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Problems with Graham's Two-Systems Hypothesis

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1. S_1 and S_2

IN *Aristotle's Two Systems*¹ Daniel Graham has put forward a bold new hypothesis concerning the development of Aristotle's thought, which he labels 'the Two Systems Hypothesis'. Graham recognizes that the interpreter of Aristotle faced with conflicting doctrines sometimes has no recourse but to posit a development in Aristotle's thought. But, with the notable exception of the speculations of Owen,² Graham finds previous developmental accounts of Aristotle's thought philosophically unsatisfactory. This is because genetic accounts (like those of Jaeger)³ have typically explained changes in Aristotelian doctrine on the basis of a shift in general outlook, not on Aristotle's attempts as a philosopher to resolve tensions arising in his earlier views. Graham's book is an attempt to give a developmental account of Aristotle's thought in metaphysics and philosophy of science without this shortcoming.

Graham argues that Aristotle's positing of matter was motivated by the failure of his earlier ontology to allow one to account for substantial change and that the analysis of substance as a composite of matter and form is structured by the model of the activity of a craftsman. Graham shows how the theory of the four causes as it is presented in *Physics* 2 is also structured by this model and how the potentiality/actuality distinction was extended to apply to Aristotle's new understanding of substantial change. Graham's account both explains apparent discrepancies in Aristotle's views and shows why Aristotle was

¹ (Oxford, 1987).

² See G. E. L. Owen, 'Logic and Metaphysics in Some Earlier Works of Aristotle', in I. Düring and G. E. L. Owen (eds.), *Aristotle and Plato in the Mid-Fourth Century* (Göteborg, 1960), and 'The Platonism of Aristotle', *Proceedings of the Aristotelian Society*, 89 (1965), 125-50.

³ See W. Jaeger, *Aristotle: Fundamentals of the History of his Development*, trans. R. Robinson, 2nd edn., (Oxford, 1948).

philosophically impelled to change his views in the manner in which he did. There is much of value here, and Graham's speculations are worthy of close consideration. But here I shall restrict myself to just one of Graham's basic points, that which is announced in his book's very title: the hypothesis that in Aristotle's writings we find two complete, independent, and contradictory philosophical systems, each with its own ontology and theory of scientific explanation.

The aspect of this thesis that is bound to be the most controversial is the contention that Aristotle's first system (S_1), found in the *Organon*, is not only different from, but fundamentally contradicts his second system (S_2), which dominates the rest of Aristotle's work. In Graham's view there is 'a fault line running down the middle of Aristotle's philosophy' (p. viii). He argues that Aristotle never recognized that his philosophical thought underwent such a radical shift, and hence at times imports the obsolete principles of S_1 into the philosophical speculations of S_2 . Graham suggests that this is bound to cause trouble, since at these times Aristotle's conceptual framework rests on a set of contradictory principles. Graham leads up to an analysis of the metaphysical puzzles of *Metaphysics Z*, which he takes to be a manifestation of the philosophical confusions that arise from Aristotle's holding contradictory principles. According to Graham's analysis, Aristotle knows that he is in trouble, but does not know the solution—which would be to cut the problem out by the roots, i.e. eliminate the principles of S_1 from his thought. In the penultimate chapter of *Aristotle's Two Systems* Graham shows 'what Aristotle should have said' by sketching the metaphysics of a consistent version of S_2 .

Although I am persuaded by the general outline of Graham's developmental account, I believe that his analysis of the logical relation between S_1 and S_2 is flawed, and that the difficulties of *Metaphysics Z* are deeper than Graham suggests. Therefore I shall restrict my comments to these points. I shall first outline some essential differences Graham detects between S_1 and S_2 . I shall then argue that the two systems are not contradictory in the manner Graham suggests; rather, S_2 is a deeper and more elaborate account which contains all of the teachings of the 'higher-level' S_1 . In the terminology of contemporary philosophy of science, S_1 is reducible to S_2 . Next, I shall turn to the shift in Aristotle's theory of explanation detected by Graham. I shall claim that to strip the philosophy of science of S_2 of the presuppositions of S_1 would be to have Aristotle abandon his ideal

of ultimate explanation, and that there is no evidence that Aristotle was ever tempted to move in this direction.

Graham presents the theses of each of 'Aristotle's two systems' in a succinct table (pp. 80-1). Here I shall mention only those theses directly relevant to the discussion at hand.

The root difference between S_1 and S_2 is one of ontology. In S_1 , which Graham calls Atomic Substantialism, the basic things in the world are the primary substances of the *Categories*. These are those concrete substances that we run across in our everyday experience: biological entities and other middle-sized things which fall under certain natural kinds (p. 26). In S_2 , which Graham calls Hylomorphic Substantialism, the theoretically basic entities are no longer such middle-sized concrete substances. Rather, concrete substances are themselves to be analysed as complexes of form and matter, and, according to *Metaphysics Z*, it is form that is ultimately to be identified with primary substance (pp. 58-62).

While both S_1 and S_2 espouse the independence of 'primary substance', what is meant by this phrase differs in each of the two theoretical discourses. In S_1 the term 'primary substance' refers to the same beings as does the phrase 'concrete substance', which is the term Graham employs in summarizing S_2 to refer to perceptible entities such as Socrates. In S_2 it will not be the concrete substance Socrates who serves as a foundation of being, but what S_2 would consider the corresponding primary substance, Socrates' form (p. 60). Graham expresses the basic difference in the ontologies of S_1 and S_2 by the following principles: SA (belonging to S_1), that 'primary substances are ontologically indivisible particulars', and H (belonging to S_2), that 'the concrete substance is composed of form and matter' (p. 180).

As Graham sees it, this difference in ontology has repercussions in the philosophy of science. The central principle of the theory of explanation of S_1 is labelled SK: 'scientific knowledge is demonstrative knowledge.' That is to say, scientific knowledge comes about through a certain kind of deduction called a demonstration, whose premisses are 'self-evident' and exhibit the cause of the fact expressed in the conclusion of the demonstration (pp. 47-8). Demonstrations are so structured that this cause will be expressed in the demonstration's middle term, 'the missing link in a chain of universals exhibited by the terms of a sequence of syllogisms in a projected demonstrative proof' (p. 50). Since by and large those premisses which ultimately ground demonstrations are definitional, expressing the essences of objects of

scientific inquiry, demonstrations serve to identify the sort of cause indicated in *Post. An.* 2. 11, 94^a34–6, which Graham labels ‘the essential cause’.⁴ Graham argues that, despite Aristotle’s best efforts in *Post. An.* 2. 11 to show otherwise, the essential cause is the only kind of cause that can be made manifest through the demonstrative scheme of S_1 (pp. 158–63).

In S_2 , as Graham sees it, Aristotle adopts a deeper notion of scientific explanation. In this system one adequately explains a fact through identifying each of the four causes described in *Phys.* 2. 3. According to Graham, the rigid notion of demonstrations grounded in the identification of and deduction from essences plays no part here. Rather, in this sort of explanation the relevant metaphysical aspects of any entity, attribute, or event are isolated and identified. Graham argues that this notion of scientific explanation had to wait until S_2 because its scheme of the four causes is structured around the ‘craft model’ which is the motivation of the metaphysics of S_2 . Graham suggests that this is how one can solve a vexed problem of Aristotelian scholarship: how to reconcile Aristotle’s own prescriptions for scientific research and exposition in the *Posterior Analytics* with the more discursive accounts actually presented in Aristotle’s scientific researches. According to Graham, Aristotle’s scientific treatises are part of S_2 , written at a time in which the S_1 theory of demonstration was already obsolete (even if Aristotle himself was not aware that this was so). What we find in these treatises is precisely what Aristotle in *Metaphysics* A. 3 and *Generation of Animals* 1. 1 says we should find: the identification of each of the four causes responsible for the phenomenon under consideration (pp. 319–23).

2. Is S_2 an extension of S_1 ?

The crux of Graham’s argument is that S_1 and S_2 are two incompatible alternative philosophical systems. Graham first rejects the traditional account of the relationship between the *Organon* and the rest of the Aristotelian corpus, that which states that the former is, as the name *Organon* implies, a logical tool to be employed in any discourse

⁴ Graham distinguishes the ‘essential cause’ of S_1 from the ‘formal cause’ of S_2 on the grounds that the latter notion is dependent on the correlative notions of matter and form, absent from S_1 (pp. 75–6).

concerning any subject. According to this view, S_1 does not itself make any substantive philosophic claims and hence does not conflict with S_2 . Graham convincingly argues that the *Categories* does indeed present an ontology: it gives an account of the basic entities in the world (primary substances), derivative entities (the various kinds of accidents), and the relations holding between these (pp. 87–90).

Graham next rejects what he calls the Extension Hypothesis, concerning the relationship between S_1 and S_2 . According to this view, S_2 is an extension of S_1 because ' S_1 is only a preliminary statement—either because it is simplified for the novice or because it does not yet take into account the full range of problems that a philosophy has to confront' (p. 90). I shall here review Graham's criticism of the Extension Hypothesis and in the light of this criticism defend a version of it.

Graham's argument against the Extension Hypothesis is as follows. He writes, 'in logical theory, one system is an extension of the other if it contains all the axioms of the other and at least one new axiom besides' (p. 91). An example of this would be the relationship between plane geometry and solid geometry. The latter theory is built on the basis of the former, but has a more encompassing subject-matter. This is made possible by additional axioms which deal with an expanded subject-matter without contradicting or replacing any of the axioms of the first theory.⁵ Graham argues that this cannot be the relation of S_1 and S_2 because a principle of S_1 , SA (that 'primary substances are ontologically indivisible particulars'), is not only absent from S_2 but is supplanted by the contradictory principle H (that 'the concrete substance is composed of form and matter'). Two systems whose principles so contradict one another cannot stand in the relation of theory and extension. Graham likens their relation to that between Euclidean and Riemannian geometries; each geometry is partially based on an axiom concerning parallel lines which contradicts the axiom of the other. They are incompatible alternatives. So, just as the geometer must decide whether to adopt one geometry or another within a given inquiry, the metaphysician must, within the context of a certain philosophical inquiry, adopt either a theory according to which the concrete substance is ontologically indivisible or one according to which it is not. Graham argues that problems of substantial change, among other considerations, lead Aristotle to a theory of the latter

⁵ Cf. the definitions of book 11 of Euclid's *Elements*.

kind; once Aristotle has arrived at this theory, he can apply the principles of the former theory only at the risk of contradicting himself.

It is certainly the case that principles SA and H are mutually contradictory, and hence S_1 cannot be an extension of S_2 in the sense in which Graham has defined 'extension'. But to posit a theoretical chasm between the two theories is not the only alternative, and the fact that Aristotle so deftly leaps from one theory to the other should make us wary of Graham's proposal. Perhaps S_2 is an extension of S_1 in a looser sense. Perhaps the root contradiction Graham detects between S_1 and S_2 is a function of the manner in which the subject-matter of S_1 is limited, and it may be that the metaphysical analysis of change that prompts S_2 need not entail the rejection of the core doctrines of S_1 . To see how this is so we need to examine more closely the nature of the contradiction to which Graham draws our attention.

In S_1 a certain kind, i.e. concrete substance, is posited as basic and unanalysable. In S_2 that same kind is posited as analysable. Is not the relation between concrete substance as conceived in S_1 and concrete substance as conceived in S_2 the same as that between the atom as conceived in classical chemistry and the atom as conceived in contemporary physics? In both cases we have on the one hand a theory in which a certain theoretical entity is posited as basic and unanalysable and on the other hand a theory in which that same entity is analysed as a complex of more basic theoretical entities. Although we might not be able to properly say that contemporary physics is an *extension* of classical chemistry, surely we would not want to make the claim that Graham makes in regard to S_1 and S_2 : that they are incommensurable and incompatible. Rather, the relationship seems to be that which holds between a science or theory and that to which it is *reducible*.

What is it for one theoretical system to be reducible to another? If a theory A is reducible to a theory B, one must be able to correlate those entities taken to be basic in A with entities or complexes of entities taken to be basic in B. Further, by means of these assumptions (which express the relations holding between the theoretical entities of the two systems) and the principles of B, one must be able to deduce every theorem of A.⁶ Is this the relation that holds between the ontologies of

⁶ See Ernest Nagel, *The Structure of Science* (New York, 1961), 353-4.

S_1 and S_2 ?⁷ There will be only one 'correspondence rule'⁸ relating the ontologies of S_1 and S_2 : that 'primary substance' as employed in S_1 has the same reference as 'composite substance' in S_2 , the synthesis of matter and form. That every primary substance falls under a natural kind and that such a kind is a species definable as genus and differentia are theses of S_1 which, properly interpreted, will preserve their truth-value in S_2 . The only thesis of S_1 that will not preserve its truth-value in S_2 is what Graham calls SA: that 'primary substances are ontologically indivisible particulars'. What are we to make of this principle (expressed in *Cat.* 5, 2^a11-13, as 'primary substances are neither said of nor in anything else')?

The assertion that a certain entity posited by a theoretical discourse is not analysable as a complex of more basic entities is not to be taken as an integral principle of that discourse. For example, one will not *qua* arithmetician identify the monad as the basic theoretical entity of arithmetic. This will be the task of the philosopher of science, such as Aristotle (cf. *Post. An.* I. 1, 71^a15-16; I. 2, 72^a21-4; I. 10, 76^a34-6). Similarly, that 'primary substance' is the basic theoretical entity of S_1 is properly taken not as a thesis of S_1 itself, but of a metatheoretical discourse explicating the logical structure of S_1 .

It might be countered that in this respect the status of a metaphysical discourse is unique, for, unlike other sciences, metaphysics itself purports to give the ultimate analysis of beings. But the notion of First Philosophy is introduced only in S_2 . Except for the use of *prōtē* in regard to concrete substances in the *Categories*, there is no indication that the level of analysis presented therein is meant to be ultimate.

I conclude that all that S_1 tells us about the world is also told by S_2 , but S_2 tells us much more. Just as contemporary physics has deepened the scientific understanding of the world offered by classical chemistry, without rejecting classical chemistry as fundamentally incorrect, so with S_2 Aristotle has deepened, not rejected, the metaphysical understanding of the world offered by S_1 . The fact that the one system takes a certain kind of entity to be basic while the other does not does

⁷ I restrict the discussion here of whether S_1 and S_2 are incommensurable to the area in which Graham finds the core contradiction between them: ontology. The apparent incompatibility of the logic of the two systems (p. 80) is also easily explained on the grounds I present here. For a discussion of whether the philosophy of science of S_1 is incompatible with that of S_2 , see sect. 3 below.

⁸ On the use of this phrase see W. Sellars, 'Theoretical Explanation', in *Philosophical Perspectives* (Springfield, Ill., 1967), 333.

not entail the two systems' incompatibility. The proposition that a certain theoretical entity cannot be further analysed need not be considered an assumption *within* a theory, but rather can be seen as a fact *regarding* that theory. If we take the S_1 principle of the ontological indivisibility of concrete substance as metatheoretical in this way, the fundamental contradiction Graham discerns between S_1 and S_2 disappears.

Even if all of the above is admitted, it might be countered that Graham is still justified in writing of a major conceptual rift between early and later Aristotle. The principles by which S_1 is supplemented are so radical that S_2 constitutes an entirely new world-view, employing a different paradigm. Thus, Graham speaks of the transition between S_1 and S_2 as a scientific revolution, similar to those discussed by Kuhn.⁹ On this view, there is such a conceptual rift between the two systems that there would be no way to translate the truths of S_1 into the vocabulary of S_2 without doing violence to the former. Because the first theory is part of a world-view rejected by the second, the conceptual content of the principle of the first theory, taken by itself, is different from the conceptual content of the first theory understood as part of the more encompassing second theory.¹⁰ Graham supports his view that there is a radical conceptual rift between S_1 and S_2 by indicating shifts in meaning in both the terms and the propositions of the two systems. Graham focuses on the following example to highlight the incommensurability of the two systems. According to the ontology of the *Categories*, the fact that Socrates is a substance entails that Socrates cannot be either more or less what he is, since substance, taken as ontologically basic, does not admit of the more or the less (*Cat.* 5, 3^b33-4^a1). But, as Graham points out, in S_2 an immature Socrates would be 'less of a man', i.e. less of a substance, than the mature Socrates. (As Aristotle puts it at *Metaph.* H. 8, 1050^a4-7, the adult is 'prior in form and substance'. Because of the conceptual shift between S_1 and S_2 , the above S_1 statement, interpreted in the theoretical framework of S_2 , contradicts the above statement of S_2 (101-3). So even if partisans of S_1 and S_2 will agree with each other's statement that Socrates is a substance, that

⁹ pp. 93-5, 103. See T. Kuhn, *The Structure of Scientific Revolutions*, 2nd edn. (Chicago, 1970).

¹⁰ This point is based on my understanding of remarks made by Graham at the 1988 University of Texas at Austin Workshop in Ancient Philosophy.

is only because they do not fully realize what the other side *means* by that statement.

Does the problem not lie in the fact that 'to be more or less of a certain substance' has not in this example been translated from the idiom of one discourse to that of the other? Were the partisan of S_2 to understand what the partisan of S_1 means when he denies the possibility of one substance's being more or less a substance than another entity, surely he would have no objection. For in denying that one man can be more or less a man than another, all the partisan of S_1 means is that for every substantial kind, a particular entity either falls under that kind or it does not. There is no concern here with the extent to which certain potencies characteristic of that kind have been actualized; as Graham points out, the notion of form as actuality is alien to S_1 (pp. 98–100, 183–206). But this is not because the notion *contradicts* anything in S_1 ; it rather belongs to a deeper level of analysis. Again, just because, within the theoretical structure of a system, an analysis is neither given nor made possible, this does not mean that this is entailed by the core of that system; rather, that there can be no such analysis ought to be considered a metatheoretical fact. The partisan of S_2 would agree with the partisan of S_1 that there is a sense in which no one is either more or less human than another, but only S_2 presents the theoretical framework for discussing the difference in levels in which certain potencies characteristic of substantial kinds are actualized.¹¹

3. Demonstration and explanation in S_2

Graham argues that in the philosophy of science, as well as in metaphysics, Aristotle's thought underwent a fundamental shift. The notion of essence, which plays a crucial role in the theory of explanation of S_1 ,¹² is alien to the craft model of generation, which

¹¹ Cf. the difference in the English idioms 'A is more of a man than B' and 'A is more human than B'. While it can be said that I am 'more of a man' than my two-year-old son, to say that one being is more human than another is properly speaking impossible, for no human being is more human than any others. The idiom can be employed only metaphorically, e.g. in saying that a human B acts like a robot, not displaying certain human faculties that are indeed possessed, or in saying that a creature A (e.g. a monkey) displays abilities more like those of human beings than does creature B (e.g. a guinea-pig).

¹² As Burnyeat has argued, demonstrations are explanations: see M. F. Burnyeat, 'Aristotle on Understanding Knowledge' in E. Berti (ed.), *Aristotle on Science: The Posterior Analytics* (Padua, 1981), 97–139. They are not mere linguistic entities; rather,

motivates S_2 . Aristotle employs this model to liken the coming into being of a substance to the imposition of form on appropriate matter. In the most developed version of the theory of the four causes this model is to be employed in scientific explanation. For every object of inquiry the scientist must seek the analogues to the matter a craftsman takes up, the form that is imposed on it, the craftsman himself, and the end the craftsman has in mind (pp. 172–81). Aristotle attempts to dovetail the two theories by identifying the essence of a thing with its formal cause. As we have seen, Graham holds this identification partially responsible for the paradoxes of *Metaphysics Z*.¹³

But suppose that Aristotle had adopted a hylomorphic substantialism free of the theory of explanation presented in the *Posterior Analytics*. What sort of scientific explanation would be possible? There are two possibilities. Either explanation would be wholly non-deductive or it would be deductive, without resting on indemonstrable first principles. In the first case scientific explanation would come about merely through the identification of each of the four causes, running down them in a list, as it were. Any fact complex enough to be inexplicable through the mere identification of the formal cause of some substances would be in principle inexplicable. Take, for example, the biological fact considered as *explanandum* in *Post. An.* 2. 16–17: vines shed their leaves. Aristotle sketches an explanation which would go something like this: the structure of flat-leaved plants necessitates a congealing of

they are the vehicle by which there is imparted *epistēmē* (scientific understanding), the disposition required for answering certain ‘why’ questions. For this reason, Graham (p. 81) improperly assigns the thesis BTC (‘a cause is an answer to the question Why’) to S_2 alone.

¹³ Graham takes this identification to be responsible for two other philosophical difficulties as well. The first is what he calls ‘the empirical problem’. When actually engaged in his biological researches Aristotle discovers that the ideas of defining biological kinds through identifying genus and species is unrealistic; in *PA* 1. 2–4 Aristotle argues that a biological definition may need to present more than one differentia (245–6). This does not strike me as evidence of the obsolescence of the S_1 theory of explanation in the context of real empirical research. Rather, Aristotle is making a relatively minor adjustment to the S_1 theory. The problem that Aristotle finds in definitions arrived at through dichotomous divisions is that such definitions are inadequate for grounding scientific explanations of the *kath’ hauta sumbebēkota* (the ‘in itself accidentals’) of the *definienda*. On this see P. Pellegrin, *Aristotle’s Classification of Animals: Biology and the Conceptual Unity of the Aristotelian Corpus*, trans. A. Preus (Berkeley, 1986), 13–49. So Aristotle is not here challenging the thesis that scientific explanations take the form of demonstrations based on indemonstrable definitions. The second problem (‘the analytic problem’) concerns the ontological status of genus and differentia. This does not seem to me to arise from the clash of contradicting systems; it arises in S_1 alone.

sap at the juncture of the leaf and the stem; a vine is a flat-leaved plant, so this coagulation will occur in a vine. This in turn will lead to the vine's having its leaves drop towards the centre of the earth (the explanation of which fact will presumably be drawn from the principles of chemistry). Much more is involved here than the simple identification of each of the four causes.¹⁴ This explanation is deductive.

Alternatively, scientific explanations in S_2 could be deductive, although not demonstrative. That is to say, they would be expressed by inferences which do not rest on immediate premisses. Hence, the premisses of these deductions would themselves demand explanation. This would be to reject ultimacy in explanation, as most contemporary philosophers of science have done. This has the consequence of either relegating such explanations to instruments allowing one to predict future events, or of making the scientific understanding that such explanations afford a relative affair; through them one would understand *more* than before, but questions could still be raised concerning the truths on which that explanation is grounded. There is no evidence that Aristotle had contemplated any such position in his philosophy of science. Even in S_2 he remains convinced of the ultimate intelligibility of the important features of the sublunar realm. Given this conviction, the fundamentals of the theory of explanation offered in S_1 must find a place in any system of hylomorphic substantialism.

I have here argued that there is no chasm separating S_1 from S_2 ; the latter is rather the maturation of the former. Despite the negative tenor of the above remarks, I would like to close by emphasizing what is of great value in Graham's book. Although S_1 and S_2 may not be incommensurable, both are indeed comprehensive systems of metaphysics and philosophy of science. Graham's isolation of the principles of the two is noteworthy; so is his account of how Aristotle developed the principles of S_2 to meet philosophic demands for which S_1 is inadequate. Although I have not here discussed these chapters of Graham's book, they contain many intriguing and valuable arguments worthy of close consideration.

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¹⁴ If we are to adopt an S_2 free of the presuppositions of S_1 , we could not even say that this explanation has identified the formal cause of shedding. For in S_2 , as Graham conceives it, form has a role only as an ontological component of substance, and shedding is not a substance.