SECTION D, SOCIAL SCIENCES

The Scientific Methodology of Nicholas of Cusa

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There are varying notions as to the importance of Nicholas of Cusa (1401-1464) in the history of science. Some writers have seen in Nicholas a precursor of Copernicus and the first thinker to expound a modern philosophy of science. Others see in him a figure pushed forward by German historians in order to antedate claims made on behalf of Francis Bacon or René Descartes to the title of founder of modern science. In the latter view, Nicholas' work is characterized as containing a few brilliant but random suggestions "having their origin in pious skepticism."[1]

This paper is an attempt to determine what Nicholas said concerning science and to understand it in the context of his philosophical system. This philosophy is primarily concerned with the limits of man's knowledge; in seeking such limits, it also seeks to work out the method whereby the clearest possible knowledge may be obtained. In its origin, Nicholas' thought is of a mystical nature. However, as it nears the plane of experience, it crystallizes into more readily understandable, often strikingly familiar, statements. Such statements are, however, not concerned with explaining real things and how they really behave, for instance with the motion or the shape of the earth. Therefore, to judge Nicholas of Cusa on the basis of whether or not he created a new cosmology is to entirely miss the import of his work.

The central fact of the system presented by Nicholas in his *De docta ignorantia (Of Learned Ignorance)*, which appeared in 1440, is that God is entirely transcendental. Therefore, the human mind cannot hope to grasp Him or His works as they are in Him; absolute truth is unattainable. But then, since men are equipped with an intellect which desires to know the truth but cannot, it seems that man is called to an existence of which he is totally incapable. The doctrine of learned ignorance was to be the solution to this contradiction.[2]

The first step toward learned ignorance is an examination of the nature of knowledge. Our knowledge is in the form of judgments, and these proceed through comparison of the uncertain with the certain. The ease of judgment depends on the distance separating the object of judgment from the object regarded as certain, so that, since equality is a matter of degree, judgment is at best only approximative. No matter how equal the measure and the thing measured, they remain different.[3]

The second step toward learned ignorance is an examination of the relationship between God's works as they appear in the universe and God's works as they are in Him. The basic idea in this relationship is the union of opposites. In this connection, Nicholas introduced the concepts of the Maximum and the Minimum. The Maximum is, that, than which nothing can be greater and, correspondingly, the Minimum is that, than which nothing can be smaller. Since the absolute Maximum is as great as it can be, all beings are contained in it, and therefore it is also as small as it can be, since there is nothing outside of it to which it might be compared. Thus the absolute Maximum is the same as the absolute Minimum. Distinctions are only found in things which are capable of more or less, and, hence, are not found in the absolute Maximum-Minimum. Therefore, it is perfectly simple; it is being.[4]

The absolute Maximum is God, and the significance of the identity of the Maximum and the Minimum is that God is as great and as small as He can be; He is pure act. This was not a new idea. The reason for putting this statement of God's nature into the form of a union of Maximum and Minimum is that in this form it gives some insight into the relationship between God and things. In God, all things are gathered together in unity; all possibilities of any particular being are in God in unity.

Another aspect of God's relationship to creation, which follows from the conception of God as Maximum-Minimum, is that He is the measure of all things, for He is the limit of all things, the greatest and the least. An example of this idea is to be found in the measure of angle. The infinite, straight line, which is not realizable, is the measure of angle, since it is the limit of angle, both the greatest and the smallest. Relative to the straight line, all angles are confined to a certain measure.

However, other quantities, such as weight, velocity, or length, do not admit of such easy application of the idea of the Maximum-Minimum to their measure. The limiting concepts of weight, for instance, are no weight on the one hand and infinite weight on the other. These seem to be disparate if transcendent concepts, but for Nicholas of Cusa they would be the same; he called infinity the largest and the smallest.[6]

However, if the true measures are such maximum-minimum limiting concepts, man will not arrive at truth using subjective measures. Therefore, learned ignorance teaches that absolute truth is beyond reach due to the transcendental nature of the true measure. Nevertheless, there is an idea of practical significance contained in this speculation, one which Nicholas applied in later works specifically concerned with science.

The relationship of creation to creator can be seen in still another perspective; the universe is a restricted or contracted form of the Maximum. Therefore, all that is known of the Maximum can be applied to the universe in a relative way. The universe is infinity contracted to the merely unbounded, absolute unity contracted to unity in plurality. Thus, in the universe, identity underlies diversity, unity is the basis of plurality, etc. The relationship of the universe to all things is the same as the relationship of humanity to all men; "humanity is neither Socrates nor Plato, but in Socrates it is Socrates and in Plato it is Plato." The universe is a principle.[6] All things are in each thing through the medium of the universe-principle, from which it follows that no individual can have an absolutely privileged status in the universe.

Nicholas then concluded that it is impossible for the various motions of the stars to have a fixed and immovable center, such as the center of the earth, for a motor. Further, the earth, like the stars, must be in motion, since the state of absolute rest cannot be determined due to fact that the absolute minimum of motion is a transcendental and identical to the absolute maximum of motion. Also, the earth must be in motion because it cannot be the center of an unbounded universe.

These statements of the motion of the earth are in fact statements to the effect that it is impossible to assert that the earth is at rest. In the same manner, Nicholas could say that the earth is not a perfect sphere because it is impossible to make such a determination.[7]

Largely on the basis of these few remarks on the motion and shape of the earth, people have claimed that Nicholas was a forerunner of Copernicus in declaring that the earth was in motion around the sun, that he anticipated discoveries such as relativity theory, the flattened form of the earth, or the rotation of the heavenly bodies on their axes. He discovered

none of these things, for the statements in question do not represent positive knowledge, but rather learned ignorance.

The examination of the limitations to man's knowledge was, for Nicholas, prerequisite to the search for the clearest possible understanding of things. Accordingly, the insights of learned ignorance find application in working out the method of obtaining such understanding. Nicholas tells the inquirer not to seek knowledge of things in the things themselves, but in their reason and cause. "There, while you seek but one, shall you find all things."[8] This is an expression of the unity of things in principle, as well as a statement of the meaninglessness of mere observation.

Nevertheless, Nicholas advocated comprehensive compilations of observations, since the more of them available, the more certain is the "skill which arises from them."[9] It is important that he regarded observation as productive only of a skill, for the knowledge of incorporeal things, principles, causes, or reasons, must be sought within the soul. When one wishes to see something incorporeal, he turns away from the senses, and the soul becomes his instrument of perception. There is, in the soul, a "completely strong and simple power which sees spiritually."[10]

This strong and simple power of the soul is the unity of all the conceptual envelopments, by means of which the soul pulls its experience together. It is unity from which the soul develops number, the point out of which the soul develops the mathematical figures, and the now out of which the soul develops time. The soul creates concepts, and this activity is seen as one of differentiation, or of counting and proportioning.[11]

Since number is the image, or contracted form, of unity, it has, in a restricted sense, the divine property of being both as great and as small as it can be. All things in the universe are thus best understood through number.

The skill that is gained from observation must then be skill in the application of number to the object under consideration, that is, in measurement. But measurement proceeds through the creation of a concept, or group of concepts, which represent the object and make it accessible to counting. The conceptual representation of an object, as a product of the intellect, has a relation to truth like that of a polygon to a circle. "Apart from its being reduced to identity with the circle, no multiplication . . . of its angles will make the polygon equal the circle."[12]

In his *Idiota de staticis experimentis* of 1450, Nicholas gave some examples of the skill of measurement. The investigation of a magnet was accomplished through the use of a balance. A piece of iron was placed in one pan and a magnet in the other so that the two were in equilibrium. The magnet was replaced in the pan by an object of the same weight, and the magnet was moved to a position above the iron, so that the iron was drawn upwards. Then weight was added to the pan with the iron until equilibrium was again restored. The additional weight was set proportional to the power of the magnet.[13] The concept of strength, or power, of a magnet, expressed in terms of the proportion of the additional weight needed to balance the pull of the magnet to the weight of the magnet, makes it possible to measure any magnet in a meaningful way.

Another determination described by Nicholas is that of the weight of air. One could determine the weight of air by dropping bodies of equal weight but different shape from a tower and measuring their time of fall by means of a water clock and a balance. The weight of the air would be obtained "from the difference in the weights of water gathered, by means of a suitable hypothesis."[14] Here, a group of concepts in the form of an

hypothesis as to the relation between weight, shape, and time of fall of bodies is used to make the measurement possible.

Presumably, when things had been reduced to the unity of number through this process of conceptualization and measurement, the soul would also perceive their identity in principle, and thus would attain the maximum of knowledge.

Nicholas of Cusa was not a scientist. He made little or no attempt to explain any known phenomena. In effect, he was trying to make such explanation possible by setting limits to man's knowledge of things and by outlining a method of investigation.

NOTES

[1]Lynn Thorndike, *Science and Thought in the Fifteenth Century, Studies in the History of Medicine and Surgery, Natural and Mathematical Science, Philosophy and Politics* (New York: Columbia University Press, 1929), 134-36.

[2]Nicolas Cusanus, *Of Learned Ignorance,* trans. Germain Heron with an introduction by D. J. B. Hawkins (New Haven, Conn.: Yale University Press, 1954), XIII-XIV, 7-8.

[3]*Ibid*, 11.

[4]*Ibid*, 6-14.

[5]Paul Wilpert, "Das Problem der *coincidentia oppositorum* in der Philosophie des Nikolaus von Cues," *Humanismus, Mystik, und Kunst in der Welt des Mittelalters*, ed. Josef Koch (Leiden-Koeln: E. J. Brill, 1953), 47, 50-52.

[6]Cusanus, *Of Learned Ignorance*, 80-84.

[7]*Ibid.*, 107-108.

[8]*Ibid.*, 121.

[9]Nicolas Cusanus, *Der Laie über Versuche mit der Waage (Idiota de staticis experimentis)*, trans. Hildegund Menzel-Rogner, Heft 5 of *Schriften des Nikolaus von Cues im Auftrage der Heidelberger Akademie der Wissenschaften in deutscher Ubersetzung,* ed. Ernst Hoffman (Hamburg: Felix Meiner, 1944), 32.

[10]Nicolas Cusanus, *Vom Globusspiel (De ludo globi)* trans. Gerda von Bredow, Heft 13 of *Schriften des Nikolaus von Cuesim Auftrage der Heidelberger Akademie der Wissenschaften in deutscher* Übersetzung, ed. Ernst Hoffman (Hamburg: Felix Meiner, 1952), 79-80.

[11]*Ibid.*, 71-74.

[12]Cusanus, *Of Learned Ignorance*, 11.

[13]Cusanus, *Der Laie über Versuche mit der Waage*, 28-29.

[14]*Ibid*, 33.