

# Aristotle on Relations

MA seminar ‘epistemology’, Fribourg

Philipp Blum, December 1, 2017

## Aristotelian change, powers, forms

### Mere appearance vs. the reality of change

Plato is an anti-realist or at least a reductionist about change: change is, or even must be, wholly explainable in terms of unchanging things and is, at least to this extent, only apparent. Aristotle’s world, on the contrary, is fundamentally dynamic: he takes the actuality of qualitative change (from red to non-red), intensification (from slower to faster), growth (from thinner to fatter) and of substantial change (coming to be, ceasing to be) as a datum; on the other hand, he also accepts “ex nihil nihilo fit”: all change is change of something, something happening to something else, i.e. in all change, something must ‘underlie’.

His hylomorphic account of change in terms of an underlying matter changing its form between opposites aspires to reconcile these opposing tendencies by providing a middle way between (i) the atomists who have unchanging things and cannot explain how change emerges from their interaction because they falsely suppose that all change is qualitative and (ii) the Platonists who admit only opposites, and nothing underlying and hence are committed to construe all change as either extrinsic or existential (and hence, given further Parmenidean assumptions, impossible). We are thus drawn into different directions: to satisfy the incompatibility condition on change, we need a succession of two different things; to satisfy the proper subject condition, we need an unchanging thing. If we have only one of them, we do not have change. But do we have change if we have both? We call the first “form”, the latter “matter”. Crucial question: in what sense does changing form + unchanging matter result in changing compound? Two subquestions:

- (i) what are the relations between (i-a) form and the compound, (i-b) matter and the compound, (i-c) form and matter? they must be of the type that underwrites our epistemic right to infer what happens with the compound from (and, more ambitiously, explain it by) what happens with matter and form;
- (ii) in what sense is the situation asymmetric enough to ascribe change to the compound? why do we privilege the change in the form over the constancy in the matter?

“Parthood” as an answer to the first two questions of (i) has problems with (ii). This has to do with it’s not directly answering (i-c), i.e. it’s not giving us a real, direct, relation between the form and the matter. But if the form is not part of compound, in what way is it its form?

Aristotelian dynamics operates with a crucial, but unfortunately quite opaque, distinction between two modes of being: potentiality, power or ground of possibility – *dunamis* – on the one side, and actuality, realisation or reality – *energeia* – on the other. Though the distinction is supposed to have a much more general application (and its difficulty is partly due to its very high degree of generality), perhaps the clearest case of the *dunamis/energeia* distinction is the relation between a capacity for change and the changes to which it gives rise. All change is due to a capacity for change, a *dunamis*: what there is constrains what must have been possible. Conversely, some *dunamis* also explains the *energeia* it is a *dunamis-for*: what can be constrains what there is. Even in this perhaps simplest case, however, the distinction is *not* the one we are perhaps more familiar with between a disposition (dispositional property, ‘potentiality’, ‘power’) like *fragility* and its manifestation, the shattering of a particular glass. *Dunamis* and *energeia* are correlative, and the *dunamis* by itself explains or grounds its actualisation. Neither does Aristotle have a simple counterfactual analysis: the *dunamis* is not what a thing would be under such-and-such circumstances, but a way the thing is in the here and now.<sup>1</sup>

---

1. As with the matter/form distinction, the issue is further complicated by the fact that this distinction too is relative: something may, e.g., have a *dunamis* to have another *dunamis*.

Aristotle's realism about change is also a realism about our perception of it: when we start to see the redness of the rose, we become related to redness – in a similar, though different way in which the rose becomes related to redness when it itself becomes red. Cashing out the sense in which redness figures in its perceiver not just apparently, but really, is in my view one of the hardest problems of Aristotle exegesis.

## Aristotelian powers

The actualisation of an Aristotelian power depends on contact (*thixei*, *Phys.* 202a5-9) with its correlative power, on which it is existentially dependent (the power to heat is activated when its bearer is in contact with something heatable). Powers are thus relative, but not for this reason relations: the power to heat, e.g., is ontologically dependent on the power to be heated (if the second were not to exist, neither would the first, and vice versa), but this dependence is grounded in some of its monadic properties. The power to heat and the power to be heated can only exist (i.e., for Aristotle: be exemplified) together, but not because they are de-relativisations of a conceptually and ontologically prior '*x* heats *y*' relation, but primitively so.

When the activation conditions are fulfilled, the activation follows by natural necessity: *unless something external interferes* and *for the most part*, both the active and the passive powers become activated. When the resulting powers are different from those activated (but also: only then), we have change. When the active and the passive power come together, they become activated. This mutual activation of the powers *is* causation (rather than: has a causal effect):

The interdependence of the relative powers translates into their mutual *qualitative transition* to exercising their powerfulness, which is what their causal interaction consists in. (Marmodoro 2014: 34)

In this causal interaction, Aristotle says, we have a transmission of a form from the active to the passive power (or rather: from the thing exercising the active power to the thing (possibly itself, but *qua* another) exercising the passive power). The transmitted form is then the "principle or cause" (*arche* or *aition*) of the motion (*kinesis*) (*Phys.* 202a9-12). Even though causation is symmetric (it is the joint activation of correlative powers), the form is transmitted *from* the one *to* the other, though Marmodoro stresses that this is just a figurative way of talking (though also admitting that we cannot explain *for what* it is a metaphor):

The transference of the form of the active power to the passive one is not a description of the mechanism of causal efficacy, but only of the type of qualitative change that takes place in the passive power. Aristotle has identified a ground-level activity that cannot be explained by more primitive ontological tools. (Marmodoro 2014: 37)

While it is, in her view, inexplicable (and only metaphorically expressible), the 'transmission of form' has to be itself a process, which takes time and may be interrupted before it is completed: the change is thus the *gradual* reception of the form by the passive power (i.e.: the activation of a thing's power to receive the form), itself a process.

Presumably, Marmodoro's reason not to think that powers are extrinsically individuated is that their *telos*, the form they are able to 'transmit', is 'given' (specified? determined?) by their activation partners, the correlative passive powers, to which they stand in a relation of ontological dependence which is not a relation. This is certainly true, but not a sufficient reason. For they also also intimately related to their passive powers in another way: when power  $p_1$  becomes activated together with its passive correlate  $p_2$ , the process (or activity) which is the activation of  $p_1$  *is* (the very same thing as) the activation of  $p_2$ . Aristotle even says that this "sameness-in-actuality" *grounds* the ontological dependence:

**Since** the actualities of the sensible object and of the sensitive faculty are one in actuality, while different in their modes of being, actual hearing and actual sounding appear and disappear from existence at one and the same moment, and so actual savor and actual tasting, etc., while as potentialities one of them may exist without the other. (*DA* 426a15-21, cited in Marmodoro (2014: 44), emphasis added)

## Aristotelian forms

When presenting his own account of change in *Physics* I.7, Aristotle first distinguishes between the (processes of) coming-to-be of simple things and the (processes of) coming-to-be of complex things:

ἔστι γὰρ γίγνεσθαι ἄνθρωπον μουσικόν, ἔστι δὲ τὸ μὴ μουσικὸν γίγνεσθαι μουσικὸν ἢ τὸν (190a.) μὴ μουσικὸν ἄνθρωπον ἄνθρωπον μουσικόν. ἀπλοῦν μὲν οὖν λέγω τὸ γιγνόμενον τὸν ἄνθρωπον καὶ τὸ μὴ μουσικόν, καὶ ὃ γίγνεται ἀπλοῦν, τὸ μουσικόν· συγχείμενον δὲ καὶ ὃ γίγνεται καὶ τὸ γιγνόμενον, ὅταν τὸν μὴ μουσικὸν ἄνθρωπον φῶμεν γίγνεσθαι μουσικὸν ἄνθρωπον. (189b34-190a5)

We can say the man becomes musical, or what is not-musical becomes musical, or the not-musical man becomes a musical man. Now what becomes in the first two cases – man and not-musical – I call simple, and what each becomes – musical – simple also. But when we say the not-musical man becomes a musical man, both what becomes and what it becomes are *complex*. (Aristotle 2014: 717–718)

A man can come to be knowing music, and also the not knowing music can come to be knowing music, or the not knowing music man a man knowing music. I call the man and the not knowing music simple coming-to-be things, and the knowing music a simple thing which comes to be. When we say that the not knowing music man comes to be a knowing music man, both the coming-to-be thing and that which comes to be are compound. (Aristotle 1992: 15)

When Socrates becomes musical (by, e.g., learning how to play the flute), we have three changes:

1. from *anthropon* to *musikon*;
2. from *mē musikon* to *musikon*; and
3. from *mē musikon anthropon* to *musikon anthropon*

Changes of type (2) are changes *out of* something: musical comes out of non-musical. But changes of type (1) and (3) are not: it is the man who becomes a musician and the non-musical man who becomes a musical man, but we cannot say that the musician comes out of the man, nor can we say that the musical man comes out of the non-musical man. (1) and (2) are distinguished by the fact that in (1), but not in (2), the ‘coming-to-be thing’ (i.e. the thing that is changing) ‘remains’. What we designated by “anthropon” at the beginning of the change is still there at the end of it, and can now also be designated by “musikon”; the lack of musical ability in virtue of which we applied “ignorant of music”, however, is no longer there.

The change reported in (3) is thus shown to have two aspects: one of constancy, exhibited in (1), where one and the same thing persists through change and acquires a new quality; but also one of variation, exhibited in (2), where one thing (ignorance of music) is replaced by something else (musicality) which comes out of it. It is a change not only of coming to be, but of coming to be-such-and-such, i.e. exhibits not just that the change in question is a substantial change (as the other two), but *also* that it is a qualitative change.<sup>2</sup>

Aristotle continues by saying that this underlying thing is ‘one in number’, but not ‘one in form’:

οὐ γὰρ ταῦτόν τὸ ἀνθρώπου καὶ τὸ ἀμούσῳ εἶναι. καὶ τὸ μὲν ὑπομένει, τὸ δ' οὐχ ὑπομένει· τὸ μὲν μὴ ἀντικείμενον ὑπομένει (ὃ γὰρ ἄνθρωπος ὑπομένει), τὸ μὴ μουσικὸν δὲ καὶ τὸ ἀμούσον οὐχ ὑπομένει, οὐδὲ τὸ ἐξ ἀμφοῖν συγχείμενον, οἷον ὁ ἀμούσος ἄνθρωπος. (190a17-21)

For to be a man is not the same as to be unmusical. One part survives, the other does not: what is not an opposite survives (for the man survives), but not-musical or unmusical does not survive, nor does the compound of the two, namely the unmusical man. (Aristotle 2014: 719)

The being of a man is not the same as the being of ignorant of music; [a]nd the one remains and the other does not. That which is not opposed remains – the man remains – but the not knowing music and the ignorant of music do not remain, and neither does the compound of the two, the ignorant of music man. (Aristotle 1992: 16)

The underlying thing is ‘one in number’ (i.e. numerically one, one in reality) because the change can be completely characterised by (1), where nothing goes out of existence. It is ‘two in form’ or (Aristotle says: equivalently) ‘two in account’ because the change is between opposites, as nothing is preserved in (2). The result of the change in (3) is complex because it is one thing to be a man and another thing to know music. It is, however, still one thing that results from the change and one thing that enters into it, because being a man and being ignorant of music (or, after the change, being musical) are one “in reality” or “in fact”.

Aristotle says that *mē musikon* and *musikon* are opposites and that they are the forms of the thing that comes to be, *musikon anthropon*. We have translated “musikon” as all of: “musical”, “musician”, “having musical knowledge” and “musicality” – these four correspond to four different views on the ontology of forms, *none* of which seems to be Aristotle’s:

“**musical**” – the bare adjective – is perhaps the best, but it misleadingly suggests that forms are qualitative features in-abstracto, especially when used, as “musikon” is in Greek, with the definitive article: “ton musikon” then becomes “the musical”, which is too close to “musicality” to be acceptable.

“**musician**” is better insofar as it may be used to designate, as expressions for forms can in Aristotle’s Greek, the man over there who possess musical abilities, Socrates. It also matches with “man”, avoiding the very misleading connotation that in change (i) Socrates changes into a quality. The problem is that it is not

2. Can we speak of (1), (2) and (3) as three *changes*, jointly ‘making up’ the change of Socrates’ becoming musical? If so, Aristotle would be saying that substantial change is prior to qualitative change in the following sense: every qualitative change is ‘composed’ or ‘made’ out of simpler existential changes (which shouldn’t be called “substantial”, because they may involve only forms, as does (2)).

generally available: there is no expression in English that stands to “white” or “pale” (i.e. not sunburnt, one of Aristotle’s favourite examples) in the way “musician” stands to “musical”.

“**having musical knowledge**” or, more generally, expressions of the form “being  $F$ ”, “having the property of being  $F$ ” are generally available, but they are not things that can be destroyed and can come into being in the way Aristotelian forms can.

“**musicality**” has the advantage that it allows for two readings, as universal and as trope as we would say nowadays, and that it may cease to be and come into being when read in the latter way (as it is in “Socrates’ musicality”); but it has the important disadvantage that we must settle on one reading and thereby prejudge the difficult question how to interpret *Metaphysics Z*, where Aristotle discusses the question in what ways forms are not only universal but also particular, a question he does not take to be decided by their verbal expressions alone.

An additional problem is the following: it has been widely discussed, especially in the medieval commentary tradition, whether Aristotelian forms are individuating, whether the form of Socrates is ‘specific’ enough to individuate him, i.e. whether it is such that no other thing does, or even could, share with Socrates its form. All of the proposed translations decide this question, the first three and the first version of the fourth positively, the second, trope, version of the fourth negatively. The question, however, should be left open: it is questionable whether it can be answered by what Aristotle says about forms at all, but it should certainly not already be answered by his official introduction of the term.

## The problem of relations

### The contemporary discussion

The most important specificity of relations, in cases where we have at least a *prima facie* reason to believe in their existence, is their multiple adicity, the fact that they ‘involve’ more than one particular. This gives rise to what I will call “the problem of converses”. That there are two relational properties whenever a dyadic relation is exemplified, leads us directly to the problem of converses. The converse of a binary relation is normally taken to be the unique relation that holds between the same particulars in the other direction. There are two roads to its acceptance: the first one starts from the given binary relation  $R$  and defines the converse as the unique relation that holds in the other direction – this is the route chosen by Russell and Whitehead in the *Principia*: the converse of  $R$  is defined as the unique relation  $\check{R}$  which holds between  $x$  and  $y$  iff  $R$  holds between  $y$  and  $x$  (Russell 1901c: 316, §1.7).<sup>3</sup> This operational conception of converses leaves it open whether the operation  $X \mapsto \check{X}$  is total. It may, for example, not be defined for relations without sense or direction.<sup>4</sup>

A different route starts from the relational fact itself, identifies by analysis the relational properties exemplified and asks about their status. In the same way, it is then argued, the property of being  $R$ -related to  $b$  is derived from and posterior to the relation  $R$ , the property of being such that  $a$  is  $R$ -related to it is derived from and posterior to the relation  $\check{R}$ . Sensible questions may then be asked about the relations  $R$  and  $\check{R}$ , which may or may not be identical, but are assured to exist in all cases.<sup>5</sup>

It is under this second, abstractionist, perspective that reflexive relations are particularly problematic with respect to their converses. The problem of converses arises because relations have ‘senses’: it has three aspects

**Problem 1** : ontological profligacy.

“If a book is on a table, *on the table* is a relational character truly predicable of the book. But this is inseparable from another relational character predicable not of the book but of the table. How are these two relational characters connected with each other? We may be tempted to say that the difference between them is purely verbal, so that, whether we say the *book is on the table* or the *table is under the book*, we are merely expressing the same fact in different language. But this cannot be true; for *being on* is different from *being under*; killing from being killed; loving from being loved. Yet it is plain that a single indivisible fact is referred to whether we say that the book is on the table or that the table is under the book.” (Stout 1940: 121)

3. Cf. also Schröder (1895: 30), and (Whitehead & Russell 1910: 32). Given the definition of the *Principia*, it can be proved that every relation has a converse (1925: 238–239, \*31.13). The same definition of converse was given by 1892: 246.

4. Russell (1901a: 48/307) says that distance is a symmetrical relation without sense.

5. I think this may plausibly be taken to be Russell’s position in the *Principles*: That every relation has a converse is taken by Russell (1903: 25, §28) to be a primitive proposition, where he defines symmetrical relations as those identical to their converses. Russell (1903: 44, §48) uses the same language, saying that in a relational proposition we may regard either one of the terms as the logical subject. It may also be Maccoll’s conception, who calls converse relations ‘reciprocal’ and claims that relations are synonymous with their converses (1902: 359).

“...it is hard to see how the state  $s$  might consist *both* of the relation *on top of* in combination with the given relata and of the relation *beneath* in combination with those relata. Surely if the state is a genuine relational complex, there must be a *single* relation that can be correctly said to figure in the complex in combination with the given relata.” (Fine 2000: 4)

**Problem 2** : indeterminacy. How can it be, Ramsey (1925: 14, 406) asked in the spirit of Leibniz’s quote above, that  $(\lambda x(aRx))b$ ,  $(\lambda y(yRb))a$  and  $(\lambda x, y(xRy))(a, b)$  represent (are logical forms of) the same proposition, given that they have different components? If they represent the same proposition, and stand for the same fact, however, what are their constituents? If relations are different from their converses, what could give us a reason to take one, but not the other, to be a constituent of a relational fact?

It is not just multiplication of entities that is at stake. Another problem is indeterminacy, both ontological and semantical. Armstrong (1997: 91), e.g., claims that  $\tilde{R}$  is not an increase in being, for every state of affairs containing it is identical with one containing just  $R$ . He does not tell us, however, which of the two relations is a constituent of this state of affairs. Williamson (1985) asks us to imagine two languages  $L'$  and  $L''$ , both differing from our language  $L$  only by inverting the order of arguments following  $R$  and by replacing  $R$  by its converse  $\tilde{R}$  respectively. By hypothesis, we cannot distinguish between  $L'$  and  $L''$ . If relations were different from their converses, we could never distinguish our language from either  $L'$  or  $L''$  – we would never be able to know what our relational expressions are standing for. In both cases, the natural reaction is to say that there is no real question because for any relation  $R$ ,  $R$  and  $\tilde{R}$  are identical.<sup>6</sup> But how can they be identical, if they apply to the same relata only if these are respectively taken to be in different orders?

**Problem 3** : regress.

“...when we analyze them, *greater* obviously differs from *less*; thus the two propositions [“ $A$  is greater than  $B$ ” and “ $B$  is less than  $A$ ”] seem to be composed of different constituents, and therefore to be necessarily distinct. To deny that they are distinct, it would be necessary to hold that both *greater* and *less* enter into each proposition, which seems obviously false, or else to hold that what really occurs is neither of the two, but that third abstract relation of which Leibniz speaks [...]. In this case, the difference between *greater* and *less* would be one involving reference to the terms  $A$  and  $B$ . But this view cannot be maintained without circularity: for neither the greater nor the less is inherently the antecedent, and we can only say that, when the greater is the antecedent, the relation is *greater*, when the less, *less*.” (Russell 1901a: 41/300)

G.F. Stout (1940) puts the problem very clearly:

If a book is on a table, *on the table* is a relational character truly predicable of the book. But this is inseparable from another relational character predicable not of the book but of the table. How are these two relational characters connected with each other? We may be tempted to say that the difference between them is purely verbal, so that, whether we say the *book is on the table* or the *table is under the book*, we are merely expressing the same fact in different language. But this cannot be true; for *being on* is different from *being under*; killing from being killed; loving from being loved. Yet it is plain that a single indivisible fact is referred to whether we say that the book is on the table or that the table is under the book. (1940: 121)

In his seminal paper “Neutral Relations”, Kit Fine puts the worry the following way:

...it is hard to see how the state  $s$  might consist *both* of the relation *on top of* in combination with the given relata and of the relation *beneath* in combination with those relata. Surely if the state is a genuine relational complex, there must be a *single* relation that can be correctly said to figure in the complex in combination with the given relata. (2000: 4)

As Castañeda has remarked *à propos de* Plato (*Phaedo*, 102 b7-c4),  $a$ ’s having  $R$  to  $b$  and  $b$ ’s having  $\tilde{R}$  to  $a$  are better thought of as two *prongs* of one state of affairs.<sup>7</sup> If we reduce  $a$ ’s having  $R$  to  $b$  to  $a$ ’s having the property *having  $R$  to  $b$*  and  $b$ ’s having the property *having  $\tilde{R}$  to  $a$* , we have reduced the relation to two *different* properties, which are bound together by a “law of joint exemplification” (Castañeda 1972: 470). What is the ontological ground of such a necessary connection between distinct (non-overlapping) entities (cf. Grossmann 1983: 161)?

6. Cf. Williamson (1985: 249) and Armstrong (1978: 42). Williamson’s argument presupposes that relations are individuated by the semantical roles of expressions standing for them.

7. “The sentence “Simmi is taller than Socrates” does not reveal the truth it expresses perspicuously, because this sentence mentions only one Form, tallness, whereas the truth or fact in question involves two Forms, tallness and shortness.” (Castañeda 1972: 469) Grossmann (1983: 158, 161) interprets this as smuggling in coordination of relational properties, but I think Castañeda is more charitably interpreted as appealing to thematic rôles (cf. below).

## The problem in Leibniz

Famously, Leibniz argued in his correspondence with Clarke that relations, if they existed, would be “in two subjects, with one leg in one, and the other in the other, which is contrary to the notion of accidents”<sup>8</sup>

Take, again, Othello’s loving Desdemona. The fundamental fact making true the relational predication is the exemplification, by the mereological sum of Othello and Desdemona, of the structural property of loving. Because the mereological sum is not simple, the structure imposed on the whole, i.e. what Russell calls the ‘form’ of the complex, is further analysable as the exemplification, by Othello and Desdemona respectively, of the two relational properties I have called “rôles” of *loving Desdemona* and *being loved by Othello*. The exemplification of these two properties is grounded in the exemplification of the metaphysically prior structural property of loving.

We may, following Leibniz, describe the relational complex on this non-fundamental level of analysis by “Othello loves in so far as Desdemona is loved” or “Othello loves and eo ipso Desdemona is loved”. This analysis has three parts:

- (i) it ascribes to Othello the relational property of loving Desdemona and the non-relational property of loving (ie. loving someone, being a lover);
- (ii) it ascribes to Desdemona the relational property of being loved by Othello and the non-relational property of being loved (ie. being loved by someone, being someone beloved);
- (iii) it ascribes to the facts stated by (i) and (ii) the relation making true claims such as “*p* in so far as *q*” or “*p* and eo ipso *q*”.

This three-pronged analysis allows us to keep what is right in the alternative accounts:

- In this sense of (i) and (ii), we may say, with Fine, that the asymmetric relation *R* distinguishes between two parts of the sum that exemplifies it by coordinating them with different things, e.g. lovers and beloved ones. This allows us to say that Othello, Don José and Abelard, say, have something in common: they are lover parts of fusions exemplifying the neutral amatory relation.
- In this sense of (i) and (ii), we may say, with the positionalist, that this difference between Othello and Desdemona, as parts of the relational complex, is due to their playing different rôles, ie. entering into this complex in different ways – as lover and as beloved respectively.
- The “*p* in so far as *q*” and “*p* and eo ipso *q*” locutions express that “*p*” and “*q*” have the same fundamental truthmaker.<sup>9</sup>

## The problem in Plato

46 years ago, Hector-Neri Castañeda discovered an interesting theory of relations in Plato’s *Phaedo*, 102B7-C4, which a year later and in English, he characterises it as follows:

The sentence ‘Simmias is taller than Socrates’ does not reveal the truth it expresses perspicuously, because this sentence mentions only one Form, tallness, whereas the truth or fact in question involves two Forms, tallness and shortness. This is in a nutshell my exegesis of the passage. [...] *Phaedo* 102C1-D1 iterates the previous points and adds a third one: Tallness and Shortness are structured (Πρὸς) by a law of joint instantiation: a simple relational fact involving taller-than is a two-pronged fact. (Castañeda 1972: 469, 470)

The multi-pronged fact ascribes to several particulars a ‘chain of universals’.

8. “...en deux sujets, qui auroit une jambe dans l’un, et l’autre dans l’autre, ce qui est contre la notion des accidens.” (Leibniz’s fifth letter to Clarke, 1890: 401 (translations: 1956: 71 and 1989: 339)).

9. Mates (1986: 216) is right about this, though wrong in taking truthmaking to be implication (or rather: entailment): “[Paris is a lover, and eo ipso Helen is a loved one]” tells us that those “facts” or individuals-cum-accidents that make “Paris is a lover” true also make “Helen is a loved one” true; presumably, if those facts were more narrowly described, the resulting propositions [...] would actually imply that Paris loves Helen.”

## References

- Annas, Julia, 1976. *Aristotle: Metaphysics, Books M and N*. 1 edition. Clarendon Aristotle Series, ed. J.L. Ackrill and Lindsay Judson, Oxford: Clarendon Press. Translated with introduction and notes; second edition: [Annas \(1988\)](#).
- Annas, Julia (editor), 1988. *Oxford Studies in Ancient Philosophy*, volume 6. Oxford: Clarendon Press.
- Aristote, 1993. *Physics, Book III and IV*. 2 edition. Clarendon Aristotle Series, ed. J.L. Ackrill and Lindsay Judson, Oxford: Clarendon Press. Translated by Edward Hussey.
- Aristoteles, 1984. *The Complete Works of Aristotle – The Revised Oxford Translation, Bollingen Series, LXXI.2*, volume 2. Princeton, New Jersey: Princeton University Press. New edition: [Aristotle \(2014\)](#).
- Aristotle, 1924. *Metaphysics*. Oxford: Clarendon Press. Translated by W.D. Ross, reprinted in [Aristoteles \(1984: 1552–1728\)](#).
- Aristotle, 1992. *Physics, Books I and II*. 2 edition. Clarendon Aristotle Series, ed. J.L. Ackrill and Lindsay Judson, Oxford: Clarendon Press. Translated by William Charlton.
- Aristotle, 2014. *The Complete Works of Aristotle – The Revised Oxford Translation*. Princeton, New Jersey: Princeton University Press.
- Armstrong, David M., 1978. *A Theory of Universals: Universals and Scientific Realism, Volume II*. Cambridge: Cambridge University Press.
- Armstrong, David M., 1997. *A World of States of Affairs*. Cambridge: Cambridge University Press.
- Beckmann, Jan Peter, 1967. *Die Relationen der Identität und Gleichheit nach Johannes Duns Scotus: Untersuchungen zur Ontologie der Beziehungen*. Number 44 in *Abhandlungen zur Philosophie, Psychologie und Pädagogik*, Bonn: Bouvier Verlag.
- Castañeda, Hector-Neri, 1972. Plato's Phaedo Theory of Relations. *The Journal of Philosophical Logic* 1(3–4): 467–480.
- Fine, Kit, 2000. Neutral Relations. *The Philosophical Review* 109(1): 1–33.
- Grossmann, Reinhardt Siegbert, 1983. *The Categorical Structure of the World*. Indianapolis, Indiana: Indiana University Press.
- Jansen, Ludger, 2006. Aristoteles' Kategorie des Relativen zwischen Dialektik und Ontologie. In Meixner, Uwe & Albert Newen (editors) *Geschichte der Ontologie und ein Schwerpunkt zu Plato*. Number 9 in *Logical Analysis and History of Philosophy*, Paderborn: Mentis Verlag.
- Johnson, W.E., 1892. The Logical Calculus. II. *Mind* 1(2): 235–250.
- Leibniz, Gottfried Wilhelm, 1890. *Die philosophischen Schriften von Gottfried Wilhelm Leibniz*, volume 7. Berlin: Weidmannsche Buchhandlung. Edited by C.J. Gerhardt; reprint: [Leibniz \(2008\)](#).
- Leibniz, Gottfried Wilhelm, 1989. *Philosophical Essays*. Indianapolis, Indiana: Hackett Publishing Co. Edited and translated by Roger Ariew and Daniel Garber.
- Leibniz, Gottfried Wilhelm, 2008. *Die philosophischen Schriften von Gottfried Wilhelm Leibniz*. Hildesheim: Georg Olms Verlagsbuchhandlung. Reprint of the Gerhardt edition in 7 volumes.
- Leibniz, Gottfried Wilhelm & Samuel Clarke, 1956. *The Leibniz-Clarke Correspondence*. Manchester: Manchester University Press. Edited by Hubert G. Alexander.
- MacColl, Hugh, 1902. Symbolic Reasoning IV. *Mind* 11(43): 352–368.
- Marmodoro, Anna, 2014. *Aristotle on Perceiving Objects*. Oxford: Oxford University Press.
- Martin, Gottfried, 1938. *Wilhelm von Ockham: Untersuchungen zur Ontologie der Ordnungen*. Habilitationsschrift, Universität zu Köln, Köln.
- Martin, Gottfried, 1949. *Wilhelm von Ockham: Untersuchungen zur Ontologie der Ordnungen*. Berlin: Walter de Gruyter. Book publication of [Martin \(1938\)](#).
- Mates, Benson, 1986. *The Philosophy of Leibniz: Metaphysics and Language*. Oxford: Oxford University Press.
- Ramsey, Frank Plumpton, 1925. Universals. *Mind* 34(136): 401–417. Reprinted in [Ramsey \(1931: 112–137\)](#) and in [Ramsey \(1978: 17–39\)](#), cited after reprint in [Ramsey \(1990: 8–30\)](#).
- Ramsey, Frank Plumpton, 1931. *The Foundations of Mathematics and other Logical Essays*. London: Routledge & Kegan Paul. Edited by R.B. Braithwaite.
- Ramsey, Frank Plumpton, 1978. *Foundations: Essays in Philosophy, Logic, Mathematics and Economics*. London: Routledge & Kegan Paul. Edited by D.H. Mellor.
- Ramsey, Frank Plumpton, 1990. *Philosophical Papers*. Cambridge: Cambridge University Press. Edited by D.H. Mellor.
- Russell, Bertrand Arthur William, 1901a. On the Notion of Order. *Mind* 10(37): 30–51. Reprinted in [Russell \(1993: 291–309\)](#).
- Russell, Bertrand Arthur William, 1901b. Recent Work on the Principles of Mathematics. *The International Monthly* 4: 83–101. Republished as “Mathematics and the Metaphysician” in [Russell \(1917: 74–96\)](#).

- Russell, Bertrand Arthur William, 1901c. Sur la Logique des relations avec des applications à la théorie des séries. *Rivista di matematica* 7(1-3): 115-148. Translated by R.C. March, with corrections by Russell, as [Russell \(1956\)](#) and reprinted in [Russell \(1993\)](#): 314-349).
- Russell, Bertrand Arthur William, 1903. *The Principles of Mathematics*. Cambridge: Cambridge University Press. 2nd edition: [Russell \(1937\)](#).
- Russell, Bertrand Arthur William, 1917. *Mysticism and Logic*. London: George Allen & Unwin. Second edition of ?.
- Russell, Bertrand Arthur William, 1937. *The Principles of Mathematics*. 2 edition. London: George Allen & Unwin.
- Russell, Bertrand Arthur William, 1956. The Logic of Relations. In *Logic and Knowledge: Essays, 1901-1950*, pp. 1-38. London: George Allen & Unwin. Translation of [Russell \(1901b\)](#).
- Russell, Bertrand Arthur William, 1993. *Towards the Principles of Mathematics*. Number 3 in The Collected Papers of Bertrand Russell, The McMaster University Edition, London: Routledge. Edited by Gregory H. Moore.
- Scaltsas, Theodore, 1990. Is a Whole Identical to its Parts? *Mind* 99: 583-598.
- Schröder, Ernst, 1890. *Vorlesungen über die Algebra der Logik (Exakte Logik)*, volume 1. Leipzig: B.G. Teubner. Reprint in [Schröder \(1966\)](#).
- Schröder, Ernst, 1891. *Vorlesungen über die Algebra der Logik (Exakte Logik)*, volume 2. Leipzig: B.G. Teubner. Reprint in [Schröder \(1966\)](#).
- Schröder, Ernst, 1895. *Vorlesungen über die Algebra der Logik (Exakte Logik)*, volume 3. Leipzig: B.G. Teubner. Reprint in [Schröder \(1966\)](#).
- Schröder, Ernst, 1905. *Vorlesungen über die Algebra der Logik II, 2. Abteilung*. Leipzig: B.G. Teubner. Herausgegeben von E. Müller, wiederabgedruckt in [Schröder \(1966\)](#).
- Schröder, Ernst, 1966. *Vorlesungen über die Algebra der Logik*. New York: Chelsea. Reprint of [Schröder \(1890, 1891, 1895, 1905\)](#).
- Stout, George F., 1940. Things, Predicates and Relations. *Australasian Journal of Psychology and Philosophy* 18(2): 117-130.
- Whitehead, Alfred North & Bertrand Arthur William Russell, 1910. *Principia Mathematica*, volume 1. Cambridge: Cambridge University Press. 2<sup>nd</sup> ed. : [Whitehead & Russell \(1925\)](#), abridged as [Whitehead & Russell \(1956\)](#).
- Whitehead, Alfred North & Bertrand Arthur William Russell, 1912. *Principia Mathematica*, volume 2. Cambridge: Cambridge University Press. 2<sup>nd</sup> ed. : [Whitehead & Russell \(1927a\)](#), abridged as [Whitehead & Russell \(1956\)](#).
- Whitehead, Alfred North & Bertrand Arthur William Russell, 1913. *Principia Mathematica*, volume 3. Cambridge: Cambridge University Press. 2<sup>nd</sup> ed. : [Whitehead & Russell \(1927b\)](#), abridged as [Whitehead & Russell \(1956\)](#).
- Whitehead, Alfred North & Bertrand Arthur William Russell, 1925. *Principia Mathematica*, volume 1. 2 edition. Cambridge: Cambridge University Press. 1<sup>st</sup> ed. : [Whitehead & Russell \(1910\)](#), abridged as [Whitehead & Russell \(1956\)](#).
- Whitehead, Alfred North & Bertrand Arthur William Russell, 1927a. *Principia Mathematica*, volume 2. 2 edition. Cambridge: Cambridge University Press. 1<sup>st</sup> ed. : [Whitehead & Russell \(1912\)](#).
- Whitehead, Alfred North & Bertrand Arthur William Russell, 1927b. *Principia Mathematica*, volume 3. 2 edition. Cambridge: Cambridge University Press. 1<sup>st</sup> ed. : [Whitehead & Russell \(1913\)](#).
- Whitehead, Alfred North & Bertrand Arthur William Russell, 1956. *Principia Mathematica to \*56*. Cambridge: Cambridge University Press. Abridged second edition ([Whitehead & Russell 1925, 1927a, b](#)); first edition: [Whitehead & Russell \(1910, 1912, 1913\)](#).
- Williamson, Timothy, 1985. Converse Relations. *The Philosophical Review* 94: 249-262.