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HISTORICAL ROOTS OF GOTTFRIED WILHELM LEIBNIZ'S UNIVERSAL SCIENCE

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This paper analyses different retrospective links between the *scientia generalis* by Leibniz and the philosophical, rhetorical and encyclopaedic traditions of the Renaissance and Early Modern Europe, emphasising the influence of Aristotle's' "Metaphysics" on the genesis of the concept of universal science in 17th century philosophy.

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The philosophy of Leibniz had the project of universal science as one of its central motives. The philosopher worked actively on it from 1676-1686. The abundance of archival materials on the problem of universal science (published and unpublished) notwithstanding, the experts in Leibniz cannot agree either on the meaning of this notion, or to what philosophical tradition it should be attributed. There are two trends in contemporary studies of the project of universal science by Leibniz. One could be traced back to Louis Couturat, where universal science is interpreted as a method of mathematical calculations for non-mathematical subjects that laid foundations for all reliable knowledge[3]. This interpretation of universal science places it within the context of the history of Modern European rationalism in general, and Cartesian philosophy in particular. Another trend implies searching for and tracing retrospective links between Leibniz's *scientia generalis* and the rhetorical and encyclopaedic tradition of the Renaissance and Early Modern Europe, so that Leibniz's universal science is viewed as an analogy to the *mathesis universalis* by Descartes, and to the traditions of Lull's Ars magna (Lull, Alsted, Comenius), humanistic rhetoric (Nizolius), logical and methodological reforms (Petrus Ramus, Zabarella, Keckermann) and encyclopaedism[4]. In this study we shall try to demonstrate that the most important reference for Leibniz's project of the universal science which makes it possible to connect both trends of interpretation and to clarify the significance of both traditions for the formation of Leibniz' *scientia generalis* is the concept of metaphysics delivered by Aristotle.

Thomas Leinkauf has remarked, however, that the problem of the genesis of Leibniz's universal science could not be limited to the abovementioned parallels, since "it remains unclear how universal science had grown, having been rooted in Lullism and various trends of Platonism; and how its development and achievements influenced what could be called a complete and metaphysically based calculation of existing things and knowledge in Leibniz's philosophy"[5].

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[3] Couturat L. *La Logique de Leibniz d'apres des documents inedits*. Paris: Felix Alcan, 1901; Duchesneau F. *Leibniz et la methode de la science*. // *L'Interrogation philosophique*. Paris: Presses Universitaires de France, 1993; Krüger L. *Rationalismus und Entwurf einer universalen Logik bei Leibniz.* // Wissenschaft und Gegenwart. 42. Frankfurt. a.M.: Klostermann, 1969*;* Mittelstraß J., Schröder-Heister P. Zeichen. *Kalkül. Wahrscheinlichkeit. Elemente einer Mathesis universalis bei Leibniz*. // *Pragmatik. Handbuch pragmatischen Denkens*. Hg. v. H.Stachowiak, Bd.1. Hamburg: Meiner, 1986. S. 392 – 414; Peckhaus V. *Logik, Mathesis universalis und allgemeine Wissenshaft. Leibniz und die Wiederentdeckung der formalen Logik im 19. Jahrhundert.* Berlin: Akademie Verlag, 1997; Mittelstrass J. *The Philosopher's Conception of Mathesis Universalis from Descartes to Leibniz*. // Annals of Science, 36, 1979. P. 603.

[4] Rossi P. *Clavis universalis. Arti della memoria e logica combinatoria da Lullo a Leibniz.* Bologna: Il Mulino, 1983; Schmidt-Biggemann W. *Topica universalis. Eine Modellgeschichte humanistischer und barocker Wissenschaft.* Hamburg: Meiner, 1983; Meier-Kunz A. *Die Mutter aller Erfindungen und Entdeckungen. Ansätze zu einer neuzeitlichen Transformation der Topik in Leibniz' ars inviniendi*. Würzburg: Königshausen&Neumann, 1996; Moll K. *Der Enzyklopädiegedanke bei Comenius und Alsted, seine Übername und Umgestaltung bei Leibniz – neue Perspektiven der Leibnizforschung* // Studia Leibnitiana. Bd. 34, H. 1, 2002. P.1 – 30.

[5] Leinkauf T. *Mundus combinatus. Studien zur Struktur der barocken Universalwissenschaft am Beispiel Athanasius Kircher SJ (1602-1680)*. Berlin: Akademie Verlag, 1993. P. 12.

The problem of the ambiguity of historical sources for Leibniz's universal science is complicated further by the fact that, as noticed by a number of scholars, Leibniz's philosophical thinking is highly dialogical. Since T.S. Eliot, who studied Leibniz in his youth under Bertrand Russell, scholars have always paid attention to Leibniz's unrivalled erudition, and justly viewed it as one of the main components of his original thought[6]. Leibniz's philosophical eclecticism was 'programmatic' and aimed at finding one fundamental truth in a variety of philosophical systems – the truth that in the end would coincide with Christian doctrine[7]. This aim at eclectic synthesis of various philosophical doctrines had been typical for a number of indirect predecessors and mentors of Leibniz – Jakob Thomasius, Erhard Weigel, Athanasius Kircher, etc. One should take into consideration the personal inclination of some scholars to eclecticism as well as the fact that at the time of Leibniz, various philosophical views and trends co-existed so that Aristotelians, the advocates of mechanical natural philosophy, and scholastics together defined the intellectual landscape[8].

To understand the originality of Leibniz's concept of universal science and his philosophy as a whole, one needs to consider the general tendency of Modern European thought towards the integration of previous traditions, as well as two characteristics peculiar to the work by Leibniz. Firstly, historiographical reviews constituted an integral, if not main, form of Leibniz's thinking. Numerous notes of various works by other authors with his remarks, comments and additions could be viewed, together with original texts by Leibniz, as sources that reflected the development of his thought. Thus, Leibniz himself saw a universal characteristic that constituted a methodological core of his universal science as a direct continuation of previous generations' scholarly work. Secondly, the texts by Leibniz are often laconic to the extreme in their wording and imply a reader's knowledge of the previous history of a particular debate. One important task of contemporary historical and philosophical studies of Leibniz is therefore to recognize hidden sources and indirect contexts of Leibniz's statements[9].

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[6] Eliot T.S. *Leibniz's Monads and Bradley's Finite Centers //The Monist*, Vol. 26, No. 4 (1916). P. 567 – 568.

[7] On Leibniz's philosophical eclecticism and on the search for synthetic unity of various philosophical systems in the 17th c., see: Mercer Ch. *Leibniz Metaphysics: Its Origins and Development.* Cambridge: University Press, 2004. P. 23, 27 – 49.

[8] Ibid., p. 73 – 74.

[9] It has been done by Konrad Moll in connection with the links between the philosophy of Leibniz and the programmes by Erhard Weigel, Hobbes and Gassendi; by Christia Mercer – in connection to the metaphysics of Leibniz, and by Breden – on the material of the scholastic debates on the principle of individuation. See: Moll K. *Der junge Leibniz. Bd. 1. Die wissenschaftstheoretische Problemstellung seines ersten Systementwurfs. Der Anschluß an Erhard Weigels Scientia generalis*. Stuttgart-Bad Cannstatt: Frommann-Holzboog. 1978; Moll K. *Der junge Leibniz. Bd. 2. Der Übergang vom Atomismus zu einem mechanistischen Aristotelismus, Der revidierte Anschluß an Pierre Gassendi.* Stuttgart-Bad Cannstatt: Frommann-Holzboog; 1982.Moll K. *Der junge Leibniz. Bd. 3. Eine Wissenschaft für ein aufgeklärtes Europa: der Weltmechanismus dynamischer Monadenpunkte als Gegenentwurf zu den Lehren von Descartes und Hobbes.* Stuttgart-Bad Cannstatt: Frommann-Holzboog, 1996. Mercer Ch. *Leibniz Metaphysics*; Breden T. *Individuation und Kombinatorik: eine Studie zur philosophischen Entwicklung des jungen Leibniz.* Stuttgart-Bad Cannstatt: Frommann-Holzboog, 2009.

Thus, an important historical and philosophical task remains in the studies of the programme of Leibniz's universal science: to clarify the meaning of universal science that had existed before Leibniz. As well, the history of the term itself, and the formulation of questions related to it.

§ 1. The unity of knowledge in the project of 'Ars magna' by Raymond Lull

Although the unity of knowledge problem has always been present in the philosophical tradition and any theory of knowlegde, the idea that it was possible to fully encompass the contents of knowledge within one system was a relatively late product in theories of knowledge. Orientation towards philosophical knowledge did not in itself suggest the statement of such possibility. The desire to unify the laws of knowledge and to build a united system of knowledge that would reflect the structure of the universe and lead men to the knowledge of God was characteristic of Early Modern European philosophy and science. This desire found its reflection in a number of cultural phenomena, but first of all – in the tendency towards encyclopaedism and in the search for one method of knowledge. The number of projects that were based on universalist principles of this type included the search for universal science and universal language. These were linked genetically and rooted in the tradition of the *ars magna* by Raymond Lull and natural theology of his followers.

Raimond Lull (c. 1235 – 1315) was the first European philosopher to attempt to create a universal science of all existing things[10]. In the spirit of medieval realism that had interpreted universals as having independent existence, Lull thought it possible to view the world as a total of various intelligible combinations formed according to the laws of logic. In order to find these laws, that is, to reveal the true nature of and connections between things, Lull developed a method that he called *ars generalis*, *ars universalis*, or *ars magna*. The main point of the method was to reduce all possible human knowledge to a certain set of primary truths, to the 'alphabet of human thoughts'. According to legend, these truths were revealed to Lull by God Himself. Later the philosopher presented them schematically, by creating a table of categories divided into six classes. According to the scheme, the first class consisted of nine absolute attributes of God: Goodness (*Bonitas*), Majesty (*Magnitudo*), Endurance (*Duratio*), Power (*Potentia*), Wisdom

[10] On philosophy of Raimond Lull, Lullism and its influence on Leibniz's combinatorics see: Yates Fr., *The Art of Raimond Lull. An Approuch to it through Lull's Theory of the Elements*. // *Journal of the Warburg and Courtauld Institute*, 17. 1/2 (1954); Rossi P. *Clavis universalis*; Schmidt-Biggemann W. *Topica universalis*; Doucet-Rosenstein D. *Die Kombinatorik als Methode der Wissenschaftnen bei Raimund Lull und G.W.Leibniz.* Diss. München. 1981; Bonner A. *The Art and Logic of Ramon Lull. A User's Guide.* Leiden, Boston, 2007.

(*Sapientia*), Will (*Voluntas*), Virtue (*Virtus*), Truth (*Veritas*), Glory (*Gloria*). The second class included nine relative attributes: Difference (*Differentia*), Concord (*Concordantia*), Contrariety (*Contrarietas*), Beginning (*Principium*), Middle (*Medium*), End (*Finis*), Majority (*Majoritas*), Equality (*Aequalitas*), and Minority (*Minoritas*). Other classes consisted, accordingly, of nine questions (whether, what, why, how, of what, how many, which, where, when)[11], nine subjects (God, Angel, Heaven, Man, Intelligible, Sensible, Vegetative, Elementary, Instrumental)[12], nine virtues (Justice, Prudence, Fortitude, Temperance, Faith, Hope, Charity, Patience, Piety)[13] and nine vices (Avarice, Gluttony, Luxury, Pride, Despair, Hatred, Wrath, Mendacity, Inconstancy)[14]. The combination of the abovementioned primary terms should provide, according to Lull, the establishing of all possible derivative truths, for example, the definitions of space, etc. To practice the combinations, Lull invented a mechanic device – six concentric discs of various diameters, linked to each other and rotating around the same axis. Lull drew nine terms of one class to each disc so that in order to get all possible combinations one had to move the discs and place six terms of various classes along one radius.

The fundamental difference between Lull's universal science and other models of knowledge lays in the fact that it is not based on a hierarchical division of knowledge into particular disciplines, but rather on a combinatory method that provides a logical connection between all things and all knowledge. According to Lull, this method could be viewed both as logic and as metaphysics, but at the same time supersedes both. It is logic in as much as it presents a schematic logic of syllogism based on the Aristotelian doctrine of categories (it is easy to notice that the class of questions is in fact, none other than Aristotelian categories[15]). The same questions-categories, however, when correlated to the class of subjects, are turned into metaphysics, or an ontological 'natural' logic that is not oriented towards speech but rather towards the knowledge of true reality[16]. An essential characteristic of the method is its universality: one who had learned the art, according the statements by Lull, possessed a possibility to acquire knowledge of all things natural through it. In its turn, natural things acquired the status of signs or symbols of divine essence[17], while sciences in their totality (Lull wrote the treatise entitled the 'Arbor de scientia' in 1295, Rome) were supposed to reflect the structure of the universe[18] and correspond to divine attributes. Thus, the foundations of things,

[11] *Utrum, Quid, Quare, Quomodo, Ex quo, Quantum, Quale, Ubi, Quando.*
[12] *Deus, Angelus, Coelum, Homo, Imaginativa, Sensitiva, Vegitativa, Elementativa, Instrumentativa.*
[13] *Justitia, Prudentia, Fortitudo, Temperantia, Fides, Spes, Charitas, Patientia, Pietas.*
[14] *Avaritia, Gula, Luxuria, Superbia, Acedia, Invidia, Ira, Mendacium, Inconstantia*
[15] There are ten questions and ten categories in another version of the great art. See Yates Fr. *Raimond Lull*. P. 2.
[16] Rossi P. *Logic and the Art of Memory*. London – New York: Continuum. P. 32.
[17] Ibid., p. 33.
[18] Ibid., p.33.

principles of art, and divine virtues presented interchangeable notions in Lull's terminological system. Being a cosmology rather than a logic[19], the Lull's great art did not draw a line between things divine and mundane. In his 'Liber de ascensu et descensu intellectus' (1305) Lull described the ascent of human intellect to the knowledge of divine archetypes, on the ladder of creation, from the lowest (stones) to the highest (angels) and further to God[20].

As it has been shown in recent studies, the philosophy of Raimond Lull absorbed various influences that had been predominately Christian, although it is not possible to exclude indirect influence of Arab philosophy and Cabbala. First of all, the doctrine of the attributes of God by Lull has been influenced by the Neo-Platonic idea of the emanations of the Divine mind reflected in the Trinitarian doctrine by St. Augustine and in the cosmology by Johannes Scotus Eriugena, which in itself was a re-interpretation of the teachings of the Greek Church Fathers, and the doctrine of the names of God by Pseudo-Dionysius the Areopagite. The idea that a man could partake of divine wisdom should also be attributed to Neo-Platonic elements of the great art by Lull[21] (Eriugena, however, defined the knowledge of God in negative terms, while Lull ascribed to Him a limited number of positive attributes). Also Lull was clearly influenced by Martianus Capella's system of liberal arts, and his geometry was guided by Boethius.

The ideas of Lull enjoyed great popularity in the Late Middle Ages (especially among alchemists), and in the Renaissance when the school of Lullists was established, along with that of Ramists and Aristotelians. Paolo Rossi has shown that Renaissance encyclopaedists and pansophists viewed the art of Lull as the *clavis universalis*: they thought it possible to draw a direct analogy between cosmological hierarchy and the hierarchy of knowledge. At the same time, neither Lull nor his enthusiastic followers had ever thought metaphysics to be an object of their specific interest. The attractiveness in Lull's system was its underlying universal symbolism, or 'natural semiotics', oriented towards symbolic interpretation of divine signs written in the 'book of nature'; it had the idea of universal language as a direct result of its development. Lull's universal symbolism found its continuation in the metaphysics and ideas of natural language by Nicholas of Cusa, and in the concept of natural theology by a Catalan Lullist Ramon Sibiuda. The latter attempted to develop a science of creation based on the reading of

[19] Ibid., p.34.
[20] Ibid., p. 35.
[21] The influence of the Augustinian doctrine of enlightenment could be found in the concept of theology as the plenitude of wisdom by the English philosopher, Roger Bacon (1214 ? – 1294 ?). Bacon gave his image of the world both experimental and encyclopaedic character. According to him, each science was an integral part of a 'general wisdom' crowned by theology, the science of Revelation. Philosophy, being formally subjected to theology, represented a way of secondary (natural) search for Revelation. Thus, nature for Bacon was a form of Revelation. This concept led to the idea of the necessity of all-embracing continuous studying of nature in order to restore the lost divine knowledge. Thus, Roger Bacon based his gnoseology mutual movement of God towards man (through the Word and creation) and man to God (through studies of the Scripture, the laws of reason and rhetoric, as well as the laws of nature).

liber naturae, rather than the studying of the Scripture[22]. Paolo Rossi has noted that traces of Lullism could be found in humanistic texts oriented towards the synthesis of rhetoric and mysticism, as well as in the writings by Pico della Mirandola, Charles de Bouvelles, and Giordano Bruno[23]. The direct influence of Lullism, or, rather, the attempts to reform it, helped create numerous versions of universal knowledge, for instance, the programme of universal science by Bernard de Lavinheta and Heinrich Cornelius Agrippa. It is interesting that some projects of universal knowledge were based on severe criticism of Lull's alphabet and his logic as a whole[24]. However, it was within the tradition of Modern encyclopaedism, and the building of universal knowledge, where the art of Lull proved to be most fruitful. A true revival of the great art of Lull took place in the 17th century when his ideas were adopted and re-interpreted by Protestant theologians who sought to reform Christian education in the context of the construction of the so-called Pansophia[25]. According to the Bishop John Prideaux, the auther of the famous 'Heptades logicae' (1639), the art of Lull was among seven greatest logical systems ever developed in human history[26]. Lull's image of the tree of sciences was also adopted by Francis Bacon and Rene Descartes[27].

§ 2. Encyclopaedism and universal science: the context of Humanism

A number of intellectual movements oriented towards encyclopaedic scope and the systematization of knowledge emerged in Europe in the 16-17th century. The term 'encyclopaedia' was invented by Humanists in the late 15th century. As far as linguistics is concerned the term was derived from the Greek word *κυκλοπαιδεία*[28], which Humanists saw as analogous to the Latin terms *orbis disciplinarum*, *orbis doctrinae*, *encyclios disciplina*. By the mid-sixteenth century,[29] this word was widely used, but often meant a mutually ordered account of sciences, not an all-embracing compendium of knowledge[30]. Apart from logicians and

[22] Rossi P. *Logic and the Art of Memory*, p. 34.
[23] Ibid., p. 29.
[24] For instance, the programmes of Rudolph Agricola and Spanish humanist, Fernando de Cordoba. Ibid., p. 35-37.
[25] Rossi P. *Clavis universalis*, p. 49.
[26] Johnson M. *The reception of the Lullian Art. 1450-1530.* // *The Sixteenth Century Journal*. Vol. 12;. 1, 1981. P. 31.
[27] Ibid., p. 37.
[28] The notion of κυκλοπαιδεία goes back to the Greek words εγκυκλιωσ παιδεια, which in Ancient Greece meant the subjects to be studied by the children of citizens. See Dierse U. *Enzyklopädie: zur Geschichte eines philosophischen und wissenschaftlichen Begriffs.* Bonn: Bouvier, 1977. P. 6.
[29] The tradition of encyclopaedic compendia developed in the Middle Ages without any direct link to theological justifications of nature and the limits of human cognition; it differed considerably from the Modern encyclopaedism. Such medieval works ('Institutiones' by Cassiodorus, 'Etymologies' by Isidore of Seville [6th c.], 'Speculum Maius' by Vincent of Beauvais, 'Didascalion' by Hugo St Victor) were based on the system of seven 'liberal arts' that had acquired its classic form in 'On the Marriage of Philology and Mercury' by Martianus Capella and existed till the late 16th c. with some minor changes and additions. What was typical for medieval encyclopaedism was the tendency of the authors to conservatism and compilations: knowledge that composed those compendia was represented as whole and complete; it could not be augmented or corrected.
[30] Dierse U. *Enzyklopädie*, p.9.

theologians, Humanists were the most passionate advocates of encyclopaedism as they aimed at a combination of logic and eloquence modelled on the Ciceronian image of the perfect speaker[31]. Thus, an Italian Humanist, Marius Nizolius, connected the notion of encyclopaedia directly with 'the one science' by Cicero[32], that is, a synthesis of eloquence and philosophy[33]. Having rejected the Aristotelian classification of sciences and chosen the classification by the Stoics as a prototype, Nizolius then presented his own model of encyclopaedia, made of three parts – 'physics, or natural philosophy', 'politics, or civil philosophy', and 'eloquence' (or logic and rhetoric). The classification by Nizolius, however, demonstrated even less logical interconnections between sciences than the Aristotelian scheme had done[34].

Another example of the way the encyclopaedic ideal was linked to the notion of universal science in humanistic circles was the book, 'Dello speccio di scientia universale', published by a medical doctor, Leonardo Fioranti, in Venice in 1603[35], where one of the first uses of the term was to be found. If Nizolius chose the Ciceronian ideal of 'one science' as the synthesis of eloquence and wisdom, then the work by Fioranti presented a metamorphosis of Lullism. This work was a compilation, written in Italian, and consisted of three parts, where the author described the origin and destiny of all possible arts, sciences, and crafts that could ever be useful to the humankind. The first part described various practical arts, ranging from agriculture, medicine, the art of war, and architecture, to painting and dance. The second part was dedicated to philosophy, grammar, politics and moral questions. Finally, the third part dealt with practical recommendations connected to medicine and hygiene. The author certainly did not desire to build an original genetic model of the described sciences but rather saw a science as wisdom necessary in everyday life. One of the main sources where Fioranti took his definitions of sciences from, apart from the Old Testament, was Raymond Lull: the latter's 'great art' became a prototype for Fioranti's 'universal science'. The book by Fioranti was an example of the kind of humanistic encyclopaedism where gravitation to universalism resulted from moral and religious utopias and was not burdened with methodological reflections on true knowledge.

[32] When presenting an image of an ideal rhetorician in Book 3 of his 'Orator', Cicero gave him 'a miraculous unity of speech and thought'. Cicero complained about the division of philosophy and eloquence that existed at his time, and insisted it was necessary to return to the practice of ancient thinkers before Socrates who did not divide the science of speech from studies and knowledge of all human life. In Cicero's opinion, philosophy and eloquence shared a source, so that eloquence together with philosophy could become the one science that was the source of all possible knowledge; cf. Cicero. *De Oratore*. L. 3. C. 35.

[33] Nizolius, M. *De veris principiis et de vera ratione philosophandi contra pseudophilosophos libri IV*. Parma. 1553. This work was also published by Leibniz in 1670 in Frankfurt with his extensive critical introduction. It was re-printed in 1674, also in Frankfurt, under a title "Antibarbarus Philosophicus". The citations here are from the first edition. See also: Dierse U. *Enzyklopädie*, p. 13-15.

[34] Dierse U. *Enzyklopädie,* p. 14-15.

[35] Fioravanti L. *Dello Specchio Di Scientia Universale, Dell'Eccellente Medico, & Cirurgico*. M . 1603.

The works of an English philosopher, Walter Warner (1562-1643), also persuades us that the seventeenth-century notion of universal science did not mean a method but rather an exhaustive corpus of knowledge where particular sciences represented the strictly ordered whole[36]. A similar meaning of the expression *scientia universalis* was to be found in 'Universal Science' by Charles Sorel (Paris, 1641)[37], where the author insisted that it was necessary to create a new system of sciences "based on reason and experiment" and corresponding to the natural order of things. The natural order of things perceived from experience, apart from other ways, was not seen as a distortion of true knowledge, but rather as its immediate continuation and reflection.

The new meanings of the terms 'encyclopaedia' and 'universal science' developed slowly over the second half of the 16th and the whole of the 17th cc., as the problem of knowledge was closely linked with the search for a cognitive method. The growing interest in the problem of method in the Early Modern philosophy resulted, first of all, from the endeavours of the humanists to systematize and master the corpus of Ancient knowledge. An important role in this process played also anti-Aristotelian tendencies of a number of thinkers who either reduced metaphysics completely (Petrus Ramus[38]), or attempted to unite the Aristotelian metaphysics with the principles of method and system (Giacomo Zabarella[39]). An example of the passion for systematization was the work by Bartholomeus Keckermann (1572-1608)[40] who combined the ideas of Agricola, Melanchthon, Ramus, and Zabarella in his doctrine of method.

§ 3. Universal science as first philosophy

In contrast to humanistic circles where the term 'universal science' was blurred and ambiguous, the only field where it could be viewed as *terminus technicus* was in Protestant theological tradition that presented a consistent re-interpretation of Aristotelian and scholastic

[36] See: Rossi P. *Logic and the Art of Memory*. Translator's Introduction, p. VIII.
[37] Sorel Ch. *La Science Universelle*. Vol. 1-5. Paris: Quinet, 1641-1645.

[38] The dialectics of Petrus Ramus is a blend of Platonic doctrine of ideas and Ciceronian topics with his operational division of reason into assessment and invention. Ramus thought natural human reason to be the basis for scientific knowledge. Unlike contemplative theological reason based on the presumption of incognizable God and, consequently, incognizable creation, natural reason, provided with a right method, i.e., orderly by itself, leads to true knowledge. According to Ramus, a man had innate, although blurred, knowledge of truth, and method was required to reveal the truth – the art of going from general to particular. Orderly reason was also a systematizing reason. Method guaranteed that the world would be cognized the way it was: having developed the Aristotelian idea of knowledge according to nature as going from general to particular, Ramus stated that his method of analysis was universal and enabled reason to follow natural order. Knowledge was represented as subjected to progressing development (while Aristotle did not imply linear growth of knowledge since syllogism, the main instrument of gaining new knowledge, was just one stage of thought). See Meier-Kunz A. *Die Mutter aller Erfindungen und Entdeckungen. Ansätze zu einer neuzeitlichen Transformation der Topik in Leibniz' ars inviniendi*. Würzburg: Königshausen&Neumann, 1996. p. 28; Schmidt-Biggemann W. *Topica universalis*, p. 69.
[39] Schmidt-Biggemann W. *Topica universalis*, p.106.
[40] Ibid., p. 94.

traditions. It was theologians who debated the delineation between the science of things and the science of God in the 16-17th c. This differentiation is genetically linked to the ambiguous definition of Aristotle's 'first philosophy': in his 'Metaphysics' it meant both the science of things (and in this case it embraced theology, mathematics and physics), and the science of God (in that case it only included theology).

What had been defined as the differentiation between *metaphysica generalis* (the 'first philosophy' by Aristotle, which studied existing things) and *metaphysica specialis* (the doctrine of God and immaterial things) in the scholastic tradition, Protestant theology transformed into the doctrine of the two types of sciences – the science of God, as much as He could be perceived by men, and the universal science (*scientia universalis*) that provided foundations for all particular sciences. A clear example of intensive theological and terminological search of the period was provided in 'Isagoge in Isagoge in Peripateticorum et Scholasticorum Primam Philosophiam primam philosophiam', (1598) written by a Marburg professor, Rudolph Goclenius, who defined the 'first philosophy' as 'universal science' (*scientia universalis*) that dealt with the first foundations of all existing things as well as the first divine substance. Goclenius used synonyms for the 'first philosophy': the notion of wisdom (philosophy, as such), theology, and metaphysics that dealt with transcendental things.[41] Thus, Goclenius identified the notion of 'general knowledge' with Aristotle's 'first philosophy', or metaphysics. It means that Aristotle's 'Metaphysics' should be included into the list of historical sources for Leibniz's universal science that has been compiled by Thomas Leinkauf and cited at the beginning of the present article; so far this circumstance has been completely ignored by scholars.

Another allusion to 'Metaphysics' is represented by the notion of 'universal science' by Francis Bacon. In the third book of the 'Great Instauration', Bacon set forth a doctrine, typical for his time, of one foundation for all sciences, that is, a 'universal science'[42]. Bacon identified it with the 'first philosophy' and with 'wisdom', which was a direct reference to Aristotle's definition of 'sought science' as the 'first science' and 'wisdom'. It is significant that Bacon also indirectly called this 'universal science', a foundation for all other sciences, a 'sought' one, since it had been suggested that this science still needed to be "studied further".[43] In Bacon's opinion, this 'universal science' should have been a "collection of axioms of numerous sciences, not just one of them"; what is suggested here is not the first notions in the sense of Lull, but rather

[41] Lohr, *Ch. Metaphysics and natural philosophy as science: the Catholic and the Protestant views in the sixteenth and seventeenth centuries.* // *Philosophy in the Sixteenth and Seventeenth centuries. Conversation with Aristotle.* Ed. by Constance Blackwell, Sachiko Kusukawa. Aldershot. Ashgate. 1999. P. 290-291.
[42] Bacon F. *De Dignitate et Augmentis Scientiarum*. T. I. Nürnberg. 1629. P. 151.
[43] Ibid.,p.152.

analogies or common laws and principles that worked in the same way in various fields of nature. An example of this kind of principle, according to Bacon, is the law 'nature reveals itself predominantly in the smallest' by Democritus, since it was equally applicable to physics and to politics, as it had been shown by Aristotle in his doctrine of family as the foundation of state. Bacon claims, that similar analogies were not coincidences, but "evidently represent common signs and marks of nature that it impressed on a number of its creatures and in different fields".[44] This passage certainly reminds one of the tradition of natural theology by Roger Bacon, the founder of English natural philosophy and an advocate for the studies of nature as one form of Revelation.

Apart from these analogies, Bacon thought the 'first philosophy' to study also 'transcendences, or circumstantial characteristics of existing things', that is, such notions as big and small, similar and different, possible and impossible, as well as entity (*ens*) and nonentity[45]. It is important that Bacon thought that these dialectical notions should not have been studied within narrow logical context, but rather in their connection to the laws of nature, and desired to turn them into instruments to explain similarities and differences between natural things, that is, in fact, to make a theory of species.

The fact that the immediate prototype for the Baconian concept of 'universal science' was 'Metaphysics' by Aristotle is proved, strangely as it is, by Bacon's demonstrative break with all previous tradition that had falsely identified, in his own words, the notions of the 'first philosophy' and 'metaphysics'[46]. He called the first philosophy the matter of all sciences, and placed metaphysics within the realm of natural philosophy that, according to him, should not only have its subject in 'external existence, movement and natural necessity but also … reason and idea'[47]. Bacon placed this kind of metaphysics among innovative disciplines, that is, the ones that were still to be created.

As it was the case with Bacon, it was the 'innovative' context where the notion of universal science was commonly used by Descartes, and it seems to have confused some scholars of early Modern philosophy who have failed to recognize traditional allusions of the term. For instance, the work by Jurgen Mittelstrass studied specifically the differences between the notion of universal science by Descartes and his *mathesis universalis*, and it has been established that the first notion was wider than the second. Mittelstrass based his analysis of the two main methodological works by Descartes: the 'Discourse of the method' that had initially

[44] Ibid., p.154.
[45] Ibid., p.155.
[46] Ibid., p.163.
[47] Ibid., p.164.

been called the ‘Project of universal science that could raise our nature to the highest level of perfection’; and the ‘Rules for the Direction of the Mind’ where universal science was called universal wisdom. The aim of Mittelstrass was to show that Descartes thought the unity of the mind (common sense) to be the foundation of the possibility of universal science as it was a basis for all sciences (including empirical ones); at the same time, he thought the real implementation of the project of universal science to be dependent on the creation of universal philosophical language. This philosophical language, in its turn, should have been based on the true analysis of conscience, so it depended on the creation of new metaphysics (here, as Mittelstrass has rightly pointed out, Descartes openly confronted Lullism). Thus, Mittelstrass concluded that Descartes thought his methodological reflections to be just a threshold of universal science, and its real emergence would happen in the future.

Meanwhile, Mittelstrass showed that, unlike the universal science, the notion of *mathesis universalis* by Descartes had been better defined and applied exclusively to quantitative disciplines such as astronomy, music (theory of harmony), optics, and mechanics. These sciences thus were *a priori*, or formal, and their unity was not explained from their contents, but from method, that is, through their subjection to the theory of computation and proportions.

The differentiation between the notion of universal science by Descartes and his *mathesis universalis* demonstrated by Mittelstrass was reinforced by the ambiguous historical and philosophical context that shaped new philosophical theories of Modernity – that is, their polemics with tradition. Thus, Descartes identified universal science with the notion of universal wisdom, as it had been the case with Bacon, and it clearly pointed towards the ‘sought science’ or the ‘first philosophy’ by Aristotle. The concept of *mathesis universalis*, in its turn, had Neo-Platonic sources and went back to the concept of ‘one science’; Descartes knew its programme through Proclus’ commentary to the ‘Elements of Geometry’ by Euclid. The terminological line between the two notions was rather uncertain since they both went back to Aristotle’s ‘sought science’ and reflected its ambiguous nature, so that Descartes viewed universal science as a science of existing things, and *mathesis universalis* as a science of intelligible things. The difficulty that contemporary scholars face: how to evaluate the correlation between the two aspects of the same science, in my opinion, reflects the fundamental problem in the construction of the new models of metaphysics that intend to overcome the breach between ideal and real, Creator and creature. It seems that here lays the problem of ‘complete metaphysical computation of existing things’ that Leibniz later tried to solve with his project of universal science through creating his projects of the logic of contingency.

§ 4. 'Universal Encyclopaedia' by Johann Heinrich Alsted and 'Pansophia' by John Amos Comenius

While Descartes made his project of universal science dependant on the success of the new metaphysics, his contemporaries – Protestant philosophers of the first half and the middle of the 17th c. who were affiliated with the German university of Herborn – strived to implement a version of universal science rooted in Lullism.

An American historian of philosophy, L. Loemker has remarked that the Herborn thinkers were characterized by "moderate Calvinism, tendency to look to the books of the Old and the New Testament when debating theological and historical points, moral casuistry, mostly borrowed from the Jesuits, preference for eclecticism, close interest to new discoveries and contemporary intellectual trends, and intense millenarist sentiment"[48]. Johann Heinrich Alsted (1588-1638) [49] was the central figure of this circle, a fine example of Protestant encyclopaedism; in his works Alsted combined the dialectics by Ramus with a tendency to ontologized logic typical for Raymond Lull, Zabarella, and Bartholomeus Keckermann. Comenius and Johann Bisterfeld were among the most famous students of Alsted.

Alsted's name was linked to the efforts to implement the project of universal science. In his early work, 'A key to the art of Lull' ('Clavis artis Lullianae', 1609), Alsted advocated the science of 'all that could be known' (*de omnium scibili*)[50]. Having rejected Keckermann's criticism of Lullism, namely that Lull's art was tangled and incomplete, Alsted insisted that, outward heterodoxy notwithstanding, the first principles of Lull presented a highly articulate system. In opposition to Keckermann, Alsted stated that all first notions set forth by Lull were logical notions; their difference from all others was that as *primae notiones* they had a special ontological status, i.e., they existed outside of a cognitive mind. Bearing on this statement, Alsted then found it possible to borrow Lull's alphabet of human thoughts, where logical categories[51], or the *topoi* of invention, were simultaneously divine attributes, or metaphysical principles. On the base of this alphabet, Alsted created his own 'general philosophical Lexicon' that was to lay foundations for all sciences.[52]

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[48] Loemker, L. E. *Leibniz and the Herborn Encyclopedists*. // *Journal of the History of Ideas* (July-Sept., I96I), Vol. XXII, No. 3. P. 323.

[49] On Alsted see: Clouse R.G. *Johann Genrich Alsted and English Millennialism*. // The Harvard Theological Review 62 (1969).

[50] Alsted, J.H. *Clavis Artis Lullianae, Et Verae Logices Duos In Libellos Tributa Id est, Solida Dilvcidatio Artis magnae, generalis, & ultimae, quam Raymundus Lullius invenit, ut esset quarumcunq[ue] artium & scientiarum clavigera & serperastra: edita in usum & gratiam eorum, qui impendio delectantur compendijs, & confusionem sciolorum, qui juventutem fatigant dispendijs. Argentorati*. Zetznerus. 1609. p. 20.

[51] It is remarkable that in 'Clavis artis Lullianae', and in his later work 'Trigae Canonicae' (1612) Alsted added Aristotelian categories to the absolute notions of Lull. This addition goes back to Cornelius Agrippa von Nettesheim. See: Schmidt-Biggemann W. *Topica universalis*, p. 111.

[52] Ibid., p. 112.

Early works by Alsted also included his 'Philosophia dignè restituta' (1612)[53], where gnoseological and metaphysical grounds for universal science were presented in their fully developed form. In the spirit of Neo-Platonic doctrine of the connection of human mind to the divine, Alsted defined the philosophy and wisdom as a pre-condition for the possibility to cognize God. Alsted made a special section of philosophy – 'Archaeology' – as the foundation of 'universal science'. 'Archaeology' was the science of beginnings, the 'basis of all sciences'. Together with 'Hexilogy' (the science of human cognitive ability), 'Technology' (the science of encyclopaedia and the specialities of particular sciences), and 'Canonica' or 'Dialectics' (the science of method), Archaeologia formed the field of premonitory knowledge that Alsted called Praecognita. Alsted put 24 disciplines into the field of science proper, including such non-experimental forms of knowledge as, for example, history. This circumstance resulted directly from an assumption that Archaeology carried in itself the elements of everything that could be known[54].

Theoretical and methodical rules of universal encyclopaedia, presented in the 'Philosophia dignè restituta', were implemented in the two encyclopaedias by Alsted, published in 1620, although in different gnoseological and theological context. Alsted embraced orthodox Calvinism in the mid-1610s and rejected the doctrine of human mind partaking of divine Mind. His interest in Lullism was also pushed into the background. Yet even at the 'post-Lullist' stage, Alsted continued to develop the concept of universal science although in a rather different form.

The 'Encyclopaedia in seven volumes' (1630)[55] (the second, revised edition of an earlier work of 1620) is the best known and the most important work by Alsted. It influenced the encyclopaedic projects of Leibniz directly: in late 1660s Leibniz saw that Alsted's work of 1630 was a possible basis for his own encyclopedia[56]. At the very beginning of his work, pointing out the Greek origin of the term encyclopaedia, Alsted, however, remarked that, unlike the Ancient system of seven liberal arts, his encyclopaedia was 'absolute', i.e., the 'system of systems', the 'circle of all disciplines used in this life'[57]. Referring to an Italian scholar and inventor, Giulio Camillo, Alsted called the encyclopaedia the Idea and the Theatre of imitators and imitated objects: "Imitators are those disciplines whose aim is the imitation of God and nature. These are

[53] Alsted J.H. *Philosophia digne restituta: Libros Quatuor Praecognitorum Philosophicorum complectens: Quorum I. Archelogia, de principiis disciplinarum. II. Hexilogia, de habitibus intellectualibus. III. Technologia, de natura & differentiis disciplinarum. IV. Canonica, de modo discendi*. Herbornae Nassoviorum. [Corvinus]. 1612.
[54] Schmidt-Biggemann W. *Topica universalis,* p. 125.
[55] Alsted J. H. *Encyclopaedia Septem tomis dictincta.* Herbornae Nassoviorum. 1630.
[56] Leibniz G.W. *Cogitata quedam de Ratione perfeciendi et emendandi Encyclopaediam Alstedii.* // Leibniz G.W. *Sämtliche Schriften und Briefe.* Hrsg. von der Berlin-Brandenburger Akademie der Wissenschaften und der Akademie der Wissenschaften in Göttingen. Reihe 6, Bd. 2. p. 394 – 397, also see: Dierse U. *Enzyklopädie,* p. 26.
[57] Alsted J.H., *Encyclopaedia Septem tomis dictincta*, p. 49.

the two things the encyclopaedia deals with, as an idea and a theatre. This is the theatre of Metaphysics, Logic, Grammar and other disciplines"[58]. Thus, Alsted viewed the encyclopaedia as a form of knowledge that reflected the world adequately, and its aim he saw in the methodical comprehension of all things that a man could know in his life, thence, the universalism of the encyclopaedia and the unity of sciences represented in it.

Alsted explained the unity of disciplines both in the spirit of natural theology and on the grounds of logical relations: the accord between the true elements of various subjects (the relations of family members, a father and a son), a shared goal (glory of God and relative rise of man above his smallness), and finally, the unity of disciplines in their implementation[59]. In other words, Alsted explained the unity of sciences by the shared first principles, the same subject of cognition (intellect and the art of will), the same object of cognition (truth and good) and finally, the same aim of cognition (human perfection)[60].

In accordance to the principle of the unity of all disciplines, Alsted put forward a universalist principle of cognition – a quotient is to be known only in the context of the whole: "it is thought that the nature of disciplines is known through their definition and differentiation … Thus, one should not explain the nature of a discipline in a particular text".[61] The main aim of the author of the absolute Encyclopaedia was, therefore, to put various disciplines in order by their methodical differentiation according to the first principles, and Alsted noted that the number of disciplines could not be infinite[62]. Thus, the Encyclopaedia got an orderly structure. It was divided into two parts: the first, Praecognita, dealt with the so-called premonitory knowledge and represented the prolegomena to the second part where the sciences themselves were explained.[63] In the Encyclopaedia of 1630, the Praecognita part was represented by four sciences – 'Hexicology' (the science of intellectual qualities), 'Technology' (the science of the qualities, order and general differentiation of disciplines), 'Archaeology' (the science of the elements and aims of disciplines), and 'Didactics (the science of the teaching and studying of sciences).

Alsted explained these four disciplines in the first volume of his Encyclopaedia. There he did not base his differentiation of disciplines on Lull's alphabet but rather on intellectual qualities or abilities (*habitus intellectuales*[64]), thus transferring the grounds for the

[58] Ibid., p. 49-50.
[59] Ibid., p. 63
[60] Ibid., p. 75.
[61] Ibid., p. 48.
[62] Ibid., p. 72.
[63] Ibid., p. 49.
[64] The notion of intellectual quality (*habitus intellectuales*) was also important in the epistemology of William Ockham and could be traced back to the category of 'possession', the eighth in the Aristotelian list of categories.

Encyclopaedia into a transcendental and psychological context[65]. However, transcendentalism here did not imply the rejection of metaphysics since cognitive abilities, according to Alsted, were divided into innate, i.e., inserted by God, and acquired, and cognition itself resulted from the influence of natural light (*lumen naturae*) and divine grace (*gratia*)[66]. Soteriological basis of Alsted's encyclopaedism was even more evident in his thesis on the difference between the so-called 'internal' and 'external' sciences (*disciplina interna et externa*). 'Internal science', according to Alsted, was "a certain intellectual quality that perfects a man and leads a trained and prepared man to artful contemplation or action". 'External science' was a "system of methodically exposed and reliable doctrines that explain something interesting and useful and serve to teach and perfect a man"[67].

In accordance to the main aim of the encyclopaedia, which consisted in the restoration of the original perfection of the man, Alsted developed the doctrine of human thinking that went up to cognition influenced by natural light and divine grace. The foundation of 'internal science' was natural light (*lumen naturae*), that was given to man at the moment of Creation and was preserved after the Fall as an impression of his original condition. This natural light was the 'radiance of divine wisdom' through which "light is recognized, that is, the obviousness and firmness of the first principles and conclusions derived from them"[68]. Natural light influenced three main intellectual abilities of man – intelligence (*intellegentia*), syntheresis (*synteresis*), and conscience (*conscientia*)[69]. Alsted called these qualities the sources of "all that could be taught and studied in sciences"[70]. Intelligence, which Alsted identified with the Greek νουζ, was a contemplative ability to perceive the first theoretical principles. Syntheresis was a practical ability to perceive the first practical premises in theory, while conscience was an ability to perceive practical premises in application to itself. Alsted called the divine light that influenced practical qualities, the law of nature (*lex naturae*). Moreover, he includes the so-called poetic intelligence (*intellegentia poetica*), also called organic, to the number of fundamental abilities responsible for the perception of the first principles[71]. Thus, according to the unity of human nature, natural light influenced both theoretical and practical spheres of human activity and revealed its foundations.

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[65] *Varietas disciplinarum est quantum ad habitum mentis, & ipsa disciplinarum genera.* Ibid., p. 49.
[66] Ibid., p. 50.
[67] Ibid., p. 50.
[68] Ibid., p. 53.
[69] Ibid., p. 51.
[70] Ibid.
[71] Ibid., p. 53.

The primary operation of thinking, said Alsted, was the connection of the mind with an intelligible object (understanding), and human thinking itself was nothing else but sheer ability or potency. His second operation was the evaluation of the truthfulness or falsity of understanding. Thence he deduced the necessary existence of such intellectual qualities that were characteristic for thinking as potency, disposing towards and insisting on acting. Thinking itself could function better or worse, and examples of that were, in Alsted's opinion, errors in religion, namely, the rejection of the thesis 'God existed', which represented a self-evident theoretical first principle[72]. Direct cognition was evidently guaranteed, in Alsted's opinion, by the logical principle 'predicate is in the subject', according to which the cause of a thing could not be given, as the thing was identical to itself[73].

Alsted began to construct the hierarchy of sciences with theoretical disciplines. The first and the most general of them was Metaphysics as it defined the elements and the subject of all other theoretical disciplines. Pneumatics, the science of created and non-created spirits, followed, which was nobler than Metaphysics since it was about God. Then it was Physics, the science of natural bodies. Mathematics was the last in this hierarchy in Alsted's thought, since the science of accidents should have been placed after the sciences of substances[74]. He made Ethics the first of practical disciplines since it "turns the soul to natural order, … holds the elements and foundations of all prudence, speaks of the affects of the soul, of virtues and their effect, of the supreme good and the highest destiny of man"[75]. Politics and economics belonged to the same section. Vocabulary was the first of the poetic disciplines; it dealt with the meaning of the words that a pupil needed to understand before studying things they signified. Vocabulary was followed by Grammar, and then – by Logic, Rhetoric, and the Art of Declamation (*Oratoria*)[76].

The paradox is that the principle of the priority of system over material, which Alsted's Encyclopaedia is based on, results in the variability of the system itself. Alsted pointed out repeatedly that the same discipline could occupy a number of places in the hierarchy of sciences, depending on the criterion this hierarchy was built - according to the chronology of invention, or to the universality of its elements. Metaphysics, according to Alsted, was the most general and the most important science, although it was the last to be invented, since its subject was the most general and the simplest. But as "we know simple things through abstracting ourselves from

[72] Ibid., p. 54.
[73] Ibid.
[74] Ibid., p. 71.
[75] Ibid., p. 70.
[76] Ibid.

things material and perceived sensually", so Physics and Mathematics preceded Metaphysics in the order of invention[77].

As had been noted above, the project's most important characteristic was the moral and practical aim that Alsted ascribed to knowledge: intellect, governed by the divine grace, was transformed into wisdom that led a man to live and act correctly[78]. Therefore, the final goal of natural theology for Alsted, as for other philosophers of his circle, was the perfect cognition of God (*cognitio Dei perfecta*)[79] so that each science should, according to him, help 'restore the divine image in man'[80].

Alsted's encyclopaedism, in this Neo-Platonic interpretation, served as a starting point for the doctrine of Pansophia, developed by his student, John Amos Comenius[81]. He worked all his life on the project aimed at the creation of the universal pedagogic programme in the spirit of Protestantism. The best known work by Comenius, the 'Pansophiae Prodromus', was nothing else but an expanded theological justification of the possibility of all-encompassing knowledge of the world. Here, Comenius formulated statements typical for Alsted's encyclopaedism, but more systematically than it had been done by his tutor. For example, the idea of creation as a form reflecting the Creator, common in humanistic circles in the 16-17th c., and expressed by Comenius in the formula 'creatures are proportionate to the Creator', was transformed into the thesis of one foundation for all existing things: 'All things are identical to each other in their foundation and only differ in their form, so they exist in God as in their archetype [prototype], in nature – as in their ectype [reflection], and in art – as in their antitype [anti-image]'[82]. In this theological context Comenius developed the idea of the harmonic symmetry of all things and made an evidently Lullist suggestion that 'all things … consist of few elements and of few differences in their forms'[83]. Alsted's Encyclopaedia, and the Pansophia by Comenius, shared the ideal of the homogeneity of knowledge based on a purely logical operational principle of the deducibility of particular consequences from a general point: "All particulars in all Pansophia should not introduce anything new, it should only be a special expansion of previous

[77] Ibid., p. 71.
[78] Ibid., p. 49, 73 – 74.
[79] Lohr, Ch. *Methaphysics and natural philosophy as science: the Catholic and the Protestant views in the sixteenth and seventeenth centuries.* // *Philosophy in the Sixteenth and Seventeenth centuries. Conversation with Aristotle.* Ed. by Constance Blackwell, Sachiko Kusukawa. Aldershot. Ashgate. P. 290 – 291.
[80] *Omnes disciplinae suo modo faciunt ad instaurationem imaginis Die in hominem* (Alsted J.H. *Encyclopaedia Septem tomis dictincta*, p. 74).
[81] The term 'Pansophia' was introduced in a Rosicrucian work of 1616, later it could be found in Alsted's Encyclopedia of 1630, and in 1633 an analogous appeared in the title of a work by one Laurenberg, a physician from Rostock, 'Pansophia, or philosophical Paideia'. On Pansophia by Comenius see: Schmidt-Biggemann W. *Topica universalis*.; also see: *Pansophia* // *Historisches Wörterbuch der Philosophie.* Bd.7: P-Q. Hrsg. von J. Ritter und K. Gründer. Basel. 1989. P. 56 – 58.
[82] Comenius J. A. *Pansophiae Prodromus*. Lugdunum. 1644. P. 67.
[83] Ibid., p. 86.

generalities, as we can see in a tree…"[84] Comenius also adopted a typical Modern preoccupation with a true method of cognition that would help "reach all-encompassing knowledge of things, possess and use them"[85]. He called it a "perfect Pansophian method", and the "general guidance or human mind, through which human minds could have, by clear light, ascended a continuous set of stairs, without taking a false step, from the foundations of things to their summits".[86] This passage clearly demonstrates its Neo-Platonic component inherited by the Herborn thinkers from Raymond Lull, Campanella and Bruno, and characteristic for both Alsted's Encyclopedia, and Comenius' Pansophia[87].

For all evident similarities in the theological presumptions of universal science by Alsted and Pansophia by Comenius, there are considerable methodological and philosophical differences between the two projects. First of all, it concerns the problem of the first elements. Alsted thought that first *a priori* foundations of all knowledge had initially been intelligible entities (as in Lull's alphabet and in substantiated Aristotelian categories), and then were transformed into the functions of intellect (*habitus intellectuales*). Comenius, however, defined the field of knowledge as including both intelligible notions and 'things themselves' in their sensuality, "we warn against the neglect of them"[88] (it did not prevent him from professing the ideal geometric method of proof in the spirit of Descartes). The comparison of the descriptions of things with things themselves was indispensable for Comenius' Pansophian method, so that in his doctrine things themselves were adequate representations of the first elements: "since things, ideas of things and images of these ideas (words) are parallel to each other, so I thought that these basic elements could be rendered similarly by things, ideas and words"[89]. Here, one could glimpse the two philosophical problems that would preoccupy young Leibniz: the problem of the combination of rationalism with sensualism, and the problem of sign, which reflected the debates on universal philosophical language started by the very first generation of Lullists.

It has been stated above that one of the most important premises of the programme of universal science was the typical early Modern idea of the congruence of the Creator and creation, according to which the world in its entirety was viewed as imitation, or as a reflection of the Creator. Alsted presented this motive by adopting the image of Theatre from the 'Theatre of Memory' by an Italian humanist, Giulio Camillo. In the passage quoted above, Comenius called the relation between the Creator and creation 'proportionate'. The image of Theatre was

[84] Ibid., p. 78.
[85] Ibid., p. 50.
[86] Ibid., p. 45.
[87] See: Loemker, *Leibniz and the Herborn Encyclopedists*, p. 324.
[88] Comenius J. A. *Pansophiae Prodromus*, p. 95.
[89] Ibid., p. 86.

also the basis for the 'Theatre of human life' by Zwinger[90] - one of the most popular encyclopaedic works of the 16-17th c. Leibniz studied the 'Theatre' by Zwinger in detail in the late 1670s when he produced his first 'Elements and models' of universal science[91].

The view of the world as a reflection of the Creator was commonplace in humanist thought, and its expression could be found both in encyclopaedic works and in such forms of activity as the systematization of knowledge and forming of scientific collections[92]. Led by a desire to represent all things of the world systematically, the museology of the late 16th – early 17th c. developed its own forms of an encyclopaedic list of things based either exclusively on visual images, or on a combination of verbal catalogue, where notions were represented, with some visual images, where particular things were represented. Both Francis Bacon and Leibniz paid attention to the art of creation collections that reflected the Universe[93]. So the fact that Comenius included 'things themselves' in his Pansophian book should not be viewed as a departure from the programme of Encyclopaedia, but rather as its extension. It is not surprising that this approach to the problem of representation found its continuation in the deliberations of a moderate nominalist Leibniz on the ways to organize a perfect encyclopaedia.

[90] Zwinger Th. *Theatrum humanae vitae*. Basel. 1586.

[91] For the summary of the 'Theatre of human life' by Zwinger made by Leibniz see: Leibniz G.W. *Sämtliche Schriften und Briefe*. VI, I. Reihe 6, Bd. 2, P. 1013 – 1020.

[92] On this see Осминская Н. *Традиция универсального музея: коллекционирование как мировоззрение.*// Arbor mundi, 2004, № 11.

[93] On Leibniz and collecting of the Baroque period see Bredekamp H. *Die Fenster der Monade. Gottfried Wilhelm Leibniz' Theater der Natur und Kunst.* Berlin, Akademie-Verl., 2004. See also an article on Leibniz: Bredekamp H. *Kunstkammer, Play-Palace, Shadow Theatre: Three Thought Loci by Gottfried Wilhelm Leibniz.* // *Theatrum Scientiarum: Collection, Laboratory, Theater: Scenes of Knowledge in the 17th Century*. Ed. by H. Schramm, L. Schwarte, J. Lazardzig. Berlin-New York: De Gruyter, 2005. P. 266 – 282.

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