Is a Whole Identical to its Parts?

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Surprising, but nevertheless true: Plato, Aristotle, Armstrong, and Lewis, all believe that if a whole is different from the totality of its constituents, it does not have these constituents as parts. Furthermore, all four philosophers allow for non-mereological composition, although for some it is an unwelcome mystery, while for others, the primary metaphysical mode of composition. In what follows I examine the treatment of non-mereological composition in these radically different metaphysical systems, the reasons why it is introduced, and the arguments offered for, or against different versions of it. I offer an account of the nature of non-mereological composition and identify the commitments undertaken by a metaphysical system that incorporates it. Finally, I argue that none of the forementioned systems can offer a satisfactory account of the type of whole that unit-classes comprise, which undermines David Lewis’s programme of understanding classes as the mereological composition of their respective unit-classes.

1. A whole, its parts, and its constituents

In the section of the Theaetetus known as Socrates’ Dream, Plato presents the following argument concerning the relation of whole to part. A whole consisting of parts is either identical to its parts or is different from its parts. But how can it be different from its parts? When we consider twice three, or three times two, or four plus two, etc., are we not talking of one and the same thing, namely six? Six is nothing other than the sum of its parts. But the sum of the parts is the same as the whole. A whole, therefore, is identical to its parts: ‘if something has parts, the whole, and the sum, will be all the parts’.4

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1 Or an operation that is very much like it. Non-mereological composition is composition of elements which results in a whole that is different from the mereological fusion of these elements.

2 A non-empty class having one, only, member.

3 Theaetetus 204b10–c5.

4 Ibid. 204d1–3.

5 ‘there is no difference between a sum and a whole’, ibid. 204d7.

6 Ibid. 205a8–10. Again, ‘With anything which has parts, it’s necessarily the case that the whole is all the parts’, 204a7–8. The translation of the text of the Theaetetus is from J. McDowell, Plato, Theaetetus, Oxford, Clarendon Press, 1973.
But Plato also considers and allows for the possibility that a whole, for example a syllable, is ‘some one kind of thing which has come into being out of them [the letters]: something which has a form of its own, and is different from the letters’. With paradigmatic logical consistency, Plato concludes that if a whole is not identical to the elements it contains, these elements cannot be parts of the whole: ‘If it’s not the case that a complex is its elements, then isn’t it necessarily the case that it doesn’t have the elements as parts?’ Hence, for Plato, if a whole has parts, it is identical to all the parts; if a whole is not identical to the constituents out of which it is made up, the whole does not have these constituents as parts.

It is uncanny that in his discussion of the nature of classes, David Armstrong is led to just this conclusion. Armstrong is exploring David Lewis’s proposal that the sub-classes of a class are mereological parts of the class. Thus, {a} is a mereological part of {a, b, c}. On this theory, a class is the mereological fusion of its unit-classes or singletons. For example, class {a, b, c} is identical to the mereological fusion of its ultimate parts, namely sub-classes {a}, {b}, {c}. It follows that there cannot be two classes with the same parts, since there is only one mereological fusion of these parts, and the class is identical to that fusion. Armstrong agrees with Lewis that a singleton, for example singleton {a}, is mereologically atomic, namely that it is not composed of parts. But Armstrong points out that the member of a singleton need not be simple, and so a way should be found to connect the internal structure of the members of singletons to the singletons. If a is a complex individual, then singleton {a} is itself mereologically atomic, but not absolutely atomic, according to Armstrong. Although it has no mereological parts, that is, {a} is not a mereological fusion, {a} nevertheless has constituents. These constituents, Armstrong explains, make up the singleton in a non-mereological way; their composition violates Lewis’s mereological canon, by allowing different things to be composed of the same constituents. Thus, according to Armstrong, singletons are mereologically atomic (having no parts), but are composed of constituents (by a non-mereological composition that Lewis does not allow for in his system). Since the composition is non-mereological, the singletons are over and above, or different from, the mereological fusion of their constituents. Hence, the Platonic conclusion quoted above: a complex

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Theodore Scaltsas

7 Ibid. 20363–5.
8 Ibid. 20511–12.
9 D. Armstrong, ‘What are Classes?’, forthcoming (presented at Princeton University, Philosophy Department, October 1989).
10 Armstrong (ibid., p. 1) refers to Lewis’s *Parts of Classes*, Oxford, Blackwell, 1990. David Lewis commits himself to this position also in his exchange with Armstrong, in Lewis, ‘Against Structural Universals’, *Australasian Journal of Philosophy*, 1986, p. 37. Lewis says: ‘The parts of a set are its (nonempty) subsets, and thus every many-membered set is composed, ultimately, of its unit subsets. This is genuine composition: many combined into one. It obeys all the canons of mereology.’
11 Armstrong uses this term in order to distinguish them from mereological parts. Armstrong, ibid., pp. 2–3.
12 Ibid., p. 2.
13 Ibid. p. 2.
(here a singleton) which is not identical to its elements does not have these elements as parts! For Armstrong, a singleton has constituents; but since the singleton is not identical to the mereological fusion of these constituents, it does not have these constituents as mereological parts.

David Lewis does not allow for this type of composition, namely for *complexes* which are different from the mereological fusion of their component parts. His reason is that this would require that there be two different things composed of the same parts, which Lewis rejects:

But how can two different things be composed of exactly the same parts? I know how two things can be made of parts that are qualitatively just the same—that is no problem—but this time, the two things are supposed to be made ... of numerically identical parts. That, I submit, is unintelligible.\(^\text{14}\)

Lewis disallows any *composition* which is other than the mereological fusion of mereological parts. 'What is the *general* notion of composition, of which the mereological form is supposed to be only a special case? I would have thought that mereology already describes composition in full generality.'\(^\text{15}\) It follows that Lewis would agree with Plato to the extent that, if a thing is not identical to all its parts, it has no parts. Lewis does not allow for the thing to have any other types of constituent than parts, since he does not allow for any other type of composition than mereological composition (but we shall examine in section 4 below a problem that is created in Lewis's metaphysics because of this position).

2. *Magical (non-mereological) composition*

Is Lewis right? Can there be other kinds of composition than the mereological fusion of parts? Lewis considers and rejects several other kinds of composition in his article 'Against Structural Universals'; one of them is pertinent to our present discussion. Namely, the formation of an individual which has no parts, but which, nevertheless, has constituents. Lewis called this the *magical* conception of structural universals, to emphasize the impossibility of *complexes* that are mereologically atomic. Let us call this the *magical composition*, and see what could be done to dispel the magic. Lewis offers the following description:

On the magical conception, a structural universal has no proper parts. It is this conception on which 'simple' must be distinguished from 'atomic'. A structural universal is never simple; it involves other, simpler, universals. ... But it is mereologically atomic. The other universals it involves are not present in it as parts. Nor are the other universals set-theoretic constituents of it; it is not a set but an individual. There is no way in which it is composed of them. (p. 41)


\(^{15}\) Ibid., p. 39.
Lewis does give an argument against this conception of an atomic complex. Let us consider, he says, the universal methane; if it does not have the universals carbon and hydrogen as parts, then we cannot explain why the instantiation of methane necessarily involves the instantiation of carbon and hydrogen. By hypothesis, the universal methane is not a mereological composition, but an individual containing no parts. Hence, it does not contain the universals carbon and hydrogen as parts. How, then, does the methane molecule contain the instantiations of these universals, namely the carbon and hydrogen atoms? The inexplicable necessary involvement of carbon and hydrogen in methane, gives rise to a modal paradox, which displays the absurdity of magical composition. We should therefore give up, according to Lewis, the conception of an individual which is both complex and mereologically atomic, namely, which has constituents but not parts.

We have already encountered this conception of a complex individual (which has constituents, though not parts) in Plato, mentioned as a possibility, but not further explored. The nature of such an individual is fully developed in Aristotle. For Aristotle, the substantial form of a substance unifies the various components from which the substance is made up into one whole. In Metaphysics Z17, Aristotle puts forward an argument that goes to the heart of the question of the unity of the many components into a single whole. His example is the unity of a syllable, which was the prime Platonic example in the passages we considered above. Before presenting Aristotle's position, by way of contrast, I shall first summarize Plato's and Lewis's. Plato held that a syllable is identical to its parts. Specifically, a syllable is all its letters, for example 'SO' is identical to 'S' and 'O'. The objection to this is that, if 'SO' is identical to 'S' and 'O', then, since 'OS' is also identical to 'S' and 'O', 'SO' will be identical to 'OS', which it is not. For Lewis, the parts of the syllable 'SO' would be 'S', 'O', and their juxtaposition. Thus, although the syllable is still identical to its parts, the parts now are not only the letters, but also their juxtaposition. But this still leaves their

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16 Ibid., p. 41.
17 Such an individual, e.g. a syllable, would be 'some one kind of thing which has come into being out of them [the letters]: something which has a form of its own, and is different from the letters' (Theaetetus 203e3–5). 'If it's not the case that a complex is its elements, then isn't it necessarily the case that it doesn't have the elements as parts?' (Theaetetus 205a1–b2). So the thing has no parts; it has constituents, but it is not identical to its constituents.
18 Although he allowed for the possibility of an atomic, complex individual (see previous note), he did not seem to favour this conception, as he did not argue for it, nor did he explain the metaphysical mechanics of this kind of composition.
19 Theaetetus 203b8–9, 203b8–10, 69–10.
21 'The universal methane consists of the universals carbon, hydrogen, and bonded', and their instances are proper parts of the instance of methane: 'The instance of carbon is supposed to be a proper part of the instance of methane'. (Lewis, 'Against Structural Universals', op. cit., pp. 41 and 42)
Is a Whole Identical to its Parts?

order, and hence the difference between ‘SO’ and ‘OS’, unaccounted for.  

Aristotle agrees with Lewis, but only on the point that an account of a syllable requires mention of more than the letters in the syllable. That is, Aristotle and Lewis require that the syllable be more than its letters. But the agreement ends there. For Lewis, the letters and their juxtaposition are proper parts of the syllable. Aristotle argues that this is not the case. This is his aggregate argument, in *Metaphysics Z17*, which is briefly the following.  
The syllable, says Aristotle, is not just its elements, but something else, too, since when the syllable is ‘dissolved, the whole, i.e. … the syllable, no longer exists, but the elements of the syllable exist.’ This additional item cannot be a further element in the whole, like the other elements of the whole, since then the same argument would apply again: when a whole is dissolved, the elements persist, but not the syllable. Hence, Aristotle concludes, the syllable consists of the elements plus a further item that is a completely different type of component than the elements, which acts as ‘the cause which makes … *that* a syllable. … And this is the substance of each thing; for this is the primary cause of its being … which is not an element but a principle’. Thus, the substance (form) is *a different type of component* than the elements it unifies, and is responsible for the being of a substance by unifying these elements into a single whole.  

(This argument, in fact, provides an objection to Lewis’s position that the instantiation of a relational universal is a *proper part* of the whole; for example that the instantiation of the universal *bonded* in the case of a methane molecule, is a proper part of the methane molecule, just as the hydrogen and the carbon atoms are. The objection provided by Aristotle’s argument is that, since the instantiation of the universal *bonded* does not survive the dissolution of the molecule, it cannot be a part of the molecule in the sense in which the hydrogen and carbon atoms are parts of 

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22 Armstrong points out that one of Lewis’s reasons for not allowing for states of affairs is that different states of affairs can be constructed out of the same parts (Armstrong, op., cit., p. 5–6, with reference to D. Lewis’s ‘Comment on Armstrong and Forrest’, *Australasian Journal of Philosophy*, 1986, p. 92). Armstrong’s examples are the two distinct states of affairs that can be composed out of the constituents: a, b, and the non-symmetrical relation loves. Similarly, different wholes can be composed out of the constituents of a methane molecule, or of the syllable ‘SO’. Yet, Lewis is not willing to give up his mereological principle of the uniqueness of composition, namely, that there is only one composition of the parts, their mereological fusion. Having no way of accounting for the difference between, e.g., syllables ‘SO’ and ‘OS’, Lewis prefers to give up structures in his ontology, presumably, such structures as the molecule, the syllable, and the alternative structures that can be composed from the same constituents (ibid., p. 92).  


26 Armstrong uses a similar argument in his paper, which I shall discuss below.  

27 See n. 21 above.
it, since they do survive the dissolution of the molecule. The instantiation of bonded depends on the methane molecule in a way that the instantiations of hydrogen and carbon do not.)

A substantial whole, then, for Aristotle, is a single, unified individual, which is not identical to a mereological fusion of its components. If it were a fusion of its components, then the aggregate argument would apply to it, showing that the fusion is not the substance. Rather, the substantial whole is different from the fusion of its constituents, being a single individual unified by its substantial form. Therefore, the composition involved in the creation of a substantial whole is non-mereological composition. The substantial whole is mereologically atomic, although it is made out of different components, and can be divided into different components.28 The aggregate argument shows that the substantial form is not such a component.

Before addressing Lewis’s modal paradox, we need to first introduce Aristotle’s distinction between substantial form and relation. Aristotle distinguished in his ontology between the category of relation and the category of substance. But now, his claim that the substantial form unites the various elements (out of which the substance is made up) into a single whole seems to clash with his claim that the substantial form is not a relation. It would appear that what the substantial form needs to do is precisely to interconnect the various elements of a substance to each other so as to make up a single whole. Hence, it must be a relation. I have argued elsewhere that Aristotle’s distinction between substantial form and relation can be maintained, even in view of the unifying role that the substantial form plays in a substance.29 The difference is that a substantial form unites elements into a whole by tying their identity to the identity of the whole, while a relation leaves the identity of the relata intact. Thus, given a related whole of ten juxtaposed books, each of the books is identifiable independently of its relation to the other books. The identity of the relata is not determined by the relation they bear to each other. But in the case of a substance, something comes to be a component of the substance by being identified in terms of the relation it bears to the whole, for example the skin, liver, or brain, of a human being. The unity that is achieved in a substance is achieved by the identity-interdependence of all the constituents in it, as determined by the substantial form. The constituents that emerge from the incorporation of the elements into the whole are what they are because of their role in the whole. It follows that these constituents cannot exist independently of

28 'As many [things] as are substances are formed naturally and are by nature, their substance ... is not an element but a principle. An element is that into which a thing is divided ..., e.g. a and b are the elements of the syllable', Metaphysics 1041b29–33.

Is a Whole Identical to its Parts?

the whole. Hence, the whole is not a mereological fusion of these constituents.

Of course the picture is more complex, importantly so for responding to Lewis's paradox. The reason is that there is no clean break between substantial forms and relations. Rather, there is a gradation: low grade substances overlap with highly interrelated wholes. For Aristotle, the *par excellence* substances are the natural organisms, and in particular, the biological ones. Artefacts are lower grade substances. The analysis of the Aristotelian position offered above can readily explain this gradation. We can understand the progression from substantial forms to relations as the progression from relata that are defined by the relation, to relata whose identities are independent of the relation. What we should therefore expect in the case of a low grade substance is that the components of such a putative substance tend to resist re-identification when integrated into the whole. They tend to retain their identity and therefore their distinctness from the whole. To that degree, the whole is less integrated than a biological substance; it is less of a *one thing* and more of a *plurality of many* interrelated things. Again, this affords degrees: the screen of the computer is so specialized to the function it performs in the computer that it is identified through its function in that whole. But the nuts and bolts in the computer are not what they are because of the computer's form. Of course, the candidacy for being a substance deteriorates drastically as we move to such wholes as walls or piles of rocks.

Let us now turn to Lewis's modal paradox. Consider a universal which is unified into an individual (by magical composition, for Lewis) rather than into a mereological fusion of mereological parts. A typical such universal for Aristotle would be the universal *human being*. Now the instantiation of *human being* involves the instantiation of *brain* and *heart*. The question for Lewis, then, is: what is it about the universal *brain* that gets it involved in necessary connections with *human being*. The Aristotelian answer is: their identity dependence. The universal *brain* is defined (at least in part) in terms of the substantial form *human being*; similarly with the universals *heart*, *liver*, etc. Their definitional inter-dependence is what makes the universal *human being* a single universal. It is also the reason why the universal *brain* cannot be instantiated independently of the instantiation of the universal *human being*. Thus, the

30 Aristotle says in the *Metaphysics* that if we divide up a concrete substance, the parts 'cannot even exist if severed from the whole; for it is not a finger in any state that is the finger of a living thing, but the dead finger is a finger only homonymously [i.e. same name but different definition]' 1035b23–25.

31 I do not mean to say that everything about the organism is identified by the form. The substance is not substantial form all the way down, as is made clear from Aristotle’s explanation in the following passage (as well as from other considerations in Aristotle’s metaphysics): ‘we shall define each part, if we define it well, not without reference to its function’ (1035b16–18, my emphasis). Aristotle says 'not without' rather than, 'solely in terms of', its function, which is determined by the substantial form.

32 Compare, ‘What is it about the universal *carbon* that gets it involved in necessary connections with *methane*?’ Lewis, ‘Against Structural Universals’, op. cit., p. 42.
Theodore Scaltsas

The instantiation of *human being* is the instantiation of *brain, heart, liver, etc.*, because that is what the universal *human being* is; these are not independently instantiatable universals, but definitionally dependent on, as well as definitionally constitutive of, the universal *human being*.

Lewis’s rejoinder would be that this is not the case with a universal like *methane*. The universal *carbon* is not defined in terms of the universal *methane*, and *carbon* can be instantiated independently of *methane*. It follows that the explanation offered above for the modal connection between the universals *human being* and *brain* is not applicable to the universals *methane* and *carbon*. So, Lewis’s complaint remains: on Lewis’s hypothesis, the universal *methane* is (magically) unified into an individual with no parts; hence, *methane* does not involve *carbon* as a part, but a methane molecule contains a carbon atom; it follows that the modal connection between the universals *methane* and *carbon* is paradoxical. The response to Lewis’s rejoinder is that, if *carbon* is definable independently of *methane*, then the universal *methane* is not an Aristotelian substantial form. Namely, the methane is less like a substance, for example a human being, and more like a related whole, for example an artefact. As a related whole, the identity of the relata survives their interrelation. So, the universal *carbon* survives its relation to *hydrogen*, which is why *carbon* is instantiated when *methane* is. But then, the universal *methane* is a relation, not a substantial form. Therefore, if we assume it to be a substantial form, a paradox will result. Namely, *qua* substantial form, the constituents it unifies are identified by the form: while *qua* relation, the entities it relates are identificationally independent of the form. Lewis exploits the modal connections in *methane qua* related whole, and complains that they cannot be explained if it is assumed to be a substantial whole. He is right. But then, this does not display a problem with substantial wholes. The paradox is artificially generated by assuming a related whole to be a substantial whole. No ‘magic’ is required, once the distinction is made. Nor shall we get any help towards understanding the kind of composition involved in Aristotelian substances by turning to molecules, artefacts, or syllables, since it is biological organisms that paradigmatically achieve substantial composition.\(^3\)

\(^3\) Unfortunately, Lewis’s is not the only inappropriate example towards understanding Aristotelian substantial composition; Aristotle’s is just as inappropriate (which is no surprise, given Aristotle’s examples)! Aristotle’s example (Metaphysics 1041b12) is that of a syllable, possibly echoing Plato’s discussion of wholes in the Theaetetus. But if, e.g., syllable ‘SO’ were a substance, then the incorporation of ‘S’ and ‘O’ into the whole, ‘SO’, would involve the re-identification of ‘S’ and ‘O’. These two letters would not exist in the syllable ‘SO’. But ‘S’ and ‘O’ do exist in syllable ‘SO’. This shows that ‘SO’ is not an Aristotelian substance; rather, syllable ‘SO’ is a related whole.

It is worth mentioning that, even if a methane molecule were an Aristotelian substance, we could still account for a necessary connection between a molecule and the carbon atom that went into the molecule’s creation (being re-identified in the process). It would be a relation of origin, very much like the necessary connection between a human being and the menstrual fluids from which it is created (according to Aristotle). The fluids do not survive the creation of the human being, just as the carbon atom would not survive its incorporation into the molecule, on the present hypothesis, but they are a necessary origin.
3. The arrangement of a state of affairs

Armstrong’s metaphysics allows for a type of composition which is ‘banned’ in Lewis’s system. To understand its nature we need to turn to Armstrong’s account of unit-classes or singletons. Unlike Lewis, Armstrong allows for singletons to be composed of constituents: ‘My contention will be that singletons are mereologically atomic, but are not absolutely atomic. ... I say that they have constituents. ... The suggestion I will defend is that the class [singleton {a}] is a state of affairs or fact, involving a’. 34 These states of affairs do violate Lewis’s canon of mereology, since two distinct states of affairs can have the same constituents. Armstrong shows this through the comparison of two distinct states of affairs: a loves b, and b loves a. Here, the two different states of affairs involve the same constituents: a, loves, b. 35

Armstrong introduces states of affairs in order to create an ontology for classes. He offers an existential argument for states of affairs, 36 to counter Lewis’s objections to them. His argument is that a truth-maker is needed to account for the truth of a statement, for example, ‘a is F’. He points out that if a and F-ness exist, their mereological fusion automatically exists, also. But the existence of a and of F-ness does not make the statement ‘a is F’ true, since it may be that a and F-ness exist without a being F. Nor, then, does their fusion make the statement true, since the fusion exists if they do, whether a is F or not. Hence, if we restrict the ontology to a, F-ness, and their fusion, only, we have no account of what it is that makes the statement true. I believe Armstrong’s argument for the need of a truth-maker is compelling for anyone who has realist intuitions regarding ontology and truth. But I shall argue below that Armstrong’s states of affairs are not the only means of satisfying Armstrong’s truth-maker argument.

We saw that two states of affairs, for example a loves b and b loves a, can be distinct, but have exactly the same constituents. It follows that an account of the difference between the two states of affairs is needed. Armstrong offers such an account: ‘in the cases where distinct states of affairs have the same constituents, nevertheless the arrangement of the constituents is different’ (ibid., p. 6). One would have thought that this adds one more constituent to the whole, namely the arrangement of the constituents, so that ultimately, the two states of affairs are different because their constituents are different. Yet, Armstrong pre-empts this mis-conception: ‘Arrangement of constituents is not a further constituent, in particular it is not a constituent relation’. 37

34 Armstrong, ‘What are Classes?’, op. cit., pp. 2–3.
35 Ibid., p. 5.
37 ‘What are Classes?’, op. cit., p. 6.
How are we to understand that the arrangement of a state of affairs is not a constituent or a relation? Armstrong has told us that the arrangement of the constituents in a state of affairs is not a part of the state of affairs. If it were, then a singleton, which is a state of affairs, would have parts; but as we saw, a singleton is mereologically atomic for Armstrong. If the arrangement, then, is not a part, nor a constituent, nor a relation, in the state of affairs, what is its ontological status?\(^{38}\)

Following Armstrong’s argument, the reason why the existence of \(a\) and \(F\)-ness is not sufficient for making ‘\(a\) is \(F\)’ true, is that \(a\) and \(F\)-ness may exist without \(a\) being \(F\). Hence, any addition to the ontology which would be a truth-maker for ‘\(a\) is \(F\)’ would have to introduce a bond between \(a\) and \(F\)-ness. Can such a bond between \(a\) and \(F\)-ness be reified in the ontology? Aristotle considered there being a relation bonding a subject to its property and rejected it.\(^{39}\) He does not specify the reason why, but it should be clear to him that an infinite regress of relations bonding the subject to the property would follow from positing such a relation.\(^{40}\) (This must also be at least one of the reasons why Armstrong does not want the subject to be bonded to its property by a relation.) But if not bonded to a subject, how are the properties of a substance unified into a single whole within the substance? Aristotle’s answer is derived from the aggregate argument we considered above. Generalizing: a number of distinct items can be integrated into a whole if their role in the whole establishes an identity dependence between each of them and the whole.

Aristotle’s solution to the unification problem is the same whether the items are separable from one another physically or by abstraction. Namely, whether it is the material components of a substance separated out physically, or the properties of a substance separated out by abstraction. In either case, the creation of a single individual out of items that can be individuated independently of each other, requires these items to become interrelated in ways that do not leave their identity intact. The individuation of each constituent will require reference to the whole, as dictated by the role that each of the constituents plays in the whole. This is the case with the physical constituents in a substance, as well as with the abstract ones. On the abstract level, we can separate out the properties of a substance by abstraction. Each of these properties (its colour, shape, size, etc.) can be individuated independently of the others, when abstracted away from the substance. But as a constituent in the substance, its role in the whole ties its identity to the identity of the whole. It is not ‘white

\(^{38}\) An arrangement cannot be identical to its state of affairs, because then ‘\(a\) loves \(b\)’ and ‘\(b\) loves \(a\)’ would need to be primitively different, given that they would have the same constituents, the constituents being all they have.

\(^{39}\) The relations he rejects are participation, communion, connection, and composition; e.g. ‘that a thing is white will be a composition of surface and whiteness’, *Metaphysics* 1045b8–16.

\(^{40}\) One of the theories Aristotle rejects is that the subject-property relation is that of participation — the Platonic relation between things and Forms — being fully aware of the regress it gives rise to.
Is a Whole Identical to its Parts?

colour' that is in Socrates; rather, Socrates is white. Socrates is not: white
colour, plus so much weight, plus size, plus shape, etc. Rather, Socrates is
a white, light, small, etc., human being. What unites the colour white to
the shape and size, etc., of Socrates is not their co-presence, or any other
relation. 41 Rather, the colour white is integrated into the whole by playing
a role in the whole, the result of which is a white whole, not a white colour.

The key to understanding Aristotle's solution to the question of the
unity of the abstract components in a substance is the realization that when
we abstract away a property from its subject, we are generating an abstract
entity; we are not uncovering it. The abstraction of a property from its
subject is not like the unearthing of a treasure, but is like the amputation of
a limb: it is a kind of separation. The amputation of the limb is the
destruction of the limb and the creation of a new entity. 42 The reason is
that the identity of the limb in the substance is dependent on the whole in
which it is a constituent. Similarly with abstract entities. Abstracting away
the colour white from Socrates is a separation that gives rise to an entity
that is not a constituent of Socrates; the abstracted entity is individuated
independently of Socrates.

If an amputated limb is displayed in a medical museum, the displayed
limb is not a limb. Correspondingly, we can understand Aristotle's
categories of quality, quantity, relatives, etc., as an ontological museum,
which, like a medical museum, has to destroy that which it exhibits in order
to exhibit it. (This is so whether we take these properties to be particulars
or universals.) These properties, which can be individuated independently
of each other in their different categories, can be unified into a whole only
by breaking down their identity barriers. When green is a constituent of a
plant, individuating green is not the individuation of a colour, but the
individuation of a green plant. As mentioned above, for green to be a
constituent in a plant is not for a colour to be co-present with a plant;
rather, it is for the plant to be green. This is not achieved by a relation
between the colour green and the plant, but by an inter-dependence
between the green and the plant, which can be expressed only by saying
that the individuation of green involves reference to the plant (while the
individuation of the colour green does not).

What follows from this is that we should not look for a bond between a
subject and its properties. The diverse items that come together into a
single substantial whole are unified, not by coming to be related to one
another, but by coming to be identity dependent on the whole. The
substantial form that unifies the elements into a substance unifies by
consuming these elements; it is a 'relation' that destroys the relata, leaving
nothing standing but the whole. Thus, for Aristotle, the truth-maker of

41 If co-presence were the metaphysical bond uniting properties to each other in a substance, infinite
regresses of the Third Man kind would ensue.

42 See n. 30.
the statement ‘the plant is green’ could not be the bonding of the plant to the colour green; the truth-maker is the plant, which is green. 43

I showed above that for Aristotle, the substantial form of a substance is neither a part, nor a component, 44 nor a relation, in the substance. Armstrong, too, has argued that the arrangement of a state of affairs is neither a part, nor a component, nor a relation, in the state of affairs. Can arrangements, then, be substantial forms? The answer is no, because of a fundamental difference in the conception of substance between Aristotle’s and Armstrong’s metaphysics. For Armstrong, substances are states of affairs. It is constitutive of this conception of substance that substances can be composed of substances. Thus, the substance ‘John loves Mary’ is composed of the substances John and Mary. 45 This is incompatible with the Aristotelian conception of substance, which disallows substances to be constituents of other substances. The reason is that for Aristotle, a substance is what it is in virtue of itself, not in virtue of belonging to another substance. Substances are where the metaphysical buck stops, with respect to what things are. But if substance a were a constituent of substance b, a would be what it is in virtue of what b is.

The Aristotelian substantial form determines the identity of the constituents in the substance. It follows that if Armstrong’s arrangements were Aristotelian substantial forms, then the arrangement of the state of affairs ‘John loves Mary’ would make John and Mary into what they are, by unifying them into a single individual, namely, the state of affairs ‘John loves Mary’. (That is, John and Mary would be to the state of affairs, as the brain and the liver are to the human being.) But this is not possible because John and Mary are what they are by virtue of themselves — that is, by virtue of their own substantial forms. 46 So, Aristotle’s solution for the unification of the constituents in a substance cannot transfer to...

43 Substantial composition does not violate Lewis’s mereological canon, in the sense that, if the wholes are different, the constituents are different. This is so because the constituents are identified through the whole, so there could not be two different wholes sharing the same constituents. This distinguishes substantial composition from Armstrong’s composition by arrangement, where different states of affairs have the same constituents. Nevertheless, substantial composition is non-mereological, because each constituent cannot exist independently of the whole. Substantial constituents are not mereological parts.

44 Into which the substance can be divided.

45 John and Mary are substances for Armstrong, in the sense of being states of affairs. Namely, sketchily, John (the substance) is the state of affairs of John (the subject) having all his properties. See Armstrong’s conception of thick and thin particulars, in his *Universals and Scientific Realism*, Cambridge, Cambridge University Press, 1978, vol. 1, p. 114, and in his *A Combinatorial Theory of Possibility*, op. cit., p. 52. For the primacy of states of affairs in Armstrong’s ontology, see the latter work, p. 43.

Instead of the state of affairs ‘John loves Mary’, we could work with a more complex example such as the state of affairs: ‘Socrates’ being F is evidence that human beings exist’ (where ‘F’ is the conjunction of all of Socrates’ properties, ibid., p. 52); this state of affairs has a thick particular as a constituent.

46 Otherwise, John and Mary in the state of affairs ‘John loves Mary’ would be different entities from John and Mary by themselves, corresponding to the attached and the detached limbs.
Armstrong's substances (states of affairs), because the solution itself prohibits substances from containing substances. It follows therefore that, since in Armstrong substances can be constituents of other substances, the arrangements that unify these substances cannot be Aristotelian substantial forms.

We can therefore conclude with the following characterization of an arrangement of a state of affairs: it cannot be a substantial form, a relation, a part, or a constituent, of the state of affairs, and it must achieve the bonding of the constituents without altering their identity.47

4. Are there singletons or unit-classes?

Without a detailed account of how arrangements operate on their constituents, we do not have a complete understanding of the unity of a singleton, when construed as a state of affairs. Turning to Lewis, we find that he does not incorporate either Aristotelian substances or states of affairs into his ontology. For him, it is a mystery how, given an object, say Bruce, the singleton \{Bruce\} is formed. For Lewis, the formation of a unit-class is not mereological composition, since it is not the formation of one thing from many, but the formation of one thing from one thing.48 But Bruce is mereologically complex. How, then, are Bruce's parts related to the mereologically atomic singleton \{Bruce\}? All that Lewis tells us is that the formation of such a singleton as \{Bruce\} 'is not composition at all (God knows what it is)'.49 But this cannot be the end of the metaphysical story. How are such atomic entities as singletons generated out of complex ones? Lewis does not provide us with an explanation.

As Lewis does not offer an explanation of the disappearance of the parts of an entity, a, when a singleton \{a\} is created from that entity, we do not know why singleton \{a\} has neither constituents, nor parts, for Lewis. Aristotle does offer an explanation of the disappearance of the parts, when a substance is created from these parts, through their re-identification by the substantial form. Can Aristotle's solution offer us an explanation of the formation of singletons? We shall approach this question by examining the nature of classes within Aristotelian metaphysics.

Classes cannot enjoy substantial unity in Aristotelian metaphysics, for the same reason that states of affairs cannot. The reason is that classes may have substantial objects as their members. If a class enjoyed substantial unity, the identity of its substantial members would depend on the identity of the class. But things, especially organisms, are the par excellence substances for Aristotle, which cannot be what they are in virtue of what

47 The state of affairs 'a's bing F' cannot be an unanalysable primitive entity for Armstrong, since it contains a and F-ness as constituents.
49 Ibid., p. 37.
something else is, for example a class they happen to be members of. So classes cannot be substances. But if not substances, what are classes? I suggest that, in Aristotelian metaphysics, classes are related wholes, and should be treated as low grade substances, in the way that Aristotle treats artefacts. We saw that what is distinctive about related wholes is that the identity of the related constituents does not surrender to the identity of the whole. Rather, like the ten juxtaposed books, they are one, qua interrelated whole, but at the same time many, qua interrelated things (By contrast, a substance is not many.) Far from re-identifying the relata, the relations belong to the relata in the way that accidental properties belong to them.

Classes are not the only type of abstract entity that needs to be treated as a low-grade substance in Aristotelian metaphysics. Nations would be treated in a similar way, clubs too, and more generally, all wholes that contain substances. Treating classes, nations, and clubs, as interrelated wholes does not make them less real than what they come out in the alternative ontologies we are considering here. Here for Lewis and for Armstrong, the ontological status of classes is dealt with in terms of supervenience. For Lewis, commitment to classes is not commitment to any extra furniture in ontology. For Armstrong, too, classes are ethereal rather than substantial entities. And that is what Armstrong thinks they should be, as she says that the generation of singletons ‘ought not to be a big deal ontologically’. Thus, that Aristotelian metaphysics incorporates classes as related wholes and not as substances, is not a demotion of classes to a lower status than they possess in Armstrong’s or Lewis’s ontologies.

What then of singletons or unit classes? Can Aristotelian metaphysics accommodate them without facing the problem they generate in Lewis’s and Armstrong’s metaphysics? The difficulty with Lewis’s singletons is

50 For Lewis, ‘the parts of a set are its (nonempty) subsets, and thus every many-membered set is composed, ultimately, of its unit subsets’ (ibid., p. 37). (The unit subsets are the singletons generated from the members of the class.) The composition referred to here by Lewis is mereological fusion. Thus, a set is the mereological fusion of the singletons of its members. What kind of entity is such a whole in Lewis’s ontology? His answer is that: ‘A whole is an extra item in our ontology only in the minimal sense that it is not identical to any of its proper parts; but it is not distinct from them either, so when we believe in the parts, it is no extra burden to believe in the whole’ (ibid., p. 34).

51 Armstrong identifies classes with states of affairs (‘What Are Classes?’, op. cit., p. 11). He agrees with Lewis that a class with many members is ‘the mereological sum of its unit-classes’ (ibid., p. 16). Thus, a many-membered class is the mereological fusion of the states of affairs which are the singletons of its members. Armstrong calls singletons monadic states of affairs (ibid., p. 15). So the singleton (Bruce) will be the monadic state of affairs of Bruce having the property of having unithood. Armstrong explains that the property of ‘having unithood’ is a supervenient second-order property. A supervenient property, according to Armstrong, is ‘no ontological addition, but rather it is an ontologically free, though insubstantial, lunch’ (ibid., p. 13). Pulling all these together we can conclude that for Armstrong, a class is a state of affairs which is the mereological fusion of monadic states of affairs, each of which is a member’s having a supervenient property that is no addition to the ontology. Since Armstrong adopts Lewis’s position on mereological fusion, a class is no ontological addition over its parts, the monadic states of affairs, which are the having of properties that are no addition to the ontology.

52 Ibid., p. 15.
that there is no explanation of how a mereologically atomic entity is created out of another entity which may be complex. The *difference* between the singleton \{Bruce\} from its wholly distinct member Bruce, according to Lewis, is mysterious. For Armstrong, singletons are generated by the formation of states of affairs which are unified by their arrangement. The arrangement is assumed to transform the parts into constituents, but we do not yet have a full explanation of how the transformation is achieved. According to the Aristotelian account developed above, a *singleton* is like a club with only a single member. We understood clubs to be related wholes rather than substances, since no substance can be constituted of substances. But what is a related whole of one relatum? A relation between *many* substances gives rise to a related whole which is different from each of the substances in it. But this cannot be repeated in the case of a single substance. What then is a singleton? How can it be over and above the substance that constitutes it? Aristotelian metaphysics cannot give us an answer to this problem, either. It is therefore mysterious what a singleton is in all three metaphysical systems — Lewis’s, Armstrong’s, and Aristotle’s. Since their nature is so problematic, it is questionable whether Lewis’s programme of viewing classes as mereological fusions of their parts, which are the singletons of their members, is a heuristic way of understanding the nature of classes.

5. Conclusion

The problem that I addressed in this paper can be summarized as follows: is there any other kind of composition of elements into a whole than mereological composition? I have argued that, although Lewis denies that there is, he nevertheless allows for a type of unification that is equally mysterious, namely, the creation of an atomic individual (having no parts) from a complex individual (which has parts). Armstrong does allow for a non-mereological composition; it is the creation of states of affairs such as ‘a’s being *F*, which has *a* and *F*-ness as constituents, but not as parts. Yet, although Armstrong specifies what the arrangement, which unifies a state of affairs into a whole, is not, he does not offer a detailed account of how the unification, which results in the production of constituents rather than mereological parts in the whole, is achieved. Plato, too, allows for non-mereological composition, although he does not favour it. But he does take a position that groups him together with Armstrong and Aristotle, namely, that non-mereological composition requires a unifying form, which is not one of the constituents, and which is responsible for the oneness of the generated whole. Yet, Plato offers no further explanation of how the form is responsible for the disappearance of the *parts* in the whole. Finally, we saw that Aristotle does advocate non-mereological composition in the formation of substances, which are unified by the substantial form. This
form is not a constituent of the substance, nor a relation in the substance, but it generates the substance by establishing an identity dependence of the elements (that go into the make-up of the substance) on the whole. The identity inter-dependence of the constituents in a substance secures the unity of the substance, and explains why the substance is not a mereological fusion of parts. We saw why differences in the conception of substance between Aristotle and Armstrong block the way to the transfer of the Aristotelian solution to Armstrong's substances.

But having an account of substantial composition does not secure the non-mereological generation of the entities that turned out to be problematic in Lewis's and Armstrong's metaphysics, namely singletons or unit classes. I suggested that, although classes would not be substances in Aristotelian metaphysics, they could be treated as related wholes, like nations and clubs. But singletons, being composed of a single member, do not constitute related wholes. Since no satisfactory account of their generation can be given, either as substances, or as related wholes, or as states of affairs, singletons do not appear to have an obvious claim to be included in the ontology. Yet a satisfactory account must be found, if Lewis's proposal to treat classes as the mereological compositions of their ultimate parts, that is, the singletons of their members, is to help us understand the nature of classes.