1-1-1989

Problems with Graham’s Two-Systems Hypothesis

Owen Goldin

Marquette University, owen.goldin@marquette.edu

PROBLEMS WITH GRAHAM'S TWO-SYSTEMS HYPOTHESIS

OWEN GOLDIN

1. $S_1$ and $S_2$

In Aristotle's Two Systems 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, Graham finds previous developmental accounts of Aristotle's thought philosophically unsatisfactory. This is because genetic accounts (like those of Jaeger) 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

---


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
Graham’s Two-Systems Hypothesis

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*, 94a34-6, which Graham labels ‘the essential cause’. 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 *S₁* (pp. 158-63).

In *S₂*, 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 *S₂* because its scheme of the four causes is structured around the ‘craft model’ which is the motivation of the metaphysics of *S₂*. 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 *S₂*, written at a time in which the *S₁* 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 *S₂* an extension of *S₁*?

The crux of Graham’s argument is that *S₁* and *S₂* 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

---

* Graham distinguishes the ‘essential cause’ of *S₁* from the ‘formal cause’ of *S₂* on the grounds that the latter notion is dependent on the correlative notions of matter and form, absent from *S₁* (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. 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 $A$. Is this the relation that holds between the ontologies of

---

Graham's Two-Systems Hypothesis

S₁ and S₂. There will be only one 'correspondence rule' relating the ontologies of S₁ and S₂. That 'primary substance' as employed in S₁ has the same reference as 'composite substance' in S₂, 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 S₁ which, properly interpreted, will preserve their truth-value in S₂. The only thesis of S₁ that will not preserve its truth-value in S₂ is what Graham calls SA: that 'primary substances are ontologically indivisible particulars'. What are we to make of this principle (expressed in Cat. 5, 211-13, 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. 1. 1, 71a15-16; 1. 2, 72a21-4; 1. 10, 76a34-6). Similarly, that 'primary substance' is the basic theoretical entity of S₁ is properly taken not as a thesis of S₁ itself, but of a metatheoretical discourse explicating the logical structure of S₁.

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 S₂. Except for the use of proté 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 S₁ tells us about the world is also told by S₂, but S₂ 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 S₂ Aristotle has deepened, not rejected, the metaphysical understanding of the world offered by S₁. 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 S₁ and S₂ 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 S₁ is incompatible with that of S₂, 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 S₁ principle of the ontological
indivisibility of concrete substance as metatheoretical in this way, the
fundamental contradiction Graham discerns between S₁ and S₂
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 S₁ is supplemented
are so radical that S₂ constitutes an entirely new world-view,
employing a different paradigm. Thus, Graham speaks of the
transition between S₁ and S₂ 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 S₁ into the vocabulary of S₂ 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 S₁ and S₂ 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, 3₃⁻³₄₃). But, as Graham
points out, in S₂ 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‘₄₋₇, the adult is 'prior in form and substance'.
Because of the conceptual shift between S₁ and S₂, the above S₁
statement, interpreted in the theoretical framework of S₂, contradicts
the above statement of S₂ (101–3). So even if partisans of S₁ and S₂
will agree with each other's statement that Socrates is a substance, that

(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. Bertie (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 substantivalism 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 *epistêmê* (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 sumbebêkota* (the ‘in itself accidentals’) of the *dfinienda*. 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.
Graham’s Two-Systems Hypothesis

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. This explanation is deductive.

Alternatively, scientific explanations in S₂ 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 S₂ 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 S₁ must find a place in any system of hylomorphic substantalism.

I have here argued that there is no chasm separating S₁ from S₂; 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 S₁ and S₂ 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 S₂ to meet philosophic demands for which S₁ 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.

Marquette University, Milwaukee

If we are to adopt an S₂ free of the presuppositions of S₁, we could not even say that this explanation has identified the formal cause of shedding. For in S₂, as Graham conceives it, form has a role only as an ontological component of substance, and shedding is not a substance.