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THE UNITY OF SCIENCE BETWEEN EPISTEMIC INERTIA AND NOWADAYS SCIENTIFIC NECESSITY

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Today, the idea of the unity of science seems to be at odds with reality, even though science was born out of the spirit of unity. Despite this impression, we consider that unity is not just an epistemic inertia, but an internal necessity of science. In this article we support the idea of unity as internal necessity of science after briefly analyzing the current situation, by reviewing the way in which the transfer of the unit to discontinuity reminds us of Francis Bacon, or of the French encyclopedists – those who achieved a broad division of science. Finally, we will present the three major theoretical directions regarding unity (encyclopedias, reductionism and transdisciplinarity) and how they have adapted to the needs of science.

Keywords: unity of science, science complexity, division of science, encyclopedia, reductionism, transdisciplinarity

1. INTRODUCTION: AN OVERVIEW OF SCIENCE COMPLEXITY

At least two centuries have passed since the idea of covering the whole field of knowledge by a single individual became nonsense. *Homo-universalis* died, paving the way to the "specialist", an exceptional alternative of *homo-faber*. Within a limited, but well-determined theoretical scope, the latter tries at solving specific problems of practical nature. The aim of this paradigm limits it to science, field, specialty/ sub-domain, research topic. At the same time, due to its insignificant evolution, the density of knowledge does not allow giving up the problem, deepening a sub-field by requiring constant long-term effort and maximum intensity.

The main reason of this hyper-specializing process is the exponential amount of information and its epistemic complexity. A century ago, this sub-field/ topic could be researched by a single person, nowadays it needs large teams, databases and high-performance technique. Also, there are no single field specialists within the team, on the contrary, they come from various fields, sometimes seemingly unrelated to each other, each member acknowledging the methodological processes they apply. It is not imperative to know in detail the procedures to be followed by other colleagues.

A **paradox**, *i.e.* the unity of science develops here. First of all, the cleavages among sciences are deepening, creating sub-domains and hyper-specialized topics which a very small number of people have access to. Meanwhile, the unification process develops: the research teams are interdisciplinary, the research topics are related to more sciences (or at least require the involvement of specialists from different fields) and more border sciences increasingly occur as a result of hybridization. Within this context, the scientific dynamics is a continuous process of vacillation between division and unification, discontinuity and unity.

2. WHAT DOES THE "UNITY OF SCIENCE" FORMULA REPRESENT?

Even if, at the level of practical activities, one can notice the natural way by which sciences cooperate, one can identify multiple negative attitudes related to theorizing and unifying the methodological developments. That is why, several questions remain open: can we talk about a real unity in science or is it just a cooperation between different fields, branches, topics? Is theorizing and developing of unitary language and methodologies a necessity or just an epistemic inertia? And, last but not least, which is the referential when we talk about the "unity of science"? We try to answer these questions throughout this paper but, as the method of philosophy in general, and that of the philosophy of science in particular, this requires we must first define the universe of discourse when referring to the "unity of science".

One cannot talk about this idea as a new one. Science, as a particular object, has long been in relation to the process of knowledge in general, a process that rationally pursued the apprehension and description of the universal - but also of the individual as part of the whole. The vision was unitary, everything being viewed as a whole, monolithically. The process of knowledge' transfer to the entity objectified as a result of knowledge does not break the idea of unity, it only tries to build a single conceptual unit structure within which descriptive parts should be identified. However, the historical age of this idea is not an argument in support of the present necessity of the unity of science. On the contrary, it can be turned into a counterargument by considering it as an epistemic inertia (as we think in the case of Descartes or Leibniz), which becomes useless within the contemporary context. That is why, the historical perspective on the unity of science remains an important subject of analysis, but it cannot be considered a benchmark to theoretically justify unity.

Nor can the causal links among sciences be denied. There is evidence of the relationship between Mathematics, Physics and Chemistry and the correlative developments that followed paradigmatic discoveries within them, not to mention the hyper-publicized impact of the whole theory of relativity on the cultural and scientific approach, or that of the psychoanalytic theories on humanities and social sciences. These connections outweigh by far the surface picture of the sensationally theoretical turnings which can be found within daily research.

As an argument, I bring to the fore an exceptional historical turning that can be regarded as a standard of what scientific research means. Bruno Latour[1] uses this example to open a classic book in the field of science philosophy in action (*Science in action*). The author correlates three scientific events that take place in three different parts of the world which have changed science as a global paradigm – biology in general, and genetics in particular. These three moments are scientifically correlative, but from tangential fields, even if two are on the same topic of research. We will present them along their historical evolution.

In the fall of 1951, X-ray images of DNA were obtained at Cavendish Laboratory, Cambridge, England. The images were blurry and, for the young researchers Jim Watson and Francis Crick, it was difficult to determine whether DNA was structured as a double or triple helix or even as a single one.

In December 1980, in Westborough, Massachusetts, the Data General building tested the prototype of a small, performance-based computer called The Eagle. The model Eclipse MV / 8000 will be sold all over the world in the coming years.

In October 1985, the clear, three-dimensional image of DNA as a double helix was obtained at the Pasteur Institute in Paris by the use of an Eclipse MV / 8000 computer and of a special program written by John Whittaker.

The above-described are only three events scattered in space and time but which, together, due to various other particular causes, not pointed out here, have determined the final result: a clear image of DNA as a double helix. It is worth noting that, trapped in the scientific paradigm specific to each, we are rarely aware of the huge and complex causal shift ranging from seemingly unimportant elements, such as: database structure, tool production, access to information, previous education, etc. up to those considered relevant: building the research team and the research itself. Displaying this extensive undetermined network where various fields are interlocked, many of them unconscious, we bring the "unity of science" again into discussion.

In this situation, identification of the referential is quite difficult, because the idea of starting a unified science is no longer relevant. But, to the same extent, scientific links and co-operations cannot be neglected. Therefore, we believe that the best image is that of a complex network, with obvious connections, doubled by a multitude of secondary, hidden, unconscious relationships within this vast majority. All these connections determine sharing of the language, up to a certain level, import and export of methods, the formation of border sciences (hybridization), transfer of technology, formation of teams with different (multidisciplinary) specializations, etc.

Within this new context, the unity of science is more about the communication among sciences, at the methodological level of interdisciplinary bridges, about the establishment of an adequate universal language, and about cooperation from a technical point of view. All these can create a new image of the unity in which awareness on the broad process of positive (methodical, linguistic,

[1] Bruno Latour, *Science in Action*, Harvard University Press, Cambridge, Massachusetts, 1987, pp. 1–17.

ideological, etc.) and negative communication (by setting boundaries and integrating elements from other sciences as a result of comparisons) is structured as a compact network of inter-determinations.

3. FROM UNITY TO DIVERSITY, A BRIEF JOURNEY INTO THE HISTORY OF SCIENCE (OR PHILOSOPHY)

Science was born from man's endeavor for knowledge, as a process of discursive-rational search. If we want to highlight the practical end of this approach, then we can consider that the process was aimed at solving particular problems. However, at the same time we must not forget the element of gratuity and the search for the general or the universal. The image of Thales from Miletus,[2] who fell into a fountain as he was counting the stars, or Archimedes' plan[3], killed by a Roman soldier for that he rebelled when his drawings on sand had been destroyed, are iconic for science meant at its beginnings. We can summarize by saying that science was born by philosophy (love – *φίλος* wisdom – *σοφία*), for the purpose of not *having*, but of *searching for* knowledge, a meaning that exists since Pythagoras,[4] who would have used this concept for the first time.

Knowledge, as a dynamic process also represented by the Greek verb ἐπίστασθαι, from which ἐπιστήμη derived, did not raise at all the problem of unity, or of the precise variety of the objects / subtypes of which the unknown was thought – as particular elements within the whole. We present some of these scientific references as variety. In his Republic,[5] Plato teaches the sharing of knowledge in opinion (doxa – *δόξα*) and science (epiteme – έπισήμη) which in turn is divided into noetic knowledge (*νόησις*) and dianoetics (*διάνοια*) represented by arithmetic, geometry, astronomy and harmony. The Platonic perspective is a modern one, as he does not only enumerate the sciences but also underlines the role that specialization has on a single field, compared with the perspective of the time represented by sophists, that of the possibility of knowing all things, not only as a general, but also as an in-depth way.

[2] Plato, *Theaitetos*, 174a, in *Opere* (*Works)* vol. VI, Scientific and Encyclopedic Publishing House, Bucharest 1989, p. 223

[3] Alan W. Hirshfeld, *Eureka Man: The Life and Legacy of Archimedes*, Walker & Company, 2009, pp. 88–89

[4] The story told by Cicero in *Tusculanae Disputationes (book V, 3, 8)* of the meeting between Leon, tyrant of the city-state Phlius, and Pythagoras is well known. Admiring the eloquence of Pythagoras the king asked him what art he possessed, and the latter replied that he was a philosopher. What is important is not the novelty of the term in itself but its meaning, which is delimited, in a form of modesty, by the classic attribute of the wise, as we find it in the seven wise men (οἱ ἑπτὰσοφοί) introducing the idea of search or the search for wisdom – *"sapientiae studious"*. The term wisdom (σοφία) translated into Latin by *sapentia* has a variety of meanings, all in relation to different types of knowledge from theoretical (epistemes, ἐπιστήμη) to practical (fronsesis, φρόνησις)

[5] Plato, *Republica* 521c–534a, in *Opere* (*Works)* vol. V, Encyclopedic and Scientific Publishing House, Bucharest 1989, pp. 321–337.

In his turn, following Plato, Aristotle[6] divides knowledge (ἐπισήμη) into: "knowing the whole" – *theoretike*, where Mathematics, Physics and Theology – *poietike*, or knowledge through art, are included, and practical – *praktike*. This restructured classification, redesigned after a millennium of interpretations of Aristotle's work grounded the structure of sciences and education during the Middle Ages. Science was divided into the triad (trivium) of the main sciences consisting of: Rhetorical and Dialectical Grammar, and the four secondary sciences (quadrivium): Arithmetic, Astronomy, Geometry and Music.

However, during the Middle Ages,[7] these classifications were technical and could not pose the problem of separating knowledge within the idea of limiting specialization, representing therefore the basis of the education specific to that period of time. The spirit of unity is deeply found in all encyclopedic attempts of the 12th and 13th centuries, like in the work of Averroes, Albertus Magnus, Roger Bacon (*Opus Majus, Opus Minor, Opus Tertum*) or Vincent of Beauvais (*Speculum Majus*).

The late Middle Ages, the Renaissance and early modernity are the moments when science begins to develop exponentially, finding its practical and experimental side and increasing its degree of complexity. The idea of unity was still indisputable and the vision of a monolithic structure, dominated by theology, was reached only sporadically - by attempts such as that of Averroes[8] and his followers, who introduced the perspective of a "double truth", both theological and scientific, and tried to release science from the authority of Islamic theology, in his case.

One of the moments of awareness of the new scientific complexity is that of the publication of the work of Francis Bacon[9], *Of the Proficence and the Advancement of Learning* (later on published in 1623, in a Latin supplement *De Dignitate et Augmentis scientiorum*) in 1605. The so-called "classification of sciences" that we find in Francis Bacon's work is actually division of knowledge, taken as a whole, into branches and sub-branches (domains, sub-domains). The criterion used by the English philosopher was in accordance with the Aristotelian vision described above; starting from the process of knowledge represented this time by the faculties specific to the human intellect: memory, imagination and reason[10]. Within this

[6] Aristotel, *Metaphysics*, 981 a–982a, IRI Publishing House, Bucharest 1996, pp. 13–16

[7] A brief review of the "classification of science" until the beginning of modernity represented by Francis Bacon was done in chapter 3.3. "Classification of sciences – early modern sciences", volume by Dan Gabriel Sîmbotin, *1600. The censorship of science imaginary during early modernity*, European Institute Publishing House, Iași 2015 pp. 182–194.

[8] Averroes (Ibn Rushd), *The Philosophy and Theology* (1160), translated from the rabies by Mohammad Jamil-Ur-Rehman, Published by AG Widgery, the College, Baroda 01/01/1921 used in the http://oll-resources.s3.amazonaws.com/titles/77/0560_Bk.pdf (17.10.2019) .

[9] Francis Bacon, *Of the Proficence and the Advancement of Learning*, British Encyclopedia, Chicago, London, 1952.

[10] We will not make a detailed presentation of the sciences presented in *Of the Proficence and the Advancement of Learning*, this having been done previously (Dan Gabriel Sîmbotin, *1600. The censorship of science imaginary during early modernity*, European Institute Publishing House, Iasi 2015 pp. 186–194), considering that viewing the map associated with this science is sufficient to realize the extent of the approach.

classification, sciences are "born" after making a correspondence between the faculties of intellect and the object of study, the following aspects being yielded: memory corresponds to history; imagination, poetry to the poet (according to Aristotle), represented by today's literature, in general; and all the others correlated with: God, nature, and man - to reason. It should be noted that Francis Bacon does not turn to theology, he wants a radical separation between the study of nature and that of God, which does not mean denial of either religion or theology.

Francis Bacon's approach is an obvious turning point in how science was viewed. The transfer from the broad unit, as he encyclopedically perceived knowledge, which he wished to capture in all possible aspects through *Restauratio Magna,* to precise problems of experimental analysis of natural sciences is done by his division of *De Dignitate et Augmentis scientiorum*, a book that opens his great work. Gradually, the two elements, the complexity and the monolithic unity of the new science appear as incompatible, even if the largest division of science maintains adjacently the idea of unity since early modernity.

Among the subsequent approaches, the most important is that of Denis Diderot and Jean le Rond d'Alembert of *Encyclopédie*, developing an introductory chapter devoted to science structure: "*Explication détaillée du système des connaissances humaines*"[11]. It does not totally abandon the idea of unity, it holds for the idea of a compact system and of the division of human knowledge. The disciplinary structure is more clearly outlined, trying to explicitly eliminate the ambiguities in Francis Bacon's classification[12], completed with the sketch, adapted after Francis Bacon, "*Systeme figure des connoissainces humaines*"[13] (Annex). The plan synthesized here is complex and the classes of objects resulting from the division process are multiple, which permitted to identify specific spaces within which each science is to be developed.

The two moments represent the turning point that re-configured the transfer from science as a unit, in the spirit of the Middle Ages, to the new science, divided into a plurality of domains and sub-domains. Science division had a projective role and it could highlight the discontinuities between different fields. But, the different ontological perspective behind each science played the most important role. There were at least three different ways of looking at the world, of continuing and rehabilitating ancient perspectives on the cosmos. The first is the Aristotelian, substantialist one, which has had a continuity of over two millennia. Chemistry, first of all, but also Biology, and later on Psychology, maintained the perspective of a substantial world, where internal mutations were a result of combinations among different elements.

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[11] *Encyclopédie ou Dictionnaire raisonné des sciences, des arts et des métiers*. Tome premier, pp. XLVII–LI https://gallica.bnf.fr/ark:/12148/bpt6k50533b/f53.item.r=Systeme%20figure%20des%20connoissainces%20humaines.

[12] „Observations sur la division des sciences du Chancelier Bacon" in *Encyclopédie ou Dictionnaire raisonné des sciences, des arts et des métiers*, Tome premier, pp.LI–LII

[13] *Ibidem* p. LIII

A second ontological perspective that radically changes science since the seventeenth century emerges as a result of mathematical development. With Galileo Galilei, Descartes, and Newton's theoretical introductions, the world is closer to a restructured, Pythagorean vision, where the number has its supremacy over the matter, being its essence. In its classical form, the Newtonian Physics, where, according to its "material point", the matter loses its role, only the forces that can be calculated and described numerically are important.

Established in its highest complexity only during the late 19th century, the third perspective is the atomist one (inspired by Leucipus and Democritus), which has been reiterated in several previous situations by Francis Bacon[14] and Leibniz[15], to only mention here. The atomism developed by Physics and, subsequently, by Chemistry, goes far beyond the degree of complexity of the specific ancient ontology, *i.e.* the Baconian one or the metaphysics of Leibniz. It describes a new world different from the previous ones, those of Aristotelian or Pythagorean inspiration.

The three different "realities" described by science also cause cleavages of an epistemic, methodical or linguistic nature. Thus, after the nineteenth century, we can no longer speak of a "reality", but of the "realities" of a science, of sciences that describe different realities. Therefore, within the new context, "the unity of science" becomes an ideal, following a broad process of retrieval.

4. CURRENT THEORIES REGARDING THE UNITY OF SCIENCE AS EPISTEMIC INERTIA

The unity of science is not just a part of the history of human culture, it keeps itself updated and can be found today in different forms. They either represent a sequel of previous ideas in the form of epistemic inertia, or are a response to today's needs. In this chapter, we will continue to present two forms of unity as epistemic inertia: encyclopedias and reductionism, without considering that one of the two directions is axiologically superior.

As previously stated, even encyclopedias are a form of asserting the idea of unity of science. Each of them represents an attempt to present all existing knowledge in a systemic way. Today, considering the complexity of science, the challenge remains the epistemic inertia that has its origins in the history thread starting from Aristotle through Aristotelianism (Averroes, Albertus Magnus, Roger Bacon, Vincent of Beauvais) to Early Modernity (Francis Bacon, Ephraim Chambers), Enlightenment (Denis Diderot, Jean le Rond d'Alembert) and late modernity (Otto Neurath, Rudolf Carnap and Charles Morris).

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[14] Francis Bacon, „Despre principii şi origini" ("About principles and origins"), *in Despre înţelepciunea anticilor* (*About the wisdom of the ancients*), Scientific and Encyclopedic Publishing House, Bucharest, 1976, p. 143.

[15] Gottfried Wilhelm von Leibniz, *Monadologia*, Humanitas Publishing House, Bucharest 1994.

However, the usefulness of such works cannot be denied. The unitary and Universalist character allows sharing of a large amount of information, which renders them practical from a didactic and cultural point of view. They can create a general picture of the world by descriptively outlining the limits of the scientific paradigm. They can be used as guidance, providing quick, useful information, but they cannot be substituted for a real, dynamic, in-depth research. This does not mean that they are easy to edit, on the contrary, their evolution requires major resources and efforts.

If, at the beginning of modernity, encyclopaedias could still be considered a major scientific endeavor, today they are merely teaching or popularizing scientific tools. However, not only have they not disappeared, but they have been developed and rediscovered. The conventional forms, the cultural symbols such as *Encyclopédie française, British Encyclopaedia, Deutsche Encyclopädie*, etc. were completed by the contemporary scientific encyclopedias focused on one area, compendia, treatises and online encyclopedias. If, in the case of classical encyclopedias, we try to preserve the structural and methodological unity at a general level, those devoted to specific areas outline the paradigm within a science, overcoming the cleavages at disciplinary level. But, the unity of current encyclopedias is not a native one, it does not come from within science, but it is a meta-scientific project.

If, in the case of encyclopedias, we are talking about a formal and content unit, the idea of unification can also be seen as a monolithic construction to reduce all sciences to a single universal science. This originates from the vision of science as a form of knowledge where the fields are related exclusively to the object of research. But, even in this situation, unity cannot be viewed from a single perspective. We can look at the unit from at least three points of view: language – the development of a single language common to all sciences, at the level of the laws of science[16] and a global unit. At the weakest level of the unit, *i.e.* the linguistic one, this seems possible and thus a famous project, that of Vienna Circle, took shape. Rudolf Carnap in his "Logical Foundations of the Unity of Science"[17], a manifest work for what reductionism means, especially stressing the correlation between reality and language and its logical consistency within science as a whole. From his perspective, the differences in the meaning of words in various sciences should be solved through analysis and reduction to a single referential. This was the declared aim of analytic philosophy.

If, in the case of linguistic unification, an optimistic perspective can be accepted, for the next two levels the problems are much more complex. In case of the laws of science, major differences make it impossible to bring them together from an epistemological and ontological viewpoint. It is also Carnap who observes that:

[16] Paul Oppenheim, Hilary Putnam, "The Unity of Science as a Working Hypothesis" in *Concepts, theories, and the mind-body problem*, University of Minnesota Press, Minneapolis, 1958, pp. 3–4. Retrieved from the University of Minnesota Digital Conservancy, http://hdl.handle.net/11299/184622 (18.05.2019).

[17] Rudolf Carnap "Logical Foundations of the Unity of Science" in O. Neurath, R. Camap, and C. Morris (ed.), *International Encyclopedia of Unified Science*, Volume I, University of Chicago Press, Chicago, 1938, pp. 42–62.

"Thus there is at present no unity of laws. The construction of one homogeneous system of laws for the whole of science is an aim for the future development of science. This aim cannot be shown to be unattainable. But we don't, of course, know whether it will ever be reached."[18]

However, his prediction did not come true. We cannot talk today, over seventy years later, about a rapprochement between sciences. On the contrary, the differences have deepened and the exponential multiplication of the domains and sub-domains, each with its own laws and methodologies, becomes a reality. However, there was an attempt to identify partial reductionist solutions. Paul Oppenheim and Hilary Putnam in "*The Unity of Science as a Working Hypothesis*",[19] after describing the levels of reality (social groups – psycho-social, multi – cellular living things, cells, molecules and / or atoms, elementary particles) seek to identify reductionist solutions for each level. They consider that it is more likely to achieve a structural reduction of knowledge in six sciences, however this approach is not achieved at present (1955). We are in the same situation today, and a systematic reduction of knowledge into six sciences or fields does not seem plausible, either methodically or from the perspective of the laws of each science.

The most powerful and most captured in the history of science of reductionist possibilities is that of total unification. It all starts from the ontological problem of unity expressed by Rudolf Carnap: *Is the world one?*[20] Only if the answer to this question is positive can we understand the steps to unify science. But, as I stated before, even if the world were one, the images transmitted to the level of science are multiple, non-unitary, coming from different historical moments. Therefore, beyond the approaches to philosophy, those which come from within science start from the idea of total unity, in order to create a unique image of the world (an ontological unity).

Mathematics, Physics, Biology, Computational sciences were in turn the "solution heroes" to the problem of knowledge discontinuity. Each of them had its role in the construction of large, coherent, yet partial images. The support of one science or another was made according to the theoretical context and there are also "saving" theories, with a role in changing paradigms, that could be regarded as unitary or unifying solutions: relativism, neo-Darwinism (together with the evolution of genetics) or the Grand Unified Theory – GUT. However, such a reductionist project cannot be a solution, because experience shows that science is diversifying not only at structural level, defending new sciences, but also at that of ontological images and constructions, increasingly determining a negative response to the *Is the world one?* question. In this situation, the variation of information can be a quality, and the diversity of systematic knowledge that solves general or particular problems is a plus. Even the *Grand Unified Theory* of science cannot disregard the variety of plans from reality while perceiving science like a monolith.

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[18] *Ibidem* p.60.
[19] Paul Oppenheim, Hilary Putnam, op. cit. pp. 9–11
[20] Rudolf Carnap, op. cit. p. 46.

5. THE UNITY OF SCIENCE AS A NECESSITY

Despite the age of the idea, the unity of science remains topical. As a result of the increasing complexity of all fields, of the variations regarding information, interdisciplinary cooperation becomes an imperative, a necessity that cannot be neglected. From the multiple attempts at establishing a new vision of unity as a solution to the current problems, we will consider transdisciplinarity. As a solution, it came mainly from the inside of science, thus gaining great extent. We can talk about several of its sources. The first is from the 70s of the last century, when Erich Jantsch,[21] in response to Jean Piaget's view on the scientific dialogue, systematizes the relations that can exist between sciences, listing five categories: multidisciplinarity – one level, multi goals, no cooperation; pluridisciplinarity – one level, multi goals, cooperation, no coordination; interdisciplinarity – two levels, multi goals, coordination from superior level; transdisciplinarity – multi levels, multi goals, systemic collaboration/coordination. Out of the five categories, the greatest complexity has transdisciplinarity, that pursues systemic cooperation between sciences, working on multiple levels.

Not much later, in the 80s, we noticed two entries from different plans. One with a relatively little impact was that of Jürgen Mittelstrass[22] (1987), who argues the insufficiency of interdisciplinarity and the need to identify a new level of collaboration, accepting that of transdisciplinarity. Later on in the 2000s, when transdisciplinarity had already overcome the fashionable status in science, he published several studies, one of them, a synthesis work, in 2011[23]. His vision is one of natural collaboration among sciences, without limited duration, that could also lead to a gradual unification on several levels. He notes the multiple situations when the process is carried out. But, there also exist discontinuities, caused either by a temporal (on the project), a spatial (in certain universities or research centers) or thematic limitation. The principles of collaboration are: temporal continuity, building a complex methodological system, openness to novelty.

The best known in the European space is the action taken by the group of Basarab Nicolescu, Lima de Freitas, Edgar Morin, Jacques Delors, Helga Nowotny, etc. They supported the need for collaboration between all types of science and, as a combination of their ideas, in 1994, November 2-6, they organized the First World Congress of Trandisciplinarity, in Arrábida, Portugal. Within that context, beyond a wide range of debates, a *Transdisciplinarity Charter* had been developed,[24] whose purpose was to develop principles underlying the development of inter-scientific

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[21] Jantsch, E., "Inter- and Transdisciplinary University: A systems approach to education and innovation", *Higher Education*, 1 (1) / 1972, pp. 7–37.

[22] Jürgen Mittelstrass, "Die Stundeder Interdisziplinarität?" In J. Kocka (ed.), *Interdisciplinarity: Praxis - Herausforderung - Ideologie*, Suhrkamp, Frankfurt, 1987, pp. 152–158.

[23] Jürgen Mittelstrass, "On Transdisciplinarity", *Trames*, 15 (65/60), 2011, pp. 329–338.

[24] The Charter of Transdisciplinarity, http://inters.org/Freitas-Morin-Nicolescu-Transdisciplinarity, (17.07.2019)

cooperation. Small in size, like a Constitution, it establishes only the general framework in fourteen articles, a preamble and a final article.

The most important programmatic changes aimed at were: reconsidering the position of the human being, introducing the idea of science *in vivo*, in the dynamics of life, in contrast to *in vitro* science (as a dead science); integrating reality levels into the scientific approach as normal; freedom of thought and free access to information as a basis for any scientific endeavor; accepting multiple forms of knowledge beyond rationality (intuition, imagination, body sensitivity, etc.), allowing openness to various methods; rethinking the economy, so that to serve the human being and not vice versa, while, in the case of the scientific endeavor by providing support to human evolution. This vision has stimulated exceptionally the communication among sciences (disciplinarity, interdisciplinarity, multidisciplinarity), all being considered parts of transdisciplinarity.

6. CONCLUSIONS

The need for collaboration among sciences is unquestionable. The large research institutes and laboratories are made up of dynamic multidisciplinary teams where the idea of ultra-specialized expertise is combined with the dynamics of collaboration. Within this context, a realistic project of unifying science must be focused not on the imposed methodological demands, but on offering institutional frameworks for collaboration. A better communication between science should be based on an inter- and multidisciplinary open spirit, while pursuing a correct relationship. Avoiding battles between sciences and within sciences where there is a desired preservation of privileges, keeping boundaries between the disciplines, methods, and fields is very important for allowing discretionary access to resources.

All these can be achieved in a context where health ethics is an intrinsic value and the immediate cost-effectiveness, both in the public sector and in private research, should be overcome, while priority should be focused on the development of human knowledge and of man as an integral being. Under these circumstances, science will find its way, and the inter-disciplinary dialogue will set up extensive communication networks building themselves in diversity by overlapping the unity of science.

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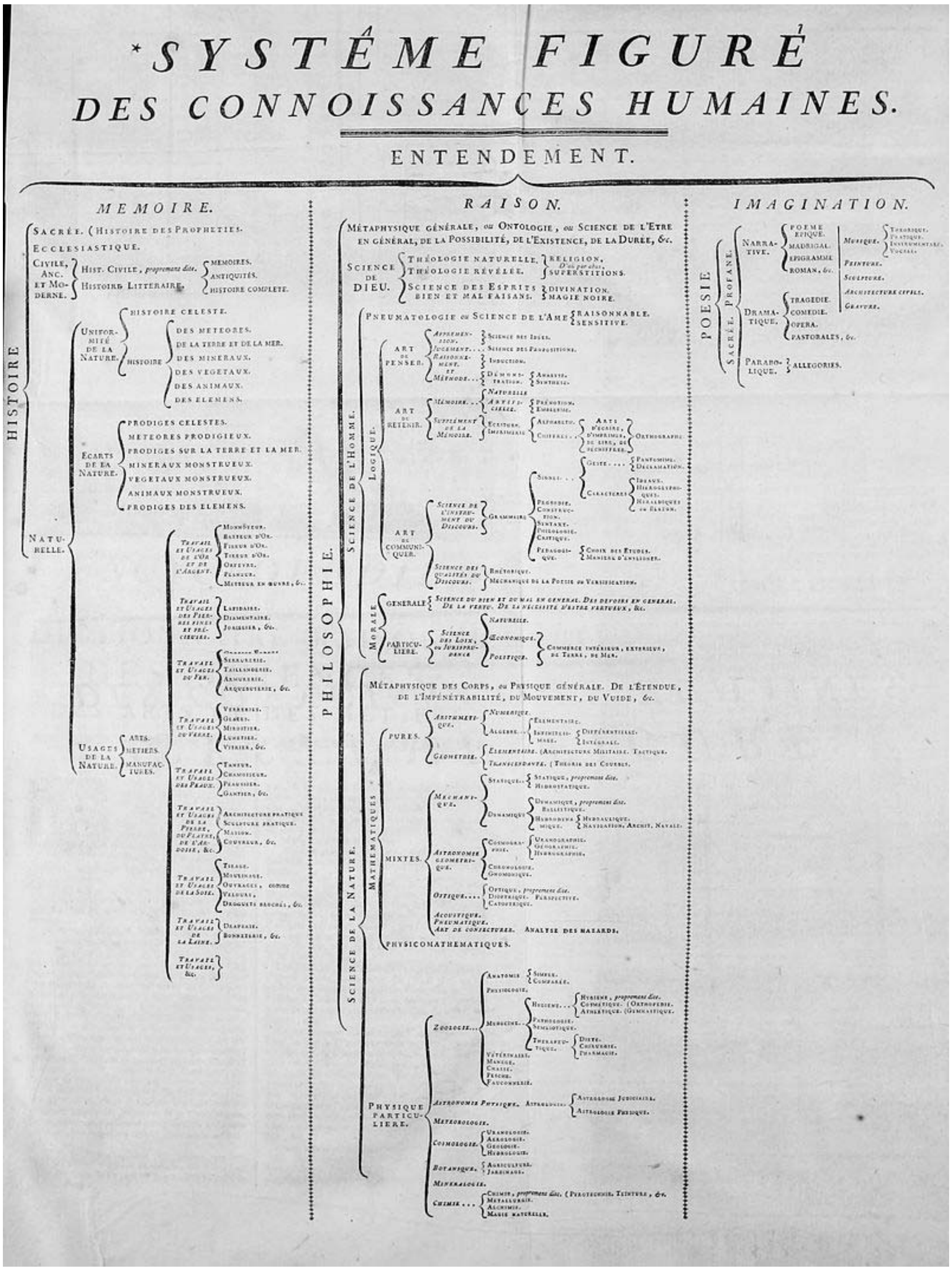
*SYSTÊME FIGURÉ
DES CONNOISSANCES HUMAINES.
ENTENDEMENT.
MEMOIRE.
RAISON.
IMAGINATION.
HISTOIRE
PHILOSOPHIE.
POESIE
SCIENCE DE DIEU.
SCIENCE DE L'HOMME.
SCIENCE DE LA NATURE.