

PRESENTATION

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A REFLECTION upon the nature of human knowledge has always accompanied the history of philosophy. From the pre-Socratic thinkers up to Kant and to contemporary neuroscience we speculate about what we can know and how we can know. This is nothing but to question about human intelligence and the ways it works. Throughout the development of human thought, there have been different forms of understanding intelligence. We have associated it to our rational activity, but also to the exercise of affects and feelings. In recent times we have questioned whether intelligence is a strictly human property or, on the contrary, if we share it with other subjects, including animals and even machines. Those who postulate or believe that the world has a transcendent Foundation which gives reason for the whole of reality, usually think of that Foundation in terms of an Intelligence. In so doing, by qualifying nature as 'intelligible' believers often mean that nature reflects the Intelligence from which it proceeds; from a more general viewpoint, when speaking of nature's intelligibility, we underline the human mind's capacity to understand the natural phenomena and reproduce them, relying upon the rationality they embody. It is common to refer to animals, particularly those which exhibit a brain activity and neural networks, as the subject of some form of intelligence, including memory and decision-making. Since the second half of the 20th century, the term intelligence has come to be associated with computer machines and the way they work, especially emphasizing the ability they have to learn from the environment, elaborate a big amount of collected data, acquire new knowledge from the feedback of their own operations. To talk about intelligence means to talk about human beings, but also to talk about nature, living beings and, to some extent, even about machines. Finally, for a non-negligible number of authors, talking about intelligence also means to talk about God. It is not surprising, then, that around the notion of intelligence we can engage a rich and exciting dialogue among anthropology, philosophy, physiology, computer science, zoology, natural sciences, and theology. The number of disciplines here involved is quite large, perhaps greater than those usually involved in the study of

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other long-thought interdisciplinary notions, such as the notion of nature, or that of natural law.

In the rich grid of comparisons and relations the term intelligence generates, it is of special interest to study whether human intelligence has any specificity at all. The contexts in which such a specificity should be examined concern comparisons between the human beings and the other living beings, between the human beings and the computer machines, without forgetting that the latter have been designed and built by the humans. There are certain notions that can help to address and guide correctly those comparisons, because of their philosophical import and rootedness in the human life. These include, among others: freedom, will, creativity, planning, intuition, foresight, memory, but also, on a higher plane, responsibility, awareness, consciousness, and sacrifice.

From this complex and attractive state of affairs the idea comes of preparing a new Monographic section of «Acta Philosophica», dedicated to exploring the relationship between human, animal and artificial intelligence, analyzing in particular the notion of creativity. The present issue has been conceived and promoted by the researchers of the DISF Research Center in Rome. This Center is usually engaged in studies at the frontier between science, philosophy and theology: for this reason, the contents of the articles in this issue represent an interdisciplinary attempt at grasping the issue of creativity and intelligence, thus going beyond a strictly philosophical approach. Sometimes, the authors had to enter more in depth within the specific scientific discipline they manage, having in mind how their own research field could give insights to other disciplines or provoke them by putting on the table new, unexpected perspectives. This will certainly open up the opportunity for an original and stimulating debate also contributing to «Acta Philosophica»'s focus on the dialogue between philosophy and the sciences, and on the relation between faith and reason.

When we perform an interdisciplinary approach, we find major difficulties in providing a definition of intelligence. We realize there are many kinds of intelligence; many tasks can be accomplished in many ways, and many of them can be carried out 'intelligently', that is successfully and in insightful ways, when judged from some specific viewpoint. We can try to understand what intelligence is when looking at *what* is produced or, also, when looking at the *way* in which it is produced. We could also fail when applying human categories to recognize and evaluate levels of intelligence in non-human subjects, because we are accustomed only to humanly known tasks. As it occurs in other big philosophical notions having a very rich phenomenology – like that of life, for instance – I think we do not need to provide a definition of intelligence, but to develop strategies in order to recognize and outline when and where an intelligence is at work. In trying to understand what human in-

telligence is and how creativity may characterize its specificity, the researchers who authored the articles published in this issue of «Acta Philosophica» make use not only of the philosophical approach (Di Francesco and Tomasetta), but also of various ‘comparisons’, including that between humans and other animals (Vitale and Branchi), human and Artificial Intelligence (Montanari), studying the rising of intelligence along the evolutionary history of human beings (Colagè and d’Errico), and how human intelligence itself may be the object of clinical studies (Keller).

Philosophy of mind certainly is a reference discipline as far as intelligence and creativity are concerned. The paper by Michele Di Francesco and Alfredo Tomasetta, *The Creative Mind: From Algorithms to Extended Subjects*, is strictly philosophical in character and then opens the issue. The authors define the product of creativity as the outcome of a deliberate action that also exhibits a ‘non-algorithmic’ form of order. Then, this definition is put at work in ordinary domains such as actions in common social contexts and daily linguistic conversations, as well as in sophisticated domains such as the proof of mathematical theorems. The turning point of the article is the consideration of creativity from the viewpoint of ‘extended mind’ (the idea that our mental processes are not confined within our bodies). From this, the idea of a ‘socially extended mind’ is pursued to propose that the subjects of creativity can be extended as well, i.e., that the creative processes take place in social contexts in which individual minds are networked.

In his study titled *Artificial Intelligence and Creativity*, Angelo Montanari considers Artificial Intelligence (AI) in its key historical moments and most recent developments. His contribution presents the fundamental aspects of current Artificial Intelligence, including machine learning and big data. The issue of creativity is dealt with in relation to other relevant notions in AI research, such as uncontrollability, autonomy and intentionality of AI systems. The crucial insight is that, although creativity might appear a desired outcome for AI, it is also problematic from the standpoints of design and application. Indeed, often, even the system designer could not know how and why a certain solution or decision has been produced by an AI system, thus posing the problem of developing *trustworthy* AI. So called XAI (Explainable Artificial Intelligence) precisely has this task.

The paper by Flavio Keller, *The Concept of Embodied Human Intelligence: Powers and Limits* enquires into human intelligence starting from the perspective of embodiment, and emphasizing that ‘embodiment’ does not imply just the brain, but also the body in all its dimensions. This allows the author to single out some of the reasons why human intelligence has distinctive characters with respect to animal and artificial domains. The hinge of the paper is the emphasis on how bodily *limitations* can spur creativity (exploration of new solutions). Limitations of the developing child as well as pathological or

‘contextual-environmental’ limitations are considered. It is then shown how children can give rise to fine cognitive processes even when their body is still immature, as well as how pathological or unfavorable conditions can trigger astonishing novelty. All this moderates the embodiment perspective, on one side, and points towards the relevance of the ‘desire to create’ at the basis of creativity, on the other.

In their article *‘Is My Animal Smarter than Yours?’: Concerns in Comparing Animal Intelligence*, Augusto Vitale and Igor Branchi contribute a thought-provoking reflection on animal cognition and on the difficulties in gaining an accomplished understanding and assessment of diverse animal species’ intelligence. The core message is that animal behavior indeed displays flexibility and innovation (with their relations to the issue of creativity) but they should be understood by carefully considering the *ecological and social context* in which they develop. This proviso – along with the requirement of interpolating field observations and laboratory experiments – might help overcoming the biases challenging the study of animal intelligence.

Finally, the article *The Roots of Creativity: Investing in Cultural Transmission* by Ivan Colagè and Francesco d’Errico, addresses the issue of creativity from the perspective of cultural evolution. The key point the authors make is that creativity finds its roots in *transmission strategies*. Faithful transmission and creativity might seem opposite processes but the authors show how creative outcomes (innovations) indeed emerge by combination, repurposing and/or context-translation of previously devised elements. Another worth-mentioning point is that in the context of cultural evolution creativity appears fundamentally as a social process (in which the individual contributions are framed) and innovations (the outcomes of creativity) are not necessarily linked with survival- or adaptation-related drives.

Taken together, the contributions gathered in this issue envisage an interdisciplinary outlook on the topics of intelligence and creativity addressed, indeed, from the specific viewpoint of different disciplines. Such an attitude appears to be coherent with the traditional view of human intelligence as emerging from a philosophical reflection open to theology. According to the latter, human intelligence is aimed at knowing the whole of reality, the very nature of things, their mutual order, their origin and their scope. In his *Summa Contra Gentiles*, Thomas Aquinas (1225-1274) affirms that “the natural appetite of human intellect (*appetitus naturalis intellectus*) is to know the genera and species and powers of all things, and the whole order of the universe.” (*Summa Contra Gentiles*, book III, ch. 59). Human natural inclination to know the whole of reality is related to the spiritual and intellectual nature of our minds, which have the capacity to participate in the universality of being. We are not satisfied in knowing only some parts of reality, no matter how deep the knowledge we have about them: we seek after the whole. Behind this as-

piration there is the feeling, or rather the conviction, that the truth lies in the whole and that the search for truth is nothing but a search for global meaning. The concepts of intelligence, truth, and that of global meaning are deeply interwoven.

Besides this general perspective on interdisciplinarity, each of the article in this issue hints at topics relevant to a philosophical anthropology open to theological insights.

The paper by Vitale and Branchi emphasizes how animal cognition is strictly linked with the animals' ecological niche and does not show attempts at going beyond what is immediately present in that niche. In contrast, classical philosophy and theology stress that human intelligence and knowledge operate in order to drive freedom and love which are properly human activities, even more than intelligence itself. It is approaching the sphere of aims and ends, then, that the difference between human, animals and machines stands out in a clearer and more discernible way. If we ask about the aims of human intelligence and the targets humans want to achieve, we should answer that these aims and targets are not only food and sexual reproduction, but also, and perhaps more powerfully, the compelling desire of understanding reality and transforming it. This is also one of the implications of the paper by Colagè and d'Errico, according to which cultural evolution appears to be intrinsically transformative and pushed forward by aims not always reducible to immediate biological needs. Moreover, the emphasis on transmission strategies in this contribution also hints, implicitly, at the theological tenet that human intelligence is aimed at nurturing freedom in order to help the other, build a rightful society, motivate one's self-giving in love and charity.

The article by Keller emphasizes the role that limitations play in the development of human intelligence and creativity. Now, Christian philosophy and theology makes it clear that self-consciousness is not only 'to be sensible to something,' but to know what to be sensible means and the implications it has, including sorrow, pain, awareness of one's own limits, and the need for care. The maximum level of self-consciousness and awareness is to be aware of our death, a death that will come anyway, without any possibility of escaping it. It is easy to realize how this awareness has contributed and still contributes to shape human intelligence. According to Theodosius Dobzhansky, the reflection upon our radical limit, upon our final exit from the world, precisely is the crucial *knowledge* which drove human evolution toward the present status. The human being is the only animal that knows s/he will die, and exerts his/her intelligence accordingly. This aspect of self-consciousness played a major role in determining what the human being is and the kind of society human beings were able to build. In this sense, the adjective 'humane' well expresses something specific to the human being, such as benevolence and compassion. No matter whether, how and when these characters emerged

in biological or cultural evolution, they represent a precise and unequivocal character of our species.

Moreover, the very theology of creation underlines the finite, creaturely, fallible nature of the human beings. They are not gods. Fallibility is a normal attribute for human intelligence, but not for a computer machine. A good computer is expected to be infallible, otherwise it cannot be 'intelligent.' When teaching a machine, we can teach only algorithms, not virtues nor ethical behaviors. Learning from environmental feedback and error/success strategies let machines develop other, more complex algorithms. Human intelligence transcends the level of data collections. *Human* justice does not act employing only codices, big data and a good set of laws, but also, and primarily, thanks to the virtue of a judge, his prudence and rightfulness. On this background, the article by Montanari and the one by Di Francesco and Tomasetta give interesting insights. Montanari highlights the need for Artificial Intelligence to be 'explainable', i.e., to be able to make transparent the processes through which the outputs are produced by the machine. This is grounded upon the idea that purely algorithmic computations may not, in many situations and contexts, exhaust the richness of human thinking. Indeed, human thinking seems to be irreducible to algorithms – and this is a key insight from the article by Di Francesco and Tomasetta who stress that the contents of human thought and language go beyond the strictly propositional format and also have a socially-extended import.

Aquinas, again, writes: "all natural entity is constituted between two intellects, the human and the divine, and it is true insofar as it conforms to both" (*De Veritate*, q. 1, a. 2c). Human intellect is able to dialogue with nature's intelligibility because they both have their origin in God's intellect. In a sense, when studying reality, human intellect and God's intellect are one in front to the other. Proper to human intelligence is not only performing abstraction, but also perceiving and recognizing *information*. It is perhaps around the very notion of information and its relationship with the divine *Logos*, that theology could engage a new fruitful dialogue with philosophy and the sciences to understand and envisage what intelligence is. But this might well be a matter for another issue of «Acta Philosophica».