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The antiquity of humans in the Americas:
Archaeological findings from Serra da Capivara

The Great Mother Archetype:
From duality to unity

Alexander von Humboldt:
Science in harmony with Art and the Soul

Natural and Artificial Intelligence:
A Philosophical and Anthropological approach

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The bronze statue of the ibis-headed Thoth, Louvre Museum in Paris, France.

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Editorial

por Fernando Schwarz

Faced with the challenge of climate change, the wisdom of indigenous peoples

Ten years after COP21 in Paris, which was presented as a historic turning point, COP30 that concluded in Belem at the end of last November confirms 30 years of hope to control climate change.

Lo The 200 states present agreed on a minimum text without specifying any particular measures, especially regarding reducing the use of fossil fuels.

Since the Rio meeting in 1992, global CO_2 65%, emissions have increased by 65%. Southern countries, which see these measures above all as a main source of financing, have not made any serious commitments. Only the European Union underwent unprecedented deindustrialization with great zeal. No other power, no countries in Asia or Africa have renounced fossil fuels.

A complete pragmatic review of our model of life and production is urgent and necessary, especially for Europe, which is today the propitiatory victim of

its own naivety and the prey of all the predatory powers that surround it.

A positive point of these COP has been that indigenous peoples are increasingly visible, but still inaudible, although already in Dubai, at COP28, Sarah Hanson stated, "We are not here simply to pose in your photos. We are rights-holders under the UN Declaration on the Rights of Indigenous Peoples, and we must be present at the decision-making table." In fact, even in Belém there were not many representatives of these peoples at the negotiating table or that other developed countries had integrated their presence and influence.

Indigenous peoples today represent around 476 million people who occupy 20% of the Earth's territories, with the characteristic of being the most crucial places for the preservation of biodiversity and climate, which is why their role is essential in the fight against climate change.

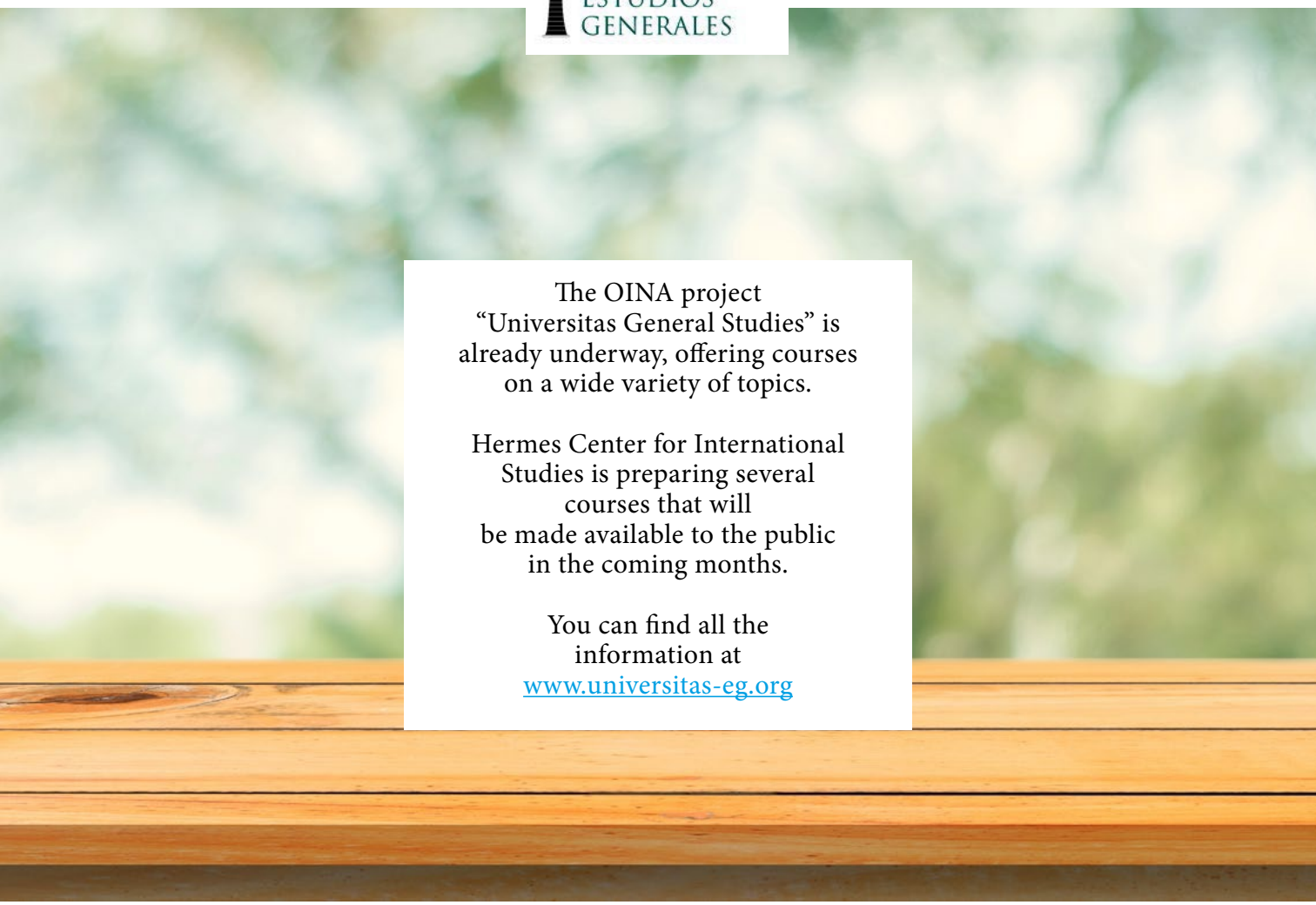
They know more than anyone else the complexity of their ecological environments and can intelligently and prudently advise the technicians and administrators of NGOs concerned about climate change.

But so far they continue to go unheard. Although they are allowed to protest and demonstrate at each COP, they only serve as a showcase effect, and the technocrats who manage the meetings still do not understand the positive role they can play.

In reality, if the demands of these peoples are ignored, it is because this would lead to admitting the need for a redistribution of power within the international climate system. Indigenous knowledge is heard as long as they do not call into question the established order.

The problem with negotiations on the functioning of the climate regime is that they rely on a global logic of figures, tons of coal, and emission reduction prospects, but ignore local realities, forgetting the famous adage "think globally and act locally." It is precisely here that indigenous peoples can collaborate effectively. We must be aware that an important anthropological error is being made: international experts are well trained in global standards, but little in local contexts, and they also do not consider the cultural realities and customs of peoples.

We must understand that it is not only a matter of climate, but of the life and survival of thousands of communities that have learned to integrate and collaborate with Nature. It is our own heritage as humanity that is at stake right now, and its consequences will not only weaken indigenous peoples, but the human species as a whole. ■



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THE ANTIQUITY OF HUMANS IN THE AMERICAS: ARCHAEOLOGICAL FINDINGS FROM SERRA DA CAPIVARA

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INTRODUCTION

The question of when the first human beings arrived in the Americas has been widely debated in world archaeology over the last century, with many theories attempting to account for the increasingly frequent evidence emerging from a great variety of archaeological research sites. For a long time, the prevailing view held that the so-called "New World" had been populated relatively late, which reinforced the notion of the "youth of the American man". However, archaeological discoveries in recent decades have been telling a very different story, indicating that human presence on the American continent may be much older than previously imagined.

Sites such as those of Serra da Capivara, in the state of Piauí, Brazil, reveal striking evidence that challenges established theories on the antiquity of humans in the Americas. Serra da Capivara contains an exceptional concentration of prehistoric sites with rock paintings and diverse material evidence, whose investigation has helped to rethink our origins and fill gaps in South American prehistory.
The Serra da Capivara National Park, declared a UNESCO World Heritage Site in 1991, hosts the oldest and one of the largest concentrations of prehistoric sites in the Americas, in addition to the largest collection of rock art in the world concentrated in a single territory. There are more than 1,300 sites and 7,000 images already identified, with many more yet to be catalogued. In this region, vestiges have been found that suggest human occupations at extremely remote dates, possibly 50,000 years ago or even more. These findings, in themselves, are sufficient to radically unsettle the paradigms that have been upheld for so many years regarding American prehistory. Even though criticism and controversy have sought to discredit the methods of investigation applied over the last 50 years of work in this region, it has become inevitable to rethink conventional models or to incorporate new variables, something that, without a doubt, has already been happening over recent decades in the work of different schools and researchers.

In this monograph, we begin by reviewing the main theories concerning the peopling of the Americas, contrasting the traditional Clovis-first model with evidence of older human occupations (pre-Clovis). We then examine the archaeological dating methods used to determine the age of these findings, particularly radiocarbon (Carbon-14) dating and the techniques of luminescence and electron spin resonance, explaining how they work and providing examples of their application at Serra da Capivara. We discuss the scientific controversies surrounding the findings from Serra da Capivara, the methodological criticisms that have been raised, and the responses put forward by the team led by Niède Guidon, the principal archaeologist responsible for the studies, discoveries and efforts to promote the sites in this region. Finally, we also highlight the rock paintings, describing their motifs, techniques, styles and possible symbolic interpretations in a purely introductory way, as a means of presenting to the reader an immense universe that remains very little explored, but which is undoubtedly rich and fascinating for those interested in the mysteries of the human being and of our origins.

General Objective

To investigate the antiquity of humans in the Americas in light of the archaeological findings from Serra da Capivara, analyzing how this evidence contributes to a reassessment of theories about the peopling of the Americas and its significance for an anthropological understanding of the human being and of human antiquity.

Specific Objectives

- To critically review the Clovis-first theory, presenting its historical context and contrasting it with evidence of pre-Clovis human occupations, especially at Serra da Capivara.
- To describe the main archaeological dating methods used and the results obtained thus far.
- To present the principal archaeological discoveries, from artifacts (lithic tools, remains of hearths, human bones, etc.) to the estimated dates associated with these finds, highlighting their relevance in a global context, in contrast with the criticisms raised by other researchers regarding the methodologies and interpretations employed at the site.
- To analyze the rock paintings of Serra da Capivara, describing their figures, painting techniques, recurring themes (fauna, hunting scenes, rituals, etc.), including possible anthropological interpretations based on the symbols depicted.

DEVELOPMENT

Human Occupation of the Americas: from the Clovis-First Theory to Pre-Clovis Evidence

For many decades, the dominant view regarding the peopling of the Americas was the so-called Clovis-first theory. According to this model, the first humans entered the continent around 13,000 years ago (toward the end of the Ice Age) via the Bering land bridge, spreading southwards and giving rise to Paleoindian cultures such as Clovis in North America. In fact, artefacts from the Clovis culture, including its famous projectile points, have been dated to around 11,000–10,500 years before present (BP) (roughly 13,000 calibrated years), and for a long time there was no scientific consensus on any human occupation earlier than this period in the Americas. This paradigm led generations of archaeologists to concentrate their investigations within this temporal limit, assuming that it would be unlikely to find vestiges older than approximately 13,000 BP on American soil.

However, beginning in the 1990s, well-documented pre-Clovis sites forced a drastic revision of this picture. The most emblematic case is Monte Verde in Chile, excavated by Tom Dillehay. At Monte Verde II, remains of wooden dwellings, hearths and a wide variety of organic materials were identified, dating to approximately 14,500 calibrated years BP. This dating places Monte Verde at least a thousand years earlier than Clovis sites and convincingly demonstrated that human presence in South America predates the Clovis culture. It is worth noting that Monte Verde presented an exceptional context of preservation (waterlogged soil), which even allowed the recovery of food remains, such as seaweeds and meat from extinct megafauna. Although there was initial skepticism, Monte Verde is now widely accepted as solid evidence of human occupation around 14,500 BP, breaking the so-called "Clovis barrier" in archaeological thought.

Another crucial site is Paisley Caves, in Oregon (USA), where typical Clovis projectile points were not found, but instead direct biological evidence: human coprolites (fossilized feces). These coprolites were radiocarbon dated to around 14,300 BP. This represents the oldest direct evidence of humans in North America currently known, roughly 1,200 years earlier than the Clovis culture. The discovery, published in 2008, provided genetic evidence of a pre-Clovis occupation in the northwestern United States, reinforcing the idea that human populations were already spread across the continent at that time.

In addition, several other sites across the Americas have provided indications of ancient occupations, although some remain subject to debate. We may mention, for example, Meadowcroft Rockshelter (Pennsylvania, USA, possibly ~16,000 BP) and Topper (South Carolina, USA, with alleged vestiges older than 15,000 BP). In the far north, the Bluefish Caves sites in the Yukon (Canada) yielded bones bearing cut marks dated to as much as ~24,000 BP, suggesting human activity in Beringia during the Last Glacial Maximum. More recently, Chiquihuite Cave in Mexico revealed lithic tools in layers dated to about 26,000–30,000 BP, although the interpretation of these artefacts as human-made is also debated. Finally, the footprints at White Sands (New Mexico), dated between 21,000–23,000 years, add to the growing body of evidence. These examples indicate that the scenario of the initial peopling of the Americas is undergoing revision, with hypotheses that include migrations much earlier than the end of the last glaciation and possibly coastal routes (along Asia and

down to South America) rather than solely the interior corridor of North America, an older conception that is now considered outdated, even though it unfortunately remains widely disseminated among the general public.

In the South American and Brazilian context, the site of Pedra Furada, located in the Serra da Capivara region (Piauí, Brazil), stands out. Excavations led by archaeologist Niède Guidon since the early 1970s brought to light a long stratigraphic sequence with indicators that, according to the research, point to human presence long before 13,000 years ago. In a paper published in the journal Nature in 1986, Guidon and colleagues announced the discovery of hearth remains (charcoal) at Pedra Furada dated to approximately 32,000 BP. Alongside these, numerous flaked stone tools were found in even deeper layers, suggesting the existence of a lithic industry as early as around 50,000 BP. If accepted, such claims would place Pedra Furada as the earliest known site of human presence in the Americas at that time.

The archaeological community reacted with considerable skepticism to these findings from Pedra Furada. Around the 1990s, many specialists (particularly in North America) questioned the anthropic nature (that is, attributable to human activity) of the vestiges. One critical argument was that the supposed lithic tools might be mere "geofacts", that is, stone fragments broken naturally, for example, by rock falls from cliffs, rather than artefacts deliberately knapped by humans. Similarly, it was suggested that the charcoal and fire marks in the oldest layers could derive from natural wildfires rather than from constructed hearths.

It is worth noting, however, that with the accumulation of pre-Clovis discoveries in different locations, the idea of human presence in the Americas prior to 20,000–30,000 years ago, while still not consensual, can no longer be dismissed outright. Guidon herself has argued that established scientific paradigms have influenced some researchers' reluctance to search for evidence in deeper layers: she observed that certain archaeological "schools", especially in the USA, limited their excavations to strata only up to around 15,000 years because of theoretical conviction, while the European (French) school has consistently defended excavating down to bedrock in search of more remote occupations, "digging until you reach the rock". Thanks to this approach, her team at Serra da Capivara claims to have found vestiges potentially as old as 100,000 years, an impressive figure that nevertheless remains in the realm of hypothesis, still lacking full validation.

In summary, the evidence gathered thus far clearly indicates to the researcher that human occupation of the Americas is older and more complex than the Clovis-first model suggested, and the sites in Piauí have played an important role in this discussion, even though the older model stubbornly persists in popular imagination.

Archaeological Dating Methods: Carbon-14, Luminescence and ESR at Serra da Capivara

To support claims of human occupations reaching so far back in time, it was essential to apply rigorous dating methods to various materials found in the archaeological sites. At Serra da Capivara in particular, a combination of techniques has been employed, including radiocarbon (Carbon-14 or C-14) dating and luminescence methods (such as TL – thermoluminescence – and OSL – optically stimulated luminescence), as well as Electron Spin Resonance (ESR). Each of these methods has distinct and complementary principles, allowing approximate ages to be assigned to different types of vestiges and time ranges. Readers wishing to delve deeper will find, in the bibliography at the end of this work, the articles describing each of these investigations and their results.

Given the informative nature of this monograph, we present here only a very brief and simplified overview of these methods and their results:

Radiocarbon (Carbon-14) Dating:

This is a widely used method in archaeology, suitable for organic materials (charcoal, bones, shells, wood, etc.) up to a maximum of about 50,000 years BP. Carbon-14 is a form of carbon that living beings absorb while they are alive; once they die, absorption ceases and the isotope begins to decay. By measuring how much Carbon-14 remains in a sample,

scientists can calculate the age of the organism. Results are expressed in years "Before Present" (BP, where "Present" is conventionally fixed at AD 1950) and later calibrated into calendar years. The maximum age achievable through this method is around 48,000 years, after which the vestiges disappear completely from the record.

At Serra da Capivara, the C-14 method was applied mainly to charcoals from ancient hearths and to organic remains such as shells and organic sediments. For example, the earliest hearths identified at Boqueirão da Pedra Furada were dated to about 32,000 BP by radiocarbon. Shells associated with archaeological layers at Toca das Moendas yielded ages of ~24,210 ± 150 and 26,970 ± 140 BP (C-14). In such cases, archaeologists do not need to date the object of interest directly (such as a tool or hearth), but can date organic material, like shells, found at the same depth; based on this, they estimate the age of the layer and of everything found around it, provided that the layer has not been mixed or "contaminated" by natural or human actions such as landslides, ancient digging or soil movement. This is a very common technique in archaeology worldwide.

Even deposits of calcite precipitated over rock paintings can be dated using C-14: at the site Toca dos Coqueiros (Pedra Furada sector), calcite covering traces of black pigment was dated to 31,860 BP, indicating that the painting beneath is at least older than this age, currently the oldest known artistic expression in the Americas.

Other methods can be applied for even older dates, beyond the limits of C-14, or for materials lacking organic matter:

Luminescence Dating (TL/OSL):

The methods of thermoluminescence (TL) and optically stimulated luminescence (OSL) serve to measure the time elapsed since certain materials (such as quartz or ceramics) were last exposed to sunlight or intense heat. While buried, these materials accumulate small amounts of energy from natural radiation in the soil. In the laboratory, this stored energy can be released in the form of light when the material is stimulated by heat (in the case of TL) or by light (in the case of OSL). The amount of light emitted indicates how much time has passed since the material was last heated or exposed to sunlight, that is, since it was last at the surface.

Luminescence is particularly useful for ancient sediments devoid of organic matter, or for ages beyond the reach of C-14. At Serra da Capivara, luminescence proved crucial for dating very deep layers. Franco-Brazilian research dated, via OSL, sedimentary layers in the shelter Toca da Tira Peia to approximately 22,000 BP, where associated lithic artefacts were found. At Boqueirão da Pedra Furada itself, lower layers containing flaked cobbles were dated by thermoluminescence and other luminescence techniques to ages such as 48,000 BP (and, in some estimates, even older). These luminescence dates significantly extended the possible chronology of human occupation in the region. It is also worth mentioning that ceramic fragments in more superficial levels were dated by TL in order to calibrate more recent occupations, for example, ceramics from Toca das Moendas with ages around 4,000–5,000 BP (TL).

The precision of luminescence dating depends on factors such as complete "resetting" of the sample in the past (by sunlight or fire). When sediments, such as sand grains, are well exposed to sunlight before burial, as occurs on riverbanks or dunes, the luminescence dates tend to be reliable, because sunlight "zeroes out" the accumulated signal in the mineral, correctly marking the moment it was covered. On the other hand, if sediment is deposited very rapidly, or under conditions with insufficient light exposure, it may retain part of an older signal. In such cases, the dating may produce an age older than the true time of burial, overestimating the time elapsed. Nonetheless, when rigorously applied, TL/OSL techniques are powerful tools for extending chronologies beyond the C-14 limit.

Electron Spin Resonance (ESR) Dating:

Also known as Electron Paramagnetic Resonance (EPR), this technique shares some principles with luminescence insofar as it quantifies damage caused by radiation in materials over time. ESR is particularly employed for dating materials such as fossil tooth enamel, calcareous shells and calcite deposits, covering a time range that may extend from thousands up to hundreds of thousands of years, depending on the context. In the case of teeth, for instance, natural radiation gradually generates free radicals in the enamel after burial; by measuring the concentration of these radicals (via spectroscopy) and knowing the annual radiation dose in the environment, it is possible to estimate the age of the

sample.

At Serra da Capivara, ESR was used together with other methods to corroborate very ancient ages. A notable case concerns a skeleton found in a burial at Toca das Moendas: cervid teeth associated with this burial were dated by ESR to approximately 22,000 ± 2,000 and 23,000 ± 2,000 BP. These very similar dates were obtained by two different laboratories, the Chemistry Department of Williams College, Massachusetts, USA, and the University of São Paulo (USP), Brazil.

Likewise, calcite covering this burial and associated cervid bones was dated by combining ESR and TL, yielding an age of around 13,000 BP. For this calcite to have formed over the bones, it is necessary that the bones themselves had already been there for a considerable time beforehand. As with luminescence, ESR was essential to provide cross-checking in contexts where C-14 could not be applied (either due to the absence of datable organic carbon or because the ages exceeded the method's limit). In short, the arsenal of dating methods employed at Serra da Capivara sites has provided a scientific basis for the chronological interpretations. The combined use of C-14, TL/OSL and ESR has made it possible to construct a preliminary chronology that covers possible human occupations tens of thousands of years ago up to vestiges from more recent pre-colonial periods.

Serra da Capivara: Archaeological Discoveries, Dates and Global Significance

Niède Guidon, the park's leading researcher, has argued that Homo sapiens may have reached the Americas at least 100,000 years ago, possibly arriving from Africa via the Atlantic Ocean, a hypothesis considered heterodox by the majority of archaeologists. Meanwhile, the mainstream of archaeology has gradually become more receptive to occupations older than Clovis, although not necessarily as ancient as 100,000 years. One of the main obstacles to broader acceptance is the scarcity of human skeletal remains that would directly substantiate these dates.

Organic vestiges (such as bones, wood, fibers, seeds or food remains) tend to disappear quickly at Serra da Capivara because of its ancient humid tropical climate, which accelerates natural decomposition. Due to these conditions, it is rare to find well-preserved human fossils or organic remains in the region, which is why the search for such evidence has focused on limestone caves, shelters and more protected rock walls.

Another line of evidence for ancient human presence at Serra da Capivara consists of coprolites of human origin found at various sites in the park. These coprolites were identified in layers ranging from the Holocene (from 11,700 years ago) to older strata reaching around 30,000 BP. There remains debate as to whether all of these vestiges are in fact human or whether some might derive from animals, but within the assemblage studied, 204 samples of coprolites/sediments were analyzed, of which 37 were identified as human in origin.

One of the most notable discoveries was evidence of the use of medicinal plants. Analyses identified, in human coprolites, several pollen grains from plants known for their therapeutic properties, in proportions that would hardly be explained merely by incidental ingestion or environmental deposition. Researchers Chaves & Reinhard (2006) conducted a critical assessment of pollen in coprolites (dated to 8,500–7,000 BP) and concluded that at least three plant genera present were intentionally used for medicinal purposes: Anacardium, Borreria and Terminalia. In the same coprolites in which eggs of intestinal worms were found, pollen from plants with potential vermifuge or palliative effects also appeared. This convergence between biological (parasites) and botanical (medicinal plants) evidence demonstrates complex cultural behavior in the region.

Controversies and Defenses: the Scientific Debate Around Serra da Capivara

A Given such surprising findings, which propose changes as profound as these to long-established paradigms, the emergence of controversy in the scientific community was inevitable.

One of the central points of contention concerns the nature of the supposed lithic artefacts from Pedra Furada. Critical archaeologists such as David Meltzer, James Adovasio and others have argued that the flaked stones found in the oldest layers may not have been intentionally knapped by humans, but rather broken by natural processes (rockfalls, wildfires that crack the stone, etc.). This claim that many pieces might be "geofacts" implies that the shapes of the flakes would not be sufficiently distinct from natural fractures to justify attributing

them to a coherent human industry.

Moreover, the stratigraphic integrity of some sites has been questioned: could more recent materials have infiltrated older layers (through bioturbation, roots, burrowing animals), thereby contaminating the dates? Critics have also drawn attention to the absence of human remains directly associated with the oldest layers: for instance, no human bone of 30,000 years has been found that could be dated, which would make the evidence more concrete. Another point often raised is the relative scarcity of clearly distinctive cultural artefacts (such as elaborate tools or clearly delimited hearth structures) in the deepest levels; much of the material consists of relatively simple lithic fragments.

With regard to rock paintings to which extremely ancient ages (25,000–30,000 years) have been suggested, some researchers have likewise expressed reservations, arguing that further independent confirmation is necessary. Since dating calcite over a painting provides only a minimum age, particular chemical factors could potentially influence the results.

An illustrative case of skepticism was voiced by the North American scholarly community during the 1990s and 2000s. In international conferences, Pedra Furada was frequently met with distrust and sometimes excluded from syntheses and analyses of the peopling of the Americas, being regarded as an "unproven anomaly" (Athena Review, 2000). Comments in specialized journals suggested that "compelling evidence" was lacking and that accepting occupations around 50,000 years ago would require much more robust proof than had thus far been presented. Some even insinuated that the enthusiasm for overturning the Clovis-first paradigm might have led the researchers to overinterpret fragile data. In other words, there were accusations of confirmation bias: given that Guidon and her collaborators expected to find ancient occupations, they might have interpreted any ambiguous indication (a broken stone, an isolated piece of charcoal) as proof of human activity. This line of criticism, though contested, did exert pressure for more rigorous and independent studies in the region.

Archaeologists who support the evidence from Serra da Capivara, led by Niède Guidon, have responded point-by-point to these criticisms. Regarding the alleged "geofacts", they argue that the spatial distribution and standardization of many flakes suggest human action: for example, the concentration of flint fragments in certain layers and the presence of characteristic features of deliberate knapping, which would be unlikely to arise from rocks falling at random. Furthermore, they note that no natural processes currently observed in the surrounding areas are known to produce equivalent patterns of flaking, and that some pieces show retouch or forms consistent with typological models of tools (scrapers, perforators).

Concerning the hearths, Guidon has pointed out that many charcoals were found in a clear stratigraphic context indicative of fireplaces, sometimes surrounded by stones arranged in a ring, as though forming a hearth base—something difficult to attribute to natural wildfires.

Multiple dates obtained through different methods (C-14, OSL, ESR) in distinct laboratories, which often converge, are also cited as evidence of the robustness of the results: it is argued that such systematic contamination as would cause several methods to agree on similar ages is improbable. For instance, the layer at Pedra Furada dated to ~32,000 BP was analyzed by at least two laboratories using C-14, and they obtained compatible results, reducing the likelihood of error or accidental contamination.

Guidon also emphasizes the rigorous scientific approach of her excavations. She stresses that excavation techniques followed international standards, with strict control of levels and exhaustive collection of material; numerous French, Brazilian and other international researchers participated in the investigations, giving them a multidisciplinary character. When confronted with criticism, a recurring stance of Guidon was to invite skeptics to examine the sites themselves: "if doubts persist, let them do the same work and then disagree or agree with proper justification," she stated in interviews. This remark reflects her dissatisfaction with what she considered a priori rejection by colleagues who, in her view, were not open to new evidence because of a kind of "psychological block" tied to traditional theories.

Recent studies of lithic technology, such as Ramos & Boëda (2019) and Parenti et al. (2018), attempted to reproduce natural fractures in rocks similar to those at Pedra Furada in order to compare them with the site's

flakes. According to some authors, the results did not satisfactorily account for all the artefacts; there remain pieces that seem more consistent with human production.

Another important line of defense is the paleoenvironmental context. Guidon's team argues that, from an environmental standpoint, there is nothing that would have prevented ancient human presence in Piauí. On the contrary, during the Pleistocene, the Serra da Capivara region possessed water sources, abundant fauna (there are fossil records of local megafauna) and rock shelters, a setting quite suitable for human occupation. The rhetorical question they pose is: why would such a fertile land, with a relatively benign (tropical) climate, remain uninhabited for tens of thousands of years, while humans were already living in far more hostile regions?

This provocation calls into question the implicit prejudice that the Brazilian interior remained empty until relatively late; on the contrary, it suggests that we might expect a very ancient human presence there, especially considering that Africa, at similar latitudes, had been populated for hundreds of thousands of years. In this way, the findings from Serra da Capivara acquire an ecological and anthropological logic: if there were humans capable of spreading across the world, regions such as Piauí could very well have received them in remote times.

To date, most researchers accept the existence of pre-Clovis sites (around ~15,000 BP or somewhat earlier), yet remain cautious regarding evidence older than ~25,000 years. Serra da Capivara therefore occupies a vanguard position in this debate.

"Today I am retired, but I can say that there is always a need to corroborate scientific theories. I believe that our work was carried out with the utmost rigor, knowledge and professionalism. If there are still those who have doubts, let them do the same work and then disagree or agree, with proper justification." The archaeologist passed away on 04 June 2025 at the age of 92.

Rock Paintings of Serra da Capivara: Descriptions, Themes and Interpretations

One of the most striking features of Serra da Capivara is the abundance of prehistoric rock paintings spread across the rock shelters. It is estimated that there are tens of thousands of painted figures on the park's numerous panels, covering rock walls and ceilings in places that today attract tourists and researchers from around the world. The rock art of Serra da Capivara is recognized both for its quantity and for its quality and thematic variety. It offers a unique glimpse into the life and worldview of prehistoric South American peoples.

A large share of the paintings depicts animals and human figures, often composing narrative scenes. Hunting is a central theme: there are many scenes of groups of hunters pursuing animals, some of them quite detailed and suggesting cooperation and the use of primitive weapons (such as spears and traps). The animals identified include species from the regional fauna, many of which still exist today and others that are extinct. Representations of animals range from simple silhouettes to figures filled internally with geometric patterns or dots, revealing aesthetic concern and possibly symbolic meaning. Frequently, animals appear in motion (running, in the case of deer and rheas), suggesting narratives of pursuit.

Human figures are generally stylized, with schematic bodies and thin limbs, but depicted in varied positions indicating action: brandishing weapons, dancing, fighting or engaging in sexual acts. One notable aspect is the presence of scenes of rituals and social life: in addition to hunting, there are depictions of collective dances, apparent ceremonies and even scenes of physical conflict (fighting). Some scenes may be interpreted as involving supernatural or shamanic beings: human figures with distinctive traits, sometimes larger or bearing adornments, which could represent spirits, deities or shamans in trance.

The paintings were made using natural pigments, primarily iron oxide minerals (hematite) to produce shades of red, which is by far the predominant color. Yellow pigments (probably limonite) and gray/black pigments derived from manganese or charcoal are also found, though in smaller quantities. The artists likely applied these pigments mixed with organic binders (fat, resin or water), using their fingers, rudimentary brushes made of plant fibers or even blowing pigment through tubes (a kind of primitive airbrush technique) (PESSIS, 2001).

Different paintings frequently overlap partially, indicating multiple phases of execution over time. Archaeologists have identified distinct styles within the park, the main one being called the Serra da Capivara Style, characterized by relatively small figures, proportional forms, dynamic scenes and firm contours. There are regional variations within the park and possible correspondences with different chronological phases, although the precise chronology of the rock art remains an object of study.

Initially, the identification of hunting scenes invites a functional interpretation: they could be related to sympathetic hunting magic, the belief that graphically representing the hunt would help bring about successful hunts (an idea proposed for many other contexts of rock art around the world). Scenes of dance and possible ritual may indicate ceremonial practices, perhaps rites of passage, collective celebrations or shamanic activities aimed at communicating with the spiritual world. Hybrid or "supernatural" figures (if interpreted as such) reinforce the notion that mythic aspects were being recorded, for example, certain images may be understood as shamans transforming into animals or as beings that are half-human, half-beast, which aligns with concepts of transformation and nature spirits common in the cosmologies of South American Indigenous peoples.

When compared with known Indigenous mythologies, it is tempting to relate some figures to persistent archetypes: for instance, the figure of a large red deer appears so frequently that some anthropologists speculate it may represent a guardian spirit of game animals, similar to the "master of the animals" present in the cosmologies of hunter-gatherer groups. The dances could also be linked to shamanic rituals described in ethnographies, in which music and choreography serve to induce trance and journeys to the spiritual realm. Naturally, such interpretations are hypotheses that must be treated with caution; we do not have a secure "dictionary" for deciphering prehistoric rock art.

Even so, the narrative richness of Serra da Capivara's paintings allows for suggestive parallels. Ethnoarchaeological studies have sought to gather oral traditions of present-day peoples in the region (such as Indigenous communities from the Northeast or the cerrado) in search of similar themes. Some creation myths, for example, speak of a time when animals and humans spoke the same language and lived closely together, which resonates with scenes in which humans and animals seem to interact almost on equal terms.

Regardless of specific interpretations, from a symbolic perspective we can infer that these hunter-gatherer groups developed concepts of spirituality, social identity and knowledge transmission. The scenes may have served to tell stories or to teach younger members about hunting techniques, dangers, communal values and so forth. We may draw a parallel with what has been documented among the Dogon of Mali, in West Africa, who present their painted rock cliffs to boys undergoing initiation rites into adult life (GRIAULE, 1965).

In Brazil, different "traditions" of rock art have been identified, each with its own styles, patterns and geographic incidence. These traditions or "schools" exhibit local sub-styles, such as the Serra da Capivara and Serra Branca styles belonging to the Northeast Tradition. In Serra da Capivara National Park, four traditions have been identified:

Itacoatiara Tradition

In the Itacoatiara Tradition, all engravings appear in low relief, either scraped or pecked. In some sites within the Park, there is a predominance of figures lacking recognizable identifying traits; however, in certain areas one can observe rare isolated zoomorphic representations, generally of lizards (Pessis, Cisneiros, Mutzenberg, 2018).

Agreste Tradition

The static figures, initially used to characterize the Agreste Tradition, were associated with figures that did not, a priori, display movement. It was later found, however, that recognizable figures composing the sites examined in preliminary classifications, whether anthropomorphic or zoomorphic, possessed an individual movement of their own, which characterizes their mode of presentation in the graphic space identified as Agreste. The absence of interaction among the motifs suggests an individualization of these figures. Researchers identified graphic elements that possessed features from the sensible world, which can be recognized, alongside motifs without the possibility of recognition (Perazzo, Pessis, Cisneiros, 2015).

Northeast Tradition

Serra da Capivara Style: Recognizable figures drawn with simplicity, using only the essential lines required for identification, those necessary to recognize the figure. Occasionally, figures appear bearing cultural attributes: they are soberly adorned with masks that cover the body while leaving the legs exposed, or they wear headdresses. They are depicted with gestural postures representing phases of bodily movement. This results in an overall dynamic vitality that conveys joy and playful activity. Gestures and posture correspond to the peak moment of movement in contrast to a resting position. There are also representations of objects and trees. Only a few rare unrecognizable motifs, configuring di-digit or tri-digit forms, appear alongside some emblematic figures.

Serra Branca Style:

In this style there are graphic motifs with characteristics of the Serra da Capivara Style, but with attributes that distinguish them, even though they still fall within the general features of the Northeast Tradition. There is greater diversification through the introduction of new components: anthropomorphic figures bearing ornaments, garments and headdresses, decorated with filled-in graphic forms that contrast with the simplicity of the Serra da Capivara profile (Pessis, Cisneiros, Mutzenberg, 2018).

CONCLUSION

Investigations into the antiquity of humans in the Americas, catalyzed by the discoveries at Serra da Capivara, have helped to reframe the continent's prehistory. Throughout this work, we revisited the trajectory of the Clovis-first theory and observed how it has gradually been expanded and challenged by evidence of older occupations at various archaeological sites. Within this context, Serra da Capivara has emerged as one of the most audacious and provocative cases, offering indications that push human presence back tens of thousands of years beyond conventional timelines. The main findings at Serra da Capivara, simple lithic tools, hearth remains, rock paintings and even human fossils, compose a rich mosaic suggesting a long continuity of human life in that region.

If the oldest dates are confirmed, we will have to accept that groups of Homo sapiens were exploring northeastern Brazil contemporaneously with Neanderthals in Eurasia, and long before the Paleoindian peoples commonly known to archaeology. This would revolutionize migration theories: it would imply, for example, that the arrival of humans in the Americas may have occurred through multiple waves, some very remote and possibly of distinct origins (via the Bering Strait, along the Pacific coast, or even by transoceanic Atlantic routes, as Guidon has suggested).

Today there is much broader recognition that the early history of the Americas is complex and still incomplete. Far from being settled, the question of the "first American" remains open: new excavations and technologies (ancient DNA, advanced paleoanthropology, refined dating methods) may either confirm or refute current hypotheses. With its vast collection of sites, Serra da Capivara remains a key location where many of these answers may yet be found.

Finally, the cultural and heritage value of Serra da Capivara cannot be overstated. Beyond contributing to a more encompassing chronology, the national park preserves a tangible testimony to human creativity and adaptability. The rock paintings, in particular, remind us that those ancient peoples were not merely survivors struggling against nature; they created art, symbolism, social cooperation and spirituality. In other words, they were as human as we are, with questions, fears and hopes projected onto the rocks of their world.

Studying and valuing this legacy promotes a deeper connection with our most remote roots and enriches our historical identity, especially that of Brazil, which discovers, in its territory, a fundamental chapter in the human saga. As Professor Jorge Angel Livraga provocatively stated, "there is no prehistory, only History", and Serra da Capivara now occupies its place in the grand History of Humanity, unveiling mysteries of our distant past and inspiring fresh reflections on who we are and where we come from.
Whenever we ask ourselves who we are and where we came from, we are doing philosophy. And perhaps, in this movement of seeking, more important than pinpointing the prehistoric human being exactly in time and space is recognizing that they shared the same fundamental anxieties and needs that we do. Scientific investigation and philosophical reflection do not stand in opposition; rather, they intertwine: one offers a technical basis, the other, meaning.

It is impossible to contemplate the skull of "Zuzu", ~9,000 BP, on display at the Museum of the American Man, without wondering about her inner life, whether she loved, whether she had children, what she thought of death and how she understood herself. By investigating the humanity of people from other times, their hearths, their flakes and their art so rich in symbolism, we touch something essential in ourselves: our own humanity. Perhaps the inhabitants of ancient Serra da Capivara are not so distant from us after all.

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Alexander von Humboldt
Science in harmony with art and the soul

Heribert Holzinger

Alexander von Humboldt

Pioneer of a scientific paradigm in harmony with art and spirituality, as well as a new understanding of nature.

At a time when science regarded nature primarily as an object to be dissected, classified, and conquered, there appeared on the scene of world history a man whose view was exactly the opposite. Alexander von Humboldt, often regarded today as the forgotten father of ecology, did not see nature as an accumulation of dead data, but as an interconnected and living whole, a global organism in which everything is related. He was convinced that the world could only be understood by combining accurate measurements with emotional and sensory experience. This revolutionary perspective was forged in the crucible of a life that was itself a great adventure, a tireless quest to understand how "all the forces of nature intertwine and intermingle."

The Life of Humboldt (1769-1859)

Alexander von Humboldt grew up as the younger of two brothers in a well-to-do Prussian noble family.

While his older brother, Wilhelm, was serious and a lover of books, Alexander showed himself to be an adventurous spirit from an early age.

Alexander Von Humboldt in his youth

From "small pharmacist" to knowledge-hungry researcher

In his solitary walks in the Tegel forests, Alexander not only found an inexhaustible source of fascination, but also a space that he found "reassuring and comforting". Nature was his emotional counterpoint to his family's expectations, a place of order and dreams. From these excursions, in which he dreamed of distant explorers like Captain Cook, he always returned with his pockets full of plants, insects and stones. This habit soon earned him the affectionate nickname of "the little pharmacist," an early recognition of his systematic curiosity. In his room, he classified and labeled his findings. At the age of ten he was already drawing maps of the planetary system and of America.
In 1787, Alexander von Humboldt began studying cameral sciences, but he also attended classes in medicine, physics, mathematics, ancient sciences, and botany. He soon began his own studies in natural sciences and embarked on his first research trips. On one of these trips he met the famous traveller Georg Forster, with whom, in 1790, he made a revealing research trip along the Rhine to England and back to Paris. Both shared an interest in the investigation of nature and the ideals of the French Revolution, although Humboldt remained more reserved in the political sphere. Eventually, he turned to mining, studied at the Freiberg Academy of Mines and completed the demanding studies in just eight months, instead of three years.

Although even then his dream was to travel the world, in 1792 he followed his mother's wish and began a career as a mining consultant in the service of the Prussian state. Humboldt modernized mining methods with great success and also thought about people who worked underground: he founded Germany's first mining school and wrote his own textbooks to promote the training of workers. His experimental curiosity led him to invent, among other things, an improved lead lamp and one of the first respiratory protection devices, both of which were tested to endanger his life.
Here, too, his intrepid investigative spirit was on display. The cold of the deep galleries of the mines made him sick and he suffered attacks of fever. But, despite physical suffering, he published his first scientific treatises on the basaltic rocks and fascinating underground flora he discovered in the darkness of the mines. In his botanical studies, he was already investigating dependence on plants and the environment. Later he devoted himself to electricity in animals, carried out bold experiments on himself and thus had a decisive influence on the beginnings of physiology.

A New Look at the World: Meeting Goethe in Jena

Jena (and Weimar, 20 kilometers away) was at that time the intellectual epicenter of Germany. Whenever Humboldt had time, he traveled there. There he took long walks with Goethe, carried out experiments with him or inspected the botanical garden started by Goethe.
While Descartes considered animals to be machines, Goethe saw them as living organisms. In a mechanical system, the parts form the whole, while in an organic system, the whole forms the parts, and these only function as a unified whole. Along with Goethe, Humboldt soon understood nature as a unified whole, as a web of life animated by forces with changing effects.
In the exchange with Goethe, Schiller, Novalis and other great thinkers of his time, Humboldt's scientific methodology underwent a profound transformation. Goethe and Novalis

provided him with impulses that combined their empirical research with a deep aesthetic appreciation of nature. As Humboldt himself later acknowledged, Goethe gave him "new senses" or "new eyes" to see the world. It was no longer just about measuring and sorting, but also about feeling and experiencing nature. Here Humboldt began to understand that the exact scientific data and the subjective and emotional reaction to nature were not contradictory.

Humboldt later admitted that the close relationship between nature and imagination in his books was largely due to the influence of Goethe. This new holistic perspective became the decisive intellectual equipment for his next great journey. He realized that his goal could not be just to collect samples. His true purpose, as he himself formulated it, was to investigate "how all the forces of nature intertwine and intermingle."

The Great Journey: A Worldview Forged in the Tropics

The decisive turning point came with the death of his mother. His considerable inheritance provided him with financial independence. Without hesitation, he submitted his resignation from the Mining Office. He was finally free to make his life's dream come true: the "great journey," a scientific expedition to unknown worlds.

The five-year expedition through Latin America was much more than a geographical exploration; it was the decisive crucible for Humboldt's revolutionary ideas. Arriving in Venezuela was already an overwhelming experience for Humboldt and his partner, the botanist Aimé Bonpland. The great richness of tropical life captivated them. "Like fools, we keep running from one place to another," Humboldt wrote to his brother, unable to assimilate the torrent of new impressions. Bonpland even feared "losing his mind if the wonders did not soon cease."

Humboldt's unwavering scientific precision was evident during a strong earthquake in Cumaná. As people screamed in panic and the houses

Humboldt's Research Journey 1799-1804

around him collapsed, he calmly got up from his hammock, readied his instruments, and began to measure the intervals between the tremors. Even in the midst of utter chaos, he remained true to his commitment to empirical data collection.

On Lake Valencia in Venezuela, Humboldt saw the surrounding forests being ruthlessly cut down to cultivate plantations and accurately documented the consequences: the unprotected land was eroded and the lake level dropped dramatically. Here he first formulated the three fundamental functions of the forest for the ecosystem: its ability to store water, enrich the atmosphere with moisture, and protect the soil from erosion. It was the birth of modern ecological thought and Humboldt became the first to warn of the ecological crisis caused by man.

The Web of Life

The high point of his journey and his intellectual development was the ascent of Chimborazo, in the Andes, which was then considered the highest mountain in the world. As he mapped the vegetation, which changed as the altitude increased, his great vision, the "picture of nature," crystallized. He realized that nature is a global network in which everything is connected. This vision was not a mere abstraction, but took shape in a magnificent drawing of 90 x 60 cm. In this cross-section of the mountain, he visualized the existence of global vegetation zones that extend like belts around the planet and repeat themselves in the mountains in vertical sequence. Nature was a coherent whole, a living organism.

When Humboldt returned to Europe, he brought with him not only thousands of plant samples and countless measurement data, but also a whole new view of the world.

Paris, Berlin and Paris, Berlin and Humboldt's Kosmos conferences

Upon his return, Humboldt chose Paris as his new home. He was a celebrity who went from salon to salon, known for his extremely rapid speech and so famous that the inscription "chez Monsieur de Humboldt" was sufficient for a coachman.

Humboldt not only exchanged ideas about science, but also took a position on one of the central contradictions of the time: the search for freedom in a society based on slavery. A staunch opponent of slavery throughout his life, Humboldt did not hesitate to address this issue when he met with slave-owning President Thomas Jefferson. With his clear stance, he inspired his determined admirer Simón Bolívar, the future liberator of South America, here in Europe.

The culmination of his life's work was found in his later years in a famous series of lectures in Berlin. In them he summarized all his knowledge about the universe in an impressive panorama, which he later published in four volumes under the title Kosmos.

Humboldt and Bonpland with indigenous people in front of Chimborazo

A world fame

Humboldt's influence transcended his time and inspired entire generations. Thomas Jefferson called it "one of the most beautiful jewels of our era." Without Humboldt, Charles Darwin would never have embarked on the Beagle or developed ideas about the origin of species. William Wordsworth and Samuel Taylor Coleridge expressed Humboldt's understanding of nature in their poems. The young John Muir,

Humboldt in Berlin in 1807 Drawing by Frédéric d'Houdetot

who would later become the father of American national parks, launched himself into the world with the declared desire to "be a Humboldt". Even Henry David Thoreau found in Humboldt's books not only the answer to his dilemma of how to be a poet and a naturalist at the same time, but also the inspiration for his bestselling book Walden. And even his mentor Goethe looked forward to Humboldt's letters and news and said that he transmitted to him in one day more knowledge "than I had acquired in years".

Humboldt's books were translated into all major languages, and between 1820 and 1855, Humboldt was considered by many not only to be the second most famous person in the world after Napoleon, but also to be the most respected scientist in the world, who corresponded or was in direct contact with all the important scientists of his day. Humboldt was not just a researcher, he was a phenomenon that changed the way humanity viewed nature.

The following explanations purport to show how Humboldt's unified understanding of nature forged a vision that inseparably linked science, art, and feelings. This concept of a living network, forged more than two hundred years ago, remains today an inspiration for a new holistic scientific paradigm that, at the same time, offers answers to the ecological challenges of our time.

Humboldt as the founder of a new science

"Nature must be felt." With these words, the great naturalist Alexander von Humboldt summed up what is perhaps the most important legacy he received from his friend and mentor Johann Wolfgang von Goethe. It was more than just a scientific method; It was a whole new way of perceiving the world. A vision that refuses to classify the world into separate categories, a vision that combines science, art, and a deep, almost spiritual, respect for life into a holistic view of nature. A vision that would mark all of Humboldt's work.

Empiricism, Rationalism, and Kant

In the eighteenth century, the question of how to understand nature occupied all scientists and philosophers in Europe. Two schools of thought vied for supremacy. On the one hand there was rationalism,

whose representatives were convinced that true knowledge could only come from pure reason and logical thought. The senses were considered deceptive; mathematics, the ideal of clarity.

On the other hand was empiricism, which argued that all knowledge came exclusively from sensory experience. The human spirit, as formulated by the philosopher John Locke, was at birth a "tabula rasa", a blank slate that was written only with the impressions of the world.

In his Critique of Pure Reason, Kant argued that our knowledge is a synthesis of both: what we receive through the senses and what our mind actively adds. Therefore, concepts such as space, time and causality are not objective properties of the external world, but the "glasses" that our mind wears to be able to order and understand the world. We impose our laws on nature, instead of merely receiving them from it. However, the revolutionary consequence of this was ambiguous:

- On the one hand, Kant elevated the "I," the self, to a creative and free actor who actively participates in the shaping of his reality.

- On the other hand, it created an insurmountable gap. We can only know the world as it appears to us (as a phenomenon), but never as it really is: the "thing-in-itself" is eternally unattainable to us.

Goethe could not and would not accept precisely this separation, this intellectual capitulation to the ultimate mystery of reality. Together with other Romantics, he created a new synthesis that was to offer an alternative to Kant's explanations.

Goethe's Answer to Kant: The Wisdom of Experience

For the thinkers of Romanticism, the purely rational analysis of the Enlightenment had demystified the world. Nature, the poet Novalis lamented, had been degraded to a "monotonous mill." Goethe shared this view. He was convinced that the interior of the human being—feelings, poetry, and art—were not disturbing factors, but essential organs of perception to grasp the living and the unity of nature.

Goethe rejected Kant's idea of an unattainable "thing-in-itself." For him, this meant a devaluation of the experiential world, an escape from the immediate reality of the present, as he evokes in his Faust with the words: "Stay, you are so beautiful." He insisted that nature reveals itself completely to the observer if he learns to look correctly: *"What I have experienced I know, and I consider experience to be the only true science."*

The Observational Thinking Method

The method developed by Goethe can be described as "observational thinking." It is a disciplined form of perception in which the observer's subjective experience—his feelings, his intuition, his imagination—merges inseparably with his capacity for rational thought. Goethe saw the key in an increasingly systematic observation of nature, the aim of which is to recognize the truth in the phenomenon itself, rather than to reduce it to abstract laws. For him, objective truth arises when the subjective experience of the observer merges with his precise capacity for observation and his acute capacity for reasoning.

Seeing the Whole First:

Schiller, Wilhelm and Alexander Humboldt and Goethe in Schiller's garden in Jena, 1797

The Building Blocks of a Holistic Worldview

While analytical science starts from the parts to build a whole, Goethe requires starting with the contemplation of the whole in

order to understand the parts in their context. To him, this was not a vague daydream, but a precise instrument of investigation that he called "exact sensory fantasy" (nowadays, better: imagination). What Goethe formulates here is nothing less than the claim to train consciousness itself as a scientific organ that can directly perceive the inner patterns and building planes of the living with the "eye of the spirit."

A central concept in Goethe's science is the "primordial phenomenon," that point at which an observation can no longer be meaningfully broken down and nature speaks in a kind of self-revelation. For Goethe, it was a strict methodological rule against the speculative dissection that Newton reproached for. While Newton attributed color to hypothetical particles of light, Goethe insisted on sticking to what is immediately shown. For him, a primordial phenomenon of this type is the polarity of light and dark, from which colors arise. At this point the reductive explanation ends and the vision begins. The primordial phenomenon thus becomes a protective wall of qualitative knowledge against a reductionism that does not capture the vitality of phenomena.

Goethe was opposed to a dead, abstract explanation that did not do justice to the living experience of color. Because the phenomenon of color is inextricably linked to the human observer. He was not interested in physical reduction, but in color as it is perceived and felt. His theory of color is not an alternative to physics, but a science of perception that focuses on the unity between subject and object. His famous warning sums up this stance: *"Look for nothing behind phenomena, they themselves are the teaching."*

The Unity of Science, Art, and Spirituality

For Goethe and most of the Romantics, there was no clear separation between the search for truth and the search for beauty. For him, science and art were two sides of the same coin, inseparable and necessary for a full existence. Science recognizes the laws of the world, art expresses its deepest mysteries. In one of his most famous quotes, he summarizes this synthesis: He who possesses science and art, also possesses religion.

For Goethe, a deep and reverent connection to the world (spirituality) arises from the combination of accurate and patient observation of nature (science) with the creative power of imagination and feelings (art). The philosopher Pierre Hadot has aptly described this attitude as a modern form of the ancient "spiritual exercises": a conscious life in the here and now, which aims at a deep connection with the cosmos. It is the wisdom that Goethe puts into the mouth of his Faust at the peak of his search: Only the present moment is our happiness.

Humboldt: the man who conceived the world as a whole

Goethe, Novalis, and other Romantics inspired Humboldt's vision of a living, interconnected, and animated nature, which reveals itself to those who are willing to approach it with all their senses: reason, feelings, and imagination.

The unity of the world

Humboldt took precisely this holistic vision with him on his research trips around the world. From the smallest lichen on a rock in Chimborazo to global climate zones, he demanded that the world be seen as a coherent whole in which everything is interrelated. Humboldt's true innovation lay not in the discovery of new facts, but in the creation of a new epistemology—a form of knowledge—that consciously fused empirical data with aesthetic experience to counteract the fragmentation of reality brought about by the Enlightenment.

Humboldt's work can be seen as a bold attempt to found a science that understands nature not as a collection

of isolated phenomena, but as "a living whole," a dynamic, living system in which everything is connected to everything. A revolutionary attempt to bridge the gap between science, art and an almost spiritual respect for life.

The web of life: nature as "one life"

Humboldt's intellectual leitmotif can be summed up in one phrase: "Everything is interaction". This idea was a direct challenge to the tradition of Carl von Linné, which divided nature into static categories. Where Linné classified, Humboldt saw interacting forces. He described nature as a "web-like interwoven fabric" in which every detail, from the moss of a rock to the movement of the planets, only reveals its true meaning "in its relation to the whole." After his return from America, he formulated this idea in an almost poetic confession.

«... and in the forests of the Amazon River, as in the heights of the Andes, I understood how, animated by a breath, from pole to pole, a single life spills out on the stones, the plants and the animals, and on the beating chest of man."

For Humboldt, the world was a single pulsating organism, a dynamic system in constant metamorphosis, whose individual phenomena are inseparably intertwined. From this deep understanding of universal interconnectedness and from their experiences already described in Lake Valencia in Venezuela, another conclusion almost inevitably emerged: human beings are capable of destroying this delicate tissue. Off the coast of Venezuela, he observed how uncontrolled pearl fishing had depleted oyster beds and set off an ecological chain reaction. Long before the term "ecology" was coined, Humboldt was already thinking and arguing in ecological terms.

However, in order not only to understand this complex and multifaceted web of interrelationships, but also to make it visible to others, Humboldt needed a new method, a tool that went far beyond tables and dry descriptions. He invented the "Picture of Nature".

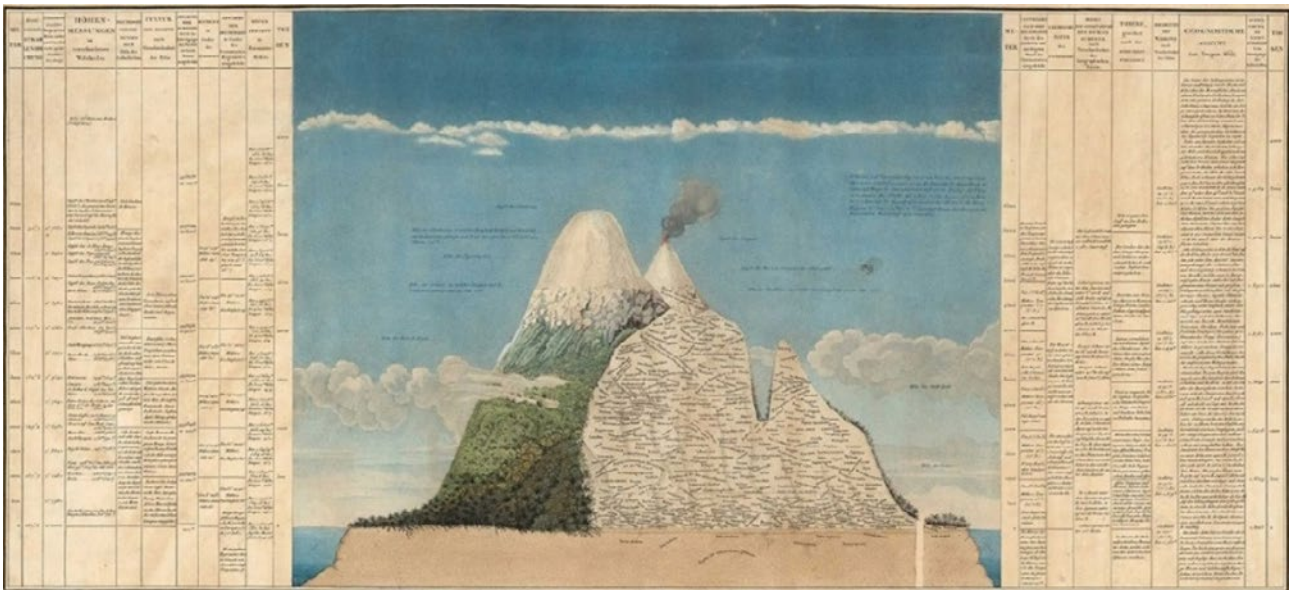
The "Picture of Nature": a new way of seeing the world

The "Picture of Nature" was Humboldt's revolutionary attempt to visualize his holistic philosophy. It was much more than a mere illustration; It was an intellectual tool, an innovative data visualization that aimed to make nature's hidden connections visible at a glance.

In essence, the "Picture of Nature" is a cross-sectional drawing of a volcano like Chimborazo, but it integrates a large amount of information into a single image. It overlays several variables (altitude, temperature, humidity, atmospheric pressure, plant species, magnetic intensity) into a single understandable graph. It showed correlations at a glance and allowed the observer to see how a change in one variable (altitude) directly affected all the others. Humboldt described his concept as a journey that "descends from the most distant nebulous spots and the double stars that revolve in space to the telluric phenomena of the geography of organisms (plants, animals and human beings)". For him, the most important thing about his entire company was precisely this representation of the "internal chain between the general and the particular".

The importance of this method cannot be underestimated. Humboldt was the first great scientist to systematically translate his discoveries into images. He had a deep understanding of the power of visualization and formulated it pragmatically: "people want to see." With his "Picture of Nature", he not only laid the foundations for plant geography and comparative climatology, but also for the entire modern scientific infographics.

But Humboldt's search for a new form of representation was not limited to images. He was convinced that the language of science also needed a renewal. To grasp the living and changing unity of nature, science had to re-recognize poetry as an instrument of knowledge.

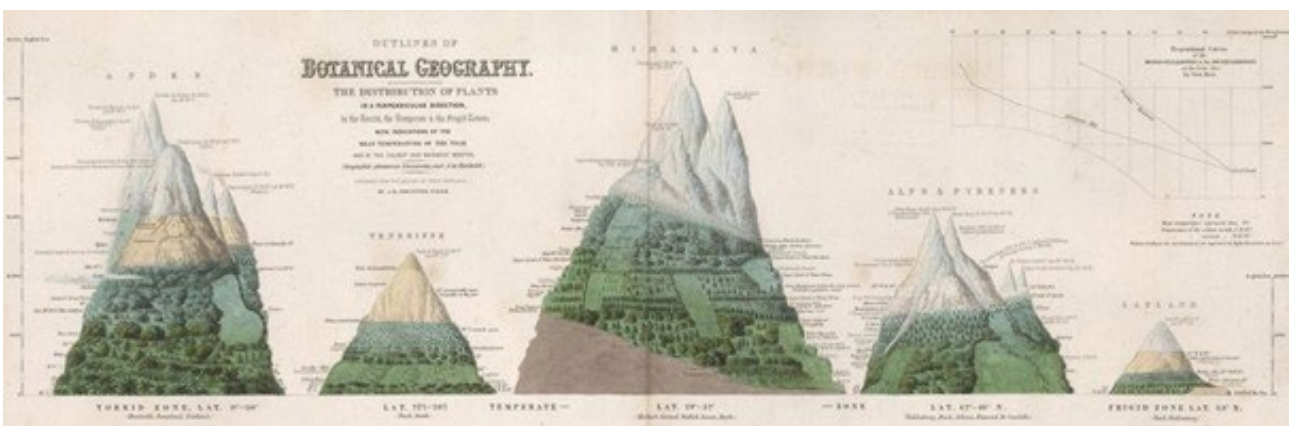


"Alexander von Humboldt's diagram 'Naturgemälde' (Painting of Nature)"

The Unity of Science and Art: Poetry as Knowledge

Long before the debate over the "two cultures"—the seemingly unbridgeable gap between the human sciences and the natural sciences—emerged, Alexander von Humboldt embodied its synthesis. He was deeply convinced that a purely analytical science could not grasp the essence of nature. To understand the living whole, not only exact measurements were needed, but also the emotional and aesthetic power of art. He wanted to combine the empirical rigor of the scientist with the soul of the poet, a skill that manifested itself even when he enjoyed his morning cup of coffee and affectionately described it as "concentrated rays of sunshine."

Intense conversations with the Jena Romantics encouraged him in his efforts to renew the alliance between philosophy, physics, and poetry, something that was taken for granted in antiquity. While scientific language could describe the mechanics of a phenomenon, only poetic language was capable of conveying the subjective experience, the feeling of reverence, and the emotional resonance of nature. He considered this to be an integral part of his truth.



Humboldt's representation of vegetation zones in different mountain ranges

The most impressive manifesto of this synthesis is his work Ansichten der Natur (Views of the Cordilleras and Monuments of the Indigenous Peoples of America). It was an entirely new literary genre, which covered precise scientific observations with vivid prose rich in images. Humboldt took his audience on a journey that, as the French writer Chateaubriand put it, gave them the impression of "riding with him on the waves and getting lost in the depths of the forests." I not only wanted to inform, but also to inspire and awaken a love for nature.

This harmonious combination of art and science was only possible for Humboldt because his understanding of nature encompassed a decisive dimension that was alien to purely objective science: he conceived of nature not only as an external object of study, but also as a profound space of resonance for the human soul.

Mirror of the soul: nature and the inner life of the human being

At the heart of Humboldt's humanistic science is the idea of a profound resonance between the outer world of nature and the inner life of the human being. He was convinced that nature maintains a "secret communication" with our feelings and that our perception of the world is inextricably linked to our state of mind. For him, this subjective dimension was not a disturbing factor to be eliminated, but a fundamental part of the process of knowledge.

He described this interaction with simple but striking images that show how external appearances reflect our inner selves.

"A light blue sky elicits different feelings than dark, low clouds."

This attitude differs radically from a science that insists on objective distance. For Humboldt, the description of nature was always also a "resonance mirror of the soul." His unique intellectual bridge consisted in uniting the two great movements of his time: the empirical method of the Enlightenment, with its demand for exact measurements, and intuition and feeling, as emphasized by Schelling's romantic natural philosophy.

Caspar David Friedrich - The Wanderer on the Sea of Fog

The definitive expression of this thought is his monumental late work Cosmos. In this "attempt at a physical description of the world", Humboldt deploys all his knowledge to present nature as a single and coherent whole. The Cosmos is more than an encyclopedia; it is an attempt to merge scientific knowledge, aesthetic experience, and a deep sense of inner wonder into one unity.

This holistic view, which understands the individual not as an isolated observer, but as an integral part of the web of life, led him consequently to a collaborative and deeply social understanding of science.

The Brotherhood of Knowledge: Humboldt's Vision for the Future

Alexander Von Humboldt did not understand knowledge as elitist private property, but as a common good of humanity that must circulate freely in order to grow. His vision of science was inextricably linked to the ideals of collaboration, open exchange and interdisciplinarity. He was perhaps the greatest networker of his time and regarded the world's scientific community as a "republic of scholars" without borders.

He actively founded a "brotherhood of sciences", seeking the collaboration of researchers from the most diverse disciplines and even artists. He was convinced that great discoveries are only possible by combining different perspectives. For Humboldt, the promotion of knowledge was above national interests. Science, according to his conviction, knows no borders.

Humboldt deploys all his knowledge to present nature as a single and coherent whole. The Cosmos is more than an encyclopedia; it is an attempt to merge scientific knowledge, aesthetic experience, and a deep sense of inner wonder into one unity.

In our current age, marked by ecological crises and increasing specialization, Humboldt's holistic approach seems as inspiring a correction as it is necessary. His legacy is not a collection of established facts, but an urgent methodological challenge: to have the courage to see the world not as a problem to be solved by specialists, but as a cosmos to be experienced in its entirety, with the rigor of science and the soul of a poet.

Conclusion: the legacy of the Cosmos, the eyes of a new era

Alexander von Humboldt was more than a tireless explorer. He was a visionary who aspired to a unified science that recognized the profound interconnectedness of all life, used art as a tool of knowledge, and established an indissoluble link between outer nature and the inner experience of the human being. He fought against the fragmentation of knowledge and tried to recover the lost unity of the world.

Humboldt's deep "web of life" marked subsequent generations: his writings inspired thinkers such as Charles Darwin, Henry David Thoreau, and John Muir, and prepared not only the theory of evolution, but also the modern environmental movement.

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The Great Mother archetype: from duality to unity

María Pashchevska

What archetype is and why do we investigate it?

Myths and symbols, as universal, timeless structures, did not remain in the past along with archaic people, but continue to influence modern human beings and their ways of cognition and interaction with reality. This is where the powerful force of archetypes manifests itself.

The connection between myths and consciousness is studied by philosophers, religious scholars, psychologists, and art historians. Neo-Kantian Ernst Cassirer discovered some fundamental structures of mythological thinking, such as the structure of the cosmos according to a single model of the duality of opposites, the "sacred" and the "mundane," on which mythical ideas about time and space depend. German psychologist Wilhelm Wundt studied the connection between dreams and the genesis of myths. This approach was further developed by representatives of Freud's psychoanalytic school. Swiss psychologist Carl Gustav Jung identified a common thread in myths and other manifestations of human imagination, which he attributed to collectively subconscious myth-like symbols –archetypes [1].

The term "archetype" comes from the Greek arkhetypon – "pattern, model, figure on a seal," formed from arkhē "beginning, origin, first place" and typos "model, type, mark of a blow" [2]. Following the Pythagoreans, this concept was later used by philosopher Plato and his disciples in the sense of eidos, "eternal ideas." In the Corpus Hermeticum, God is called τὸ ἀρχέτυπον φώς (archetypal light) [6, p.21]. Emphasizing the individual significance of the universal archetype, C.G. Jung says that "there are present in every psyche form which are unconscious but nonetheless active – living dispositions, ideas in the Platonic sense, that preform and continually influence our thoughts and feelings and actions." [6, p. 88].

"All rituals imitate a divine archetype", and their "continual reactualization takes place in one and the same atemporal mythical instant" [7, p.76], – notes Romanian historian of religion Mircea Eliade in his studies of magic, religion, symbols, and myths. He points to the loss of connection with sacred reality and primordial, mythological time by modern, non-traditional people. Celebrations, ceremonies, and myths as role models allow people to transfer between different levels of existence – the ordinary or mundane and the archetypal – while the higher mystical experience involves ascending from the personal god to the transpersonal, universal, such as archetypes [4].

By exploring mythical and religious texts and symbols through the concept of archetypes, we come to the search for a single core, a common idea that unfolds in a multitude of diverse forms, names, and motifs. This allows us to learn not only about the characteristics of a particular tradition, but also about the timeless inner nature of human beings as such. As by Laura Winckler: "to reflect on these models and understand, by analogy, the psychological behaviors and attitudes that stem from them is to hold a mirror up to our own inner reality. Invoking the gods is a way of connecting with this celestial and archetypal dimension, which can shed light on the path of our life" [8].

The Great Mother archetype through its duality and cyclical nature

Lo Maternal myths and cults have very ancient origins and are common to all humanity. The earliest evidence of worship of the Mother Goddess are female statuettes – the last Ice Age "Venuses," often decorated with various geometric patterns, among others the swastika. As Mircea Eliade notes, it was their discovery that has raised problems that are still being discussed, as it is currently impossible to determine the religious functions of these figurines [7]. Later ideas about the Mother Goddess are associated with the image of the primordial divine couple that gave birth to the universe.

The ambivalence of the goddess-mother's functions is manifested in her simultaneous creation and destruction, patronage of cities and wild nature, cosmos and chaos, giver of life and ruler of death [10, p. 178]. In his work "Archetypes and the Collective Unconscious," C.G. Jung points out that the archetype of the mother is almost immeasurable in its many aspects and manifestations. He cites several symbolic images that correspond to maternal aspects, such as a field, a cave, a spring, water, an oven, or a city, a church, a country – that is, things that give life and shelter. Ambivalent images are those associated with death and absorption, such as snakes, large fish, and manifestations of the elements [3, pp. 113-114].

Personifying nature itself, the goddess is associated with the cyclical nature of the vegetation world, the power of the earth and water. Agricultural cultures, as Eliade points out, create cosmic religions, because their activity is centered around the central mystery – the periodic renewal of the world [11, pp. 55-57]. "The fertility of the earth is bound up with feminine fecundity; hence women become responsible for the abundance of harvests, for they know the 'mystery'

of creation. It is a religious mystery, for it governs the origin of life, the food supply, and death." [7, p. 40].

A grain sprouts from the ground, matures, falls to the ground, and sleeps there until it is reborn. Just as the grain sleeps, so too does the deceased person of the ancient world sleep until their rebirth, buried in the form of an embryo and placed in a vessel – examples of this have been found in many parts of Asia [12]. Everything comes from the womb of Mother Earth and everything returns to it. We can recall how the personification of Maha Devi Sita from the Ramayana was found as a child in the ground, plowing it with a plow, and Sita immerses herself in the same ground, completing her earthly journey. The Egyptian Isis and Osiris, the Babylonian Ishtar and Tammuz, and the ancient Greek Cybele and Attis represent in this aspect the mystery of the earth and the eternal rebirth of the grain-ear.

In his Treatise on the History of Religions, M. Eliade traces the evolution of the image of the Great Goddess from Mother Earth, Tellus Mater, to the patroness of vegetation and harvest, and later to the protector of life and the one who can revive it, overcoming death [5, p. 299].

Elementary and transformative characters of the Feminine by Erich Neumann: the spiritual transformation

A structural analysis of the Great Mother archetype based on extensive mythological and psychoanalytical material was carried out by C. G. Jung's student Erich Neumann in his monograph "The Great Mother." He considers the concept of the "Great Mother" as a later, developed aspect of the ancient Archetypal Feminine, dividing the latter into two types: elementary and transformative.

The elementary type has characteristics related to self-containment, preservation, and nourishment, and is more passive and unconscious in relation to the "maternal." Whereas the transforming type of mother is associated with being active, confrontational, and going beyond the usual, there is something heroic about it, a challenge, a dialogue with the world, consciousness, and effort. The Archetypal Feminine dynamically unfolds from the inner circle of the elementary type to the transformative type, and along the four poles of archetypal ambivalence, expressed as the "Good Mother" and the "Terrible Mother," as well as the "positive transformative type" and the "negative transformative type." [Table 1]. The archetype of the "Great Mother" combines both aspects, positive and negative [13].

The axis "Good Mother" – "Terrible Mother" is characterized by the contrast between life and growth, outward liberation and decay and death, and self-restraint. Like a seed, buried in the womb of the earth and rising out of the darkness, consciousness sprouts from the darkness of the unconscious. The ambivalence of the transformative type has an opposite, which can be generalized as the pair "purification-dissolution." Fading and death will now have connotations primarily of madness as a psychic-spiritual death, characterized by dissolution, disappearance, destruction, and a psychic-spiritual extinction. The positive type corresponds to the spiritual transformation associated with purification, enthusiasm, inspiration, and can be expressed in poetic gift, everything mantic, religious, prophetic. At the individual level, this leads progression of the personality

Good Mother	Positive transformative type
Mother	Virgo
Vegetation mysteries	Inspiration mysteries
Negative transformative type	**Terrible Mother**
The Young Witch	The Old Witch
Mysteries of drunkenness	Death mysteries

Table 1. Simplified diagram of the dynamic structure of the Great Mother archetype according to E. Neumann.

and spiritual transformation of consciousness.

Although we see the pairs of opposites, the dynamic nature of the archetype allows a transition from one state to another. This is precisely what mysteries are: transformations that are revealed through mythological narratives and the characteristics of goddesses. By mysteries, Neumann means "not only the concrete and historical enactment of a mystery festival, as, for example, the Eleusinian mysteries, but, more generally, a psychic sphere common to all mankind" [13, p.71].

Durga india, Indian Durga, Egyptian Sekhmet, Anatolian Cybele: The Great Mother's double power

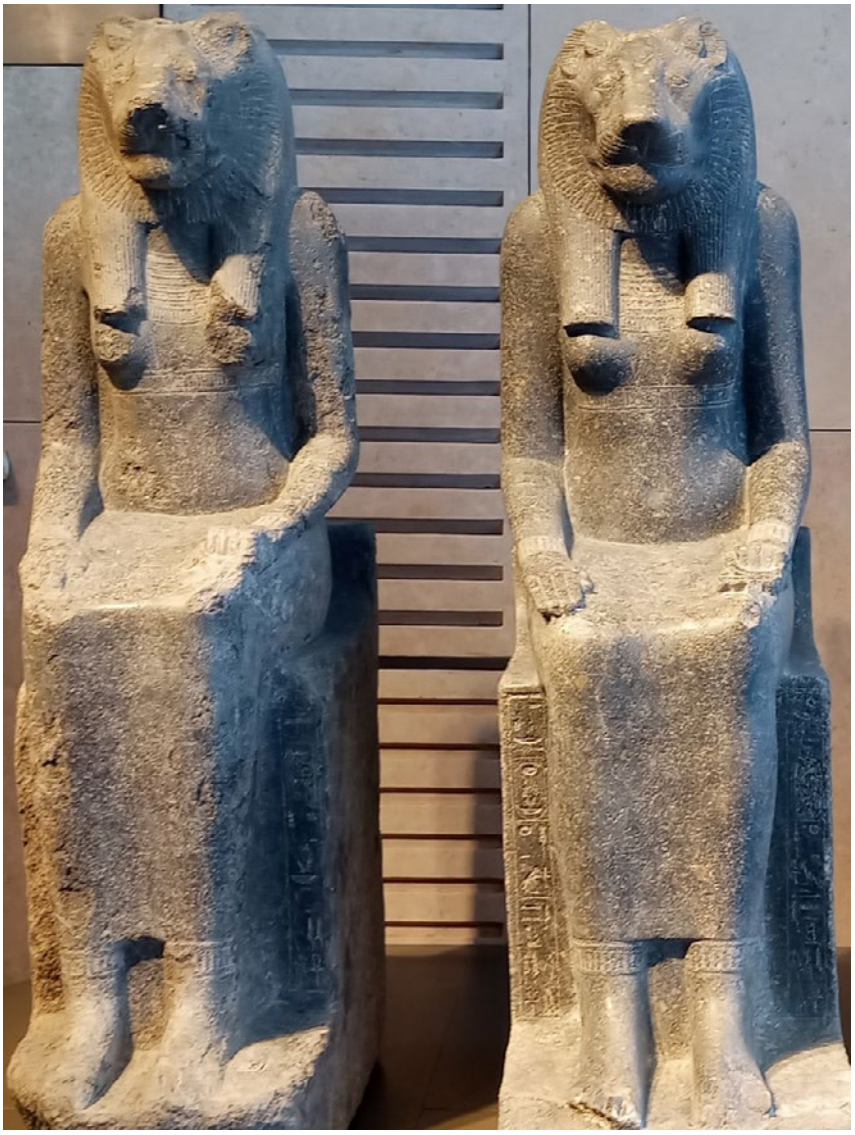
By analyzing the Great Goddesses who originated in different times and parts of the world – the ancient Indian Durga, Anatolian Cybele, the ancient Egyptian Sekhmet –

we can see a number of common characteristics, attributes, functions, and transformations that are typical to these goddesses and correspond with the archetypal properties of the Great Mother as described by Erich Neumann, Carl Jung, and Mircea Eliade.

Durga is "the one who is difficult to oppose," "inaccessible," and is often referred to as "Mother of the Universe" or "Universal Mother". "I am the power that manifests everywhere, I am life, I am death," says the Great Mother, Durga, in the Markandeya Purana [15]. Sekhmet is one of the most prominent goddesses of ancient Egypt and an archaic form of the mother goddess Hathor. Her name means "Mighty" or "She who loves Maat," that is, justice. In some ancient texts, she is referred to as "She before whom evil trembles," "The Mistress of dread" [16], and her image as the nurturer of kings bears her name as "The Mother of Pharaohs". The Great Mother of the Gods (Meter), the personification of the fertility of nature, Cybele (Kybele), sometimes Cybeba, "Mountain Mother" (Meter Oreia) was identified with Ceres, Demeter, Tellus, and Gaia [10]. The names of the goddesses themselves indicate their ambivalent power.

The most common aspect of the Great Mother is her personification of Mother Earth in all her life-giving manifestations. Sekhmet, in the hypostasis of Hathor, is the ruler of agriculture and fertility, as well as childbirth. Cybele represents the mother of Nature, vegetation, and motherhood. The Indian Durga had no direct connection to agriculture, but her rituals were aimed at purification and renewal of life on a cosmic level.

The transformative aspect of the Great Goddess is associated with blood as a symbol of life and death in their cyclical nature. To punish rebels against the gods, Durga takes on the form of the black Kali, and consumed by a passion for destruction, cannot drink her fill of blood and stop. Having



regained consciousness, she bathes in the river and returns from it in the form of Gaurī, bright and radiant. Kali and Gaurī are the wild and tamed forms of Durga [17]. Similarly, the merciful Hathor transforms into the formidable Sekhmet to restore justice, and when her goal is achieved, she returns to the form of Hathor, the goddess of love and the arts. The altar and statue of the goddess Cybele were sprinkled with blood. Her ceremonies are associated with Attis in the symbol of the ear of wheat, which dies and is reborn [9].

As patronesses of civilization and protectors of the city, goddesses have the attributes of royal power: a lion, a crown, and a throne. Durga rides a lion (sometimes a tiger) into a great battle with a demon [22]. Sekhmet herself is a lioness, depicted as a woman with a lion's head. Cybele is accompanied by one or two lions; less often, the goddess is depicted riding a lion [20]. Sekhmet's head is crowned with a solar disc with an uraeus, similar to the crown of the pharaohs. Cybele also wore a crown as a symbol of power. Cybele and Sekhmet share the symbol of throne on which the goddesses sit in numerous sculptural images. All three goddesses were revered by warriors and were patronesses of battles. One of the prayers to Kali also highlights her political aspect: "O Mother, let me remain with humanity, do not make me an impartial, indifferent ascetic" [21, p. 210].

It is interesting to notice the connection between goddesses and time. Just as Cybele is the wife of Kronos, the all-consuming god of time, Durga, in her incarnation as the black Kali, wife of Shiva, the god of destruction and all-consuming time, personifies the gloomy abyss of chaos that transcends time and space [22, p. 107]. In one of the ritual texts of the Temple of Horus in Edfu, we

find another identification with time: "O Sekhmet of yesterday, Wadjet of today, you have come and replenished this table of the Living Falcon..." or "Sekhmet of yesterday…Wadjet of today…protect the King with that papyrus of life which is in your hand, in this your name of Wadjet". The goddess Sekhmet is the divine and visible representation of sekhem, the original power that arose at First Time, the instance of creation [23].

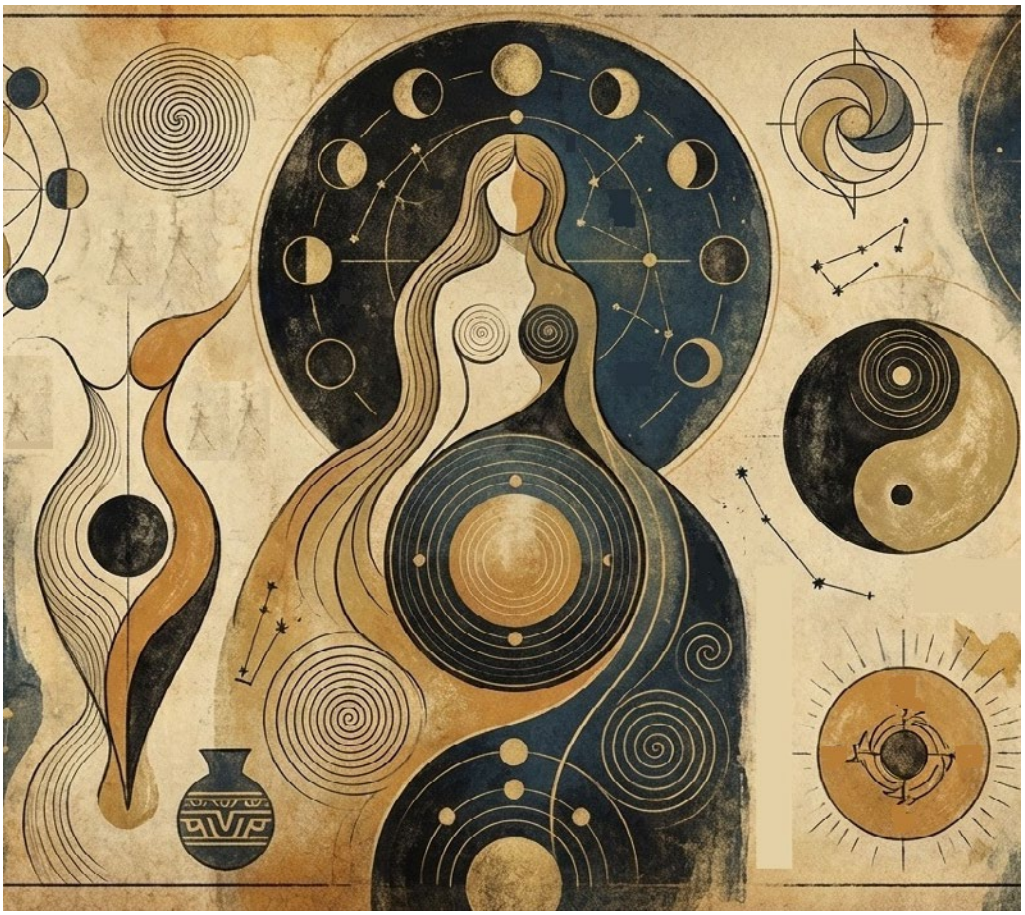
Referring to Erich Neumann's archetypal typology of manifestations of the Great Mother, we can conclude that archaic goddesses embody several types at once: birth and growing life, transformations of inspiration expressed through rituals with music and ecstatic states, as well as the mysteries of death and destruction, followed by purification and rebirth.

Overcoming duality and the birth of wisdom: Sofia, Hestia, Prajnaparamita

The Great Mother representing the Nature, the Matter manifests as a dual power. But there is another aspect of a Cosmic Mother, transcendent and non-dual. Representing the primordial Fire, Wisdom, Virtue, the goddess rarely had specific attributes, iconography or images being a spiritual principle. Nevertheless, the archetype takes a feminine form, of a mother: the mother of the gods, the mother of the buddhas.

Greek Hestia (or Roman Vesta) is far more than the goddess of the hearth. According to the Pythagoreans and presocratics, Hestia is the cosmic fire in the center of the Universe, and all other celestial bodies rotate around her [14]. "Philolaus has located the fire in the middle, the centre; he calls it Hestia, of the All, the house [policeipest] of Jupiter, and the mother of the Gods, the altar, the link, the measure of nature" [18].

Plato and Neoplatonists talk of Hestia as one of the principle or essential components of the cosmos itself, "the being of things" [19], "and in each thing that which is essential is the most ancient, as deriving its subsistence from the Hestia of beings" [25]. Being the center, "Hestia alone abides at home in the house of heaven"



[24] and is not involved into the mundane affairs or even stories of the Olympic gods.

Proclus describes Hestia as "the cause of the virtues" [26], and Homeric Hymn calls both Hestia and Hermes: "you two, well knowing the noble actions of men, aid on their wisdom and their strength" [27].

Prajnaparamita in Buddhism and Sophia (Wisdom) in the Old Testament both are considered to be the true nature of all phenomena, the true essence of all existences, the eternal mother that gives birth to all beings, and the transcendental wisdom leading to the ultimate Truth. This makes them symbolically related to Hestia.

The goddess Prajnaparamita embodies the perfection (paramita) of wisdom (prajna) that leads to Buddhist enlightenment; therefore, she is referred to as the "mother of all Buddhas" or Bodhisattvas [30]. The Sanskrit and Greek terms for "wisdom" – prajna-paramita and Sophia are equal. "Prajna" means "superior knowledge" (like jnana in the Bhagavad Gita), like "gnosis" [29]. Wisdom (sophia) and virtue (aretê) are closely bound up with one another.

Sofia is equated with the law (törä), Prajnaparamita is identified with Dharma. Both have existed from all times, are extremely pure, are compared to light. They dispense the waters of knowledge, and the "food of life", "the food of the ambrosial (deathless) Dharma". Sofia is the nurse and nourisher of those who desire immortal food [28]. Likewise, in the Protrepticus wisdom gives a share of immortality, and it is said of nous and phronesis that "this alone of our possessions seems to be immortal, this alone to be divine" [29].

As we can see, the Great Mother as a cosmic spiritual aspect goes beyond the pair of 'feminine-masculine' or 'anima-animus' in a human soul. It is no longer just about the transformation of the feminine archetype, but about the transmutation of human essence, the opening of the lotus of the heart-soul of every human being that leads to the liberation from the limits of the matter, and thus – overcoming any duality.

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Natural and artificial intelligence

A philosophical and anthropological approach

José Morales Sauces

Of God as God no image can be formed.
But can you form an image of the understanding,
of intelligence?, does it have any form?, is it not its activity
the most inconceivable, the most unrepresentable? God is inconceivable;
but do you know the essence of intelligence?

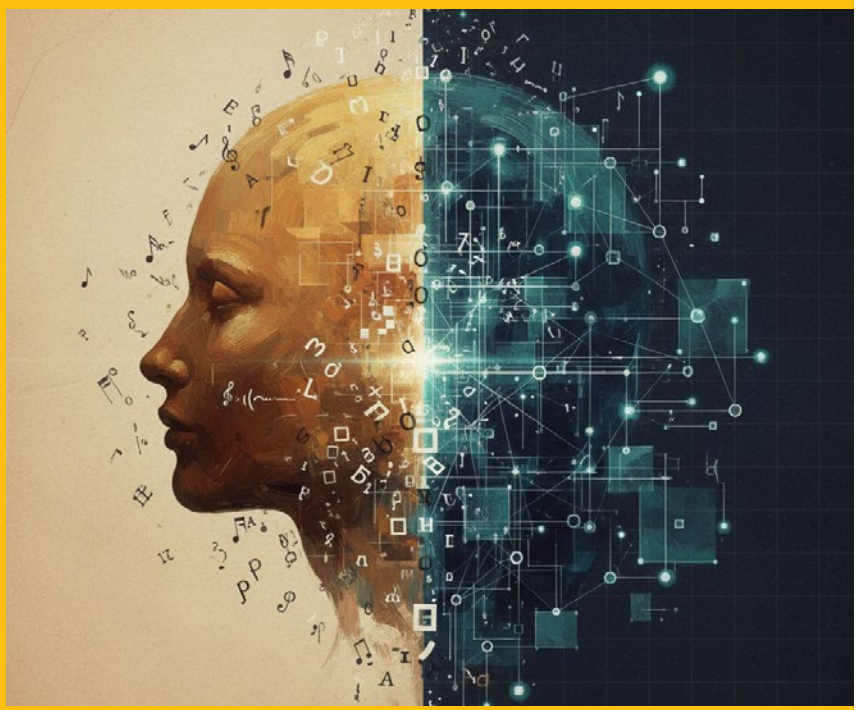
Ludwig Feuerbach

It is not the intelligence that thinks, but the person.
Mariano Yela

El The birth of the Internet (ARPANET) and the World Wide Web (WWW) in the seventies of the twentieth century marked a milestone that changed the way we communicate. The 21st century began with the massive expansion of access to the Internet, 5G networks, Big Data, smartphones, social networks or cloud computing. This meant an exponential leap in the treatment of information; but the real revolution came with the application of Artificial Intelligence (AI)[1]and Machine Learning (ML) models. Today, virtual assistants such as Siri or Alexa, automatic translation systems, chatbots, the Internet of Things (IoT), predictive analytics in industry and, above all, artificial intelligence systems such as ChatGPT, which generates responses in natural language, are very common. We are undoubtedly facing one of the pillars of the Fourth Industrial Revolution[2].

This leads us, from a philosophical and anthropological point of view, to ask ourselves if human beings have found a competitor who is surpassing some of their capacities associated with natural intelligence, such as thinking, reasoning, inferring, intuiting or even feeling; or we are simply dealing with a machine, a creation and extension of the human being, which executes computational processes by applying programming languages and mathematical algorithms.

It should be clarified that questioning the true scope of this revolution and its effects on human beings is not an exercise in neo-



Luddism[3], a critical current with the impact of digital technology, automation and artificial intelligence on society. It is a question of carrying out an analysis of whether the computational operations generated by AI models are "intelligent" processes, in imitation of this human capacity, or even, as its defenders claim, is a genuine intelligence that can surpass it.

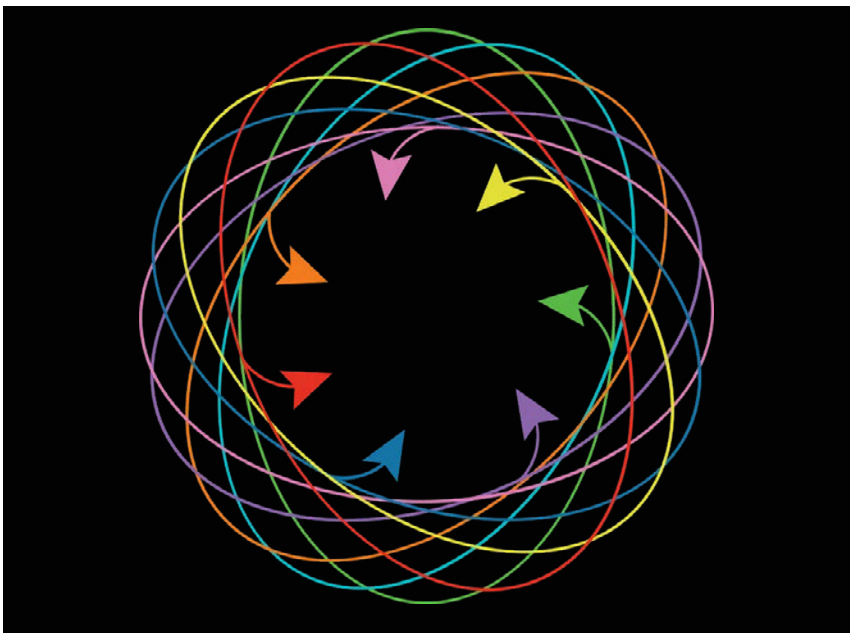
A problem of concepts?

The headlines used in the media or social networks to refer to AI and its capabilities express words that humanize it. They convey the feeling of being in front of an emerging power and that human beings are losing the battle with intelligent machines. This needs a conceptual clarification to address the new scenario.

When we give AI models capabilities such as intelligence, thinking, intuition, reasoning, etc., are we talking about the same capabilities that are typical of human beings or are we just performing a metaphorical exercise to identify and understand their internal processes? I believe that this is part of the conceptual confusion that we are experiencing about the scope and application of these models. Let's make an analysis through language that may help us understand it.

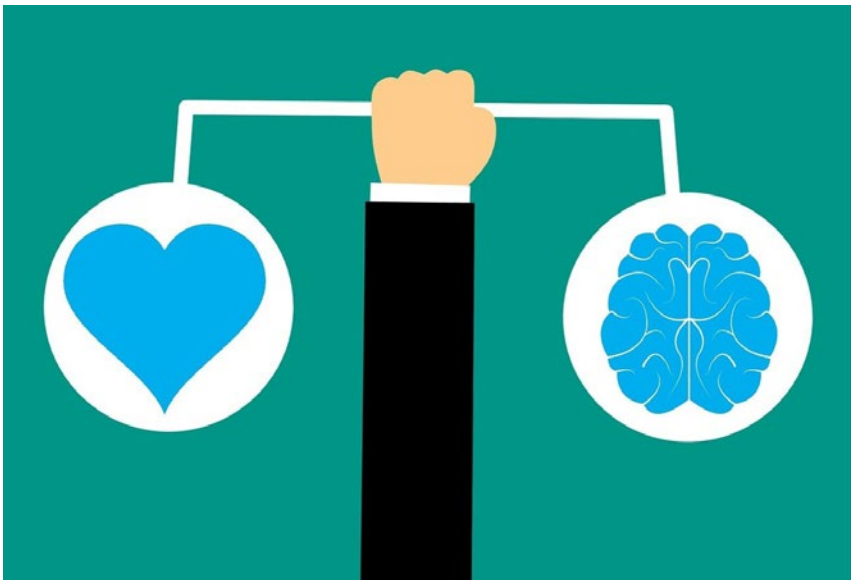
Language is one of the main features of humanization. Only the human being is capable of combining the signs at his disposal to manufacture meaning. The linguist Charles F. Hockett[4] speaks of fifteen defining features of natural language, of which he highlights those related to the production of meaning:

1. Semanticity: the sign corresponds to a particular meaning. It is a fundamental element of any method of communication.
2. Arbitrariness: there is no correlation between the signal and the sign. For example, the phonemes that create the word "nothing" in themselves have no relation to that concept.
3. Productivity: whereby a finite set of elements allows the generation of a potentially infinite number of semantically different messages.
4. Prevarication: the message may be intentionally false.
5. The existence of a metalinguistic function, by which language itself can refer to the form of what has been said, or speak of language itself



From this point of view, the diversity of nuances that we associate with the word intelligence can be expressed through the concept of "word-suitcase". Lewis Carroll, in his work Through the Looking Glass, presents a conversation between the characters Alice and Humpty Dumpty. Both conclude that there are difficult words that have two meanings that they call the suitcase-word. Later, Marvin Minsky[5], one of the fathers of artificial intelligence, in his speech "Consciousness is a big Suitcase", takes up the concept to talk about linguistic combinations or "double" ideas. It claims that we use words like intuition or consciousness like word-suitcase, as we use them to encapsulate our confused ideas about the mind, and it contains all sorts of mysteries that we can't yet explain. For example, he says that memory is a suitcase-word that we use to describe, or rather to avoid describing, dozens of different phenomena[6].

What is intelligence?



Ha Let's take a brief look at the interpretation that some authors made about the concept of intelligence, its meaning and scope.

Analysing the etymological origin of a word helps us to understand the richness, the variety of nuances it expresses and how it has evolved over time. In ancient Greek, several words are used to express "intelligence," each with different nuances depending on whether we use them in a philosophical, ethical, spiritual, or practical context. The main ones can be:

1. νόος (noos) / νοῦς (nous) – Mind, intellect, understanding. It refers to the ability to think, reason, or understand the divine and the human.
2. φρόνησις (phronēsis) – Prudence, practical wisdom. It is intelligence applied to the right action; Aristotle associates it with ethical virtue.
3. σοφία (sophia) – Wisdom. Closer to a deep or philosophical intelligence; refers to elevated knowledge.
4. σύνεσις (synesis) – Understanding, discernment. Ability to capture and relate ideas.
5. γνῶσις (gnōsis) – Knowledge, understanding. More focused on the knowledge acquired.
6. ἐπιστήμη (epistēmē) – Science, systematic knowledge. It is a more structured way of knowing as rational knowledge.

In Latin, the word intelligence comes from the Latin intelligentia, derived from the verb intellegere, which means 'to understand' or 'to perceive'. The verb is composed of inter and legere ('to read' or 'to choose'), which can suggest the ability to interpret or discern about a fact, circumstance or experience. The Sanskrit concept of "Viveka" also has an aspect related to intelligence; that of seeing clearly what is essential, what is true.

In the Middle Ages, the Latin term intellectus, especially in scholastic philosophy, referred to compression and was used to speak of the soul, immortality, and the active intellect. It was used to refer to the mind's ability to understand reality; as in the Latin phrase "Adaequatio rei et intellectus" (adequacy between the thing and the intellect), which describes truth as a correspondence between the mind and the object. This theory, also known as the theory of correspondence, was held by St. Thomas Aquinas[7], being reformulated in the twentieth century by Alfred Tarski to apply it to formal languages.

The word intelligence made its first appearance in scientific texts thanks to Francis Galton[8] (1822-1911), who considered intelligence to be hereditary, being one of the first scientists to give it a systematic and quantifiable treatment. His studies influenced the subsequent development of intelligence tests. In the twentieth century, psychologist Alfred Binet[9] introduced the concept of intelligence quotient (IQ) as a measure of human intelligence. Later, Howard Gardner proposed his theory of multiple intelligences[10], expanding the concept to dimensions such as music, space or interpersonal, among others.

The German thinker Hans Magnus Enzensberger[11] goes to the roots of the concept of intelligence and traces its historical evolution in European languages. List the terms we use to qualify intelligence or lack thereof. Enzensberger says that "anyone who wants to be considered modern

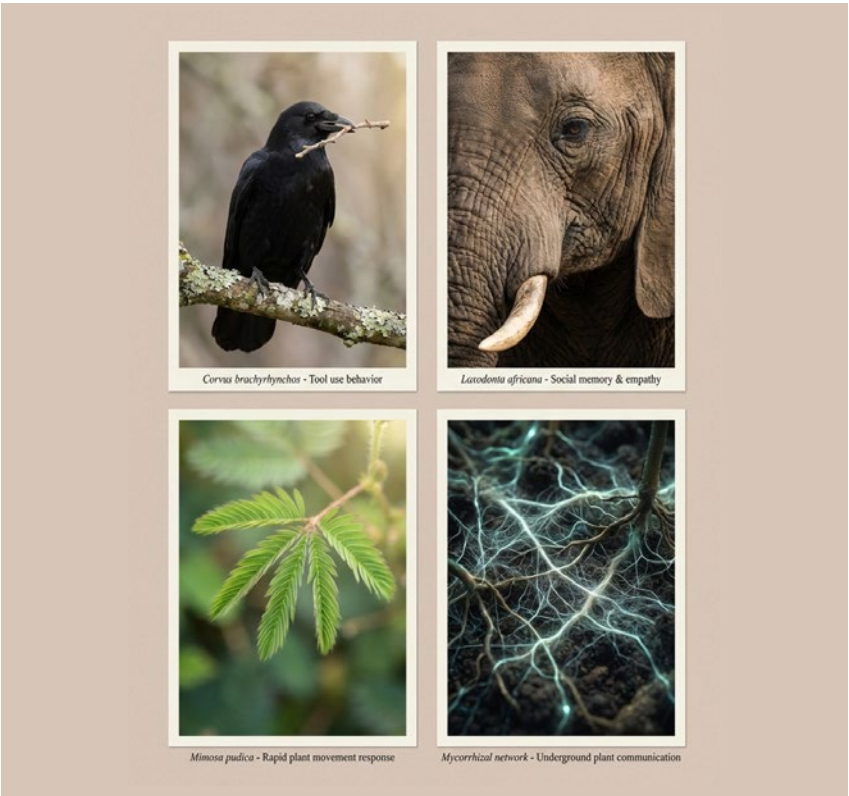
must necessarily be intelligent. Some people who value this quality are surprised when they hear the statement that no one knows exactly what that is: intelligence." From the container of intelligence as a concept come many nuances that enrich that quality. They appear, says the author: the reasonable, the understanding, the insightful, the wise, the high-thinking, the profound-thinking, the gifted, the clairvoyant, the brilliant-minded, the quick of reflexes, the judicious, the subtle, the punctilious, etc. A huge repertoire of expressions that show that intelligence is not something that can be taken lightly.

The American psychologist Robert Sternberg[12] states that intelligence is the ability to adapt, select or transform the environment to achieve goals, it is not reduced to the result of a single IQ test, but is manifested in three types: analytical, creative and practical. For Lev Vygotsky[13], intelligence is built through social interaction, with language being the fundamental psychological tool that allows us to internalize knowledge and mental activities. Philosopher Martha Nussbaum[14] highlights the importance of emotional and ethical intelligence as the basis for global and compassionate citizenship. It encourages the development of the capacity for empathy and imagination to understand the perspective of others.

The problem becomes even more complex if we incorporate the presence of intelligence in animals and plants into the debate. It is not a peaceful issue. Once again, we find ourselves with the need to define what intelligence is, if it is present, even primarily, in the adaptive behaviors of elephants, primates, crows or plants. Emmanuelle Pouydebat, in her book on animal intelligence, states that "the idea that humans are more intelligent than other species is a priori strongly rooted in the minds of many people, regardless of whether they are experts or laymen. Of the vertebrates, the most intelligent are mammals and birds, and of the mammals, apes, elephants, and cetaceans are considered to be the most intelligent."[15] But to what extent do these criteria conform to reality? Is it possible to compare something like intelligence between such different species?

Intelligence, says the author, is a concept that cannot simply be applied to the animal world, since its definitions respond to human semantic criteria, and, like most of them, relate intelligence and language. What they are for, if anything, is to evaluate human intelligence. In this context, the comparison between human and animal intelligence would have to focus on the ability to adapt.

Writer and naturalist Jennifer Ackerman, on the question of bird intelligence, states: "Scientists who study animals tend to avoid the term intelligence, because of the human connotations it carries... In his research on animals, Aristotle wrote that animals exhibit elements of our "human qualities and attitudes," such



as "docility or ferocity, gentleness or harshness, courage or cowardice, fear or daring, passion or malice, and on the intellectual plane a certain sagacity." On the other hand, if you dare to suggest that birds currently possess something similar to human intelligence, consciousness, and subjective sensations, they may accuse you of anthropomorphizing or interpreting the behavior of a bird as if it were a human being dressed in feathers."[16]

Stefano Mancuso, botanist and researcher in plant neurobiology, has dedicated his work to research on intelligence in plants. After decades of experiments, plants are beginning to be considered beings capable of calculating, choosing, learning and memorizing[17]. Mancuso says that plants talk to each other, they recognize their relatives; There are, as in the animal kingdom, opportunistic, generous, honest, deceitful plants that reward those who help them and punish those who try to hurt them.

Characteristics of intelligence, such as learning and memorizing, are present in plants. Mancuso designed an experiment in which he repeatedly dropped pots with Mimosa pudica from a height of 15 cm. At first, plants closed their leaves in response to the stimulus. But after several repetitions, they stopped reacting by closing their sheets. After a few days, the plants were still remembering that the stimulus was not harmful. That is, they had memorized the experience.

Artificial intelligence

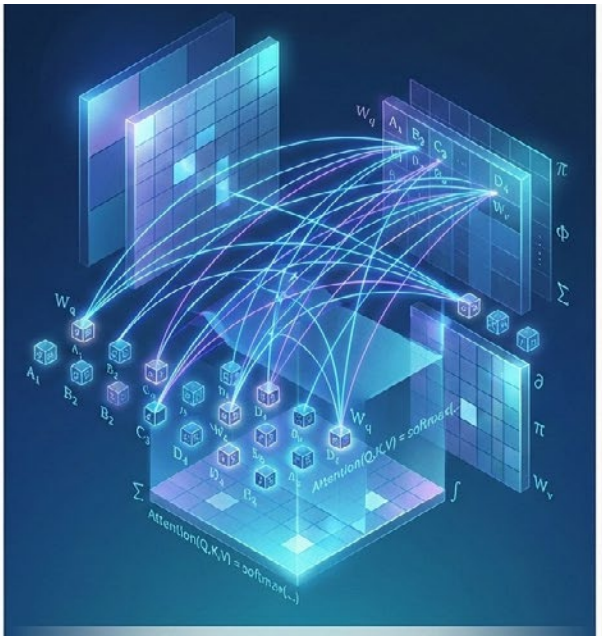
The term "artificial intelligence", as I have already pointed out (see note 3), was coined by John McCarthy[18] at the Dartmouth Conference, held in the summer of 1956 at Dartmouth College (New Hampshire, USA). This academic event is considered the beginning of artificial intelligence as a scientific discipline and was attended by figures such as Marvin Minsky, Claude Shannon and Nathaniel Rochester. According to the conference proposal paper, the study would be based "on the conjecture that every aspect of learning or any other feature of intelligence can, in principle, be described with such precision that a machine can simulate it."[19] They wanted to figure out "how to get machines to use language, form abstractions and concepts, solve kinds of problems that are currently reserved for humans, and improve themselves." The forecasts of advances in AI did not materialize as their creators had predicted. Project funders found results to be disappointing in general programmes; those that tried to emulate aspects of human brain activity. The field of AI went through a period that has been dubbed the "AI winter".

Erik Larson, a computer scientist and author of the book The Myth of Artificial Intelligence[20], says that during the 1970s and 1980s, attempts to control or solve the common-sense knowledge problem dominated AI research efforts. The emergence of the World Wide Web spurred the resurgence of AI due to the increased availability of massive data sets. "Supervised learning algorithms such as artificial neural networks, decision trees, and Bayesian classifiers had existed for decades in university labs. But, without extensive data sets, they had not yet revealed their potential in problems of interest such as facial recognition, text classification, spam or fraud detection."

On the term "artificial intelligence," John Haugeland[21] proposed that machine-generated intelligence be called synthetic intelligence (SI), an alternative term to artificial intelligence that indicates that machine intelligence does not have to be an imitation or in any way artificial; it can be a form of authentic intelligence. He drew an analogy with synthetic diamonds and rhinestones: only the synthetic diamond is a real diamond.

AI challenges human intelligence

After the first quarter of the 21st century and after the advances made in the application of generative AI, the question that is present in many debates is whether it has reached human intelligence. Have we reached a strong or general AI (AGI), in which a machine is truly intelligent and self-aware, or are we just dealing with weak AI, in which computer systems simulate intelligent behaviour? What ethical implications does this have?



These questions have found different answers from researchers in artificial intelligence. Ray Kurzweil, Google's former director of engineering, in his book The Age of Spiritual Machines, predicted that machines could pass the Turing Test[22] in 2029: "By 2029, computers will pass the test, although the validity of the tests remains a point of controversy and philosophical debate." Sam Altman, CEO of OpenAI, believes that general AI is close and that it could surpass humans in many intellectual tasks in the next decade: "If artificial intelligence can do a whole job autonomously, then we are already facing what they call Artificial General Intelligence."[23] Geoffrey Hinton, a Nobel laureate in physics and pioneer of deep learning, helped develop modern AI and expressed concern about its potential uncontrollability: "Most tech leaders publicly downplay the dangers of AI." Yoshua Bengio, a leading researcher in AI and neural networks, believes that AI should be strictly regulated and should not surpass human intelligence without ethical safeguards. Yann LeCun, chief AI scientist at Meta (Facebook) believes that AI can reach human levels in certain areas, but he does not see a total surpassing of human intelligence imminent.

Erik Larson argues that many of the promises about AI—especially so-called general AI, or AGI—are based more on futuristic speculation than real science. He denies that AI is close to matching human intelligence. He argues that current systems, such as those based on machine learning (ML), lack the capacity for true inference, which is essential for human thought. Larson, a critic of the fireworks of Strong AI, believes that "the general (not weak) intelligence of the kind that we all exhibit on a daily basis is not due to any algorithm running inside our heads, but rather draws on the totality of the cultural, historical and social context from which we think and act in the world". Bill Gates told the Next Big Idea Club that GPT-3-type large language models (LLMs) are like a "stochastic parrot."[24] They can generate text that seems coherent, but without a true understanding of what they are saying, which would reinforce John Searle's hypothesis. Gates argued that while these AI systems are highly adept at mimicking human language, we are still far from developing an AI that truly understands and reasons like a human being.

A "mystery" behind ChatGPT

We like mystery, feeding words into the uncertainty of a code execution process behind a digital backdrop.

Something like the stage of John Searle's experiment[25]. The Chinese Room was a thought experiment that Searle proposed in his paper Minds, Brains, and Programs, published in Behavioral and Brain Sciences in 1980, through which he tried to refute the validity of the Turing test and the belief that thought is simply computation.

ChatGPT, or any other great language model (LLM), has revealed itself almost like a new oracle. We enjoy asking questions in the form of a prompt, an instruction or input that is given to an artificial intelligence system, after which we hope that it will generate an answer that meets our expectations.

Browsers such as Google Chrome or Bing answer our questions by selecting information using keywords and semantic searches, offering the best result in the first place. Generative AI systems such as ChatGPT or Copilot answer our questions using natural language, through a direct and clear answer, without the need for us to dive into hundreds of websites.

Let's see how ChatGPT explains how it works:

ChatGPT works by combining artificial intelligence and natural language processing (NLP), generating text as a human would. ChatGPT (based on the GPT-5 model) was trained with huge amounts of text data from the internet, books, articles, code, conversations, etc. The model learned language patterns, relationships between words, and how people structure ideas and arguments. In essence, ChatGPT predicts the next word in a given sentence. For example: "The sky is colored...". The model predicts that the next most likely word is "blue." By doing this millions of times with different contexts, ChatGPT learns to generate coherent and relevant responses. It uses transformers techniques, a neural network architecture designed to understand complex relationships between words. This allows you to understand nuances of language (irony, context, emotions) and respond with structured texts, such as explanations, summaries, or code. Do you want me to explain it to you with a simple analogy (for example, as if I were a person learning to speak) or in a more technical way (mathematical and algorithmic)?

Statements such as "generate text as a human being would", "trained", "learned", "predicts", "understand", etc., are surprising. The question we can ask ourselves is: why does the ChatGPT system use words typical of human creativity or intelligence to express the internal execution of programming languages, mathematical models and algorithms? It is evident that there has been a "humanization" of computational processes, perhaps for didactic purposes, through the use of metaphors and allegories, perhaps seeking to generate expectations for the future arrival of Artificial General Intelligence (AGI).

The natural language generated by ChatGPT is the result of the execution of several processes: one derived from the application of programming languages[26] such as Python, which is the base language of its system; C++, which is used for performance-critical tasks; CUDA, an NVIDIA technology for hardware acceleration using GPUs; Go, which is used to handle multiple user requests simultaneously; and Rust, which reduces bugs that can compromise ChatGPT's stability. Also involved are several libraries specialized in working with deep neural networks, such as TensorFlow and PyTorch, which allow ChatGPT to learn from vast amounts of data and improve its ability to generate text. The other vital process is machine learning (ML), which has set a milestone in artificial intelligence and natural language generation. Processes such as tokenization[27] or attention mechanisms such as the Transformers architecture[28] have been fundamental to these advances.

Determinism or non determinism in ChatGPT

The question we can ask ourselves, once we know the internal computational processes of ChatGPT, is: where is the "intelligence" of this system? Any programming language follows a strict and regulated syntax, deterministic in its results. However, ChatGPT developers and users attribute this "intelligence" to the fact that this system is not deterministic; Faced with the same question, he will not always give the same answer, so it is necessary to attribute to him an intelligent, understanding, reasoning process, etc., such as that attributed to human beings.

Researcher Adam Fletcher[29] gives an explanation for ChatGPT's alleged non-determinism . He says that large language models (LLMs) typically exhibit non-deterministic behavior, generating slightly different results even with the same inputs. He claims that an AI model follows strict mathematical principles, but the actual execution of these calculations introduces some variability. Machine learning (ML) models use numbers with decimals, which leads to precision limitations that can lead to small rounding errors during calculations. This will cause effects on the output text and the user will get slightly different answers if we repeat the same question to the system.

Ethical debate on AI

The advances in the use and development of AI in our society have clear ethical implications that have been addressed by the European Union. In 2019, the European Commission approved a series of ethical guidelines for the use of trustworthy Artificial Intelligence. These guidelines are based on seven key requirements that artificial intelligence systems should meet in order for it to be considered trustworthy:

1. human action and oversight,
2. technical soundness and security,
3. privacy and data management,
4. transparency,
5. diversity, non-discrimination and equity,
6. social and environmental well-being and
7. accountability.

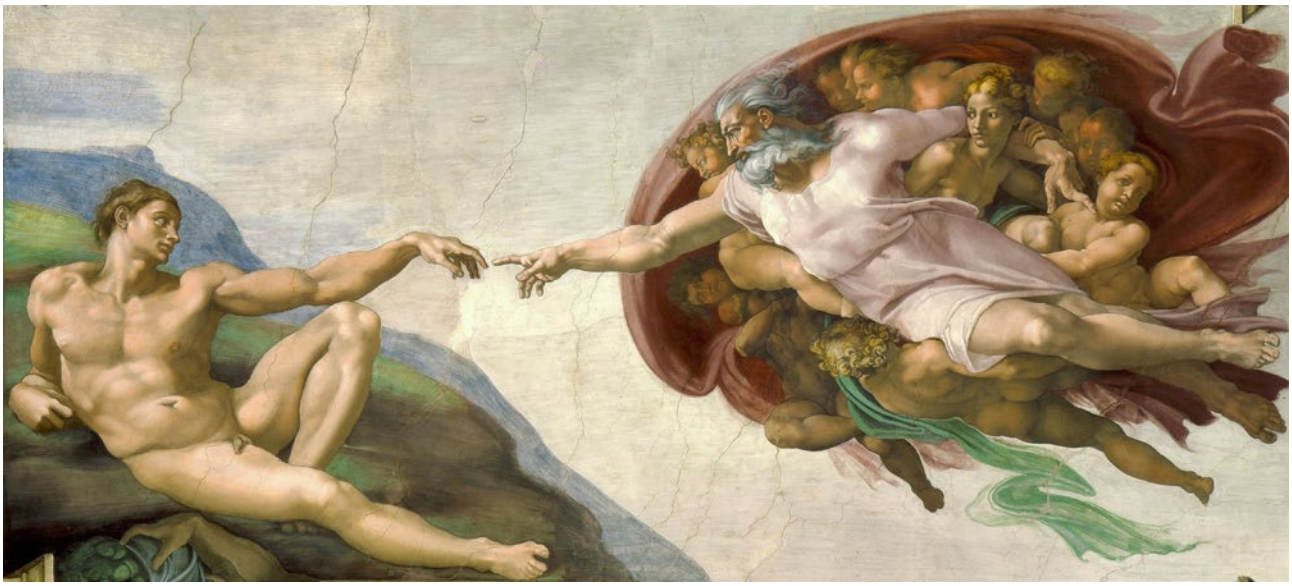
In 2020, the European Commission published the White Paper on Artificial Intelligence[30], which highlights the need for the development of artificial intelligence to be carried out on the fundamental values and rights of human dignity and the protection of privacy. Also important is the Toronto Declaration[31], which outlines a series of principles based on human rights and establishes the duty of States to prevent discrimination in the design or implementation of machine learning systems in public and private contexts.

AI ends where human creativity begins

In 1996, the Deep Blue computer, from the IBM company, beat the all-powerful chess player Garry Kasparov in a chess game. Years later, Kasparov wrote an interesting book entitled Deep Thinking[32], where he expressed with remarkable brilliance the opportunities of the human-machine challenge: "We have other qualities that machines cannot match. They have instructions, while we have purposes. Machines cannot dream, not even if we put them in sleep mode. Humans can, and we need our smart machines to turn our biggest dreams into reality. If we stop having big dreams, if we stop looking for a greater purpose, then we ourselves may be the same as machines."

We can conclude that the texts generated by AI systems are not the result of calm reasoning, but the result of rounding in mathematical operations and the choice of the most likely word next. It is more a simulation of intelligence than a conscious intelligence. Large language models (LLMs) still can't understand a joke or metaphor in the same way that a human does, as they lack the cultural context and emotional nuances needed for true understanding. They do not "see" as we see, nor do they "think" as we think; however, they show capacities that, like animals or plants, reflect certain aspects of intelligence as a general concept. The challenge is to understand and integrate this "new kingdom of nature" into our world.

They do not "see" as we see, nor do they "think" as we think



Notes

1. The term artificial intelligence was coined by John McCarthy at the Dartmouth Conference, held in the summer of 1956 at Dartmouth College (New Hampshire, USA).
2. The Fourth Industrial Revolution, or industry 4.0, is a term coined by Klaus Schwab, founder of the World Economic Forum, in 2016, after the previous revolutions (mechanization, electricity and computing).
3. Luddism has its origins in the semi-legendary figure of Ned Ludd or Ned Ludlam, a weaver who, towards the end of the eighteenth century, supposedly destroyed a power loom in protest. Their name was adopted as a symbol of the movement, and followers called themselves "Luddites". Today, "luddita" is used (sometimes figuratively or even pejoratively) to refer to someone who rejects or distrusts new technologies. Their concerns are similar to those of the Luddites: job losses, dehumanization, and concentration of economic power.
4. Charles F. Hockett (1916–2000) was an American linguist who was highly influential in the development of twentieth-century structural linguistics.
5. Marvin Lee Minsky (1927-2016) was an American scientist considered one of the fathers of artificial intelligence. He participated in the Dartmouth Conference (1956), where John McCarthy coined the term "artificial intelligence".
6. Consciousness is a big suitcase | Edge.org. (n.d.). https://www.edge.org/conversation/marvin_minsky-consciousness-is-a-big-suitcase?utm_source=chatgpt.com
7. Thomas Aquinas used this phrase to define truth in his work Summa Theologiae: "Veritas est adaequatio rei et intellectus" ("Truth is the adequacy between the thing and the understanding"). This definition appears in the Summa Theologiae, Part I, Question 16, Article 1.
8. Galton, F. (1869). Hereditary genius: An inquiry into its laws and consequences. Macmillan and Co. Retrieved from https://galton.org/books/hereditary-genius/
9. Alfred Binet (1857-1911) was a French psychologist known for developing the first intelligence test, the Binet-Simon Scale, together with his collaborator Théodore Simon.
10. Theory of multiple intelligences (1983): Gardner proposed that intelligence is not a single general ability, but a set of distinct modalities. Its original list included: linguistic, logical-mathematical, musical, bodily-kinesthetic, spatial, interpersonal, intrapersonal, and naturalistic (added later). This theory challenged traditional IQ tests and inspired more holistic approaches in education.
11. Enzensberger, H. M. (2019) The Labyrinth of Intelligence: A Guide for Idiots. Translation by Francesc Rovira. Editorial Anagrama.
12. Sternberg, R. J. Beyond IQ: A Triarchic Theory of Human Intelligence. Cambridge University Press, 1985.
13. Vygotsky, L. S. Thought and language. Trans. Francisco Martínez. Paidós, 1995.
14. Nussbaum, M. C. Cultivating Humanity. Harvard University Press, 1997.
15. Pouydebat, E. (2018). Animal intelligence: plovers' heads and elephants' memories. Editorial Platform.
16. Ackerman, J. (2017) The ingenuity of birds. Translation by Deza Guil, G. Editorial Ariel. p. 33.
17. Mancuso, S., & Viola, A. (2015). Sensitivity and intelligence in the plant world (D. Paradela López, Trans.). Gutenberg Galaxy. Retrieved from https://www.galaxiagutenberg.com/wp-content/uploads/2015/02/Sensibilidad-e-inteligencia_web.pdf
18. John McCarthy (1927-2011) was a mathematician who received the Turing Award in 1971 for his contributions in the field of artificial intelligence. He is also credited with the concept of cloud computing .
19. McCarthy, J., Minsky, M. L., Rochester, N., & Shannon, C. E. (1955). A proposal for the Dartmouth summer research project on artificial intelligence. Dartmouth College. Retrieved from http://jmc.stanford.edu/articles/dartmouth/dartmouth.pdf

20. Larson, E.J. (2022). The myth of artificial intelligence. Shackleton Books.
21. John Haugeland was an American philosopher, specializing in philosophy of mind, cognitive science, phenomenology, and Heidegger. Haugeland, John (1985), Artificial Intelligence: The Very Idea, Cambridge, Mass.: MIT Press.
22. Turing test. A procedure proposed by Alan Turing in 1950 to determine whether or not a system (usually a computer) has reached the human level of intelligence, on the basis that the questioner believes that it is a human being.
23. Moreno, L. (2025, May 15). Interview with Sam Altman, executive director of OpenAI: La Vanguardia. https://www.lavanguardia.com/neo/20250515/10682934/sam-altman-director-ejecutivo-openai-inteligencia-artificial-trabajo-forma-autonoma-frente-llaman-inteligencia-artificial-general.html
24. In machine learning, the term stochastic parrot is a metaphor, introduced by Emily M. Bender and colleagues in a 2021 paper, describing large language models as systems that statistically mimic text without actual understanding.
25. John Searle was an American philosopher and university professor. He was a professor of philosophy at the University of California at Berkeley, and is celebrated for his contributions to the philosophy of language, the philosophy of mind and consciousness.
26. Navarro, S. (November 8, 2025). Find out what programming language ChatGPT uses. keepcoding. https://keepcoding.io/blog/el-lenguaje-de-programacion-que-usa-chatgpt/
27. In AI, a token is a basic unit into which text is broken down so that a model can process it. They are pieces of data, such as words, subwords, characters, or even punctuation marks.
28. Transformers are a type of artificial neural network. They are the core architecture behind models like ChatGPT (GPT-5). They work like a big mathematical machine that takes tokens, converts them into vectors, and probabilistically decides which is the next most coherent token.
29. Adam Fletcher, Ph.D and Consultant Data Scientist at Equal Experts. He poses non-determinism as a problem, since there can be no exact and repeated results in the face of the same question.
30. Fletcher, A. (2025, November 9). Non-determinism in AI: Why answers may vary. Equal Experts https://www.equalexperts.com/blog/data-ai/non-determinism-in-ai-why-answers-may-vary/
31. European Commission, White Paper on Artificial Intelligence - a European approach toexcellence and trust, Brussels, 19 February 2020, COM(2020) 65 final.
32. Toronto Declaration on Protecting the Rights to Equality and Non-Discrimination in Machine Learning Systems, 16 May 2018, accessed in https://www.accessnow.org/cms/assets/uploads/2018/05/Toronto-Declaration-D0V2.pdf.
33. Kasparov, G. (2017). Deep Thinking. Where artificial intelligence ends and human creativity begins. Teell Editorial. Garry Kimovich Kasparov (born April 13, 1963 in Baku) is a Russian chess grandmaster, politician, and writer.