The infinite in Cusanus' cosmological and geometrical perspectives

FEDERICA DE FELICE

The infinite in Cusanus' cosmological and geometrical perspectives

That Cusanus is one of the most important of Quattrocento's philosophers and a key figure in Western culture is well known. Ever since Ernst Cassirer in his epochal book *Individuum und Kosmos in der Philosophie der Renaissance* labeled Cusanus "the first modern thinker"[1], the interest in Cusanus' thought has burgeoned. Critical studies have pointed out—and continue to point out—the different aspects and implications of his vast and multifaceted speculative activity[2]. The aim of my article is to pursue the relation between infinte and finite in Cusanus' cosmological and mathematical point of view, in order to underline – in the Cardinal's thought – the *status* of the finite mind as the condition of the possibility of the impossibility to attain the infinite.

THE UNIVERSE AS «INFINITAS FINITA»

As Alexandre Koyré underlines—and Hans Blumenberg[3] and more recently Karten Harries[4] and Jean Seidengart[5] have stressed—, Cusanus playes an

[1] CASSIRER, Ernst: *Individuum und Kosmos in der Philosophie der Renaissance*. Leipzig: Teubner 1927, 10: "But this contrast [between the being of the absolute and the being of the empirical-conditioned] is now no longer merely posited dogmatically; rather, [according to Cusanus] it is to be grasped in its ultimate depth; it is to be conceived from out of the conditions of human knowledge. This position on the problem of knowledge determines Cusanus as the first modern thinker". All translations are mine.

[2] See VANSTEENBERGHE, Edmond: *Le Cardinal Nicolas de Cues (1401–1464)*. Paris: H. Champion 1920 (repr. in Frankfurt am Main: Minerva 1963); RITTER, Joachim: *Die Stellung des Nicolaus von Cues in der Philosophiegeschichte. Grundsätzliche Probleme der neueren Cusanus-Forschung*, in: Blätter für Deutsche Philosophie 13 (1939–1940), 111–155. Ritter understands Vansteenberghe to say that Cusa "stands with Eckhart, with Böhme, Kant and Hegel in a single movement, being equal to them in creative, philosophical power, in depth of probing, in breadth and universality of philosophical conception". RITTER, Joachim: *Die Stellung des Nicolaus von Cues*, 111. See also HOPKINS, Jasper: *Nicholas of Cusa (1401–1464): First Modern Philosopher?*, in: Midwest Studies in Philosophy XXVI (2002), 13–29; REINHARDT, Klaus/ SCHWAETZER, Harald (ed.): *Nikolaus von Kues: Vordenker moderner Naturwissenschaft?* Regensburg: S. Roderer Verlag 2003.

[3] *Cf.* BLUMENBERG, Hans: *Die Legitimität der Neuzeit*. Frankfurt: Suhrkamp 1966, spec. Part. 4, § I. Aspekte der Epochenschwelle, 531–558; § II. Cusaner: Die Welt als Selbstbeschränkung Gottes, 559–638.

[4] *Cf.* HARRIES, Karten: *Infinity and Perspective*. Cambridge, MA: MIT Press 2001.

[5] Jean Seidengart analyzed the variety of options concerning cosmological infinity, also taking into consideration other authors relevant to this history, like Patrizi, Benedetti and Ursus. *Cf.* SEIDENGART, Jean: *Dieu, l'univers et la sphère infinie*. Paris: Albin Michel 2006.

essential role in the debate on cosmological infinite space, that is an essential component of the modern worldview [6].

From the end of the sixteenth century on, Cusanus' thought is strictly connected with that of Copernicus[7]: Bruno, in *De immenso* (written in 1583 and published in 1591), associates Cusanus, to which he owes much of his natural philosophy, with the author of *De revolutionibus orbium coelestium*, as if the astronomical theses of the latter could be a clarification of the speculations of the former[8]. In the *Mysterium Cosmographicum* (1596), Kepler expresses his admiration for the Cardinal, mentiones him as his forerunner and enthusiastically calls him *Cusanus mihi divinus*[9] in a context in which he praises Cusanus for recognizing that curvature and rectilinearity are fondamental notions[10]. Later, Descartes would refer to Cusanus in

[6] *Cf.* KOYRÉ, Alexander: *From the Closed World to the Infinite Universe*. Baltimore, MD: J. Hopkins Press 1957.

[7] As Pietro Daniel Omodeo underlines, "among the reasons for the early modern reading of Cusanus as a Copernican or as a proto-Copernican, one should not neglect his authority as a Catholic cardinal who was part of the Roman curia. This aspect became particularly relevant when the reconciliation of the Bible and the 'Pythagorean system' of Copernicus became a heated issue, precisely between the end of the sixteenth century and the beginning of the seventeenth. Apart from this, the fact that Cusanus belonged to the Platonizing humanist culture made him appealing to those who shared this cultural background. The French humanist Léfèvre d'Étaples, editor of Cusanus' *Opera* (1514), praised in the preface the author's anti-Aristotelian philosophy ('*philosophiae Aristotelicae acerrimus disputator fuit*'), his Christian stylistic simplicity, the concordant spirit of his views on religion, and his Platonic approach to mathematics" [*Copernicus in the Cultural Debates of the Renaissance: Reception, Legacy, Transformation* (= Medieval and Early Modern Philosophy and Science 23). Leiden: Brill 2014, 166]. See also: MORAN, Demont: *Nicholas of Cusa (1401–1464): Platonism at the Dawn of Modernity*, in: HEDLEY, Douglas/HUTTON, Sarah (éds): *Platonism at the Origins of Modernity. Studies on Platonism and Early modern Philosophy*. Dordrecht: Springer 2008, 9–30.

[8] BRUNO, Giordano: *De Immenso*, in: *Opera latine conscripta*. Napoli: D. Morano 1879, I, 1, 382: "It is incredible, oh Copernicus, [...] you could assert more audaciously what Nicholas Cusanus had already affirmed with a lower voice in the book *On Learned Ignorance*". For the reception of Bruno and Cusanus, see MEIER-OESER, Stephan: *Die Präsenz des Vergessenen: Zur Rezeption der Philosophie des Nicolaus Cusanus von 15. bis 18. Jahrhundert*. Münster: Aschendorff 1989.

[9] *Cf.* KEPLER, Johannes: *Mysterium Cosmographicum*, in: *Gesammelte Werke*. Bd. I, ed. by Max Caspar. München: C.H. Beck'sche Verlagsbuchhandlung 1938, c. II, 23.

[10] For Kepler the world in its entirety was "constituted" by curved lines, which set limits, rather than by straight lines, which have neither end nor order: "The idea of the universe is perfect. Nevertheless, let us reject straight lines and surfaces, as they are infinite, and consequently scarcely admit of order, from this complete, thoroughly ordered, and most splendid universe" (*Mysterium Cosmographicum*, in: *Gesammelte Werke*, Bd. I, c. II, 25). From Cusanus, Kepler maintained the idea of the correspondence (theological coincidence) of the center and the periphery of the universe, understood as images of two persons of the Trinity, while leaving aside any infinitist speculation. In Kepler's world, the Sun, at the center of the divine epiphany, acquired a very strong symbolic position. This was undoubtedly one of the central elements in his acceptance of Copernicus's hypotheses. For Kepler's Cusanian sources, see BIALAS, Volker: *Zur Cusanus-Rezeption im Werk von Johannes Kepler*, in: REINHARDT,

his considerations on cosmological infinite (or, to be more precise, indefiniteness), conceived as a consequence of God's omnipotence and would regard the cardinal as an ally in the cosmological-theological controversy on heliocentrism and the infinity of space[11].

As one may read in the first book of *De Docta ignorantia*, infinity properly belongs to God alone, since God is «the infinite, absolutely maximum power»[12] and includes everything: the infinite could take two forms, the infinitely large and the infinitely small, which are both contained in the concept of *maximum* that admittes one absolute *maximum* (God) which could also be seen as unifying absolute *maximum* and absolute *minimum*, being infinite and therefore without degree.

The second book of *De docta ignorantia* deals with "one infinite universe" (*unum infinitum universum*). The universe, as *explicatio/contractio* of God, displays divine infinity without actually being infinite, its being is finite but unbounded: "Therefore, God is the enfolding of all things in that all things are in Him; and He is the unfolding of all things in that He is in all things"[13]. Cusanus calls it *privative infinitum*:

Klaus/SCHWAETZER, Harald (eds): *Nikolaus von Kues: Vordenker moderner Naturwissenschaft?* Regensburg: S. Roderer Verlag 2003, 45–53.

[11] *Cf. Descartes to Mersenne* (Deventer, late November 1633), in: ADAM, Charles/TANNERY, Paul (éds): *Œuvres de Descartes*. Paris: Librairie Philosophique J. Vrin 1996, vol. 1, 270–273. See also Descartes to Pére Chanut, (6 June 1647), in: ADAM, Charles/TANNERY, Paul (éds): *Œuvres de Descartes*. Paris: Librairie Philosophique J. Vrin 1974, vol. 5, 52. For Cusanus' cosmology, see: KRAFFT, Fritz: *Das kosmologische Weltbild des Nikolaus von Kues zwischen Antike und Moderne*, in: MFCG 28 (2003), 249–289; HUJER, Karel: *Nicholas of Cusa and His Influence on the Rise of New Astronomy*, in: XII[e] Congrès International d'histoire des sciences 3A (1970), 87–92; OMODEO, Pietro Daniel: *Nikolaus von Kues als Kopernikaner: Sein Beitrag zur Astronomie nach der Auffassung der Renaissance*, in: Coincidentia: Zeitschrift für europäische Geistesgeschichte 2 (2011), 403–444, and more recently, OMODEO, Pietro Daniel: *Copernicus in the cultural debates of the Renaissance reception, legacy, transformation*. Leiden: Brill 2014. For Cusanus' contributions to the rise of modern natural conceptions and epistemologies: REINHARDT, Klaus/SCHWAETZER, Harald (eds): *Nikolaus von Kues: Vordenker moderner Naturwissenschaft?* Regensburg: S. Roderer Verlag 2003.

[12] "infinitam absolute maximam potentia" (CUSANUS, Nicolaus: *De docta ign.*, III, 1, 185).

[13] "Deus ergo est omnia complicans in hoc, quod omnia in eo; est omnia explicans in hoc, quod ipse in omnibus" (NICOLAS CUSANUS: *De docta ign.*, II, 3, 107). English translations are taken, in most cases, from *Complete Philosophical and Theological Treatises of Nicholas of Cusa*, translated by Jasper Hopkins, 2 vols. Minneapolis/Minnesota: The Arthur J. Banning Press 2001; NICOLAS CUSANUS: *De docta ign.*, II, 3, 107: "Just as oneness precedes otherness, so also a point, which is a perfection, [precedes] magnitude. For what is perfect precedes whatever is imperfect. Thus, rest [precedes] motion, identity [precedes] difference, equality [precedes] inequality, and so on regarding the other perfections. These are convertible with Oneness, which is Eternity itself (for there cannot be a plurality of eternal things). Therefore, God is the enfolding of all things in that all things are in Him; and He is the unfolding of all things in that He is in all things". "Sicuti enim unitas alteritatem praecedit, ita et punctus, qui est perfectio, magnitudinem. Perfectum enim omne imperfectum antecedit, ita quies motum, identitas diversitatem, aequalitas inaequalitatem et ita de reliquis, quae cum unitate convertuntur, quae est ipsa aeternitas; plura enim aeterna esse non possunt. Deus ergo est omnia complicans in hoc, quod omnia in eo; est omnia explicans in hoc, quod ipse in omni-

> "But since the universe encompasses all the things which are not God, it cannot be negatively infinite, although it is unbounded and thus privatively infinite. And in this respect it is neither finite nor infinite"[14].

The universe is *infinitum* in the sense that it is not terminated (*interminatum*) by anything external: if God is actually infinite, he must encompass everything. Cusanus thought that an infinite with something outside it, an infinite that does not include everything, is not infinite, by definition, and he is infinite as it is itself the collection and the unity of all interconnections of all existing beings (*connectio omnium*)[15]. The universe "exists actually only in a contracted manner"[16]: it is not extensively (nor intensively) infinite, because of its intrinsic ontological limitation[17]. In this way, is neither finite nor infinite in comparison to God. Therefore, Cusanus also calls it an *infinitas finita*[18] or *infinitas contracta*.[19] Cusanus' interest in the infinity of God is matched by his stress on the finitude of human and created

bus"; NICOLAS CUSANUS: *De docta ign.*, II, 3, 111: "God is the enfolding and the unfolding of all things, that insofar as He is the enfolding, in Him all things are Himself, and that insofar as He is the unfolding, in all things He is that which they are, just as in an image the reality itself (veritas) is present". "Deum omnium rerum complicationem et explicationem, et – ut est complicatio – omnia in ipso esse ipse, et – ut est explicatio – ipsum in omnibus esse id quod sunt, sicut veritas in imagine". NICOLAS CUSANUS: *De docta ign.*, II, 5, 118: "But everything which exists actually, exists in God, since He is the actuality of all things. Now, actuality is the perfection and the end of possibility. Hence, since the universe is contracted in each actually existing thing: it is evident that God, who is in the universe, is in each thing and that each actually existing thing is immediately in God, as is also the universe". "Omne autem actu existens in Deo est, quia ipse est actus omnium. Actus autem est perfectio et finis potentiae. Unde, cum universum in quolibet actu existenti sit contractum, patet Deum, qui est in universo, esse in quolibet et quodlibet actu existens immediate in Deo, sicut universum".

[14] "Universum vero cum omnia complectatur, quae Deus non sunt, non potest esse negative infinitum, licet sit sine termino et ita privative infinitum; et hac consideratione nec finitum nec infinitum est" (NICOLAS CUSANUS: *De docta ign.*, II, 1, 97).

[15] *Cf.* NICOLAS CUSANUS: *De docta ign.*, II, 10, 154.

[16] "ipsum autem non est actu nisi contracte" (NICOLAS CUSANUS: *De docta ign.*, II, 1, 97).

[17] *Cf.* NICOLAS CUSANUS: *De docta ign.*, II, 1, 97: "Although with respect to God's infinite power, which is unlimitable, the universe could have been greater: nevertheless, since the possibility-of-being, or matter, which is not actually extendible unto infinity, opposes, the universe cannot be greater. And so, [the universe is] unbounded; for it is not the case that anything actually greater than it, in relation to which it would be bounded, is positable. And so, [it is] privatively infinite". "Licet in respectu infinitae Dei potentiae, quae est interminabilis, universum posset esse maius: tamen resistente possibilitate essendi aut materia, quae in infinitum non est actu extendibilis, universum maius esse nequit; et ita interminatum, cum actu maius eo dabile non sit, ad quod terminetur; et sic privative infinitum".

[18] *Cf.* NICOLAS CUSANUS: *De docta ign.*, II, 2, 104: "For the Infinite Form is received only finitely, so that every created thing is, as it were, a finite infinity or a created god, so that it exists in the way in which this can best occur". "Quoniam ipsa forma infinita non est nisi finite recepta, ut omnis creatura sit quasi infinita finita aut Deus finite creatus, ut sit eo modo, quo hoc melius esse possit". See MAHNKE, Dietrich: *Unendliche Sphäre und Allmittelpunkt. Beiträge Zur Genealogie der Mathematischen Mystik*. Halle: Niemeyer 1937, 81–87.

[19] See NICOLAS CUSANUS: *De docta ign.*, II, 4, 114.

orders and their infinite distance from God: "the infinite and eternal world falls disproportionally short of Absolute Infinity and Absolute Eternity"[20].

Now, to say that God is the *alpha* and the *omega,* the first and the last, seems reasonable enough. But to say that he is also the biggest and the smallest, the straightest and the roundest is harder to image. How can God be straight and round?

In our finite world, dominated by the principle of contradiction, such a coincidence is unthinkable, but God, as absolute infinity, excludes nothing —this is the key point—, so, including everything at once, by causing all contradictory things to coincide in him, God is the Oness of all. And because God must be excluded from nowhere and be present everywhere, God is the trascendent oness that is immanent in every part of the world: *maxime propinquiter ac distanter* from the world[21].

In order to express the *aenigma* of universe, Cusanus employs the metaphor of the infinite sphere, derived from medieval neo-Pythagoreanism, for defining God "the infinite sphere, whose center is everywhere and whose circumference is nowhere"[22]. It means that in the infinite universe every point can be considered to be at its center and on its circumference at the same time. As the sphere expresses infinity without being itself infinite, the physical universe can be said to be infinite since it contains all things except God, in Whom all is contained. In so doing, he maintained the clear distinction (*distanter*) between God, the infinite sphere, and the world, while indicating such a likeness (*similitudo, propinquitas*) between them[23]. The universe is physically finite, but also infinite in its essence because the spherical form partakes of infinity[24]. It is, in other words, a relative infinite.

[20] "infinitus et aeternus mundus cadat absque proportione ab absoluta infinitate et aeternitate" (NICOLAS CUSANUS: *De docta ign.*, II, 4, 114).

[21] *Cf.* NICOLAS CUSANUS: *De docta ign.*, II, 4, 116.

[22] BAEUMKER, Clemens: *Studien und Charakteristiken zur Geschichte der Philosophie insbesondere des Mittelalters*. Münster: Verlag der Aschendorffschen Verlagsbuchhandlung 1927, 207–214, here 208, where the author refers to the second definition of God given in the *Liber de XXIV philosophorum*.

[23] *Cf.* NICOLAS CUSANUS: *De docta ign.*, II, 4. NICOLAS CUSANUS: *De venatione sapientiae*, XVIII, 50: "Since knowledge is assimilation, the intellect finds all things to be within itself as in a mirror that is alive with an intellectual life. When the intellect looks within itself, it sees in itself all the assimilated things. And this assimilation is a living image of the Creator and of all things. But since the intellect is a living and intellectual image of God, who is not other than anything: when the intellect enters into itself and knows that it is such an image, it observes within itself what kind of thing its own exemplar is". "Cum cognitio sit assimilatio, reperit omnia in se ipso ut in speculo vivo vita intellectuali, qui in se ipsum respiciens cuncta in se ipso assimilata videt. Et haec assimilatio est imago viva creatoris et omnium. Cum autem sit viva et intellectualis dei imago, qui deus non est aliud ab aliquo, ideo, cum in se intrat et sciat se talem esse imaginem, quale est suum exemplar in se speculatur".

[24] NICOLAS CUSANUS: *Apologia doctae ignorantiae*, 11–15: "With respect to the mirror and the symbolism (speculum et aenigma), that God – as He is [in Himself] – is incomprehen-

The Aristotelian, Ptolemaic cosmos saw our finite world as a sort of bubble within, but separated from the infinite. The centre of the bubble is the centre of the earth. From that centre to the orbit of the moon, everything is made of various combinations of the four elements: earth, water, air and fire. From the moon to the stars the spheres are made of the fifth element, aether. Leaving the bubble, above the level of the fixed stars, beyond the spheres visible to astronomers, we encounter a fundamental difference. The space above the fixed stars is not made of any material, because if we rise to that level we have left the material world. Infact there is no space there, either, or time. The intellegible realm is not a realm of less or more (*plus ac minus*), before or after. It is the absolute, God himself.

Cusanus rejects in part this system. In his cosmology (as in his theology), Cusanus doesn't allow a space that is not a part of the infinite[25]. He rejects the ancient idea of pure matter below and pure spirit above. If the finite is included in the infinity, there must be no boundary between the two—there must be nowhere where the infinite is not. It is difficult to overstate the revolutionary quality of this idea. Before Copernicus and before Kepler, nearly a century before Galileo's trial, Cusanus declares that the earth is not the center, that the earth moves and that there is no center, other than God. He still believes that the sun rotated around the earth, but he conceives of both moving in all infinite voids.

Because the universe is not a limited bubble within God, the cosmos must be infinite. And because something with no circumference or edges can have no center, it makes no sense to speak of the earth at the center of the universe.

According to Rhys W. Roark[26] the speculations of Nicholas do not require or anticipate a modern decentered infinite cosmological space. In fact, the "perspectivalism" that informs Cusanus' mysticism still understands that all manifest mathematical measures are necessarily finite as based upon Euclidian geometry. Nor does this "perspectivalism" modify

sible. For in an image the truth cannot at all be seen as it is [in itself]. For every image, in that it is an image, falls short of the truth of its exemplar. Hence, it seemed to our critic that what is incomprehensible is not grasped incomprehensibly by means of any transcending. But if anyone realizes that an image is an image of the exemplar, then leaping beyond the image he turns himself incomprehensibly to the incomprehensible truth". "Respexit hic vir ad speculum et aenigma, quasi Deus sit – uti est – incomprehensibilis. Veritas enim in imagine nequaquam, uti est, videri potest; cadit enim omnis imago eo, quia imago, a veritate sui exemplaris. Hinc visum est reprehensori incomprehensibilem non capi per transcensum incomprehensibiliter. Sed qui videt, quomodo imago est exemplaris imago, ille transiliendo imaginem ad incomprehensibilem veritatem incomprehensibiliter se convertit". It should be remarked that, in the *Docta ignorantia*, Cusanus uses the expression *sphaera infinita* exclusively for God, and referres to the world merely as *machina mundi*, or *machina mundana*.

[25] See DICK, Steven J.: *Plurality of Worlds: The Origins of the Extraterrestrial life Debate from Democritus to Kant*. Cambridge, England: Cambridge University Press 1982.

[26] *Cf.* ROARK, Rhys W.: *Nicholas Cusanus, Linear Perspective, and the Finite Cosmos*, in : Viator (2010), 315–366.

the general outlines of the Aristotelian cosmos, either its planetary order or its spherical shape. Cusanus' references to the cosmos' infinity must be understood as finitely indefinite, in consonance with Aristotelian definetions of perpetual quantities compared to the truly qualitative and transcendent infinite, God. In this respect, concludes Roark, neither Cusanus nor Alberti anticipate Newtonian cosmology of the infinite universe or its artistic translation in paintings of the sublime.

We could say that, because of Cusanus' conception of a universe without a center and, therefore, without any circumference, it seems essential to conceive another space, besides the physical cosmos and the theological space: it is a sort of metaphysical space where the similarity may appear between man and God, as being creator, insofar man experiences himself, at any time, as the center of the world. We could say that Cusanus' universe is, therefore, anthropogenic in its spatial limited dimensions, but theogenetic in its absolute dimensions.

The perspective of the observer became a key point for Cusanus, when he turned his attention to the problem of how the infinite and the finite came to be perceived as different. If the infinite is present at every point of the world, and God is in everywhere, why can we not see that? Why is our vision so narrow? Cusanus concluded that each beeing sees only as much he is able to see[27]. As material and rational beings, we are able to perceive the infinite only by dividing (anlysis) into comprehensible (for us) elements.

The process through wich we understand is also the process that blocks our access to the infinite. If we could see as God sees, there would be no finiteness. Such perspectivalism brings a certain limitation and otherness (*alteritas*) to our knowledge. The challenge, for Cusanus, is how to overcome this otherness in order to identify with its object, so that the mind can realize the *adaequatio rei et intellectus*. In theological terms, it means the problem for the intellect to raise itself to that "Simplicity where contraddictories coincide"[28]. This unification (or *coincidentia*) is achieved not by prometheian overcoming of the mind, but by a dynamic, dialectic analysis of the essential finitude of the human. To improve our vision we do not see more through improving our knowledge, because knowing is the very process that separates us. As we know, Cusanus approaches the problem intoducing his concept of *docta ignorantia*. The first step in this edu-

[27] *Cf.* HEROLD, Norbert: *Menschliche Perspektive und Wahrheit. Zur Deutung der Subjektivität in den philosophischen Schriften des Nikolaus von Kues*. Münster: Aschendorff 1975, 2–3; FALCKENBERG, Richard: *Grundzüge der Philosophie des Nicolaus Cusanus mit besonderer Berücksichtigung der Lehre vom Erkennen*. Breslau: Koebner 1880, 3: "That which Nicholas wanted, Leibniz, Kant, and Kant's successors brought about". See also KOCH, Josef: *Die Ars coniecturalis des Nikolaus von Kues*. Cologne: Westdeutscher Verlag 1956, 47–48.

[28] "Simplicitatem, ubi contradictoria coincident" (NICOLAS CUSANUS: *De docta ign.*, III, Dedicatory letter to Cardinal Cesarini, 264).

cated not-knowing (learned ignorance) is to end our vain habit of attempting to analyse God through concepts.

What is original is the idea that we can see more of God, not if we end to see the world, but if we see more of the world: the mind does not directly see the infinite of God himself, but sees the myriad ways in which it is manifested in the material world—in their particular, not in concepts[29]. We do not see the ultimate unity of things that is God, but we do see that unity showing itself in multiplicity. In other terms, the goal is not to form abstract concepts from observation, but the best we can do is to see introspectively as many particulars of the material world as we can, from as many different viewpoints as possible:

> "oneness, without which number would not be number, is present in the plurality. And, indeed, this [is what it] is for oneness to unfold all things: viz., for it to be present in the plurality"[30].

So, if we are able to imagine something like the totality of all particulars, unfoulfing in all its richness, we have done the best we can. Cassirer, a keen reader of Nicholas of Cusa, stressed the centrality acquired by every single being from the angle of an infinite sphere without center and periphery, that is, the individual acquired the dignity of an infinite center of infinite relations.

"Circularis et rectilinealis coincidunt in infinito": the geometrical infinite

Although in all Cusanian writings—first of all in *De Docta ignorantia*—Cusanus occurs frequently in mathematics and uses concepts, definitions and geometric figures in a symbolic way in order to signify the truths that transcend the rational level, Cusanus was interested in mathematical questions, deeply analized in various texts drawn up over fifteen years between 1445 and 1459[31]. All of these deals with the *vexata quaestio* of the squaring

[29] Cusanus holds, for instance, that sight gives things from one side and under a certain aspect. *Cf.* Nicolas Cusanus: *De coniecturis*, I, 11.

[30] "Unitas igitur, sine qua numerus non numerus esset, est in pluraliatem et hoc quidem est unitatem explicare, omnia scilicet in pluralitate esse" (Nicolas Cusanus: *De docta ign.*, II, 3, 108).

[31] Cusanus' *mathematica scripta* are: *De geometricis transmutationibus* (1445), *De arithmeticis complementis* (two versions; 1445), *De circuli quadratura* (1450), *Quadratura circuli* (1453), *De mathematicis complementis* (the first edition, in a book, was accomplished in Bressanone in September 1453, the second edition in two books was completed in November 1454), *Declaratio rectilineationis curvae* (1454), *De una recti curvique mensura* (1454), *Dialogus de circuli quadratura* (1457), *De caesarea circuli quadratura* (that Cusanus wrote in July of 1457 in Andraz Castle, where he had fled to escape the threats of Duke Sigismund of Austria), *De mathematica perfectione* (two versions; 1458), *De mathematicis aurea propositio* (1459). All mathematical writings are listed in chronological order in the twentieth volume of the critical edition of the *Opera omnia* of Cusanus, edited by Menso Folkerts (Hamburg:

of the circle, which nobody—claims Cusanus in *De mathematicis complementis* and, before that, in *De quadratura circuli*—has been able to approach more than Archimedes did[32].

The cardinal believed to give the *complementum* to the work begun by Archimedes—who achieved an approximate result, which consisted in the famous limits of π ($3 + 10/71 < \pi < 3 + 1/7$) determined in the third proposition of his treatise the *Measurement of a circle*—, and to solve the problem remained unsolved until then. Certainly the issues relating to square the circle and arc transformation of the circle in a straight line were not new arguments among intellectuals of the mid-fifteenth century: most of the mathematicians of the time were interested in the method of isoperimetric figures. Already Ramon Lull in the *Geometria Nova* and, in particular, in *De quadratura et triangulatura circuli*, work that Cusanus transcribed *manu propria* in 1428 (Codex Cusanus 83), attempts to resolve the question of squaring of the circle.

Moving from the *regula doctae ignorantiae*[33], Cusanus, in *De circuli quadratura*, claims that "there is no proportion between finite and infinite"[34] and "the infinite force is incommensurable with respect to all that is not infinite, as the capability of the circle remains incommensurable with respect to all that is not circular"[35], that is to say that it is impossible to express precisely, through a *habitudo numerabilis*, the relationship between the side and the diagonal of the square, or between the radius and the circumference. The epistemological corollary of the theses is the irreducibility of a curve to a straight line (that is, the difficulty of squaring of the circle) because of the overwhelming distance (disproportion) between infi-

Meiner 2010). In Appendix is the Magister Paulus text to Nicolaum Cusanum cardinalem, where Paolo Toscanelli critizes *De mathematicis complementis*. There are two translations: the German one by Joseph Ehrenfried Hofmann (*Die matematischen Schriften*. Hamburg: Meiner 1980) and that of Jean-Marie Nicolle (*Les ecrits mathématiques*. Paris: H. Champion 2007). Introductions and commentary by Joseph Ehrenfrien Hofmann to *Mathematische Schriften* carefully explain the mathematical issues Cusanus has treated in his writings (excluding two works, which were not known to the illustrious scholar).

32 It is important here to mention—even if very briefly—that Cusanus is one of the main responsible for transmitting to the European Renaissance a certain image of Archimedes as the mathematician who better than others strove in the antiquity to get to the squaring of the circle. On this aspect, see DE BERNART, Luciana: *Cusano e l'archimedismo nel Medioevo. Ibridazioni teoriche, eredità contese, sperimentazioni e polemiche nella matematica europea del XVI secolo*, in: THURNER, Martin (éd.): *Nicolaus Cusanus zwischen Deutschland und Italien*. Berlin: Akademie Verlag 2002, 339–381.

33 *Cf.* NICOLAS CUSANUS: *De docta ign.*, II, 1. See also NICOLAS CUSANUS: *De ven sap.*, XXVI, 79, 1–3 e XXXVII, 108, 18s; NICOLAS CUSANUS: *De coni*, I, 10, 49, 9–12; NICOLAS CUSANUS: *De ludo globi*, I, 15, 16–19 and II, 96, 22–24.

34 "finiti ad infinitum nulla est proportio" (NICOLAS CUSANUS: *De circuli quadratura*, 115).

35 "vis infinita est incommensurabilis per omne non infinitum, sicut capacitas circularis per omnem non circulum incommensurabilis manet" (NICOLAS CUSANUS: *De circuli quadratura*, 28). *Cf.* NICOLAS CUSANUS: *De docta ign.*, I, 3, 9; CUSANUS: *De theologicis complementis*, 5, 23–30.

nite and finite: "The measure and the thing measured differ"[36]. The contradiction of opposites (*recta et curva*) may be resolved in infinity, since a circle of infinitely long radius has a straight line for its circumference. In the *De theologicis complementis* (1453), the Cardinal speaks of the circle as a polygon with infinitely many sides and angles, that is the figure in which finiteness and infinity coincide:

> "In a circle oneness and infinity coincide—a oneness of essence and an infinity of angles. Or better: [in a circle] infinity itself is oneness. For the circle is the whole angle. Thus, the circle is both one and infinite; and it is the actuality of all the angles that are formable from a line. From the foregoing considerations you may elicit how it is that the Creator of the one universe caused a single universe similar to Him to come forth from a single point"[37].

The procedure adopted by Cusanus refers to the so-called method of "archification" by isoperimetric polygons. Through what he calls *continuae trasmutationes geometricae*, Cusanus try to realize to the squaring of the circle or, rather, the "circulation of the square".[38]

Passing on an unlimited number of finite determinations, we can see the maximum proximity to the perfect *aequalitas* of the opposite magnitudes, to that *absoluta praecisio semper inattingilis* by human mind[39]. This is the real limit that Cusanus saw in ancient attempts:

> "The ancients sought after the squaring of a circle; and this investigation presupposes that if a circular line is given, then there can be given a straight line that is equal to it. But they were never able to obtain this result. If they had sought after the circularizing of a square, they might have succeeded. Herefrom you know that a circle is not measured but measures—i.e., [by illustrative

[36] "Cum mensura a mensurato necessario differat" (NICOLAS CUSANUS: *De docta ign.*, II, 1, 91). See NICOLAS CUSANUS: *Id. De sapientia*, II, 38, 6: "In this world there is neither preciseness nor rectitude". "In hoc mundo non est nec praecisio, nec rectitudo".

[37] "In circulo vero unitas et infinitas, unitas essentiae et infinitas angulorum. Immo ipsa infinitas est unitas. Circulus enim est totus angulus, sic est unus pariter et infinitus, et est actus omnium formabilium angulorum ex linea. Ex quo elicias, quomodo creator unius universi ex uno puncto, quem creavit, fecit prodire unum universum in similitudine" (NICOLAS CUSANUS: *De theologicis complementis*, 9, 49–55).

[38] It is in Raimondus Lullus' and Heymericus de Campo's philosophy that Cusanus could trace the instance of the triangle and the circle; in particular, in Heymeric's *De sigillo aeternitatis* Cusanus found the image of circle with the inscribed triangle and the races from the centre (*Cf.* Codex Cus. 106, foll. 77[r]). See COLOMER, Eusebio: *Nikolaus von Kues und Heimeric van den Velde*, in: MFCG 4 (1961), 198–213, here 204–205.

[39] *Cf.* NICOLAS CUSANUS: *De docta ign.*, I, 13, 35: "I maintain, therefore, that if there were an infinite line, it would be a straight line, a triangle, a circle, and a sphere. And likewise if there were an infinite sphere, it would be a circle, a triangle, and a line. And the same thing must be said about an infinite triangle and an infinite circle". "Dico igitur quod, *si esset linea infinita*, illa esset recta, illa esset triangulus, illa esset circulus et esset sphaera. Et pariformiter *si esset sphaera infinita*, illa esset circulus, triangulus et linea. Et ita de triangulo infinito atque circulo infinito idem dicendum est".

analogy], that eternity is not measurable, because it exceeds everything measurable; instead, eternity measures all duration"[40].

Circulum non mensurari, sed mensurare means that the infinite circle, image of the absolute *maximum*, is the measure of all finite things[41]. The intellect being continually guided forward by this exemplar in the mind toward ever higher understanding of how this measurement reveals the truth in all things.

Of things admitting of more or less, we never come to absolute *maximum* or *minimum*. Therefore, he states, since only the cause of all causes is the *maximum*, and is the only absolute infinite not subject to being greater or lesser by any degree, we never come therefore to absolute equality, except in the *maximum*. That is, only the *maximum* which contains all things in it, including the *minimum*, is equal to itself. Since only in the *maximum* is found absolute equality, all things differ. But, of the absolute *maximum*, there is no comparative relation, so we can only declare our learned ignorance[42].

Any curve which admits of more or less cannot be a *maximum* or *minimum* curve. Only measuring a curve with the rule of learned ignorance, we see that the *maximum* curved line is straight, and the minimally curved line is straight, therefore, a curve is in reality nothing, but partaking in a certain amount of straightness to a greater or lesser degree. Now comparing the curved and straight, the straight line participates more in the infinite line than a curved line participates in it: "I premise that a straight line is simpler than a curved line, since a curved line, deviating from a straight line, cannot be conceived apart from concave and convex"[43].

Cusanus used the example of the infinite line to demonstrate that the *maximum* is in all things and all things are in the *maximum*.

Nicholas demonstrated a fundamental truth about the nature of the curved and straight. The mind's attempt to relate the curved and the straight represents its capability to measure the universe as a bounding array of *maximum* numbers, which once identified – and distinguished in

[40] "Quaesiverunt veteres circuli quadraturam, et haec inquisitio praesupponit, quod data circulari linea possit dari recta sibi aequalis. Et hoc numquam reperire potuerunt. Si quaesivissent *quadrati circulationem*, fortassis invenissent. Ex quo habes circulum non mensurari, sed mensurare, scilicet aeternitatem non esse mensurabilem, quia omne mensurabile excedit, sed mensurat aeternitas omnem durationem" (NICOLAS CUSANUS: *Theol. compl.*, 11, 4–10).

[41] See COUNET, Jean-Michel: *Mathematics and the Divine in Nicholas of Cusa*, in: KOESIER, Teun/BERGMANS, Luc (éds): *Mathematics and the Divine: A Historical Study*. Amsterdam: Elsevier 2005, 273–290.

[42] *Cf.* NICOLAS CUSANUS: *De non aliud*, 19, 46: "For not even reason attains to what precedes reason". "Nam nec ipsa etiam ratio ad id, quod rationem antecedit, pertingit".

[43] "Praemitto autem lineam rectam esse curva simpliciorem, cum a recta curva declinans non sine concavo et convexo concipi possit" (NICOLAS CUSANUS: *De ven. sap.*, 26, 74).

the same way as the human mind is distinguished from God—could be incomprehensibly comprehended.

Similarly the circle is *in* every polygon, in such a way that each polygon is *in* the circle. The one is in the other, and there is one infinite perimeter of all: given a finite straight-line, a finite circular-line will be its measure. Thus, given an infinite circular-line, an infinite straight-line will be the measure of the infinite circular-line.

Because the infinite circular-line is straight, the infinite straight-line is the true measure that measures the infinite circular-line. Therefore, the coincidence of opposites is as the circumference of an infinite circle; and the difference between opposites is as the circumference of a finite polygon[44]. It means that the *maximus in se* is neither *linea*, nor *triangulus*, nor *circulus*, nor *sphera*, *sed per infinitum et proportionabiliter supra*: "Hence, the measure and the measured—however equal they are—will always remain different"[45].

The ancients who were looking for the *ars* (term derived from Lullus) of squaring the circle, assuming the coincidence of the circle and the square in equality, failed in their aim. The *aequalitas*, in fact, is not achieved at the level of reason (*per rationem*), which, dominated by the principle of contradiction[46], does not admit the *coincidentia oppositorum,* and therefore it rejects it as impossible; this coincidence should be investigated by the intellect (*intellectualiter*), grasped in higher mental vision (*visus mentalis*)[47]. In fact, as we learn from Aristotle, the straight and the curved belong to two qualitatively different, opposite species (*genera*), and between them there can be no equality[48]; no *commensurabilis habitudo*. This rela-

44 *Cf.* NICOLAS CUSANUS: *Theol. compl.*, 13, 9–26.

45 "Hinc mensura et mensuratum quantucumque aequalia, semper differentia remanebunt" (NICOLAS CUSANUS: *De docta ign.*, I, 3, 9).

46 See VENGEON, Frédéric: *Mathématiques, création et humanisme chez Nicolas de Cues*, in: Revue d'historie des sciences 59–2 (2006), 222: "according to him, the impossibility of squaring the circle is equivalent to the geometric expression of the principle of non-contradiction".

47 NICOLAS CUSANUS: *De coni*, 2, 82: "I once tried affirming that a comparative relation between the diameter and the circumference of a circle is unattainable and inadmissible because of the need to avoid the aforementioned coincidence [of contradictories]; and immediately I saw what had to be affirmed geometrically and what had to be denied. For in the [common] conceptions of our minds and in all the demonstrations of Euclid, or of whomever else, I found this unique rationale [to be applicable] in regard to a variety of figures". "Temptavi ego aliquando affirmans quadraturam circuli per rationem inattingibilem atque inadmissibilem propter iam dictam coincidentiam vivanda et statim quid geometrice affirmandum quidve negandum vidi. Nam in ipsis animorum conceptionibus atque in cunctis demonstrationibus Euclidis aut quorumcumque unicam hanc causam repperi in varietate figurarum". In the second edition of the work Cusanus replaces *quadraturam circuli per rationem* with *diametri et circumferentiae circuli proportionem*: the Cardinal is convinced to be able to demonstrate, in the meantime, the squaring of the circle.

48 See NICOLAS CUSANUS: *De beryllo*, 45: "But in his Metaphysics he says that a curve and a straight line are opposed by nature, so that the one cannot be transformed into the other".

tionship, which is equivalent to that existing between diagonal and side of the square, is for the reason absolutely *inattingibilem atque inadmissibilem* untranslatable into a precise arithmetical proportion:

> "We know that we cannot obtain any numerical proportion between the diagonal and the side [of a square], since no two numbers can be exhibited which are related to each other in precisely this way. Given any [two numbers], the relationship between them is either greater or lesser than [the relationship] between the diameter and the side"[49].

Pass over into infinity, through an infinite asymptotic approximation process, we see that the most perfect geometric figures—the infinitely large circle and the infinitely large sphere—are at the same time coincident with their generating point.

Of course, the point is not the oneness (*unitas*): with Proklos' *Commentary on the first book of Euclid's Elements*[50], Cusanus says that the oneness, for of its semplicity and indivisibility, is more perfect than the point and precedes the point. Unlike point, oneness is without position because it is immaterial, without any magnitude or place, while point has really a position. The oneness in which the opposites coincide is the original foundation that serves as the convergence point of seriality. The geometric transmutations proposed by Cusanus presuppose the concept of absolute infinite: what is right can coincide with what is curved, because one is their measure, the Oneness. Thus, from the notion of *simplex infinitum* in which the *maximum* and *minimum* coincide, flows the principle of the coincidence of opposites with which Cusanus undermines the primacy of the oppositional Aristotelian logic.

As a mathematician, he know that one cannot reach infinity by counting up to a large number and then adding one more; likewise, "for preciseness that admits of more—i.e., preciseness that can be more precise—is

"In Metaphysica autem dicit curvum et rectum in natura contrariari, quare unum non posse converti in aliud". See ARIST.: *Met.*, I, 5, 986a 25, where the philosopher reports that the straight-curved couple was one of ten pairs of opposites considered by the Pythagoreans as the fundament of things and their qualities.

49 "Scimus quod omnis numerabilis proportio diametri ad costam est inattingibilis, cum nulli duo numeri dari possent qui praecise sic se habeant; sed quibuscumque datis, habitudo eorum est aut maior aut minor quam diametri ad costam; et quibuscumque datis, possunt dari numeri propinquiores illi habitudini" (NICOLAS CUSANUS: *De possest*, 42).

50 Note that the Greek text of this work has been printed for the first time in Basel, by Simon Grynaeus in 1533, and it occurs that the latin translation has been made by Francis Barozzi (or Barocius) in Padova in 1560, nearly a century after Cusanus died; it is nevertheless true that handwritten copies of Proklos' work have spread around in the fifteenth century. We know that very well, we also know that Bessarion, with whom Nicolas was related, owned many of these copies. Consequently nothing prevented Cusanus from accessing to the *Commentary* in its Greek version before its translation, either he could have read the text by himself, or somebody else could have translated it for him.

not absolute preciseness"[51], infact, "precise equality befits only God"[52]. Our knowledge of the truth, says Cusanus in the wake of Boethius, is realised *in multitudine et magnitudine*[53], and mathematical figures can be explicated only in their magnitude, without which they cannot be imagined or conceived: "But its 'material' is magnitude, without which a mathematician does not conceive of anything"[54]. In other words, we can see the figure separated from its sensitive matter, but not from each matter: in fact, the figure cannot be seen in their *absoluta quidditas,* without any quantity: "They see shape only as quantified"[55].

Nevertheless, *signa mathematicalia* represent, by virtue of their *incurruptibilem certitudinem*[56], the most appropriate symbols to express the "precise truth is unattainable"[57], provided that, as the unthinkable infinite is the condition for thinking, the oneness is the condition for trasforming all serial (opposite) figures, until arriving nearest to their perfect *aequalitas*.

Mathematics gives an extraordinary *manuductio* to the researcher: it shows, on the one hand, that human reason cannot reach the *absoluta praecisio*; on the other hand, it shows, so to speak, the condition of the possibility of this impossibility; in other words, geometrical figures show the impossibility to demonstrate the quadrature of the circle because this is "visible" only transcending any *comparativa proportio*, any *humana mensura*, i.e. by an intellectual intuition able to grasp the *veritas*, no longer contracted, or complicated, but *absoluta* through the beryllus of the *coincidentia oppositorum*[58].

If the aim of Cusanus is to seek the mathematical perfection, which consists of the *adequatio* of the straight and the curved line[59], this *aequalitas*

51 "Praecisio enim, quae plus recipit, puta quae praecisior esse potest, non est praecisio absolut" (NICOLAS CUSANUS: *Id. De sapientia*, II, 37, 12).

52 "precisa[m] aequalita[tem] solum Deo convenit" (NICOLAS CUSANUS: *De docta ign.*, I, 91); NICOLAS CUSANUS: *Id. De sapientia*, II, 29, 2: "God is Absolute Precision". "Deus est ipsa absoluta pracisio"; and NICOLAS CUSANUS: *Id. De sapientia*, II, 31, 8: "There is only one, infinite preciseness". "Praecisio non sit nisi una et infinita".

53 See NICOLAS CUSANUS: *De docta ign.*, I, 11, 32; NICOLAS CUSANUS: *Id. Mente*, X; NICOLAS CUSANUS: *Compendium*, V; NICOLAS CUSANUS: *Possest*, 43, 27–32.

54 "Sed materia eius magnitudo est, sine qua nihil concipit mathematicus" (NICOLAS CUSANUS: *De beryllo*, 63).

55 "Non videt figuram nisi quantam" (NICOLAS CUSANUS: *De aequalitate*, 5).

56 *Cf.* NICOLAS CUSANUS: *De docta ign.*, I, 11, 32.

57 "Praecisionem veritatis inattingibilem" (NICOLAS CUSANUS: *De Coniecturis*, I, *Prologus*, 2; 4–5). See also: NICOLAS CUSANUS: *De docta ign.*, I, 36, 89.

58 See NICOLAS CUSANUS: *De math, perf.*, 2–3. NICOLAS CUSANUS: *De Theologicis complementis*, spec. cap. II e III; NICOLAS CUSANUS: *De mathematica perfectione*, § 1: "mathematics leads us almost to the divine and eternal absolute". "Mathematica nos ducant ad penitus absoluta, divina et aeterna".

59 *Cf.* NICOLAS CUSANUS: *De math. perf.*, 2, 1–5: "My goal is to arrive at mathematical perfection through the coincidence of opposites. And since this perfection consists for everyone

is attainable in its highest approximation only by the method of coincidence.

Despite his various attempts and under the harsh critique of Paolo Toscanelli[60] before and of Georg von Peuerbach, his friends and correspondent, and his pupil, Johannes Müller Regiomontanus, after[61], Cusanus adheres, in his mathematical calculations, to the impossibility of *continuous transitions* and, accordingly, also of an exact squaring of the circle. Within this limit, he seeks the proximity, approximation (no coincidence) of God in his absolute distinction from all that is finite. Cusanus believes he has found the solution to the problem of the squaring of the circle, he has finally reached that mathematical *perfectio* which consists of the *transumptio*, the transformation of the square into the circle: by the *visio intellecttualis* we see the coincidence of the straight line with the curved, of the chord with the arc, we see their *aequalitas*. Now mathematics does not proceed anymore according to the discourse of the *ratio*, but according to the vision of the *intellectus*: "how can I know the relation between a given chord and [his] arc, since there is no numerically determinable relation between these different quantities? It will therefore be necessary to resort to the intellectual vision"[62]. Since between the straight and curved, between the arc and the chord, which are opposite quantities, there can be no countable relationship, it is necessary to apply intellectual intuition[63].

In other words, the paradoxical nature of the mathematical problem of squaring the circle, whose solution transcends the scope of the *ratio*, al-

in making a straight line equal to a curved line, I propose to look for the relation of two straight lines that stand between them like the chord and its arc". "Intentio est ex oppositorum coincidentia mathematicam venari perfectionem. Et quia perfectio illa plerumque consistit in recte curueque quantitatis adequatione, propono habitudinem duarum rectarum linearum se ut corda ad suum arcum habentium investigare".

60 See *Appendix Magister Paulus ad Nicolum Cusanum cardinalem*, in Cusanus' *Opera omnia*, edited by Menso Folkerts (Hamburg: Meiner 2010, 229–232).

61 Regiomontanus criticized the groundlessness of the calculations *lulliani* of Cusanus, and defined him as a *geometra ridiculus Archimedisque aemulus* (REGIOMONTANUS, Johannes: *De quadratura circuli*. Nuremberg: Johann Petri 1533, 27ss.). See CANTOR, Moritz: *Vorlesungen über Geschichte der Mathematik*. Leipzig: B.G. Teubner 1894–1908, II, 187–208; HOFMANN, Joseph Ehrenfried: *Einführung*, in: KUES, Nikolaus von: *Mathematische Schriften*. Hamburg: Meiner 1980, XII, XXXII; SANTINELLO, Giovanni: *Introduzione a Niccolò Cusano*. Bari: Laterza 1971, 104.

62 "Cum inter illas quantitates adeo contraria forte non cadat numerabilis habitudo. Necesse erit igitur me recurrere ad visum intellectualem" (NICOLAS CUSANUS: *De math. perf.*, 2–3).

63 See VANSTEENBERGHE, Edmond: *Le Cardinal Nicolas de Cues (1401–1464)*. Frankfurt am Main: Minerva 1963, 282: "The great discovery of the Cardinal, the discovery that constitutes the basic originality of his system, is – to use modern terms – his critique of the faculty of knowledge. 'The principle of contradiction has validity only for our reason'. Is not all of Hegel germinally present in this affirmation? And does not the fact alone of having formulated it make of Nicholas of Cusa one of the fathers of German thought?".

lowed Cusanus to prove the effectiveness of his epistemological wonderful discovery: the principle of the coincidence of opposites[64]. The paradox consists in the fact that the reason, in a such way, contradicts its own *modus operandi*: the more it attempts to elevate itself to simple unity in which all the contradictories are unified, the more it becomes aware of his constitutive impotence and of its necessary link with the world of otherness, and so it transports the split and opposition within itself[65].

In this way, David Albertson states: "Geometry was for him (i.e. Cusanus) a kind of mathematical laboratory for speculative discoveries, or better, a kind of playground where he could observe his mind's movements and exercise it for theological tasks"[66].

We could say that this intellectual mathematics represents a breeding ground for a metaphysical anthropology which try to reconcile the power of the man with the infinite power of God.

Abstract

That Cusanus is one of the most important of Quattrocento's philosophers and a key figure in Western culture is well known. Ever since Ernst Cassirer in his epochal book Individuum und Kosmos in der Philosophie der Renaissance *labeled Cusanus "the first modern thinker", the interest in Cusanus' thought has burgeoned. Critical studies have pointed out – and continue to point out – the different aspects and implications of his vast and multifaceted speculative activity. The aim of my article is to pursue the relation between the infinite and the finite from Cusanus' cosmological and mathematical point of view, in order to underline – in the Cardinal's thought – the status of the finite mind as the condition of the possibility of the impossibility to attain the infinite.*

64 Two opposites, the chord and the arc of circle, coincide in the absolute *minimum*, the *minimum* degree of their opposition: "Here, therefore, the chord and the arc would coincide, if they reached the minimum quantity in them". "Coincideret igitur ibi corda et arcus si ad minimam quantitatem in talibus deveniretur". This means that the minimum chord is equal to the minimum arc of circle:

"I say to see where is the equality between chord and arc, that is in their unqualifiedly minimum". "Dico me videre ubi est corde et arcus aequalitas scilicet in simpliciter minimo utriusque". CUSANUS, Nicolaus: *De math. perf.*, n. 4.

65 See CUOZZO, Gianluca: *Mystice videre. Esperienza religiosa e pensiero speculativo in Cusano*. Torino: Trauben 2002, 47ss.

66 ALBERTSON, David: *Mathematical Theologies: Nicholas of Cusa and the Legacy of Thierry of Chartres* (= Oxford Studies in Historical Theology.) Oxford: Oxford University Press 2014, 244. See also BRIENT, Elisabeth: *How can the infinite be the measure of the finite?*, in: CASARELLA, Peter J.: *Cusanus: The legacy of Learned Ignorance*. Washington D.C.: The Catholic University of America Press 2006, 210–225.