INTERMEZZO

HUMAN INTELLIGENCE AND ARTIFICIAL INTELLIGENCE

Salvatore Lorusso
Foreign Member of the Russian Academy of Natural Sciences, Russia

Spartaco Paris
Director of the Interdepartmental Centre for Territory, Construction, Restoration and Environment, Sapienza University of Rome, Italy

with the participation of Giulia Famiglietti
PhDc at the Department of Architecture and Construction, Sapienza University of Rome, Italy

1. The involvement of human intelligence and artificial intelligence

How are the sensorium and human cognitive systems evolving with the growing ubiquity of artificial intelligence (AI)?

In the first place, it can be said that creativity, data, and AI are redefining the future of communication and business. Those working in digitalization and digital marketing understand that the primary objective is to reach out to people; consequently, creativity, technology, and marketing are increasingly intertwined in the world of AI.

It is nevertheless useful to put the current expansion of generative AI within a broader digital revolution of an almost Copernican nature. It does not merely introduce new tools, but profoundly reorganizes cognitive processes, decision-making mechanisms, and forms of technical mediation, thereby affecting the ways in which knowledge is produced, responsibility is assigned, and work is organized.

In practical terms, if AI is a phenomenon with which society must inevitably come to terms, for creative practitioners working in the sector, it represents a necessary operational tool, as it enables ideas to be rapidly developed and elaborated. It is clear therefore that contemporary strategies are reshaping the way we communicate in today's digital world. Yet it is equally true that long before digital technology was first used – considering how practical digital technology is, including its operational rules – it was the human element that was omnipresent.

Ultimately, what is important is that both human and digital intelligence coexist in a fairly well-balanced way, and are grounded in an awareness regarding the future that there must be a deep understanding of reality and current trends with a process that is supported by the enormous quantity of information and knowledge drawn from the many fields of learning.

Technological change has produced radical transformations in the way human beings understand themselves and interact with the world. The speed of this transformation is accelerating exponentially, requiring an understanding of our human past. Technological and sociological shifts increasingly suggest that machines may be capable of performing many tasks traditionally carried out by humans; nevertheless, human

intelligence will continue to play a central role, engaging with technologies that can contribute to the realization of our highest aspirations.

The major convergence of the twenty-first century, even before the advent of technology itself, lies in the human imagination, on a large scale. Today, the global population numbers approximately eight billion people, with a literacy rate of around 85%. This collective, cultural, and cognitive potential represents the true driving force of contemporary development, provided that the assertion "The imagination must flee from habits" is not overlooked. The statement aptly reflects the thought of Italo Calvino, who understood lightness not as superficiality, but as the capacity that goes beyond convention, habit, and reality, to envisage new possibilities. It is within this conceptual framework that major multinational organizations are proceeding as regards the coexistence between human beings and the new "thinking" machines, in other words, delegating functions that have always been normal human attributes.

What is happening today, however, is that delegating functions – at individual, social, scientific, and economic levels – is done on a massive scale and occurs at an alarming rate. According to the Argentine-born philosopher, Miguel Benasayag, the fundamental error lies in assimilating the living being to the machine, equating the brain with hardware and thought with software – a biologically flawed analogy.

In the frenetic pursuit of innovation, it therefore becomes necessary to define how humans and machines, which are inherently different in nature, can coexist. Intelligence today must be viewed in a broader perspective to encompass a dimension that includes humanity, as well as the capacity to understand each other within the context of human identity. Intelligence is relational and implies overcoming rigid dualities: not only that between algorithms and human cognition, but also that between individuals and the rest of the world.

What is needed therefore are rules and expert knowledge; otherwise, the risk is of inhabiting a world constructed by others which is no longer ours. As with every major technological revolution, the current phase of transformation may generate both positive and negative consequences.

In the final analysis, the core issue is that people will essentially have to respond to demands by providing transversal competencies and a strong capacity to build relationships. This centrality within every evolutionary process becomes increasingly more significant and necessary, given that innovation is continuous, rapid, and simultaneously accelerative and obsolescent. The human management of artificial intelligence – grounded in distinctly human attributes such as intelligence, creativity, critical thinking, adaptability, and the capacity for synthesis – thus proves to be decisive.

2. Artificial intelligence in organizational and management models and its environmental impact

The intelligence revolution is increasingly embedded within the organizational and managerial models of enterprises, profoundly transforming their structures and opening a critical debate on technology, ethics, and responsibility.

Companies are currently facing two major challenges: geopolitical uncertainty, which reshapes global markets, calls into question consolidated paradigms, forces a redefinition of organizational supply chains; and, simultaneously, the rapid advancement of artificial intelligence.

Over the past three years, the diffusion of generative AI has shifted from an emerging phenomenon to a structural component of organizational systems. The year 2023

marked a phase of discovery and caution; 2024 was characterized by widespread experimentation, with a growing number of pilot projects and dedicated budgets; 2025 represents a threshold of maturity, in which generative AI has become an integral part of everyday processes and of the very way work is organized. Although the sectors most affected are those with high data intensity, and digitalization is still at an early stage in many contexts, investment in AI is expected to double by 2026, accounting for approximately 20% of corporate budgets over the next three years. If complexity has become a structural condition of the contemporary world, true innovation today increasingly lies in simplification.

One key principle emerges: simplification does not mean reducing value but rather unlocking it. Simplicity becomes a form of leadership capable of making organizations more agile, technologies more effective, and people more creative. According to international analyses, companies that succeed in reducing organizational stratification through the introduction of algorithmic systems demonstrate an adaptive capacity to environmental contexts that is up to five times greater. In the application of AI models, particular attention must be paid to the selection and quality of the data employed. While emphasis is traditionally placed on algorithmic efficiency, it is the quality and governance of the data input that prevent inaccuracies and biases.

Data quality and data security are therefore as crucial as the algorithm itself. In this respect, as highlighted in editorial and publishing-sector analyses, it is also necessary to consider and evaluate the environmental impact associated with the use of AI in corporate activities. The environmental impact of AI concerns the sustainability of AI technologies, energy consumption and the carbon footprint of data centers, as well as the production and financing of AI systems and the extensive digital infrastructure that supports them.

Data centers constitute the backbone of artificial intelligence and consume enormous amounts of electricity for both operation and cooling systems, thereby contributing significantly to greenhouse gas emissions. Furthermore, the production of AI hardware and devices involves highly resource-intensive processes, including the extraction of rare earth minerals and substantial water consumption, which result in environmental degradation and pollution. An ethical approach to AI innovation must therefore be pursued, aiming to reconcile technological progress with environmental stewardship and to mitigate the ecological footprint of artificial intelligence.

For the sake of completeness, it is also worth mentioning that AI is entering the world of corporate culture as a tool that is able to craft a more coherent and meaningful narrative of industrial memory – an aspect that can be extended to an international context. In this perspective, special effects are not what are being sought from AI, but a shared space for interpreting, in which to tell the story of Italy's industrial history in a rigorous, creative, and inclusive manner, transforming it into a cultural and social capital.

Preserving means generating the future: through AI, memory is given a renewed voice, transforming it into a source of civic engagement.

3. AI and cultural heritage

A wide range of research initiatives is currently underway in connection with the development of artificial intelligence within the cultural heritage sector. The following Italian projects are briefly referenced as representative of both the diversity of heritage assets – historical-artistic, archaeological, architectural and monumental, archival, and bibliographic – and the variety of interventions that foster a close relationship between

AI and the humanities.

a. The RePAIR project at Università Ca' Foscari in Venice, Italy, combines the computational capabilities of artificial intelligence with the precision of robotics to reassemble the frescoes from the ceiling of the Casa dei Pittori in Pompeii, starting from thousands of fragments. It represents a significant example of the dialogue between AI and the humanities, as it intervenes in one of the most labor-intensive phases of conservation practice: the physical reconstruction of shattered artworks. At present, however, this experience should be approached with caution. Rather than a consolidated application, RePAIR is a promising research programme whose effectiveness will be assessed once concrete results are obtained, particularly as regards principles of responsibility, traceability, and reversibility that are intrinsic to conservation and restoration practices (Figure 1).

b. Again, in Venice, another noteworthy case – framed within the transition from "big data" to "long data" – deals with the cataloguing, transcription, interpretation, and narrative-oriented processing of more than 80 kilometres of shelving at the Archivio di Stato di Venezia. The application of artificial intelligence has enabled thousands of legal documents to be brought to life, transforming them into narratives of life experiences, thus making them more accessible and allowing their previously hidden intrinsic truths to emerge.
In light of the above, such a case study can reasonably be considered capable of reducing cultural barriers in linguistic and comparative historiographic research, while simultaneously enhancing its scholarly value through AI-based methodologies.

c. To further illustrate the diversity of AI applications, reference may be made to the creation of a digital twin of St. Peter's Basilica in Rome. By employing drones, helium balloons equipped with cameras, and laser scanners, the reconstruction made it possible to visualize what was visible as well as what was hidden within the building's structures, thereby revealing previously unknown details and concealed passages.
The project was developed by Microsoft in collaboration with the French company Iconem, which has stated: "The best way to humanize artificial intelligence is to use it to process what human beings create and bring into existence through science and technology" (Figure 2).

d. With a similar aim – also oriented toward breaking down cultural barriers – another significant example is the ongoing research on the hybridization of art, medicine, and materials science within linguistic and historiographic studies at the Milano Innovation District (MIND), conceived as an ideal urban laboratory for building the city of the future. It is here that the laboratories of the Scuola di Restauro di Botticino have been established. As reported by Giuseppe Venier, CEO of Umana, a partner in the project, this environment has made it possible to bring together the past and the future of art and literature – ranging from the decoding of the Greek language to contemporary processes of artistic formulation, such as in the installations of Ian Cheng and the live simulation of digital works conceived as a "virtual or contemporary ecosystem."

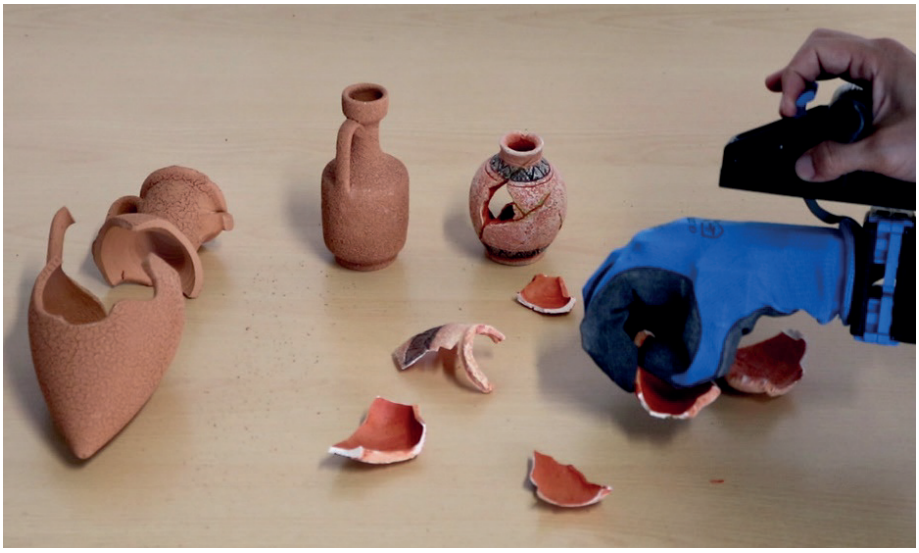

Figure 1. "RePAIR" project. Physical reconstruction of fragmented artworks through manual or computer-assisted restoration, referring to the development of an intelligent robotic system capable of processing, recognizing, and autonomously assembling large fractured artefacts.

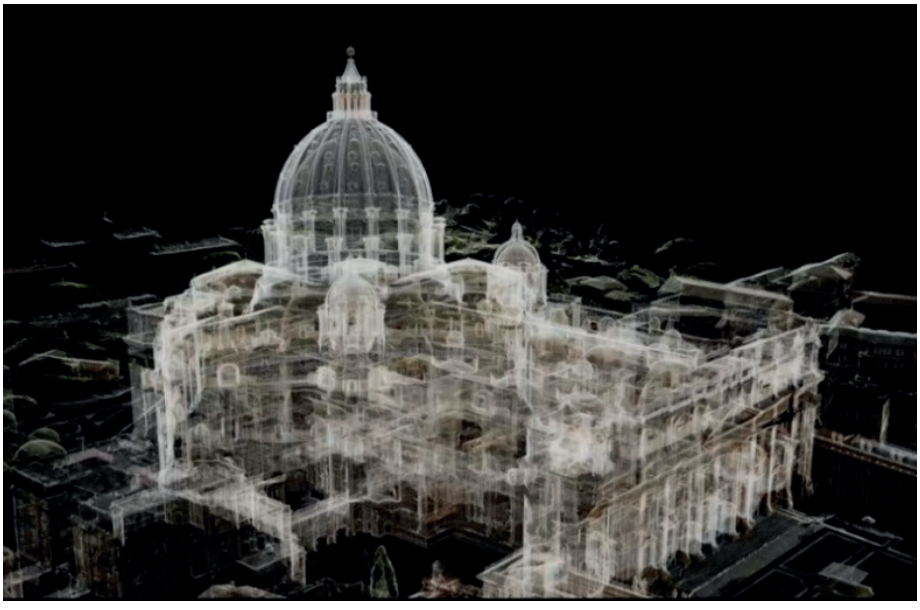

Figure 2. "La Basilica di San Pietro: AI-Enhanced Experience" project. Digital model of St. Peter's Basilica. AI-generated images derived from photogrammetric data enhance the visualization of both the interior and exterior of the Basilica, supporting experts and the general public in exploring the monument's polychrome universe.

4. Towards an operational ethics of artificial intelligence

The 2025 AI Index Report by Stanford University describes how AI has become a fully infrastructural technology that is developing along intertwined trajectories, and economic and geopolitical technologies, and assesses its evolution through twelve indicators:

- performance in calculation tests on entry into high-criticality domains (medicine, mobility, urban services);
- growth in investments and organizational adoption;
- USA-China competition, interpreted primarily in terms of supply chains, semiconductors, and standards;
- persistence of safety and reliability vulnerabilities despite accelerated regulatory efforts;
- cultural differences in social perception;
- reduction in computational costs;
- improvements in energy efficiency;
- renewed role of the state as an industrial player;
- entry of AI into education amid infrastructural constraints and skills gaps;
- increasing predominance of industry over academia in developing more advanced models;
- role of AI in the scientific revolution;
- still-evident weakness in logical-formal reasoning, which continues to require human guidance and verification.

Within this framework, the "pillars" proposed by Stanford perform an additional function: they demonstrate that the ongoing revolution is not merely driven by a form of innovation-oriented fideism or by market forces alone but is already subject to systematic monitoring by the academic world – which appears to be lagging behind industry and critical evaluation. Measuring performance, investment flows, supply chains, standards, social impacts, and cognitive limits means acknowledging that AI is not a simple tool, but a force capable of reorganizing value chains, relations between capital and labor, and power asymmetries between states and platforms, all within precise material conditions regarding energy, microchips and infrastructures.

Precisely because these indicators highlight there are points of tension (such as safety, responsibility, and distributive effects), they also foreshadow the need for more mature forms of governance: not general restraints, but criteria, rules, and responsibilities capable of steering a transformation that has already entered the core of our institutions.

For this reason, the discussion can be taken one step further, to go beyond a mere diagnosis of the phenomenon toward an explicit hypothesis of AI ethics.

It is not a question of defending an abstract notion of a "threatened humanity," but of recognizing a fundamental point: what we call artificial intelligence today is not, strictly speaking, a new form of intelligence – intelligence remains a specifically human prerogative – it is a powerful mode of acting in the world. AI constitutes an infrastructure of automated actions that reshapes responsibility, decision-making hierarchies, possibilities of inclusion and exclusion, and, not least, the distribution of environmental costs.

From this perspective, it is helpful to consider the framework proposed by Luciano Floridi (Ethics of Artificial Intelligence. Developments, Opportunities, Challenges, Raffaello Cortina Editore, 2022), which translates the ethics of the

infosphere, as environmental ethics applied to the digital world, into a set of operational principles: beneficence, non-maleficence, autonomy, justice, and explicability. Adopted as criteria for design and governance, these principles promote verifiable data, traceable decisions, and contestable outcomes and, above all, they make it necessary to clarify who is responsible for what – and on what terms – when an automated system produces effects in the real world.

Alongside this approach, the proposals of "technological humanism" advanced by Marta Bertolaso (Technological Humanism, Carocci Editore, 2023) help to avoid a frequent shortcut: reducing ethics to a mere list of external constraints. Ethics, on the contrary, is an internal dimension of the technical process, capable of holding together knowledge, care, and responsibility – it is not only what we can do with AI, but what it is worth doing, and with what consequences for individuals and institutions.

From this perspective comes a practical orientation: AI systems should be designed and implemented by asking, on a case-by-case basis, whether they generate measurable benefits without transferring harms (for example, in the form of bias, opacity, or unjustified energy consumption), whether they preserve genuine spaces for human autonomy and decision-making, and whether they allow for public explanation and discussion of the choices embedded within the models.

The debate on the future of artificial intelligence is therefore particularly vibrant. To avoid oversimplification, two points need clarification.

The first concerns what is meant by "AI." As clarified by Alfio Quarteroni (Challenges, Opportunities, and Pitfalls of Artificial Intelligence. Toward Digital Twins, Accademia Nazionale dei Lincei, Corsini Lectures, 6 December 2024), the key distinction does not lie in the use of algorithms per se – they have been used for centuries – but because of the machine-learning mechanisms that can be improved, starting from the data they use (Figure 3). In this sense, as of 2024, there has been no evidence that the Turing test has been surpassed: so-called "general AI" remains a theoretical horizon, while real-world impact is produced by forms of "restricted" AI – powerful, yet highly specialized.

The second clarification is cultural: artificial intelligence can be interpreted as a fourth pillar of knowledge, alongside theory, experimentation, and simulation. Alfio Quarteroni emphasizes the convergence between physical–mathematical models and data-driven learning – commonly referred to as scientific machine learning. It is precisely within this convergence that digital twins emerge: dynamic systems interacting with their physical counterparts through sensors, capable of detecting anomalies and supporting informed decision-making.

However, when considering the transition toward systems that not only describe reality but actively orient actions within the physical world – bridges, buildings, infrastructure networks, and cultural heritage assets – the pressing issue is not in choosing between enthusiasm or fear, but in equipping ourselves with an operational ethic. The path outlined by Luciano Floridi is particularly significant in this respect: the five principles – beneficence, non-maleficence, autonomy, justice, and explicability – can become verifiable requirements for both design and governance.

A similar orientation can be found in the notion of "technological humanism" proposed by Marta Bertolaso. Technology is not neutral, insofar as it structures relationships, access, and power. The critical question to ask, therefore, is what kind of public space and what kind of coexistence are we building through these systems.

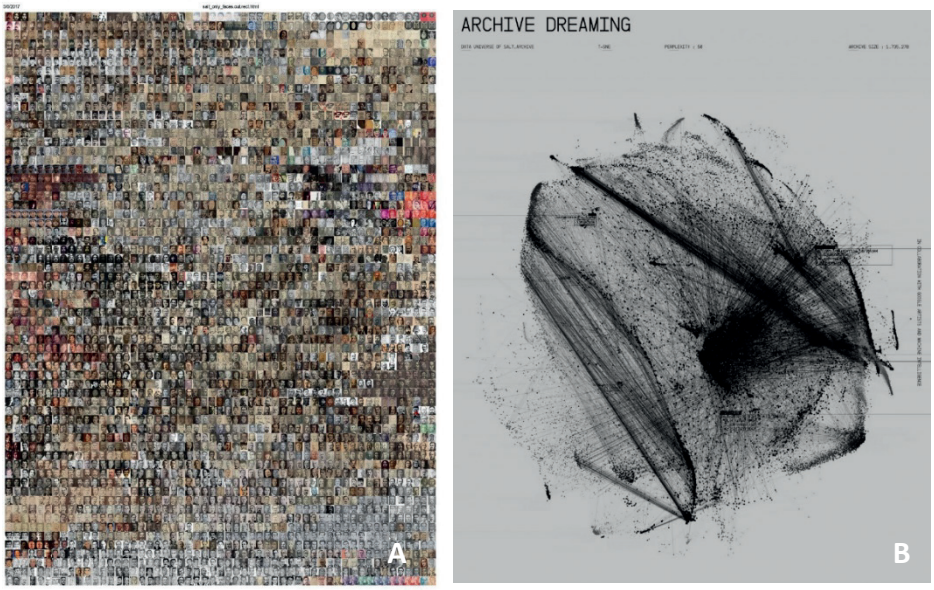

Figure 3. Refik Anadol, "SALT Research Archive Dreaming – AI Data Sculpture" project. Interactions of multidimensional archival data translated into an immersive multimedia installation. When the installation is inactive, it "dreams" of unexpected correlations among documents. (A) Results of facial recognition using AI. Basic database of 1.7 million data points; (B) The t-SNE (t-Distributed Stochastic Neighbour Embedding) technique is used to reduce the dimensionality of complex data by mapping it into 2 or 3 dimensions for visualisation: hidden groups and patterns in high-dimensional data are thus revealed. In summary, 1.7 million t-SNE documents correspond to an interactive or visual map of a huge archive, which transforms the map of unstructured data, into coherent and interpretable groups, visually, of the quantity of archival documents that have been considered.

5. Artificial intelligence: optimists, catastrophists, evolutionists

An intense and often polemical debate on the future of artificial intelligence is currently underway, marked by the emergence of strong concerns regarding the potential implications of this technology.

In this situation, two principal positions stand out.

a. The first holds that digital life represents the next natural and desirable step in cosmic evolution and that, if left unobstructed, it will ultimately lead to positive outcomes.
b. The second is adopted by those who oppose such a digital life, considering it detrimental to humanity and asserting the moral superiority of human life over digital forms of existence.

It is nevertheless indisputable that AI is already so widespread that, in the not-too-distant future, it may enable a profound and comprehensive transformation of the world – a position that is no longer marginal.

The ethical and philosophical debate that has followed can broadly be traced back to three interpretative stances, often defined as optimists, catastrophists, and evolutionists:

- The optimists, who foresee no fundamental problems if human interests continue to progress in parallel with artificial intelligence models.
- The catastrophists, who anticipate a temporal threshold beyond which digital technologies will come to dominate human beings.
- The evolutionists, who believe that AI will ultimately replace humans after they have been subjugated and gradually become extinct because of the power acquired by artificial superintelligence.

The argument that "power, as a consequence of superintelligence, legitimizes itself" is not entirely new. Similar claims were already advanced in the 1960s, when it was suggested that "machines could become the measure of the human being".

Therefore, in reply to the question posed at the outset of this contribution, it is clear that concrete measures must be taken not only by the scientific community, but also by the political sphere. Such measures should aim at deliberately slowing down this process of evolution, at least until these "machines" not only become superintelligent but also conscious, in other words, endowed with awareness by the representatives of the aforementioned worlds, that is, by the said individual – the very human being of the twenty-first century who is organizing and harnessing the power of artificial intelligence, and shaping its trajectory in both the present and the future.