

## Abstract

### Meaning of numbers between Plato and Aristotle

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The dissertation titled “The Transformation of the Concept of Number between Plato and the Early Academy” deals with the problem of numbers in early Platonism between Aristotle and Plato. In Plato’s dialogues, within professional mathematical disciplines of knowledge, numbers fulfil a function of propaedeutic procedure to the method of thinking – dialectic.

Dialectic engages in the most general structures of thinking whose centre is the problem of being and good, which is only mentioned marginally in our thesis. The philosophy of dialogues is based on the ontological and epistemological dignity of unchanging and eternally existing ideas. In *Metaphysics A* Aristotle describes Plato’s and the Platonic doctrines of the early Academy in whose centre there are principles expressed by numbers: one and indefinite two, which are assessed according to Aristotelian principles doctrine as form and matter. Aristotle mentions Platonic dialectical method which focuses on researching the general in speech. This method distinguishes Platonic thought from Pythagorean philosophy in Aristotle’s precursors’ philosophy overview. In the criticized doctrine, numbers have the same meaning as ideas or ideal numbers standing on the scale of ontological dignity higher than ideas, but in Plato’s dialogues, we learn nothing about it. *Metaphysics M* and *N* subject ontological basis of Platonic mathematics to extensive criticism including the theory of ideas, numbers and principles. The basis for criticism is the sum and total expression of Aristotle’s metaphysics in the division of kinds of being from which one kind is subject of perishing and second kind is eternal, but both are established by a single principle – unmoved mover and god. In the criticism, Aristotelian metaphysics based on being of an individual physical thing collides with Platonic dialectic and ontology standing on the hypothesis of indisputable being of thought structures of being which is primarily expressed by the numbers and objects of geometry depending on the principles of one and indefinite two.

The problem of numbers is researched by the following procedure: Aristotle’s criticism of Platonic philosophy of the early Academy is based on the Aristotelian interpretation of ideas and numbers in the sense of the cause and principles doctrine of the world and physical being, but the meaning of ideal structures within dialectical method of thinking is left quite aside. On the basis of the already reconstructed opinions of the Platonic Academy (L. Robin, *La Théorie Platonicienne, Des Idées et des Nombres D’Après Aristote*; H. Cherniss, *Aristotle’s Criticism of Plato and the Academy*; K. Gaiser, *Platons Ungeschriebene Lehre, Studien zur systematischen und geschichtlichen Begründung der Wissenschaften in der Platonischen Schule*) which are mainly based on Aristotle’s criticism in *Metaphysics*, the thesis tries to reveal the strategy of description and criticism of Platonic philosophy so that the result can be compared with the dialectic and ontology of Plato’s dialogues. Aristotle’s summary of Platonic philosophy in *Metaphysics A 6* is a model of Platonic ontology for this research.

The first range of problems focuses on the issue of Platonic numeric principles of the *one* and *indefinite two* (Chap. 3) described in *Metaphysics N 1-2* in more semantic variants, connected with the opinions of Plato’s followers Speusippus and Xenocrates and criticized within the meaning of the Aristotelian doctrine of unity of being and measure, or more precisely of the indefiniteness of matter and category of relation. An important part of objections to indefinite two, understood as “other” from being, is a challenge to Plato’s solution of the problem of not-being which we can encounter in the dialogue *Sophist*. In the contemporary interpretation of this dialogue is indicated Plato’s possible answer to the

criticism. Part of this answer is a proposal of the first dialectic meaning of Platonic principles. The main issue of *Sophist* is the justification of an option to tell untruth where speech follows the dialectical division of the structure of the highest genera: being, sameness, difference, movement and rest. Within these genera, not being is only understood as different from being but not as completely incomprehensible and impossible absolute not being. The question of the multiplicity of individual things is also answered by stating the pervasion of being and diversity through the whole physical universe. The result of the research in this chapter does not want to claim that the concepts of “being” and “different” – “other” in *Metaphysics N* – from the dialogue *Sophist* are models for the Aristotelian extrapolation of Platonic principles one and indefinite two, but it is one of more variants of principles of the dialectical method, which is always only partially depicted in the dialogues, depending on the topic, and serves to answer a sub-question.

The part of the problem of numbers is a question of the meaning of the Platonic “objects of mathematics between ideas and things of the world of senses” (Chap. 4). The criticism of these objects is situated in *Metaphysics M* 2-3 and is based on the argument of separate existence of general ontological assumptions of geometry and arithmetic from dimensions and multiplicity of physical objects. The answer to this criticism is sought in the central books of the dialogue *Republic*: in the description and interpretation of the image of the Sun and a divided line and in the didactic lecture on professional disciplines of knowledge which lead thinking to dialectic. The result of the research states that the process of knowledge to dialectic reminds of Aristotle’s method of “abstraction” of general from individual using the adverb “like”, but different are ontological grounds of these methods. Dialectic is a special form of dialogue, where intelligible ideas and hypotheses grasped about themselves without their professional and practical expression are anticipated. In epistemology and didactics of *Republic*, Platonic “objects of mathematics between” ideas and things of senses have sense in the theory of knowledge. Ontological sense which grasps causation of “objects of mathematic” in physical world is explained in the research of the dialogue *Timaeus* and attacked is in Aristotle’s criticism.

In the third section, the dissertation focuses on the problem of Platonic ideal numbers or self-existent number kinds (Chap. 5) which was also important for Plato’s successor at the Academy – Speusippus. In detail, it deals with the division of the doctrines of ideal numbers (*Metaphysics M* 6) according to commensurability and incommensurability of units. It studies the basic critical procedures against this establishment of numbers in *Metaphysics M* 7-8 including objections based on Aristotelian logic of definitions according to genera, kinds and kind differences and the explanation of movement and coming into existence using Platonic principles and ideal numbers (Chap. 7). It confronts the question of the meaning of ideal numbers with the interpretation of the final part of Plato’s dialogue *Phaedo* where Socrates uses the “hypothesis of ideas” to justify the immortality of the soul (Chap. 6). Within the dialogue, ideal numbers are not in any way put above other ideas in hypotheses in which ideas prove the veracity of the assertion about a certain state of the world or the object of our belief. Within the hypothesis of ideas, the important meaning belongs to the unity which divides numbers into odd and even. The meaning of one and number unities within dialectic presents the research of a method and the first and second hypotheses in the dialogue *Parmenides*. One and being prove to be next central principles in this dialogue. On these principles depend relations in dialectical series: one – number – multiplicity in which it is just indicated that every general term also has the meaning of a unity and a number in increasingly complicated relations that can go up to multiplicity without limits.

The most important part of the research of Platonic numbers concentrates on Aristotle’s reproaches of inability to explain coming into existence by means of the principles, universals, numbers and objects of geometry (Chap. 8). Ideal and mathematical structures are

criticized particularly from the position of formal cause and efficient cause. The answer to the questions of coming into existence and the whole of Platonic cosmology is studying Plato's dialogue *Timaeus* which describes the sophisticated dialectic of divine causal effect on the coming of the world into existence (Chap. 9). The division in this dialogue provides another variant of dialectical principles of understanding of coming into existence: being and receptacle. In the description of establishing of the world soul through the divine craftsman and the ideal example is explained dialectic of expression of universals: ideas, numbers and objects of geometry in the soul as the basis of the existence of the world. The world body is formed by similar structures.

Model structures accessible only to the reason of god are expressed in several steps of the constitution of the world soul. In the first order, there are basic terms of Platonic dialectic: existence, sameness and difference interpreted as what might correspond to ideal numbers in the Aristotelian criticism. In the second order, the mixture of these terms is dialectically divided and composed as an intelligible unit and the whole by means of advanced mathematics of units and relations, geometry and the theory of harmonies. This mathematics bases the ideal shape of a sphere and establishes the function of the soul, which in further steps finds expression in astronomical celestial order and in the order of succession of time. The description of establishing the soul forms the ontological antipole to dialectical knowledge which, in individual stages of the establishment of the world and the soul, rises in reversed order as described in *Republic*. Only because god put the general, numeric and geometric structures into the order of the world soul, a partial trained human mind can examine these structures by means of professional disciplines. The answer to critical objections regarding the principle of indefinite two and matter is sought in the sections of *Timaeus* devoted to the geometrical arrangement of the body of the world and four elements. The same numeric and geometric order described in the world soul in the overall perspective is in the body of the world described in defining geometrical shapes of the individual elements.

The final confrontation of Aristotle's criticism of Platonic numeric ontology is created by studying Plato's dialogue *Philebus*, where the description of dialectical ontology based on the definition of units and numbers and grasping unlimited contradictions and infinity emerges (Chap. 10). The genera of limited and unlimited mentioned in this dialogue present another partial dialectical grasp of Platonic dialectic and a model for the Aristotelian criticism of Platonic principles and numbers. The differentiation of ontology of mathematics based on the examination of being and professional mathematics researching numbers and the objects of geometry is not ignored either.

The conclusion of the dissertation provides a brief overview of the doctrines of Plato's followers Speusippus and Xenocrates (Chap. 11.1) who must have been confronted with Aristotle's criticism. Their solving the issues of principles, numbers, ideas, mathematics and geometrical dimensions shows the need to cope with Aristotelian criticism. These thinkers' views create the basis of Platonic philosophical tradition going back deep into our millennium.