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Introduction: The Metaphysics of Relations

Anna Marmodoro and David Yates

1.1 Background

(David Yates)

It is uncontroversial that there are a great many relational truths, but the grounding of such truths raises a host of philosophical problems. The metaphysics of relations can usefully be thought of as addressing two broad questions: (1) What kinds of relations are there, and how should we account for them? (2) What is the ontological status of relations? An important area of recent debate falling under (1), and largely inspired by Kit Fine, concerns how we should account for the difference between a non-symmetric relation such as 'Abelard loves Heloise' and its *differential opposite*, 'Heloise loves Abelard'.[1] A natural supposition, endorsed by Russell, is that such relations hold between their relata *in a particular direction*, with the two possible directions of the '_loves_' relation (from Abelard to Heloise and from Heloise to Abelard) corresponding to distinct relational states.[2] As Fine notes, however, it follows from this that every two-place non-symmetric relation aRb is distinct from its converse bR*a. If Abelard loves Heloise, but not vice versa, then the relation '_loves_' holds from Abelard to Heloise, whereas the converse relation '_is loved by_' holds from Heloise to Abelard, *not* from Abelard to Heloise. Given directionalism, the '_loves_' relation and its converse must therefore be distinct relations. However, it seems intuitively clear that 'Abelard loves Heloise' and 'Heloise is loved by Abelard' describes just one relational *state of affairs*, hence that there should be just one relation holding between them.

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[1] All references to Fine in this section are to Fine (2000).
[2] Russell (1903); Fine refers to this position as 'directionalism'.

The key question, if Fine's objections to directionalism are correct, is how to account for the differential application of relations that are directionally *neutral*. Both *positionalism* and Fine's own *antipositionalism* are attempts to do this. As Fine characterizes positionalism, relations have argument-places into which the relata slot, and (binary) non-symmetric relations are such that where you slot in the relata determines which of two distinct relational states you get. Positionalism deals with the problem just posed above for directionalism, since 'Abelard loves Heloise' and 'Heloise is loved by Abelard' describe the *same* way for Abelard and Heloise to occupy the two argument places of the loving relation. Fine, however, finds problems with positionalism when it comes to *symmetric* relations: '_is next to_' has two separate argument positions, so 'Abelard is next to Heloise' and 'Heloise is next to Abelard' should express two *different* ways for Abelard and Heloise to be next to each other. However, intuitively there is just one way for them to be next to each other, so positionalism is guilty of double-counting relational states in symmetric cases.

According to Fine's antipositionalism, non-symmetric relations and their differential opposites differ in the manner of completion of relational states by their relata. Fine posits a primitive resemblance relation 'co-mannered completion', holding between an n-adic relational state S and its constituents $a_1, \ldots, a_n$ on one side, and another n-adic relational state S' and its constituents $b_1, \ldots, b_n$ on the other, just in case S is formed from $a_1, \ldots, a_n$ and an n-adic relation R *in the same manner* as S' is formed from the same relation R and $b_1, \ldots, b_n$. Suppose for the sake of argument that the manner in which Abelard and Heloise complete the neutral amatory relation to yield the state of Abelard loving Heloise is primitively like the manner in which Anthony and Cleopatra complete the amatory relation to yield the state of Anthony loving Cleopatra. As Gaskin and Hill note, there is no obvious way for Fine to explain why these completions are co-mannered yet distinct from the manner in which Anthony and Cleopatra complete the amatory relation to yield the state of Cleopatra loving Anthony.[3] If the state of Abelard loving Heloise is co-mannered with that of Anthony loving Cleopatra, it cannot be co-mannered with Cleopatra loving Anthony, but on Fine's account there is no explanation of this fact.

Notice that without the assumption that 'Abelard loves Heloise' and 'Heloise is loved by Abelard' express the same relational state, we cannot set up Fine's argument against directionalism; and without the assumption that 'Abelard is next to Heloise' and 'Heloise is next to Abelard' express the same relational state, we cannot set up Fine's argument against positionalism. We might therefore seek to avoid Finean worries about the directionality of relations by denying that there

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[3]   Gaskin and Hill (2012), pp. 178–9.

are *any* relational states. This does not require us to deny that there are relational *truths*, because we might hold in addition that such truths have exclusively monadic truthmakers. The truthmaker for 'a is longer than b', on this view, is not the instantiation of an irreducibly relational polyadic property *being longer than* by the ordered pair (a, b). Rather, it is the instantiation of certain monadic *lengths* by a and b.

Suppose for the sake of argument that the truthmaker for 'Abelard loves Heloise' is the possession of certain monadic psychological properties by Abelard (bracketing concerns about the apparently relational nature of mental representation). The fact that 'Abelard loves Heloise' does not entail 'Heloise loves Abelard' is accounted for by the (putative) fact that the truthmaker for the latter claim, if it is true, is the possession of the appropriate monadic psychological properties by *Heloise*, not Abelard. If we can account for the non-symmetry of the amatory relation without supposing that lovers instantiate problematic properties that hold, or at least appear to hold, in a particular direction, then Finean worries about the metaphysics of relations seemingly do not arise. If *all* relational truths could be shown to have monadic truthmakers, it would make matters considerably simpler.

Relational truths that do not require relational truthmakers are typically described as *internal* relations. Fix the intrinsic lengths of all the objects in the domain, and we get the relative length relations for free. If we can show that all members of a given class of relational truths are internal in this sense, we will have *reduced* (or perhaps *eliminated*) the relations in that class. Once we fix the lengths of a and b, no additional relational entity connecting them is needed as truthmaker for 'a is the same length as b'. By way of contrast, spatiotemporal relations are often taken to be *external* to their relata: to get a and b to stand in the relation of being 1metre apart, it is not enough to fix their intrinsic natures. Something more—a relational property—seems to be required, and if any relational properties are non-symmetric, then we cannot avoid the challenge of explaining what their non-symmetry consists in. Many of the papers in this volume can usefully be seen in terms of where they stand on the question of internal vs external relations. However, there are several distinct ways of understanding the internal/external distinction, and it is not clear that all have the same ontological import.

1.2 Ancient Perspectives

(Anna Marmodoro)

A traditional perspective rooted in the works of Plato and Aristotle, and continued by medieval philosophers, has it that there are no irreducible relational

properties. Aristotle, on whose views the following remarks will focus, took relations such as *taller than* to be reducible to monadic properties. However, the monadic properties in the reduction base are of a very different kind from typical monadic properties such as colour or shape. For instance, for Aristotle, 'Sicinnus being the slave of Themistocles' is a state involving Sicinnus and Themistocles having monadic properties. Crucially, the properties in question are not merely being a slave and being a master. Rather, they are being a slave *of* and being master *of*, respectively. Sicinnus' property of being *a slave of* is in some sense 'pointing' toward Themistocles, and Themistocles' corresponding property of *being a master of* is likewise 'pointing' toward Sicinnus. Thus what might appear to be an instance of a single relational property between Themistocles and Sicinnus, had by both Themistocles *and* Sicinnus, is, for Aristotle, Themistocles and Sicinnus instantiating two distinct monadic properties, each in some sense directed toward the other.[4]

Neither Plato nor Aristotle argues explicitly for this reductive theory of relations. On the other hand the existing textual evidence allows us to develop a working hypothesis as to why they would have endorsed such a view and why they would not have argued explicitly for the reduction. For the ancients, properties are instantiated by individual subjects; in particular for Aristotle this is so because individual subjects are the primary beings in the ontology, with properties being existentially dependent on them. Individual subjects, such as Themistocles and Sicinnus, have 'ontological boundaries', which demarcate the being of each subject according to Aristotle's criteria for substantiality as stated in *Metaphysics* VIII 3. There cannot be relational properties in the ontology because they would undermine the ontological primacy and boundaries of each subject, by belonging, not to one subject only, but equally to all n relata of an n-adic relation, as if the property in question were divided and distributed among all subjects in question. It is additionally not possible for the ancients that two or more individuals taken together would make up a single subject—a subject by hypothesis constituted of e.g. Themistocles and Sicinnus. (Aristotle is explicit in disallowing that substances compose into substances.) But this is precisely the type of subject that would be needed to serve as the bearer of a polyadic relational property, if being belongs to a subject.

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[4] Note that these monadic properties essentially characterized by their directionality are sometimes, in the literature on ancient metaphysics, referred to as *relational properties*; but they are not properly so called in my sense of the term. They are—putatively—properties that *ground* relations, but the properties themselves are *monadic*. See Brower (1998) for discussion; see also Marmodoro (2014), pp. 26 ff. for extended discussion of the idea that Aristotelian relations are grounded in monadic, directed relatives, and an application of this idea to Aristotle's metaphysics of powers.

Furthermore, properties for the ancients are the simple natures that explain how individuals are qualified in such and such a way. For example, the nature of the property redness that inheres in an apple is what explains, metaphysically, the colour of that particular apple. On this understanding of the metaphysical role of properties, *asymmetric* polyadic relations would have no work to do, if admitted in the ontology. If the nature of a relation stands for a single feature of individuals, it should qualify all the relata in the same way, assuming that it could belong to many. But how could a *single* polyadic relational property explain both, e.g. masterhood in one relatum (Themistocles) and slavehood in the other (Sicinnus), characterizing each of them *differently*? Even if one thought per hypothesis that there could be a single subject composed by the related individuals (which, as we saw above, the ancients would not admit), how could a single property, with a single and simple nature, explain the different characterizations of that subject? So the ancients would argue. From this point of view, the burden of proof is on those who believe that it can be shown how two features of being can be embodied in one relational property, it is not for their opponents to show that such a relation can be reduced to two monadic, non-relational properties.

The idea that n-adic relations might be reduced to n monadic property-instances, somehow pointing toward each other, is not popular among contemporary philosophers, largely due to Bertrand Russell, who refers to it as the *monadistic* theory of relations.[5] Russell thought that Aristotle's account of relations faces a problem in that, to characterize monadic property-instances as being 'towards each other', an analysis of how property-instances could be both monadic and directed would be needed. I said above that for Aristotle, e.g. Themistocles does not have the property of being 'master of' *simpliciter*; rather, he is 'master of' relative to Sicinnus. Likewise, Sicinnus is not 'slave of' *simpliciter*, but relative to Themistocles. What does this talk of having a property *relative* to another amount to? Russell's view is that

In the first way of considering the matter, we have 'L is (greater than M)', the words in brackets being considered as an adjective of L. But when we examine this adjective it is at once evident that it is complex: it consists, at least, of the parts greater and M, and both these parts are essential. To say that L is greater does not at all convey our meaning, and it is highly probable that M is also greater. The supposed adjective of L involves some reference to M; but what can be meant by a reference the theory leaves unintelligible. An adjective involving a reference to M is plainly an adjective which is relative to M, and this is merely a cumbrous way of describing a relation.[6]

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[5] Russell (1903), §§212–14.   [6] Russell (1903), §214.

Russell's point is that while we can refer to the property Themistocles has of being master of Sicinnus using a complex one-place predicate '__is master of Sicinnus', this does not mean that the property itself is monadic. The reason, for Russell, is that being master of Sicinnus involves a relation *to Sicinnus*, so the *prima facie* monadic form of the predication seems, in Russell's words, little more than 'a cumbrous way of describing a relation'. He remarks, 'what can be meant by a reference [to a co-relatum] the theory leaves unintelligible'.

Making a departure from Russell's way of thinking about these issues, I have argued elsewhere[7] that one of Aristotle's fundamental tenets in metaphysics is that there are no relations—no beings that are 'shared' by two or more subjects. Rather, there is *ontological dependence* between subjects (where the subjects can be properties, or substances, or their parts); and ontological dependence is not a relation. Aristotle explains ontological dependence with the notion of *ontological containment* (my terminology).[8] Ontological containment presupposes another core view of Aristotle's, namely the *metaphysical unity of a subject*—a position that is hard to imagine any system could do without. Here the subject can be a substance, or an activity, or a part, or a property, so long as it is *one*, even if metaphysically complex. For Aristotle, a unified subject is constituted by what is ontologically contained or included in it.[9] What is ontologically contained in the subject belongs to it. Assuming the unity of a subject, Aristotle can then account for ontological dependence through the notion of ontological containment.

Returning to our example, the masterhood of Themistocles is ontologically dependent on the slavery of Sicinnus, on account of the fact that certain types of actions of Themistocles constitute, together with certain types of actions of Sicinnus, a single unified activity or subject. It is the oneness of this activity (and not any polyadic property) that grounds the ontological dependence between master and slave.[10] Aristotle's answer to Russell would be that a being relative to

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[7]   What follows draws on Marmodoro's (2009) application to the European Research Council for a starting investigator award (number 263484), and is currently under development as part of her project *Power Structuralism in Ancient Ontologies*.

[8]   The type of ontological containment is determined by the type of entity the subject is. Different types of entity have qua subjects different types of unity, and so the metaphysics of containment and ontological dependence differ accordingly, but the explanatory principle is the same.

[9]   The unity of a subject is not, and cannot, be understood in terms of relations—a lesson Aristotle was taught by Plato's Theory of Forms and the difficulties he saw the theory prey to.

[10]   I have argued more fully for this interpretation of Aristotle's account of relatives in Marmodoro (2007) and (2014). For Aristotle, ontological dependencies are found everywhere in the ontology. For example, essential parts of (secondary) substances are ontologically dependent on these substances—e.g. the property flying animal on the property wing: 'wing, having reference necessarily to a winged creature, and of a winged creature as being such because of its wings' (*Categories* Ch. 7). That is, wings are wings of an organism, and flying organisms are winged.

b, is not a cumbrous way of describing a relation, but a simple way of alluding to non-substantial complexes involving a and b that claim some degree of ontological unity, such as the slave-master activity-complex, or, e.g. the learner-teacher activity-complex. A full-fledged explanation of the way a and b are involved in an activity-complex could draw on Kit Fine's account of antipositionalism in neutral relations.[11] The relevant Finean thought to be developed for an Aristotelian account of activity-complexes is that the relativity of a and b is grounded on their asymmetry in their activity-complexes, which is to be explained through the states and constituents of their activity-complex.[12]

1.3 Internal vs External Relations

(David Yates)

Internal relations, roughly speaking, are those whose holding is in some sense in the nature of their relata, external relations the rest. The question of whether there are any irreducible relational properties is often framed in terms of whether there are any *external* relations, with internal relational truths taken to have monadic truthmakers and hence to reduce to monadic properties. Framing the question of the ontological status of relations in terms of the internal/external distinction is not always helpful, however, as there are several extant ways of understanding the distinction between internal and external relations, not all of which have the required ontological import. Furthermore, even the most promising way of understanding the internal/external distinction does not track the reducible/irreducible distinction in a neat and tidy way. Some clarificatory remarks are therefore in order. I mention two ways of understanding the distinction between internal and external relations for illustrative purposes, but there are others.[13]

   Internal relations are widely agreed to inhere in the natures of their relata, but that is an imprecise notion, and because external relations are understood in contrast to internal relations, externality is of no help. Let us therefore try to precisify 'internal', to see whether there is a sense of the term such that a relational truth has a monadic truthmaker if, and only if, it is an internal relation. Consider the following precisifications:[14]

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[11] Fine (2000), pp. 28–32.

[12] Fine (2000), p. 29. I can only gesture here for reasons of space to Kit Fine's work on neutral relations as making available the conceptual resources to account for how a and b would be involved in the activity-complex.

[13] See Schaffer (2010b) for further discussion.

[14] In what follows, I assume transworld identity for simplicity. The central points are not affected if the discussion is restated in counterpart-theoretic terms.

I1: $R(x,y)$ is internal$_1$ iff $R(x,y)$ is essential to x and y.

I2: $R(x,y)$ is internal$_2$ iff '$R(x,y)$' is made true by monadic properties of x and y.

If R is internal$_1$, then necessarily, if either x or y exists, then $R(x,y)$, which is close to what Bradley had in mind when he claimed that '[e]very relation ... essentially penetrates the being of its terms and is, in this sense, intrinsical.'[15] If all relations are internal$_1$, then every thing is ontologically dependent upon every thing to which it is in some way related, and arguably, therefore, to *every*thing. The idea that every proper part of the cosmos ontologically depends on every other, for Bradley, leads to a kind of monism: no proper part of the cosmos is an ontologically independent *substance*, and to consider any such part in isolation from the totality of relations into which it enters is to fail to capture its whole nature. The only true substance is the cosmos as a whole. Were we to hold in addition that the only genuine property-bearers are substances, it would follow that there are no genuinely relational, polyadic *properties*, for the only things capable of instantiating such properties—proper parts of the cosmos—are not substances. If, as Bradley seems to suppose, the only genuine properties are monadic properties of the entire cosmos, then these must be the truthmakers for any relational truths concerning its proper parts.

I have so far considered one way, stemming from Bradley, in which it might be argued that if all relations are internal$_1$, then there are no irreducible relational properties, although there are ways of thinking about essential relatedness that undermine this conditional, of which more presently. If all relations are internal$_2$, things are more straightforward, for in that case all relational truths have monadic truthmakers, and there is no *need* to posit irreducible relational properties. It is interesting to note that Russell, in defending his doctrine of external relations, denied that all relations are either internal$_1$ *or* internal$_2$:

I maintain that there are such facts as that x has the relation R to y, and that such facts are not in general reducible to, or inferable from, a fact about x only and a fact about y only: they do not imply that x and y have any complexity, or any intrinsic property distinguishing them from a z and a w which do not have the relation R. This is what I mean when I say that relations are external.[16]

The claim that there is an R such that it is false that $R(x,y)$ implies any complexity in x and y plausibly amounts to the claim that at least one R is not internal$_1$. If everything is essentially related to everything else, then it seems the nature of every thing is as complex as the relational structure of the entire cosmos, and this,

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[15] Bradley (1897), p. 347.   [16] Russell (1910a), p. 374.

qua atomist, is precisely what Russell wanted to avoid. The natures of things, for Russell, were not essentially complex in the way that Bradley's monism seems to imply. It is not clear why Russell needed to deny in addition that all relations were internal$_2$ in order to defend atomism, but deny it he did.

One argument Russell offers against the internality$_2$ of all relations is, roughly, as follows. Suppose we want to say, which is plausible, that the relation *taller than* is determined by the monadic heights of its relata, hence that being taller than is not an irreducible relational property. Simmias, let us say, is 1.6m tall, Socrates 1.5m tall. That Simmias is taller than Socrates is determined by their intrinsic heights, but in Russell's view, this determination depends on a further relation *greater than* obtaining between the *magnitudes* of Simmias' and Socrates' heights. In Russell's view, we are bound to be left with a residue of irreducible relations, which are external$_2$ (and of course, given Russell's atomism, external$_1$). I shall not discuss further Russell's grounds for rejecting the claim that all relations are internal$_2$. Let us instead focus on whether either of the internal/external distinctions afforded by (I1) and (I2) track the reducible/irreducible distinction for relations. I begin with some grounds for doubting that all internal$_1$ relations are reducible.

Ontic structural realists hold that the relational structure of reality, as discovered by fundamental physics, is in some sense ontologically basic, and reject the idea of intrinsic natures. Some ontic structural realists eliminate things altogether, and hold that relational structure is all there is.[17] Others prefer to say that there are individuals, but that those individuals have only relational properties.[18] On the latter view, it seems that fundamental physical entities must be relationally individuated, if they are individuated at all, for there are no other candidate properties available to do the job. This position is consistent with the sort of monism Bradley apparently endorsed, but does not require it. We might instead deny that there are any substances, understood in the classical sense as ontologically independent bearers of intrinsic properties, and hold that all property bearers are ontologically interdependent. It makes sense to describe physical particulars as conceived by these more moderate ontic structural realists as essentially related, hence to say that they allow internal$_1$ relational truths, but deny that there are monadic properties available to be their truthmakers. It is difficult to see how to square the idea that relational structure is ontologically basic with the denial of genuinely relational properties.

Ontic structural realism is not the only case in point. Causal structuralists take the identities of physical *properties* to be determined by their causal

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[17] Ladyman and Ross (2007).   [18] Esfeld (2004).

contributions.[19] On one version of this view, properties are powers or dispositions, which are individuated by the potential stimulus and manifestation relations in which they stand to each other.[20] This position is often stated as the thesis that properties have their causal roles essentially and plausibly entails that properties are internally$_1$ related to each other. However, it is not obvious that these relational truths concerning properties have monadic truthmakers. Rather, they seem to be ontologically fundamental and prior to the identities of the properties that essentially stand in them. Of course, one might simply insist, in the spirit of Bradley, that these structuralist theories inevitably collapse into some form of monism, according to which the relational truths are made true by monadic properties of the entire structure, but it is hard to see what form this monism could take in the case of properties.

Suppose we focus instead on the fact that the mere existence of their relata is sufficient for the truth of internal$_1$ relational truths, and suggest that this alone means we do not need to posit irreducible relational properties to account for internal$_1$ relational truths—we get those for free. It is indeed plausible, given causal structuralism, that the mere existence of causal properties is sufficient for the truth of the various laws of nature relating them. However, this is just what we would expect if standing in certain nomic relations were *ontologically prior* to the properties themselves. It is of course a matter of considerable controversy whether relations could be prior to their relata; nonetheless, the fact that the mere existence of the relata suffices for the truth of internal$_1$ relational truths does not settle the issue of the ontological status of internal$_1$ relational properties. Nor should we expect it to: as is familiar from Fine's work on essence, ontological priorities are finer grained than modality.[21]

Even if it is the case that all internal$_1$ relations have monadic truthmakers, that is not sufficient to show that the reducible/irreducible distinction is coextensive with the internal/external distinction. To do that we would need to show that if there were any *external$_1$* relational truths, they would have irreducibly relational truthmakers. This seems even less plausible, for there are many intuitive cases of relations that are not internal$_1$ but which do not seem to require an irreducibly relational property distinct from the monadic properties of the relata. I have

[19]   Hawthorne (2001). Note that causal structuralists do not typically hold that physical properties are relational properties *of their bearers*; rather, the claim is that the properties themselves are relationally individuated.

[20]   Bird (2007a), (2007b).

[21]   Fine (1994). The existence of Socrates is sufficient for the truth of '{Socrates} exists', and the existence of {Socrates} is sufficient for the truth of 'Socrates exists'. Intuitively, however, Socrates is ontologically prior to his singleton, and not vice versa. See Yates (2013) for an application of Finean essence to causal structuralism.

already discussed one such example: once the monadic lengths of all the objects in the domain are determined, it seems that no further *properties* are needed in order to make true all the relational truths concerning their relative lengths. It seems, then, that internality$_1$ is neither necessary nor sufficient for reducibility.

That brings us to (I2), which is the standard way of thinking about the internal/ external distinction in contemporary discussions. Supposing the monadic properties of a thing to be its intrinsic properties, the idea of internal$_2$ relations can be fleshed out by appealing to the notion of *intrinsic duplication*.[22] According to a popular view, an intrinsic property is one the having or lacking of which is independent of what else there is.[23] Intuitively, an individual's intrinsic properties are those that cannot be changed merely by addition or subtraction of wholly distinct individuals to or from its world. Internal$_2$ relations may now be taken to be those that hold between x and y if, and only if, they also hold between any possible intrinsic duplicates of x and y. Plausibly, the relation *longer than* is internal$_2$: if A is longer than B, then on the assumption that length is intrinsic, necessarily any intrinsic duplicate of A is longer than any intrinsic duplicate of B. I argued above that it is unclear whether we get internal$_1$ relations for free, given the mere existence of the relata, because one could just as well suggest that the existence of the relata depends on their being thus-and-so related. It is somewhat clearer, however, that we get internal$_2$ relations for free, given the existence *and intrinsic natures* of the relata.[24]

Suppose we accept that if all relations are internal$_2$, then there are no irreducible relational properties, because all relational truths have monadic truthmakers. As with the previous case, it remains to be shown that if there are any external$_2$ relational truths, then these have irreducibly relational truthmakers. However, this is plausibly not the case: that a relational truth is not made true by the monadic properties *of its relata* does not imply that its truthmaker is an irreducible relational property of its relata. That a relational truth is external$_2$ leaves open the nature of its truthmaker. An example will help make this point. Suppose Lewis' early counterfactual theory of causation

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[22] C.f. Lewis (1986b), p. 62.

[23] Langton and Lewis (1998) finesse this rough sketch in various ways, but I cannot go into detail here for reasons of space.

[24] I set aside the question of why internal$_2$ relations seem to be intuitively clearer candidates for reduction, although one might suggest it has to do with *deducibility* of internal$_2$ relational truths from monadic properties of the relata. For instance, we can deduce that A is longer than B from 'A is 5cm long and B is 4cm long'—at least on the assumption of the prior quantitative relation '5 is larger than 4'. Russell (1903) appealed to the fact that we need prior quantitative relations in such cases to argue that there must be at least *some* external$_2$ relations. Interestingly, one often hears it said in reply that quantitative relations are internal$_1$, and so reducible.

is true.[25] Causal dependency is first defined in counterfactual terms, and causation is defined by taking the ancestral of causation dependency. For actually occurring events x, y:

1. y causally depends on x iff had x not happened, y would not have happened.
2. C causes E iff there is a chain of stepwise causal dependencies between C and E.

On Lewis' account, the counterfactual 'had x not happened, y would not have happened' is true iff either (i) there are no possible worlds in which x does not happen, or (ii) some possible world at which x does *not* happen and y does not is closer to actuality than any possible world at which x *does* happen and y does not.[26] Causation, on the above account, is an external$_2$ relation, because counterfactual dependency is external$_2$. Suppose some event E causally depends on an event C. This is made true by the facts that (a) there exists a possible world w where neither C nor E happens, (b) w resembles the actual world more closely than any possible world where E happens but C does not. Neither (a) nor (b), however, are determined solely by the intrinsic properties of C and E.

The important point for our present purposes is that Lewisian causation is both external$_2$ *and* reducible—the counterfactual theory is a reductive *analysis* of causation. Given Lewis' Humean supervenience, the actual causal truths are determined by the pattern of instantiation of intrinsic fundamental qualities throughout spacetime.[27] Roughly, the idea is that the factors that determine which worlds are closest to ours—including the laws of nature—supervene on this pattern, so the pattern determines the actual causal facts. The mere fact that an external$_2$ relation R holds between x and y does not, therefore, imply that R is an irreducibly relational property. The externality$_2$ of a relational truth leaves open the nature of its truthmaker.

Now it is true that Lewis held spatiotemporal relations (and only spatiotemporal relations) to be irreducibly relational properties, so causal relations *do* have such properties among their truthmakers, on his account. This does not, however, affect my main point, which is that the externality$_2$ of a relation R does not imply that *R itself* is irreducible. There is also no obvious reason to hold that if a relational truth is external$_2$, then it must have irreducibly relational properties among its truthmakers, as is the case with causation on Lewis' view. A relation could be external$_2$, in the sense of not being determined by the monadic properties *of its relata*, and yet still be determined by monadic properties *of some thing*

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[25] Lewis (1973).   [26] We can ignore (i) as yielding a vacuously true counterfactual.
[27] Lewis (1986b).

or things. If we combine Humean supervenience with the claim that spatiotemporal relations are internal$_2$, then Lewisian causal relations are a case in point. The spatiotemporal relations between monadic fundamental property-instances partially individuate the pattern upon which all contingent truths supervene, but if the relations are—somehow—determined by the monadic properties, then causal truths will have only monadic properties among their truthmakers. However, even on this theory, causal relations are not determined solely by monadic properties of their relata, because the pattern in question remains global, despite the fact that we have stripped it of fundamentally relational properties.

The temptation, when assimilating the reducible/irreducible distinction for relations to the internal/external distinction is to suppose that a relation $R(x,y)$ is reducible iff it is internal$_2$, and irreducible otherwise. I hope I have said enough to show that this simple theory cannot be true. That a relational truth $R(x,y)$ is *not* made true by monadic properties of x and y does not tell us that it *is* made true by x and y instantiating an irreducibly relational property. Only if we hold that relational truths in general can only have properties of their relata as truthmakers would this follow, and the case of Lewisian causation shows that this is not the case. That is not to say, however, that the internal$_2$/external$_2$ distinction has no bearing on the ontological status of relations; quite the contrary. The following conditionals do seem to hold:[28]

A. that $R(x,y)$ is internal$_2$ is sufficient but not necessary for R to be reducible;
B. that $R(x,y)$ is external$_2$ is necessary but not sufficient for R to be irreducible.

If *all* relations are internal$_2$, then that is good reason to believe that there are no irreducible relational properties. Finding a type of relation that is external$_2$ merely undermines the case for the reducibility of relations to monadic properties, rather than providing a positive case for anti-reductionism about relations. In order to provide such a case, we need independent reason—that is, reason in addition to their externality$_2$—for holding that particular relational truths have irreducibly relational truthmakers.

There are at least two ways of arguing against irreducible relational properties. One could argue case by case that particular classes of relational truths are reducible by providing plausible candidate monadic truthmakers for them, be they properties of the relata or not. Alternatively, one could argue a priori against very idea of an irreducible relational property. Broadly speaking, ancient thinkers

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[28] These conditionals are of course logically equivalent, given that a relation is internal$_2$ iff it is not external$_2$, and that 'irreducible' is the negation of 'reducible'. I have included them both for clarity.

favoured this latter strategy, whereas contemporary metaphysicians sceptical about relations typically embrace the first. Contemporary arguments for irreducible relations are typically based on the role of relations in modern physics, especially quantum mechanics. It is often argued that physics shows us that nature is fundamentally relational. Opponents can respond by arguing that the fundamental relations in question are internal$_1$, but what follows from this? Are internal$_1$ relations in fundamental physics ontologically basic, or can they be treated as a metaphysical 'free lunch' alongside internal$_2$ relations? The lack of agreement on this crucial point indicates that much work remains to be done.

1.4 The Papers

Plato was the first philosopher to discuss the phenomenon of plural-subjects and plural-predication, e.g. you and I are two, but neither you, nor I are two. In 'Relations as Plural Predications in Plato', *Theodore Scaltsas* argues that Plato devised an ontology for plural-predication through his Theory of Forms, namely, plural-partaking in a Form. Plato, it is argued, used plural-partaking to offer an ontology of related individuals without reifying relations. Scaltsas argues that Plato's theory of plural-relatives has evaded detection in the exegetical literature because his account of plural-subjects through the Theory of Forms has not been recognized for what it is. He concludes that Plato's handling of related individuals through plural-predication is not only a 'first' in philosophy, but also an 'only', having remained a unique account in the metaphysics of relations, and that Plato's account suggests a fresh approach for contemporary debates on the subject.

In his 'Aristotelian vs Contemporary Perspectives on Relations', *Jeffrey E. Brower* examines a longstanding tradition in philosophy according to which relations are to be understood in terms of individuals and their monadic properties. Brower suggests that this tradition, which enjoyed ascendancy in the West prior to the twentieth century, has its roots in antiquity, especially in the work of Aristotle, and received its most sustained development and careful defence at the hands of philosophers during the Middle Ages. Brower provides a systematic introduction to the types of theory characteristic of this tradition, arguing that they are much more subtle and sophisticated than contemporary philosophers have appreciated.

Despite vigorous disagreements on a variety of questions about relations, most medieval philosophers agree that relations should not be construed as polyadic properties on the general principle that no accidents can have more than one subject. Modern philosophers who are accustomed to thinking of relations as polyadic properties might well wonder why such properties found so little favour

among medieval philosophers. The answer is not obvious, since medieval philosophers tend to simply assume the rejection of polyadic properties without bothering to defend their assumption. In his paper, 'Why do Medieval Philosophers Reject Polyadic Accidents?', *Sydney Penner* examines some reasons for rejecting polyadic properties that can be gleaned from ancient and medieval accounts.

Various philosophers have raised compelling objections to the standard philosophical and logical assumption that relations hold of their relata *in a particular order*. Positionalism is an alternative to the standard account which is intended to capture the ordinary assumption that the distinction between the claims made in, e.g. 'Abelard loves Eloise' and 'Eloise loves Abelard' is explained by differences in the roles (or positions) attributed to the relata. The former claim posits Abelard in the role of *lover a*nd Eloise in the role of *beloved*. The latter claim reverses this assignment. In her paper 'Positionalism Revisited', *Maureen Donnelly* proposes a revised version of positionalism, based on a broadly Aristotelian notion of *relatives*, which she terms 'relative positionalism'. Donnelly identifies the positions in a relation as co-relative properties of the relata. She argues that relative positionalism can overcome the standard objections to positionalism, and has the right structure to explain differences in the symmetry properties of arbitrarily complex relations.

In 'There are (Probably) No Relations', *E. Jonathan Lowe* argues that genuine relations, if any such there be, are external, in that they do not supervene on the intrinsic properties of the relata. Internal relations are cases of formal, as opposed to material, predication, where no genuine property or relation is predicated of the subject(s) of the predication. Genuine properties, by contrast, are denoted by material predications on the subjects of predication. The question of whether there are any relations, for Lowe, comes down to the question of whether any true relational predications involve material predication. Lowe argues that the best candidates, causal and spatiotemporal relational predications, involve formal predication, and goes on to suggest that the very idea of irreducible relational properties may be incoherent, concluding that there are (probably) no relations.

Many contingent facts concern objects standing in relationships by accident, prominent among these being spatiotemporal relationships, often taken as the paradigm of external (irreducible) relational properties. In his paper 'External Relations, Causal Coincidence, and Contingency', *Peter Simons* argues that while spatiotemporal relations are external to their relata, in the sense that they are not determined by the mere existence or natures thereof, such relations reduce to internal relations between the processes upon which spatiotemporally related individuals ontologically depend. Assuming that processes are ontologically prior

to individuals, Simons argues that since processes have their spatiotemporal locations essentially, they are internally spatiotemporally related. Assuming in addition relationism about spacetime, Simons concludes that we do not need to posit relational truthmakers to account for true spatiotemporal predications. Simons accounts for the contingency of spatiotemporal relations between individuals, and the existence of spatiotemporal coincidences, in terms of the contingency of the relationship between concrete individuals and their sustaining processes.

In his 'Causal Relations', *John Heil* takes up the task of arguing that causal relations are internal, in Lowe's sense. On the received view of causation, causal relations are a distinctive species of external relation. Heil explores the implications of adopting a conception of causation according to which causal relations are understood as manifestings of reciprocal powers. On such a conception, causation would most naturally be seen as a kind of internal relation, a relation founded on non-relational features of its relata. Heil concludes by assessing the consequences of such a view for familiar conceptions of natural necessity.

In 'Is Powerful Causation an Internal Relation?', *David Yates* first argues that there is a tension in the view that powerful causation is an internal relation. Powers are ontologically dependent on other powers for their individuation, but in that case—given an Aristotelian conception of properties as immanent universals—powers will not be intrinsic on several extant analyses of 'intrinsic', since to possess a given power P requires the existence of other concrete particulars as bearers of the powers that individuate P. Yates suggests several ways for Aristotelians to resolve this tension, but argues that all tenable options involve individuative type-level causal relations between powers. While the individuative relations between powers are internal in the sense that powers are essentially related, this is a different sense of 'internal' to the one that justifies reduction of token causal relations to the intrinsic powers of their relata, and not a sense that supports reducibility of the relations in question.

Causal structuralism is the view that, for each natural, non-mathematical, non-Cambridge property, there is a causal profile that exhausts its individual essence. On this view, having a property's causal profile is both necessary and sufficient for being that property. It is generally contrasted with the Humean or quidditistic view of properties, which states that having a property's causal profile is neither necessary nor sufficient for being that property, and with the double-aspect view, which states that causal profile is necessary but not sufficient. Arguments in favour of causal structuralism primarily focus on problematic consequences of the other two views. In her 'What a Structuralist Theory of Properties Could Not Be', *Nora Berenstain* argues that causation does not provide an appropriate

framework within which to characterize all physical properties. After distinguishing between the causal and the nomological, Berenstain suggests that what is needed is a structuralist view of properties that is not merely causal but incorporates a physical property's higher-order mathematical and nomological properties into its identity conditions. This view retains the naturalistic motivations for causal structuralism while avoiding the problems it faces.

Mathematical structuralism and structural realism about science both take relations to be irreducible. In this respect they both run counter to the prevailing, or at least prominent, view of many influential metaphysicians that relations are ontologically derivative if not eliminable in favour of individuals and their intrinsic properties. In his 'Structuralism and the Metaphysics of Relations', *James Ladyman* adduces some examples of irreducibly relational features of the physical world (including the entangled stated of quantum mechanics) to motivate structuralism and to provide a naturalistic basis for the metaphysics of relations. There are different versions of structuralism depending on how fundamental relations or structure are taken to be, and the nature of the ontological dependence that is posited. Structuralism is often related to the idea that relations can individuate, and to debates about PII and the nature and status of individuality. Ladyman argues that popular forms of argument against the grounding of individuality in relations only work if they also work against grounding individuality in non-relational properties. He goes on to argue that physical structuralism does not imply that all physical systems are ontologically dependent on the whole universe. Monism is motivated, Ladyman contends, only if relations are deemed to be metaphysically problematic on independent grounds.

On Ladyman's view, the world consists of nothing more than relations with no particulars that they relate. Could the world be nothing but structure? In their 'Relations All the Way Down?', *Sebastián Briceño* and *Stephen Mumford* argue that even though there are a number of problems with the standard view of relations accompanied by a particularist ontology, substituting for it a world of pure structure is not progress. A world of pure structure would be no more than a Platonic entity, lacking any resources for concretization. Consequently, there would be no possibility of distinguishing between a world-kind and its concrete instance or instances. A world of pure structure would be metaphysically untenable, but it is also argued that the view has insufficient empirical motivation. The history of science does not support the claim that structure is preserved through theory change nor that the structural components of a theory are extricable from its ontological commitments.

As far as classical physics is concerned, it is possible to trace causal relations between physical objects (i.e. particles in this case) back to intrinsic properties of

these objects (such as their mass and charge). On this view, combined with a powers-based theory of causation, it is arguable that causal relations turn out to be internal instead of external relations. In his 'The Reality of Relations: the Case from Quantum Physics', *Michael Esfeld* argues that the decisive blow to this view comes from quantum physics, with Bell's theorem proving that no dynamics based on the local, intrinsic properties of quantum objects can yield the empirical predictions of quantum mechanics. Nonetheless, Esfeld argues, quantum entanglement by no means implies that we have to abandon an ontology of objects in favour of an ontology of structures. All extant proposals for a quantum ontology of matter in spacetime, Esfeld suggests, are committed to objects, but on these proposals, the dynamics of these objects are determined not by their local, intrinsic properties, but by an holistic property instantiated by all the objects together—that is, a structure that takes all the objects in the universe as its relata. The view set out in this paper thus amounts to combining ontic structural realism with an ontology of objects that can be conceived as substances. This suggestion is illustrated by drawing on the ontology of quantum physics worked out by Bohm and Bell.

In 'Rovelli's Relational Quantum Mechanics, Anti-Monism, and Quantum Becoming', *Mauro Dorato* defends Rovelli's relational interpretation of quantum mechanics (RQM) from some foreseeable objections, so as to clarify its philosophical implications compared to rival interpretations. In particular, Dorato considers whether RQM presupposes a hidden recourse to both a duality of evolutions and of ontology (the relationality of quantum world and the intrinsicality of the classical world, which in the limit must be recoverable from the former). He then concentrates on the pluralistic, anti-monistic metaphysical consequences of the theory, due to the impossibility of assigning a quantum state to the entire universe. Finally, Dorato notes interesting consequences of RQM with respect to the possibility of defining a local, quantum relativistic becoming (in flat spacetimes). Given the difficulties of having the cosmic form of becoming that would be appropriate for priority monism, RQM seems to present an important advantage with respect to monistic views, at least as far as the possibility of explaining our experience of time is concerned.