

The Matter/Form and its Relation to the Study of Physics - An Analysis

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Abstract

This paper looks at Physics as a natural science that involves the study of *matter/form* and its motion through space and time, along with related concepts such as energy and force. Aristotle introduces his notions of matter and form in the first book of his *Physics*, his work on natural science. Natural science is concerned with things that change, and Aristotle divides changes into two main types: there are accidental changes, which involve concrete particulars, or “substances” (*ousiai*) in Aristotle’s terminology, gaining or losing a property (see *Categories* 1–5, *Physics* i 7). For instance, the changes whereby Socrates falls in a vat of dye and turns blue, or puts on a few pounds from excessive feasting during the Panathenaia, count as accidental changes (in the categories of quality and quantity, respectively). Socrates, a substance, gains the property of being blue, or the property of weighing twelve stone. The other main kind of change is substantial change, whereby a substance comes into, or passes out of, existence. For example, when Socrates dies, or is born (or perhaps conceived, or somewhere in between conception and birth), a substantial change has taken place.

Matter and form are required to account for this second kind of change, if it is to conform to Aristotle’s general conceptual analysis of change. In any change, he contends, there must be three things: (1) something which underlies and persists through the change; (2) a “lack”, which is one of a pair of opposites, the other of which is (3) a form acquired during the course of the change (*Physics* i 7, 190a13–191a22). Thus, for example, in an accidental change, the underlying thing is the substance which acquires a new accidental property. For instance, when Socrates learns to play the flute, he transitions from a state of being unmusical (the lack) to a state of musicality (the form). But for us to be able to say that there is something which has changed, there must be something which remains the same throughout the change, and in this case the obvious candidate is Socrates, who is one and the same person throughout his musical training. In accidental changes there is always a substance to underlie the change, but this is not true for substantial changes, since these involve the coming to be or passing away of a substance (see the amusing remark of Irving Copi, quoted at the start of the entry on identity over time). In these cases, the thing that underlies is the matter of the substance. When someone builds a house, it is the bricks which persist through the change. They transition from a state of not being a house to acquire the property of being a house. Aristotle often uses the example of artefacts like houses, even though he does not regard them as substances properly-speaking (*Metaphysics* vii 17, 1041b28–30), because their matter is more straightforward to identify.

Key words: identity, identity over time, matter, form, Aristotle, course of the change.

Introduction

Aristotle does not simply focus on the case of artefacts because their pre-existing matter is *easier* to identify. There is a particular issue here with the case of organisms, which arises out of Aristotle's insistence that a human being, for instance, is composed of a rational soul, which is the form, and an organic body, which is the matter (for further discussion of this problem, see Ackrill 1972/73). It is characteristic of the matter of artefacts that numerically the same stuff which makes up one object can later be used as the matter of another: for instance, when one melts down a bronze statue, and then molds it into some jewelry, it is the same bit of bronze throughout. It is crucial that a thing's matter can survive such changes, if it is to play the role that Aristotle needs it to play in cases of substantial generation and destruction, as being the thing that underlies such changes. If an artefact's matter only contingently has the form it has, the same does not obviously seem true of organisms. Unlike in the case of a house built from bricks, it does not seem as though one's body predates one's existence, and so can serve as the underlying thing in a case of substantial generation. One might think that at least the body does exist after death, but in fact Aristotle would disagree. Instead, he insists that a dead body is only "homonymously" called a body—that it is only described as "a body" by extension, because it superficially resembles a living body (De Anima ii 1, 412b10–25; Metaphysics vii 10, 1035b9–25). It is not a real body, because it is incapable of performing the functions normally associated with bodies, just as a statue's eye, or an eye in a painting, is not a real eye, because it is made of stone or paint, and thus cannot serve the function that genuine eyes exist for—seeing (for further discussion, see the supplement to the entry on Aristotle's psychology on a fundamental problem about hylomorphism).

It might seem that Aristotle is rather going against ordinary linguistic usage here, since we in fact regularly do refer to dead bodies as "bodies". Whether a dead body is really a body might seem like a trivial linguistic issue, which can simply be decided by fiat. The obvious way to resolve the problem might seem to be simply to drop the insistence that the body cannot exist without being coupled to a living human soul. Allowing that a dead body remains the same body as its living counterpart will not help the difficulty of what to say about the matter that predates the coming to be of the organism, when there is no apparent body, living or dead. What is more, Aristotle is deeply committed to his position that the human body is essentially ensouled, because of his view that things are defined by their functions (Meteorologica iv 12, 390a10–15; Generation of Animals ii 1, 734b24–31). It seems as though he believes that a human being's matter must be contingently alive, so that it can serve as the underlying thing that remains when the human being comes into existence, but also that it must be essentially alive, because it is functionally defined. If so, he contradicts himself.

Nevertheless, the same analysis holds in the case of organisms, which are the substances proper: when an organism is created or destroyed, when an acorn becomes an oak tree, or a human dies, there must be some matter which persists through the change. To say otherwise would be to say that things can come to be out of, or vanish into, nothing, and Aristotle understandably agrees with his predecessor Parmenides that this is impossible (*Physics* i 8, 191a23–b17). Aristotle's metaphysics takes as its starting points observed phenomena,

and seeks to preserve common sense beliefs where possible. We never experience anything simply appearing or disappearing at random.

The word “form” may misleadingly suggest that what is acquired in a case of substantial generation is simply a shape, and this impression is reinforced by some of the examples that Aristotle uses, especially when focusing on artefacts: plausibly the form of a bronze statue just is its shape. When we consider organisms, however, it becomes apparent that having the right shape is not sufficient to possess the form. A thing’s form is its definition or essence—what it is to be a human being, for example. A statue may be human-shaped, but it is not a human, because it cannot perform the functions characteristic of humans: thinking, perceiving, moving, desiring, eating and growing, etc. The connection between a thing’s form and its function emerges in *Physics* ii 3, where Aristotle distinguishes his four kinds of cause: material, formal, efficient, and final, and suggests a special connection between the formal and final cause.

Objective:

This paper intends to explore Matter’s nature which is generally considered to be anything that has mass and volume, and the laws of nature are rules that all natural processes appear to follow.

Principle of individuation

Aristotle needs something like prime matter is to serve as a so-called “principle of individuation”. While the predominant view has been that this role is reserved for matter, other scholars have maintained either that Aristotle means it to be form, or that he does not see the need for a principle of individuation at all. Some of this controversy seems to have resulted from a failure to be clear about what a principle of individuation is, or what problem it is supposed to solve.

To see why this is so, one may focus on a controversy about individuation which Popper sought to dissolve, by pointing out that it derived from a false opposition. This was a controversy begotten by a disagreement between Anscombe and Lukasiewicz regarding the principle of individuation in Aristotle (see Anscombe et al. 1953). Popper points out that their disagreement is only apparent, due to the fact that they are answering different questions: Lukasiewicz insists that form should be counted as the “source of individuality” because it explains how a thing with many parts is a single individual and not a plurality, it accounts for the unity of individuals. He has in mind questions like “How do all these bricks constitute a single house?” or “What makes this collection of flesh and bones Socrates?”, and here Aristotle does indeed appear to make use of form. On the other hand, Anscombe says that it is matter which makes an individual the individual it is, numerically distinct from other individuals of the same (and other) species. Yet this is an issue about numerical distinctness rather than unity. It is perfectly consistent to say that Socrates is one man because of his form, which unifies his matter

into a single whole, and he is a numerically distinct individual from Callias because his matter is numerically distinct from Callias' matter.

Lukasiewicz's problem a principle of unity

It has become conventional to call an answer to Lukasiewicz's problem a principle of unity, and an answer to Anscombe's problem a principle of individuation. The traditional view has been that individuation is a metaphysical issue: what is it that makes one individual different from another (of the same kind)? However, some scholars have argued that Aristotle at no point addresses this issue, but is instead concerned with the epistemological question of how we tell one individual from another (see Charlton 1972).

It is worth considering why one might think that the metaphysical issue is not worth pursuing. The obvious reason is if one thought that there was no answer to the question "what makes this individual numerically distinct from that one?"—that nothing *makes* them distinct, they just are. An advocate of this view might point out that even if we accept that matter is what makes this individual distinct from that one, we still have no answer to the question "what makes this portion of matter numerically distinct from that one?". There will always be certain of these numerical distinctness facts that remain unexplained on any theory. But if explanation has to stop somewhere, why not stop at the beginning? Why not just say that it is a bare fact that Socrates is numerically distinct from Callias, and leave matter out of it?

One might think that one could respond to this argument by insisting that there is an answer to the question what makes Socrates' matter numerically distinct from Callias' matter: it is the matter itself. If matter can explain the distinctness of individual substances, why should it not also explain its own distinctness from other matter? Whether or not this move is legitimate will depend on which facts are and which facts are not in need of explanation but may correctly be assumed to be primitive. The problem is that "this matter is distinct from that matter because it is this matter" seems to be a very similar sort of explanation to "Socrates is distinct from Callias because he is Socrates"—both are cases of x explaining its own distinctness from y . Either both should count as adequate explanations or neither should. But the advocate of matter as principle of individuation adopted this view precisely because she found this sort of explanation unsatisfactory, or not an explanation at all. Therefore this response does not seem to be open to her.

Numerically distinct from

It seems that those who are committed to there being something which accounts for the numerical distinctness of individuals must say that there is nothing that accounts for the numerical distinctness of the distinctness-makers. The only alternative would be to introduce some *further* thing to account for *their* distinctness, and so on; but this results in an infinite regress, which, as well as being ontologically bloated, appears to be vicious, since we can never grasp the full account of what makes Socrates and Callias distinct. Both sides agree that explanation must stop somewhere, but they differ over where it is appropriate to stop: is it a basic, inexplicable

fact that Socrates is numerically distinct from Callias, or that their matter is distinct? (See Markosian 2008, §8, for a contemporary discussion of this question.) At any rate, even if it is difficult to prove that there is an important metaphysical question here, the traditional interpretation of Aristotle is that he thinks there is.

There are two main texts which have been thought to show Aristotle advancing the view that matter is the principle of individuation: *Metaphysics* v 6, 1016b31–2, and vii 8, 1034a5–8. In the first of these, we are told:

Moreover, some things are one in number, some in form, some in genus, some by analogy; in number those whose matter is one...

According to the traditional interpretation, here we have the claim that x and y are numerically identical (or “one in number”) if, and only if, they have the same matter (or the matter of x is “one” with the matter of y). An alternative reading takes this passage to be about unity rather than individuation: Aristotle would be saying that x is numerically one if and only if x 's matter is one, where a thing's matter being “one” means that it is one continuous piece (of bone, for example).

The second important passage for detecting Aristotle's views about individuation comes at vii 8, 1034a5–8:

And when we have the whole, a form of such a kind in this flesh and in these bones, this is Callias or Socrates; and they are different in virtue of their matter (for that is different), but the same in form, for their form is indivisible.

According to the traditional interpretation, these lines are saying that Socrates and Callias are numerically distinct because of their matter, not their form, and on the face of it this is the clearest example of Aristotle affirming that matter is the principle of individuation. We can adopt an alternative reading, however, if we suppose that “different” means not numerically distinct, but qualitatively different. In that case, the passage could be making an epistemological claim about how we discern Socrates and Callias: suppose Callias is pale and Socrates dark; they are different, but not different in form; they differ because of their matter, since pallor and darkness primarily qualify their skin, i.e., part of their body.

Matter substantial form and some *proximate* matter

There is a difficulty for the idea that matter can act as the principle of individuation, which arises out of the following problem that can be raised for Aristotle's hylomorphism (see Fine 1994). It seems that two substances, e.g., Socrates and Callias, may have numerically the same matter at different times; that it is possible (however unlikely) for all and only the particular elements that now compose Socrates to end up composing Callias at some later date. In such a case, Socrates and Callias would have the same matter, albeit at different times. Moreover, both being human beings, they would have the same form. But they themselves are compounds of matter and form, so if their matter and form are numerically the same, they must themselves be numerically the same.

Put schematically, the argument looks like this:

1. It is possible that Socrates and Callias be composed of numerically the same matter (albeit at different times).
2. Socrates and Callias have the same form.
3. Socrates and Callias are compounds of matter and form.
4. Therefore, it is possible that Socrates and Callias are numerically the same.

Of course two different people cannot be numerically the same. So, if the argument is valid, at least one of its premises must be false.

One possible rejoinder to this argument is that it turns on an equivocation in the meaning of “matter”. As we have seen, for Aristotle matter comes in different levels. In the situation envisaged Socrates and Callias would have the same remote or low-level matter (the same elements) but they might still have different proximate matter, since the proximate matter of a human being is his body. Since a substance is a compound of a substantial form and some *proximate* matter, we are not entitled to conclude that Socrates and Callias are the same. Although this may be an effective way of dealing with the initial problem, it can be restated so as to avoid this objection that the argument equivocates on “matter”. Each level of matter is a compound of the matter at the level immediately below it and a form. If the proximate matter of two things is to be different, despite their lower-level matter being the same, the reason must be that the forms of the proximate matters are different. We can redescribe the situation so that not only are Socrates’ and Callias’ forms the same, but the forms of their bodies are also the same, and the forms of the matter of their bodies, and so on all the way down. Although it is unclear what in general is required for the matter of two things of the same form to have the same form, e.g., for Socrates’ and Callias’ bodies to have the same form, it seems reasonable to suppose that it is sufficient for two things to have the same form that they be qualitatively the same. So we can ensure that Socrates’ and Callias’ matters have the same form, if we suppose that they are qualitatively the same. One might insist that no two things are qualitatively the same, but there is little reason to think that Aristotle is committed to Leibniz’s doctrine of the identity of indiscernibles. What is more, although strict qualitative identity, i.e., having all the same non-relational and relational properties, may require demanding metaphysical assumptions such as an eternally cyclic universe, probably all that is required is that there be no *relevant* qualitative difference between Socrates and Callias, where “relevant” means such as to result in them or their matter having different forms. While one might insist that two things must be qualitatively the same to have the same form, this also does not seem to be Aristotle’s view. So if we tailor our example to this requirement, we can thwart the charge of equivocation. The argument then is valid, so we must choose one of its premises to reject.

One might try to reject the first premise of the argument, on the grounds that a person's matter is essential to them. We have seen that Aristotle plausibly does believe this about a person's *proximate* matter—their body—since a dead body is only homonymously a “body”. Nevertheless, he is committed to their more remote matter—the elements that make them up, for instance—being capable of existing independently of them. He needs there to be something to underlie the change whereby a substance comes into or goes out of existence, to make it consistent with his account of change in general in *Physics* i 7. There seems to be no reason to deny that, when a tree, for instance, dies, the earth, air, fire and water that constituted it still exist in the dead stump. But, if so, there seems no reason to think they could not leave the stump, and end up becoming the matter of some new tree. This is all that is needed for the problem to arise. Prime matter, if it exists, will not help: if the elements are allowed to escape the substances that they underlie, it seems that the prime matter that underlies *them* should also be capable of doing so. It is supposed to be capable of underlying *anything*; so insisting that it is confined to being the prime matter of a particular sort of thing makes no sense.

A more promising option is to reject the second premise of the argument, that co-specific or relevantly similar things like Socrates and Callias must have a common form. This one might reject if one were a believer in particular forms. The question of whether Aristotle's forms are particular or universal has garnered a huge amount of scholarly attention (those in favour of particular forms include Sellars 1957, Frede 1978, and Irwin 1988; those in favour of universal forms include Albritton 1957, Lewis 1991, and Loux 1991). If Aristotle believed in universal forms, he could have constructed particular forms out of some kind of indexed version of the universal (e.g., an ordered pair of the universal form and the thing which had it); but that would make the identity of the particular form dependent on that of the substance that had it. Since it is the substance's form which is acting as principle of individuation, if the common form premise is rejected, particular forms cannot be individuated by the substances that have them, on pain of circularity: what makes Socrates different from Callias is that they have different forms; and what makes their forms different is that one belongs to Socrates, the other to Callias. To play this role, particular forms would have to be defined independently of the things that have them. It would be a particular form which combines with a thing's matter to make it the thing that it is. Some scholars find this conception of particular forms problematic.

Compound of form

A final reaction to the argument would be to reject the third premise, the idea that anything enmattered is a compound of its matter and form at a given time. Certainly the most straightforward way of understanding hylomorphism is that the compound is compounded of the thing's matter and form at a particular time, and the relation between the compound and the thing is identity. This way of understanding composition is not only problematic because it leads to the problem currently under discussion: assuming that things can change their matter, we might well also wonder (a) how just one of the matters, which it has at a particular time, can yield the whole thing, and (b) how different matters at different times can yield the same thing. An alternative way to understand compounding would be to say that a thing is the compound of its form and all the various matters

that it has at different times: $X=F(m_1, m_2, \dots, m_n)$, where $m_1 \dots m_n$ are X 's proximate matters in order of temporal occurrence. This would solve worries (a) and (b) above, since now all the different matter-slices are incorporated into the one object. It does not obviously help with the problem at hand, however, since, if it is possible for Socrates and Callias to have the same matter at a time, there seems to be no barrier to them having exactly the same sequence of matter-slices throughout their lives (provided that they are not born at the same time, and live to exactly the same age).

Finally, one could relativize the concept of a compound to a time: enmattered objects are absolutely identical to compounds, but a compound is not absolutely a compound of matter and form, but only relative to a particular time. $X=F_t(m)$, where m is the proximate matter of X at t ; or, combining this idea with the previous one, $X=F_t(m_1 \dots m_n)$, where t is the period of time for which X exists, and $m_1 \dots m_n$ are its matters in order of occurrence. This solution does deal with the problem directly, since Socrates and Callias can have the same form and matter, and yet be different compounds because the times are different. There may also be a modal version of the puzzle: Socrates is such that his matter and form could be identical with those of Callias at a certain time. This puzzle might be solved by also relativizing compounds to worlds.

Exegetical problem

There is an exegetical problem with ascribing this final way of understanding composition to Aristotle, and that is that it apparently conflicts with the view that he expresses in *Metaphysics* viii 6, 1045a7–10, and vii 17, 1041a26, that a form is what unifies a compound. The problem is how to understand the role of the time in the unification of the compound by the form: it cannot be just another element to be unified, for the time at which the matter exists does not figure as a part of the resulting unity. If we try to make the form unify a given portion of matter into many different things, depending on what time the unifying takes place at, we also run into the difficulty that such a process no longer seems worthy of the title “unification”, since the result is many objects, not just one. Indeed we can reformulate the problem without mentioning composition at all: if a common form must unify common matter into one and the same thing, and Socrates and Callias have the same form and the same matter, they are one and the same. Since Aristotle (and many neo-Aristotelians) would surely be unwilling to give up the unifying role of form, this does not look like a viable solution.

We have seen that there are some textual reasons to think Aristotle makes matter his principle of individuation; but in fact particular forms are better suited to play this role. We need to distinguish between two different questions, one about unification, the other about individuation: (i) what makes this giraffe (or this giraffe-matter) one and the same giraffe (over time)? (ii) what makes this giraffe distinct from that one? The first question seems to be the one which Aristotle addresses in *Metaphysics* vii 17, and does not obviously require an answer that is unique to the giraffe in question. Giraffeness in general may well suffice. The answer to the second question, however, cannot be the universal species, since it is common to both giraffes, nor can it be their matter, since they could (albeit improbably) be composed of the numerically same stuff at different times. It is not so

obvious that Aristotle sees the need to address the second question, but, if his forms are particular, not universal, he is in a good position to do so.

Conclusion

Important theoretical work cannot be found for matter-involving forms, then, pure forms are the more ontologically parsimonious choice. In fact, more is at stake here: although, “definition”, “form” and “essence” are often treated as though they were interchangeable, a definition is strictly-speaking something linguistic, whereas an essence or form may have a structure that corresponds to something linguistic, but it is still a thing in the world. For example, the essence or form of a human being is a soul.

In any event, one can see that Aristotle’s initial contrast between matter and form grows quickly complex once hylomorphism leaves the domain of change. Although introduced as contrastive notions suited to explicate change and substantial generation in the absence of generation *ex nihilo*, any easy contrast between form and matter turns out to be difficult to sustain once it finds employment in its further applications. Even so, as Aristotle implies, and as many of his followers have affirmed, hylomorphism proves no less elastic than explanatorily powerful across a wide range of explanatory roles.

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