy. Since AI effectiveness often depends on large datasets, data security, anonymization, consent processes, and cybersecurity measures become critical (WHO, 2021).

## 7 CONCLUSION: THE CONTINUOUS STRUGGLE FOR EMANCIPATION

The evaluation conducted from the perspectives of the sociology of knowledge, philosophy of science, and the history of technology demonstrates that knowledge throughout history has not been a purely “mental” phenomenon; rather, it is a mode of production constructed within social conditions, institutions, and power relations (Mannheim, 1936/2017). Kuhn’s paradigm approach, Bourdieu’s analyses of scientific fields, and his emphasis on epistemic communities reveal that knowledge is not the product of individual genius but a collective and institutional process (Kuhn, 1962/2012; Bourdieu, 2004/2015).

In this context, the Enlightenment ideal of “emancipation” remains a central agenda of modern critical theory. According to Habermas, emancipation is not a utopian goal but pertains to historical conditions under which the public use of reason is possible (Habermas, 1984). Yet Horkheimer and Adorno warn that modern rationality may transform into a form of “instrumental reason,” becoming part of domination mechanisms (Horkheimer & Adorno, 1944/2010).

Thus, the development of AI and digital information technologies carries a dual potential:

1. To make knowledge an emancipatory instrument,
2. To commodify knowledge and turn it into a functional component of power apparatuses (Habermas, 1984; Horkheimer & Adorno, 1944/2010).

This tension constitutes the fundamental dialectic of our age. The Enlightenment principle “*Sapere aude*” (“dare to know”) requires not only acquiring knowledge but also continuously interrogating the conditions of knowledge production in a critical manner. Therefore, digital literacy must be regarded not merely as technical competence but as ethical and critical judgment capacity (Gilster, 1997).

## 8 CONCLUSION: A NEW TEST OF REASON AND HUMANITY IN THE INFORMATION SOCIETY

This study aimed to demonstrate that the information society is not only a phase of technological progress but also a profound transformation in how humans understand

themselves, society, and the world. The fact that knowledge in the modern world becomes a means of production while simultaneously being reconstructed within regimes of power, ethics, meaning, and truth constitutes the fundamental sociological issue of our era. Consequently, the information society does not merely bring an age of producing “more knowledge,” but also imposes the necessity of questioning how knowledge is produced, by whom it is controlled, and for what purpose it is circulated.

In the introduction, Edgar Morin’s seven essential knowledge principles—developed against the “blindness of knowing”—constitute a summary of the epistemic and moral crisis faced by modern humanity: Knowledge has multiplied, yet understanding has weakened; communication has increased, yet empathy has declined; speed has risen, yet wisdom has retreated. Morin’s seven forms of knowledge are not only pedagogical but also sociological manifestos, because these principles define the moral and mental infrastructure required for knowledge to become human. Moreover, this framework intersects with the fundamental truths of humanity that our ancient cultural sources—such as Yunus Emre and Mevlânâ—pointed to centuries ago: A human being can become an Earthling only insofar as they see the other as “like themselves”; and they can remain human only insofar as they remain an Earthling.

Following this basic framework, Part I revealed through Mannheim’s sociology of knowledge the relationship between knowledge and social existence. Mannheim’s thesis of existential determination shows that knowledge cannot be explained merely by whether it is “true or false”; rather, knowledge always takes shape within a specific historical position, class perspective, and cultural context. This teaches us that knowledge is not innocent. Knowledge often ceases to be a “mode of thinking” and becomes a “mode of establishing order.” Therefore, in the information society, the central question is not “What do we know?” but rather: “Under what conditions, and in whose interest, do we know?”

The Frankfurt School’s critique of the Enlightenment provides a crucial warning at this point: Reason, although carrying emancipatory promises, may become a mechanism of domination when transformed into instrumental rationality. Thus, the relationship between knowledge and power has become increasingly visible in the modern world; reason has sometimes become not the language of liberation but the language of control. Habermas’s emphasis on Enlightenment as an “unfinished project,”

however, keeps the door of hope open: Knowledge does not only produce control; it can also offer the possibility of transforming humans and society in a critical manner when reconstructed through emancipatory interests. At this point, education and digital literacy mean not merely technical skills but critical judgment, ethical consciousness, and the construction of public reason.

Part II, through Kuhn, Bourdieu, and Burke, demonstrated that knowledge is not a “myth of progress” but a social process shaped by paradigms, field struggles, and historical institutions. Knowledge is socially produced; yet it also determines the direction of society. Therefore, the greatest risk of the information society is not that knowledge transforms humans, but that humans lose knowledge—meaning that knowledge loses its human significance. Knowledge, if not joined with meaning, becomes information; if not joined with wisdom, becomes instrumentality; if not joined with ethics, becomes violence.

As later chapters show through the historical journey of computation from the mechanical era to the digital age, digital transformation is not merely a technical development; it is a rupture restructuring humanity’s memory, working habits, speed of thought, and social relations. The entry of AI into vital areas such as healthcare represents the most advanced stages of modern knowledge, *yet also* makes ethical questions sharper: algorithmic bias, transparency, responsibility, privacy, and justice will determine not only how “powerful” the information society is, but how “human” it can remain.

The core conclusion of this study is the following:

### **8.1 The true test of the information society is not producing knowledge, but remaining human with knowledge**

In today’s world, knowledge is fast; yet truth is constructed slowly. Technology is strong; but ethics is fragile. Information is limitless; but meaning demands limited and serious labor. Therefore, Morin’s seven forms of knowledge are not only necessary for education but a necessity for the future of humanity. If the information society cannot construct Earth identity, empathy, the courage to confront uncertainty, and a shared ethics of the human species, what emerges will not be an “information society,” but a barbarism equipped with information.

For this reason, the sociology of knowledge is not merely a theoretical discipline; it is also a form of vigilance. The sociology of knowledge teaches us this: Knowledge is not only knowing things; it is also questioning the conditions, direction, and intention of knowing. The call “Sapere aude” today means not only daring to know, but daring to construct an ethical consciousness that prevents knowledge from turning into power. Ultimately, the true measure of civilization in the information society is this:

**Can the human being use the knowledge they possess not to destroy another’s life, but to make another’s life livable?**

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### Authors' Contribution

All authors contributed equally to the development of this article.

### **Data availability**

All datasets relevant to this study's findings are fully available within the article.

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