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Monday:

Dr. Matt Duncombe (University of Groningen): Dialectic and deduction in Aristotle's *Prior Analytics* 1

Dialectical arguments involve two arguers, with each side trying to win, given certain implicit or explicit rational rules, such as 'don't beg the question'. Deductive arguments involve one demonstrator, trying to show that if a set of premises is true, a certain conclusion must be true. A recent study (Netz 1999, 297-8) argues that Greek mathematical proofs evolved from dialectical arguments. This paper argues for a similar pattern of development in Aristotle's logic. I argue that a close reading of *Prior Analytics* 1 suggests that Aristotle's deductive science is primarily concerned with dialectic and only derivatively with deduction for its own sake. Aristotle's famous definition of 'syllogism' (*sylogismos*) as '(i) a discourse (*logos*) in which, certain things having been posited, (ii) something other than what has been laid down (iii) follows by necessity' (*An. Pr.* 24b18) is usually taken to show that he is concerned with deduction. However, I argue that it shows that he conceives of the syllogism as primarily a dialectical tool. *Logos* in clause (i) is best understood as 'discourse' because of the public nature of argument in the Academy. Clause (ii) rules out deductively valid inferences such as '*p*, therefore, *p*', because, I argue, they are question begging, which would only be a worry if the syllogism were being used as a dialectical tool. Finally, 'following by necessity' in clause (iii), although close to a definition of deductive consequence, is also the trump card of dialectic: a necessary inference cannot be rationally disputed. Indeed, even if the opponent brings up further information, a deductive argument is indefeasible. Thus, it is are maximally compelling in dialectic.

Daniele Labriola (University of St. Andrews): On The Science Of Dialectic And Its Educative Role In Plato

'Running in the background during the account of the aspiring dialectician's ascent to the Form of Good in *Republic* VII is the role of the dialectician as educator. Whilst revealing, I argue that in the *Republic* Plato has left this educative role unarticulated. To explain this, I suggest that the *Republic* shows us a nascent conception of *dialektikē*, of dialectic as the science of Forms. Plato is testing the waters, so to speak, by presenting the science of dialectic (*dialektikē*) as the pinnacle science of philosophy. Accordingly, he has not fully worked out the scope of being an expert in such a science. Yet a look at the *Phaedrus*, *Sophist* and *Statesman*, dialogues that are commonly placed after the *Republic*, reveals that Plato returns to adjust the educative role of *dialektikē*. I shall say a few words on this adjustment, arguing in particular that the account *dialektikē* remains generally coherent between the *Republic* and these later dialogues, even with the noted adjustment.'

Dr. Daniel Herrick (Princeton): Generic and Specific Mathematical Entities in Aristotle's *Metaphysics*

I give a new interpretation of Aristotle's philosophy of mathematics. Central to Aristotle's view is, I argue, the distinction between *generic* mathematical properties like 2-dimensionality, and *specific* mathematical properties like triangularity—i.e. being a specific way that the generic mathematical property of 2-dimensionality is instantiated. Since sensible substances perfectly and actually instantiate generic mathematical properties, they can be regarded *qua* generic mathematical entities for the purposes of mathematics. I argue that *Metaphysics* M 3's presentation and development of this view involves a good deal more of the metaphysics of Z, H, and Θ than is generally supposed. In particular, I argue, Aristotle draws on his discussions of *kath'hauton* properties (Z 3 and 4), "intelligible matter" (Z 10-11, H 6), and potential and actual being (Θ). I show how Aristotle employs these doctrines to construct a philosophy of mathematics that overcomes many of the limitations ordinarily attributed to his view.

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Dr. Michalis Sialaros (Birkbeck) and Dr. Apostolos Doxiadis: Introducing the 'Muse of the Hypotenuse': A discussion of the influences of Poetry and Rhetoric on the formation of Greek mathematics.

'Two plus two equals four' is often stated as a prototype of objective knowledge: the result is the same no matter who derives it. In this sense, all mathematical writing is inspired by an ideal of anonymity. Nevertheless, all works produced by human beings are affected to some degree by the aims, capabilities and weaknesses of their creators; thus, the investigation of the mindset of mathematical authors—a mindset that is partly shaped by the non-mathematical cultural influences that they are exposed to—becomes significant to a study of the history of mathematics. The aim of this paper is to investigate the intellectual makeup of the early Greek mathematicians, in an effort to identify the cultural influences that may have played a crucial part in the creation of the kind of mathematics we call 'Greek-style'.

Janine Gühler (University of St Andrews): A defence of Aristotle's account of Abstraction

This paper is a critical introduction to Aristotle's philosophy of mathematics. According to Aristotle, mathematical objects are abstracted from physical objects by focusing on their mathematical aspects. This kind of abstraction as an explanation for how mathematical knowledge is possible has been widely criticised. I present Frege's criticism on abstraction and illustrate it with his counting blocks example. The main idea is that abstracting to units makes the abstracted items indistinguishable and thus prevents any form of counting. This criticism is confronted with two solutions that I offer in support of Aristotle. The first solution beats Frege on his own grounds and questions his use of 'unit'. The second solution explains how Aristotle's units remain identical while the counted items are still distinguishable. The solution suggests that the abstracted items though lacking any perceivable matter still have different intelligible matter.

Peter Griffiths (Independent Scholar): The Egyptian Numerical Impact on Archimedes's Computation of pi in 212 BC.

Despite rounding off obstacles, the ancient Egyptians were aware that the square on the hypotenuse of a right angle triangle equalled the sum of the squares of the other two sides, particularly if the other two sides each equalled 7 units so that $7^2 + 7^2$ equalled approximately 10^2 . However where the other two sides of the right angle triangle were not equal then the Egyptians continued to assume that one of the other two sides equalled a constant 7 units. This meant that the other of the two sides varied inversely with the adjacent angle. The Egyptians called this variable side the Seked which was effectively 7 times the cotangent of the adjacent angle. The text of Archimedes's *On the Measurement of the Circle* is an application of this Seked system, but the constant side of the right angle triangle instead of being 7 units becomes 153 units and then 780 units, both serving as constant denominators apparently to help express the square root of 3 (equalling $\cot 30$ degrees) as a fraction, that is $265/153$ and $1351/780$. The main formula used by Archimedes to compute PI was the crucially important half angle formula in its iterative or recursive form, $\cot u + \operatorname{cosec} u$ equals $\cot u/2$. A diagram can be drawn illustrating this half angle formula and the Seked system. In the formula $\cot u$ is clearly less than $\operatorname{cosec} u$, but this difference is reduced as the angle u is reduced. After the appropriate multiplication of 3×2^n , the reciprocals $\tan u$ and $\sin u$ give the upper and lower limits for PI without any need for the circumscribed and inscribed operations shown in Proposition 3 of *On the Measurement of the Circle* which may be superfluous. Archimedes recognised the need for common denominators but in spite of the ingenious application of the half angle formula he was unable to express amounts to a high number of decimal places which is essential for an accurate value for pi.

Dr. Andrew Gregory (UCL): Thomas Kuhn and Ancient Science.

Kuhn's work on the nature and development of science has had a major impact on studies of science since the publication of *The Structure of Scientific Revolutions* in 1962. In *SSR* and other works, Kuhn makes some comments on the nature of science in the ancient world. This paper examines the nature of those claims, how scholarship since 1962 relates to those

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claims and asks how studies of science in the ancient world can be used to investigate the validity of some of Kuhn's ideas.

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Tuesday:

Prof. John Sisko (The College of New Jersey): Is Parmenides' Monad a Pre-Cosmic arche? In this paper I assess the possibility that Parmenides' monad is, in effect, a neo-Ionian arche, a source from which or out of which the structured cosmos comes to be formed. I establish a positive rationale for the interpretation: I show that three prominent accounts of Parmenides' philosophy prove to be problematic, and I show that Anaxagoras and Empedocles consider Parmenides to believe that the monad is a pre-cosmic arche. Finally, I confront Parmenides' reasons for claiming that the monad is imperishable, homogeneous, unmoved and perfect, and I show how these claims might harmonize with the proposed interpretation.

Dr. Andreas Schwab (Universität Heidelberg): Aristotle and his commentators on Thales' Psychology

Recent scholarship on early Greek philosophy and science is particularly interested in the history of its transmission as well as its complex history of reception. Thanks to Aristotle and his treatise *On the soul* there are two significant testimonies on Thales' thought on the soul, to which some commentators already in Late Antiquity paid special attention. In this paper I will examine these interpretations both in their respective contexts and in comparison with each other in order to illustrate how they understand Thales' doctrine of the soul and how their comprehension of both, Aristotle and Thales, is influenced by their own notion of the soul.

Aimee Schofield (University of Manchester): Building Philon's Catapults: Problems of Interpretation

Philon's *Belopoeica* (a treatise on catapult construction) seems at first glance to provide us with a comprehensive guide to building the catapults used in defensive structures and by armies in the ancient world. However, in attempting to use these treatises to build replica catapults, the level of technical knowledge which Philon assumes that his readers have becomes strikingly clear. This paper will highlight the difficulties of interpretation which face anyone trying to reconstruct ancient catapults using this treatise and explain how these problems can be overcome by using Philon's text in combination with the treatises of Heron, Biton, and Vitruvius.

Luca Pitteloud (Université de Fribourg Switzerland): The Status of Mathematical Objects in Plato's *Timaeus*

In this paper I will examine the status of mathematical objects in Plato's *Timaeus* by looking at the following elements: 1) the numbers and figures (53b5) that the Demiurge uses in order to fashion the four elements, 2) the ontological status of the numbers which characterize the intervals between the segments involved in the fabrication of the World-Soul (35b4-36b5) and all the immortal souls (41d6) and, 3) the common function of mathematical objects conceived as intermediaries between the sensible and the intelligible. I will argue that mathematical objects can belong to neither the sensible nor the intelligible, since their main function is to help to reduce the gap involved by the separation between these two ontological categories.

Neils Hermansson (University of Edinburgh): Plato's medical theory in the *Timaeus*: a non-confrontational offer of a rational foundation for, and influenced by 'Hippocratic' medicine.

At *Timaeus* 81e8 Plato starts explaining how diseases arise, declaring this to be obvious to all. Timaeus then applies his unique corpuscular physics, physiology and anatomy to established Hippocratic nosology. For treatment Timaeus favours regimen over drugs. The right regimen depends on knowledge of the nature of man, which is congenial to the nature of the universe. Man, unlike the universe, is subject to an allotted lifespan. I show that Plato's rationalistic medical theory in the *Timaeus* is neither confrontational nor eristic towards the empiricist view. Incorporating the thought of medical authors, poets and sophists, Plato engages in critical and constructive dialogue.

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Dr. Robert Lloyd (): How old are the Platonic Solids?

Recently a belief has spread that the set of five Platonic Solids has been known since prehistoric times, in the form of carved stone balls from Scotland, dating from the Neolithic period. A photograph of a group of these objects has even been claimed to show mathematical understanding of the regular solids, a millennium or so before Plato. I argue that this is not so. The archaeological and statistical evidence do not support this idea, and it has been shown that there are problems with the photograph. The high symmetry of many of these objects can readily be explained without supposing any particular mathematical understanding on the part of the creators, and there seems to be no reason to doubt that the discovery of the set of five regular solids is contemporary with Plato.

Dr. Paolo Badalotti (Udine): Simplicius' Commentary on Aristotle's *De Caelo*.

Simplicius' commentary on Aristotle's *De caelo* is not simply an explanation of the text – it also discusses Aristotle's theories thoroughly explaining the philosopher's thought. This commentary gives us the most detailed account of the history of interpretations on the *De caelo* making reference chiefly on Alexander of Aphrodisias and relying on several other works – some of them lost – which were written not only by other Aristotelian commentators but also by thinkers of other philosophical schools. From this point of view, Simplicius' commentary presents us the account of many centuries of exegetic work on several, and sometimes contrasting, cosmological theories. The aim of this paper is to underline the importance of this commentary – giving some examples of Simplicius' methodology while discussing the theories presented by Aristotle in his treatise – and to point out the existence of a "commentaries' literature", in which various types of works used different methodologies to approach and discuss philosophical texts, mainly Aristotelian. In the last part of the paper I will focus my attention on the fact that for Simplicius using some Platonic dialogues – mainly the *Timaeus* – was part of the traditional method of explaining Aristotle's writings.

Gabriella Guarino (): The zoology of Plutarch: examples of animal's virtues.

After Aristotle the zoology turns into ethology. The real point of the zoology in Plutarch is that all animals of whatever provenance are intelligent. The author demonstrates that the Stoics, in so far as they affirm the irrationality of animals, contradict their own tenets. He proves that animals of all kinds are rational. The zoology in Plutarch is based on the desire to understand animals, on the study of many aspects of animal communication, on the analysis of animal emotions, on the observation of animal culture, of learning, of sexual conduct. In my paper I focus on examples of animal's virtues described by Plutarch: through the *exempla* he demonstrates the cleverness of animals.

Michiel Meeusen (Leuven): Picturing the World - Some Remarks on Epistemology and Ontology in Plutarch's *Quaestiones Naturales*

Plutarch's collection of *Quaestiones Naturales* consists of ca. 40 physical problems in the Ps.-Aristotelian tradition of *Problēmata physica*. Its epistemological organization and underlying ontology are relatively understudied both by Plutarchists and historians of science. In our contribution we intend to substantiate the scientific (i.e. natural philosophical) value Plutarch ascribes to questions like why seawater cannot provide nourishment to trees (*Q.N.* 1), or why trees and seeds naturally receive more nourishment from rainwater than from irrigational water (*Q.N.* 2), but also more paradoxical (c.q. paradoxographical) ones like why the tears of wild boars are sweet whereas those of deer are salty and ordinary (*Q.N.* 20), or why bees are quicker to sting people who have just committed adultery (*Q.N.* 36). We will argue from these examples that Plutarch does not necessarily intend to study nature 'as it actually is' but 'as it could be potentially'. Clearly, Plutarch does not intend to verify or falsify these 'folkloristic' phenomena in an empirical fashion; after all, he is not looking for the *ὄτι* but the *διὰ τί* in nature (cf. *Quaest. conv.* 680CD: *δεῖ ... τὸ μὲν διὰ τί γίγνεται τῷ λόγῳ μετέναι, τὸ δ' ὅτι γίγνεται παρὰ τῆς ἱστορίας λαμβάνειν*). We will show that Plutarch is – knowingly or not – taking a rather anti-Aristotelian position in this regard, because for Aristotle science should progress from a consideration of what actually appears to the senses (cf. the much discussed *De part. an.* 640a14-15: *πρῶτον τὰ φαινόμενα λεηπτέον ... εἶτα τὰς αἰτίας λεκτέον*).

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Nevertheless, the kind of physical problems Plutarch and Ps.-Aristotle solve share a basic educational dynamic as scientific school-discussions, but it remains to be seen whether Plutarch 'believes' these natural phenomena *only* for reasons of intellectual exercise: in any case, they receive Plutarch's benefit of the doubt. We will try to show that this is in line with his more general Platonically inspired epistemology and ontology, according to which nature is a priori considered ontologically unstable, so that knowing about nature is also bound to remain uncertain (this idea is central to the ἐπιποχὴ statement in the finale of *De primo frigido*). In conclusion, we argue that Plutarch's scientific εὐλάβεια can be connected with his more general religiously inspired concern with the Delphic μηδὲν ἄγαν as a middle course to be steered between the excesses of atheism and credulity.

Dr. Andrew Gregory (UCL): Presocratic Targeting of Homer and Hesiod

This paper argues that on the question of whether all phenomena are natural or not, some presocratic thinkers specifically targeted passages in Homer and Hesiod where phenomena are put down to the actions of the gods. Of particular interest is Anaximander on meteorology, where he cites five phenomena given in a famous passage of Hesiod. This is important both for the presocratic idea of the natural and for opposing the Cornford line that there is only a 'thin veil' between the world views of Anaximander and Hesiod.

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Wednesday

Dr. Ulrike Steinert (UCL): Some problems regarding the interpretation of Ancient Mesopotamian medical texts on women's diseases.

Reading and interpreting medical cuneiform texts from Mesopotamia is fraught with difficulties, due to their mostly fragmentary nature, their laconic style, the specialist jargon in which they are written, but also due to vast cultural differences between ancient and modern concepts of disease and healing. In this talk, some of these issues will be exemplified through recipes from the Babylonian gynaecological corpus, and an interdisciplinary approach will be applied in order to test various possibilities for resolving some of the problems hampering our understanding of Mesopotamian concepts of female illnesses.

Keith Stewart (University of Exeter): Galen's elemental theory of the human body

In the late secondary century AD Galen wrote *On the Natural Faculties*, which contains a debate on the nature of matter in the universe. This debate was polarised between those who believed that matter was made up of discrete, tiny and indivisible atoms (which randomly collide to create more complex compounds) and those who theorised that matter was a continuous substance made up of four distinct elements: fire, air, water and earth. Galen adopted the elemental theory of matter and used the theories of Hippocrates, Plato and Aristotle to develop a biological model of all living things. This paper will show how Galen constructed a sophisticated elemental theory to describe how all living beings function. Galen's theory was based on Hippocrates' ideas concerning the qualities (hot, cold, dry and wet), the elements (fire, air, water and earth) and the humours (blood, black bile, yellow bile and phlegm). Galen also used the elemental natural philosophy of Plato and Aristotle to show how complex organs in the body function. Galen was a strong critic of rival theories and this paper will also show how Galen used the authority of Hippocrates, Plato and Aristotle to not only refute the atomic theory of matter, but also to challenge other rival elemental theories. The overall aim of this paper will be to show how Galen constructed and presented a biological theory of the mixture of qualities, elements and humours as the best candidate for the explanation of the way that the organs in the body function.

Dr. Marzia Soardi (Palermo): Aristotle on spontaneous generation

In the Book III of the *De generatione animalium*, Aristotle discusses about the problem of spontaneous generation, which will be object of interest for centuries, up to modern science. The aim of the paper is to examine this topic trying to highlight what is the most remarkable problem in the Aristotelian theory: the ability of the matter of self-moving and self-reproducing and, connected to this, the relationship that exists in nature, in the Aristotelian biology, between a teleological based function and the presence of a necessary counterbalance in material form. In the last part of the paper the attention will also be focused on the connection between spontaneous generation and sexual reproduction, underlining, once again, the importance of the material aspects, alongside the teleological ones.

Dr. Attila Németh (Eötvös Loránd University, Budapest): Cicero and the Epicurean Sorites

In his criticism of the Epicurean Velleius' arguments for the anthropomorphism of gods in Book I of *De Natura Deorum*, Cicero's Cotta, a pontifex and an advocate of the New Academy, applies a series of arguments, some of which only make sense if we reconstruct them as a series of interconnected soritical arguments - or so I will argue. The reconstruction will bring to light Cicero the philosopher applying a Carneadean type of weapon in a theological context, namely the sorites, as well as the consequences it has concerning the Epicurean arguments criticized.

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Aiste Celkyte: () The ancient version of emergence? The Stoic definition of *summetria*

Plotinus criticizes the Stoic definition of beauty for claiming that wholes can have properties that are not explicable by the properties of the constituent parts. If this criticism is justified, then the Stoics must have had a concept of emergence centuries before the British emergentists applied this concept to the sciences. In the first part of this paper, I ask whether the Stoic account of properties is capable of supporting the concept of emergence. In the second part, I discuss the significance of the ancient version of emergence in its historical context and for modern debates.

Dr. Andree Hahmann (University of Oxford): Divination and the nature of chance

It is well known that the notion of providence is particularly important for Stoic philosophy. Stoic providence, however, is characterized by two sides. On the one hand there is the divine will and on the other hand there is the divine foreknowledge. The divine will is reflected in the concern for the welfare of individual creatures and the preservation of the world. This activity of God, however, presupposes his foreknowledge of future events. Therefore, the ancient criticism is directed at both sides of providence. So, for instance, Alexander of Aphrodisias rejects the idea that the gods can know the future in advance, since the future is contingent by nature and thus is essentially unpredictable. For this reason, he turns against the possibility of a science of divination, which is claimed by the Stoics. According to Alexander, the contingent nature of the future is expressed by the importance of chance in explaining human affairs. Against the Stoics he emphasizes that they dismiss the nature of chance by defining it as a hidden cause from human understanding. This paper focuses on the Neo-Aristotelian criticism of the Stoic contention that providence presupposes divine foreknowledge. Therefore, the Stoic and Aristotelian concepts of chance are carefully distinguished from each other. I want to demonstrate that the Stoics' definition of chance as a hidden cause from human understanding refers to a particular cause which is at the same time the object of their science of divination. I will thus proceed in three steps. First, I shall consider the arguments put forward by Alexander against the possibility of divine foreknowledge. In this context, the Aristotelian definition of chance is particularly important. Then, I will contrast the Aristotelian definition of chance with the Stoic definition. Finally, I will show why and in what sense the Stoic determination of chance is not only compatible with divine foreknowledge, but, furthermore, is the real object of divination as the science of divine foreknowledge.

Roberto Grasso (University of Edinburgh): The mesotês-like homeostatic physiology of perception in Aristotle.

A survey of occurrences of *mesotês* in Plato, Aristotle and Nicomachus of Gerasa suggests that the word is an 'achievement term' denoting things, states and activities that constitute a 'mediating balance'. I accordingly claim that Aristotle's thesis that *aisthêsis* is a *mesotês* describes perception as a homeostatic process: the sense-organ preserves its receptive condition unaffected in response to the stimulation of external perceptibles. Several aspects of Aristotle's theory of perception confirm this interpretation, which also avoids a problem of 'acquired blind spots' following from the premises Aristotle employs in his own explanation of the blind spot of touch.

Dr T. Crowley (University College Dublin): Perceptible Bodies' at *De Gen. et Cor.* II.1

Near the beginning of *De Gen. et Cor.* II.1, Aristotle claims that the generation and corruption of all naturally constituted substances are 'not without the perceptible bodies' (328b32-3). By 'perceptible bodies' here Aristotle is usually understood to be referring either exclusively to the simple bodies, or to some set of entities that includes the simple bodies, but excludes naturally constituted substances. In this paper I argue, firstly, that the simple bodies are not included among the 'perceptible bodies' in this context; and secondly, that the assumption behind the usual reading, namely, that these 'perceptible bodies' ought to be distinguished from the naturally constituted substances, is flawed. I explain that Aristotle's point here is not primarily about *which* perceptible bodies are necessary for the generation and corruption of

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substances, but rather that it is precisely in virtue of their being perceptible that perceptible bodies are necessary for the generation and corruption of naturally constituted substances.

Dr. Andrew Gregory (UCL): Number and Numerology in Early Pythagoreanism. There are several aspects of early Pythagoreanism which could be described as numerological. There is the attribution of characteristics to numbers, the use of small integers to underpin music theory, the use of the perfect number 10 to determine the number of heavenly bodies. This paper examines numerology in this early context, and rejecting Burket's influential line that numerology is a 'primitive' belief, argues that the early Pythagoreans investigated several ways in which number may relate to the world, in contexts where the modern conception of the relation of numbers to the world was by no means evident.