

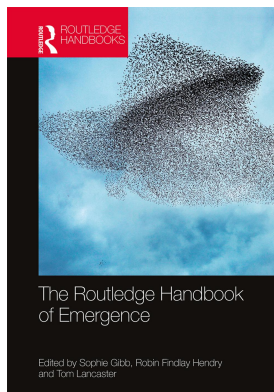
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DEPENDENCE

Paul Noordhof

Dependence is the most general notion under which a host of familiar metaphysical relations between entities – causation, supervenience, grounding, realisation, etc. – fall. In the first section of this chapter, I will offer some preliminary clarifications to outline the territory in a little more detail. Some years back, this would have primarily involved differentiating kinds of dependence in terms of the strength of the modal operators used and the other details of an analysis deploying them. Now, there has been a proliferation of non-purely modal accounts of dependence. The second section identifies the various reasons that have been offered for this proliferation. The third section discusses a notion of ontological dependence and grounding, each of which draws on an appeal to the essence of the depending, or depended upon, entities. In spite of their popularity, we will see that such notions are of little assistance in capturing a central case of interest to us: the proper understanding of emergence. In the light of this, the fourth section defends a purely modal treatment of some of the problem cases outlined in the first section and also discusses a non-modal notion of construction. I close with a hypothesis that the combination of three features, a non-dependence account of fundamentality, various notions of construction and purely modal properties, remove the motivation for appeal to an independent account of grounding in this, and perhaps any, area.

Clarification of the territory

Three preliminary clarifications are needed. First there is a distinction between necessary dependency and sufficient dependency. For entities F and G , G is *sufficient dependent* on F if and only if the existence or instantiation of F is sufficient in a to-be-further-specified respect for the existence or instantiation of G . In many cases, this will mean that the existence or instantiation of G is necessary in the same to-be-further-specified respect for the existence or instantiation of F . In which case, F is *necessary dependent* upon G . In recognising this connection between sufficient dependency and necessary dependency, we are not assuming that dependency is a non-symmetric relation against those who hold it is an asymmetric one. The point is just that there are these distinct types of dependency. Many familiar characterisations of dependency relation – for example, supervenience and grounding – have focused on sufficient dependence relations (e.g. see Fine (2012), pp. 37–40). Nevertheless, necessary dependence relations are important manifestations of dependence too: an entity upon which something, an F , is necessary dependent is something

whose absence is sufficient for the absence of F. E. J. Lowe, amongst others, has focused on this idea of dependence (Lowe (1998), pp. 136–141).

The second clarification concerns dependency as a general, neutral term and dependency as a particular minimal kind of relationship. Dependency relations include grounding, supervenience and so forth. The use of ‘dependency’ in the last sentence is the general neutral term for these different kinds of relations. However, dependency is also used to characterise the minimal way in which there is a connection between the instantiation of two properties, for example. Often, the latter is characterised modally. Other notions of dependency – such as supervenience or grounding – are constructed from, or given additional characteristics to, this more minimal notion. The use of ‘dependence’ here is not neutral about what dependency relation is being referred to. For example, whereas it would be incorrect to characterise dependency in the neutral sense earlier as non-symmetric because grounding, for example, is taken to be an asymmetric relation, the second minimal sense of dependency is *non-symmetric*. If F depends upon G, it does not follow that either G does not depend upon F or that G does depend upon F.

A third preliminary clarification relates to the strength of the dependence relation involved. Some philosophers distinguish at the outset between a particular kind of dependence relation often dubbed ontological or metaphysical dependence from sometimes nomic, sometimes causal dependence. They take our present topic to be metaphysical dependence (e.g. Fine (1995), pp. 270–271; Lowe [1998], pp. 136–137). The sharper focus may be the outcome of theorising, but it should not be a starting point. After all, others have begun with causation as the obvious model for dependence relations (e.g. Kim (1984), p. 53). The exact relationship between metaphysical dependence and nomic dependence is open for debate – especially if, for example, you are drawn to a powers ontology, as we shall discuss later. So it is better to consider dependence to be a more general category under which these potentially different kinds of dependence relationships may hold.

There may be different sets of sufficient conditions for the target entity. For a property G, say, possible sufficient conditions are F_1, F_2, F_3 . Suppose that the F properties are complex properties: $F_1 = M_1 \ \& \ M_2, F_2 = M_3 \ \& \ M_4, F_3 = M_5 \ \& \ M_6$. Then a necessary condition of one of these sufficient conditions will not be necessary for the target entity. Relative to a particular sufficient condition holding, though, the target entity will be necessary dependent upon particular components of these nomic sufficient conditions. Call this notion *relative necessary dependence*. In this sense, for example, G is relative necessary dependent upon M_1 .

Metaphysical and nomic dependence relations keep the conditions backing these dependence relations fixed. For example, in the case of nomic dependence, the same laws are assumed to hold. To cover the case of nomic dependence arising from how things are arranged at the start of the universe, the initial conditions may be assumed to be fixed too. It is plausible that this will cover the case of dependence between effects of a common cause. However, the dependence relation between cause and effect is one for which it is not the case that the dependence conditions are kept fixed, certainly not in a deterministic universe (Lewis (1973), pp. 13–19). To consider whether a candidate effect is present in the absence of a cause, there will be at least some cases in which we are evaluating circumstances in which the laws are a little different (or the particular matters of fact are) in order for the cause to be absent. Thus, Peter Simons was incorrect to suggest that causal dependence just involved a weaker sense of must than metaphysical dependence, although, setting aside the powers ontology, this is more plausible for the case of nomic dependence (Simons (1987), p. 295). So, there is what we may call *variable condition dependence* of which causation is the most familiar example.

As a sketch of the territory ahead, within the context of the clarifications already made, I provide the following diagram (Figure 2.1). I have left off relative necessary dependence and kindred notions because they will not detain us in the discussion ahead.

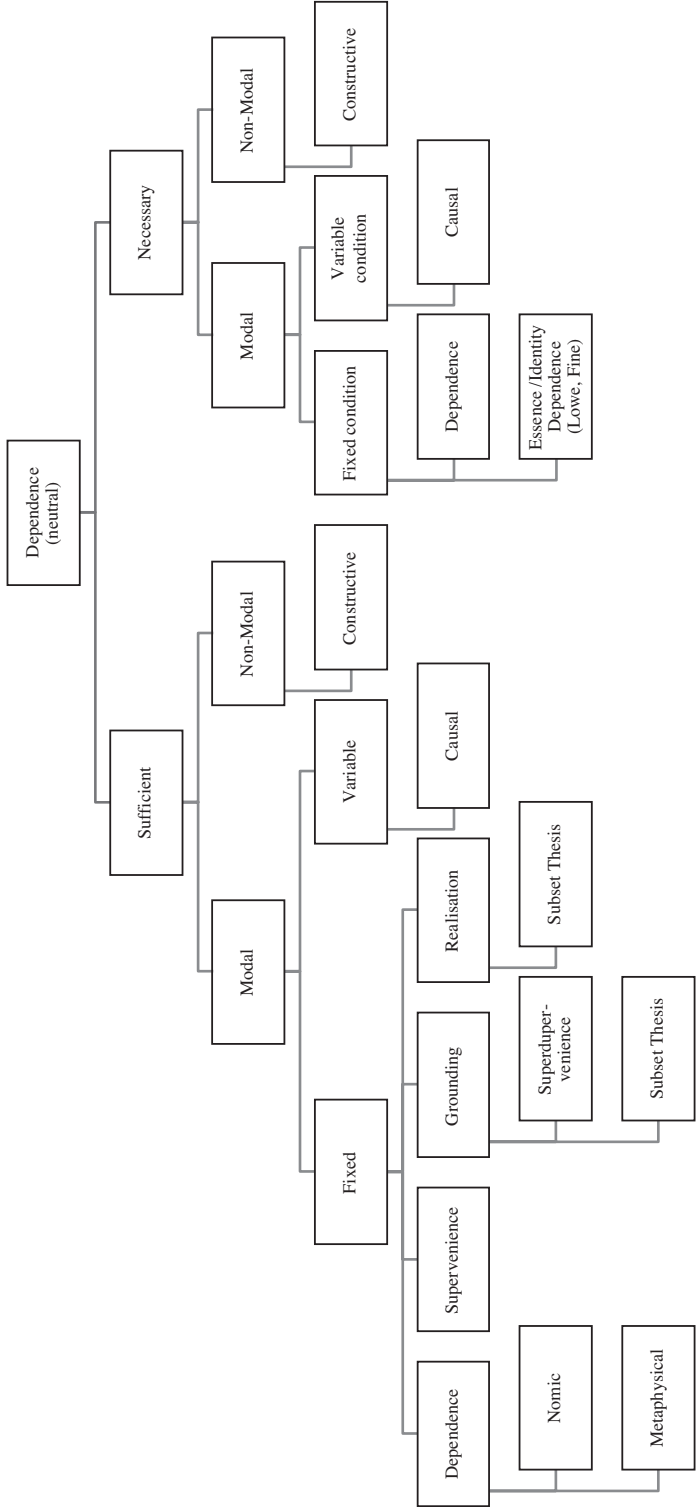


Figure 2.1 Various kinds of dependence.

The issue of non-modal accounts of dependence will be discussed later. They may require some adjustment to the diagram. Before that, I am going to focus on modal accounts and the issue that has received significant attention as of late, namely, whether a pure modal analysis can be given. This will be relevant to the issue of how we should formulate the distinction between doctrines of emergence and non-reductive physicalism.

The case against pure modal accounts of dependence

An important recent theme in the discussion of dependence has been the putative failure of the modal analysis of dependence. Figure 2.1 shows how the varieties of dependence have proliferated. This is largely due to the failure of the modal analysis. According to this analysis,

X is necessary dependent upon Y if and only if necessarily, if X exists/is instantiated, then Y exists/is instantiated (see e.g. Simons (1987), p. 295).

X is sufficient dependent upon Y if and only if necessarily, if Y exists/is instantiated, then X exists/is instantiated.

Where X and Y are property instances, replace ‘exists’ on the right-hand side with ‘is instantiated’. For the purposes of our present discussion, the strength of necessity in these formulations should be taken to be metaphysical. A number of cases have been presented to demonstrate the problematic character of these analyses and in favour of a hyperintensional notion of dependence: grounding and its kin. A context is hyperintensional if and only if substituting logically equivalent propositions (or necessarily co-extensive terms) fails to be truth preserving.

Consider the relationship between Socrates and the singleton set {Socrates}. By the modal analysis noted earlier, each is necessary dependent upon the other. If {Socrates} exists, then Socrates exists and if Socrates exists, then {Socrates} exists. Each is also sufficient dependent upon the other as a result. Yet, the claim runs, {Socrates} is dependent upon Socrates but not vice versa (e.g. Fine (1995), p. 271; Lowe (2006), pp. 34–35).

A second type of case concerns metaphysically necessary existents (e.g. the number 2). By the modal analysis, my existence is necessary dependent upon 2’s existence and 2’s existence is sufficient dependent upon me. Yet it may be argued that these dependency claims should not fall out of the fact that 2 is a necessary existent alone and are, intuitively, false (Fine (1995), p. 271).

A third type of case concerns the essential properties of substances. The particular property of *Socrates’ humanity* is essential to Socrates and can only be possessed by him. In which case, by the modal analysis of dependence, Socrates is necessary and sufficient dependent upon his humanity. From which it follows that, given substances are independent existences, Socrates is not a substance.

A related fourth case concerns events like that of being Socrates’ life. Socrates’ life couldn’t fail to imply the involvement, and hence existence, of Socrates. Equally, Socrates couldn’t exist without having his life, although its exact features may vary. Therefore, Socrates existence is both necessary and sufficient dependent on his life. Nevertheless, it is plausible that the event of being Socrates life is dependent on the existence of Socrates but not vice versa. To rule out another option, Socrates and his life cannot be identified because the life has a certain duration that Socrates does not, and Socrates has a certain weight that his life does not (Lowe (1998), pp. 143–145).

Modal analyses of dependence have been at the heart of analyses of the more complex notion of supervenience. Dissatisfaction with the utility of this notion has compounded

concern about the appeal to modality. Supervenience is primarily a complex relation of sufficient dependence. A preliminary characterisation in terms of families of properties, A properties and B properties, is

A properties supervene upon B properties if and only if there cannot be a difference of A-properties without a difference of B-properties.

or, as it is more normally put,

it cannot be the case that there is indiscernibility with respect to B-properties without indiscernibility with respect to A-properties (e.g. see the first explicit modern use in Hare (1952), p. 145).

The basic idea differs from the simple case of dependence described earlier because it takes a family of properties, the B-properties, to be exclusively determinative of the A-properties. By contrast, if X is sufficient dependent upon Y , it is still possible that X may also occur without Y , either just by itself or because of some Z upon which it is also sufficient dependent. Nevertheless, like modal dependence, the envisaged relation is taken to be

Reflexive: If $A = B$, then A supervenes upon B and B supervenes upon A.

Non-symmetric: If A-properties supervene upon B-properties, it is possible that B-properties supervene upon A properties.

Transitive: If A-properties supervene upon B-properties and B-properties supervene upon C-properties, then A-properties supervene upon C-properties.

(Kim (1984), p. 67)

The preliminary understanding of supervenience is inadequate. As McLaughlin and Bennett point out, it has the implication that F properties supervene upon not-F properties. Something cannot fail to differ in F without differing in not-F. Yet it is not plausible to suppose that this relationship is the one intended by those who appeal to supervenience (McLaughlin and Bennett (2011), 3.5).

More developed accounts of supervenience avoid this consequence. Here are two illustrations. First, there is a version of Jaegwon Kim's notion of strong supervenience.

A *strongly supervenes* on B just in case, necessarily, for each x and each property F in A, if x has F, then there is a property G in B such that x has G, and *necessarily* if any y has G, it has F. i.e. $\Box(x)(F)(Fx \ \& \ F \ e \ A \ \supset \ (\exists G) (G \ e \ B \ \& \ Gx \ \& \ \Box(y)(Gy \ \supset \ Fy)))$.

(cf. Kim 1984), p. 65)

If x has F, it does not have not-F, and it is not the case that, necessarily, if x has not-F, then it has F. There is also Frank Jackson's account of global supervenience developed from work by John Haugeland (1982), David Lewis (1983) and Terence Horgan (1982). Jackson holds that

Any world which is a minimal physical duplicate of our world is a duplicate simpliciter of our world.

(Jackson (1998), p. 12)

In more general terms,

A properties supervene upon B properties if and only if, any world which is a B-duplicate, is a duplicate simpliciter (and, thus, an A duplicate).

(cf. Kim 1984, p. 68)

Kim's characterisation allows for various readings of the modal operators. For example, in the case of nomological dependence, the second occurrence will be that of nomological necessity as will, plausibly, the first. The model for a supervenience formulation of metaphysical or ontological dependence is plausibly

A strongly supervenes on B just in case, necessarily_n, for each x and each property F in A, if x has F, then there is a property G in B such that x has G, and necessarily_m if any y has G, it has F i.e. $\Box_n(x)(F)(Fx \ \& \ F \ e \ A \ \supset (\equiv G) (G \ e \ B \ \& \ Gx \ \& \ \Box_m(y)(Gy \ \supset Fy)))$.

(e.g. Noordhof (1999a), p. 295)

Here the subscripts 'n' and 'm' represent nomological and metaphysical necessity, respectively. The crucial point is that the instantiation of the G property is taken to metaphysically necessitate the instantiation of the F property. Kim suggests the opposite ordering, but this would mean that the supervening properties necessarily had a supervenience base but were just a nomological consequence of the supervenience-base properties (Kim (1984), p. 66).

As I noted earlier, supervenience adds to pure modal dependence relations the idea of exhaustive determination within a world. It is for this reason that supervenience formulations of physicalism and the relationship between the evaluative and the natural have been popular. Nevertheless, it has been argued that inadequacies in such formulations add to the case for impure modal, or non-modal, accounts of dependence. Some alleged inadequacies relate to specific features of global supervenience but, in fact, rest upon assumptions about what we should take as the supervenience-base of mental properties that should not be accepted. For example, consider two simple worlds. In w_1 , a has F and G and b has G; in w_2 , a has G but not F and b doesn't have G (where F is a mental property, G a narrowly physical one). Since the two worlds differ in G properties, they are compatible with the global supervenience of F properties on G properties. Although they are incompatible with the strong supervenience of F on G, they are not incompatible with the strong supervenience of F on an object having G and occurring in a world with another object having G. The latter might be a surprising supervenience-base for F, but if it holds in all possible worlds, then there is no reason to suppose that the instantiation of F is incompatible with physicalism, contrary to what Kim implies (Kim (1987), pp. 319–326); the original case is Petrie's (1987, p. 121), though he does not draw Kim's conclusion.

The more substantial inadequacies of formulation are brought out by comparison with other doctrines such as dualism within an occasionalist framework, emergence and ethical non-naturalism. I go through them in turn.

A version of Malebranche's occasionalism holds that God takes arrangements of narrowly physical properties as the occasion to bring about the instantiation of non-physical mental properties. If God is a consistent necessary existent, then in all possible worlds, corresponding to each arrangement of physical properties, he has a distinct non-physical mental property instantiated. Thus, there is a metaphysically necessary connection between arrangements of physical properties and avowedly non-physical properties (Wilson (2005); Wilson (2014), p. 543).

We can deal with this case now. One response is to distinguish between intra-world and inter-world consistency. While a consistent God would have a care to ensure the same narrowly

physical properties caused the same non-physical mental properties within a world, there is no reason to think that consistency requires the same non-physical mental properties across all possible worlds. A second is to note that God cannot falsify necessary truths and specifically, necessary truths about possibilities (assuming S5 modal logic). Thus, if the distinct natures of P_1 and M_1 are such that it is necessarily true that it is possible that P_1 and not- M_1 , then God cannot make it otherwise. To claim he can is question begging against the proposed definition of non-reductive physicalism. A third is to count this counterexample as a special case. The characterisation of non-reductive physicalism would have a 'no divine power' external condition. Finally, of course, if it turns out that a putative necessary God is not possible, then there is no need to deal with this case.

The second case concerns the proper characterisation of emergentism if a powers ontology is true. A distinctive feature of the latter is that fundamental properties are powers that have their causal profiles essentially. Suppose that one part of G_1 's causal profile is that, in circumstances C (as specified by the instantiation of an arrangement of powers), G_1 causes the instantiation of F_1 (a candidate non-physical mental property). Then the connection between C , G_1 and F_1 is that of metaphysical necessitation. So, appeal to such a connection cannot capture what is characteristic of non-reductive physicalism. Another example with the same conclusion is the case of ethical non-naturalism which I have discussed further elsewhere (Noordhof (2003)).

In the next section, we will examine whether accounts that are not purely modal succeed in analysing these cases.

Modality plus accounts: grounding and ontological dependence

In this section, I am going to consider accounts that take necessitation to be a necessary but insufficient condition for the relevant connection. There is an additional element.

Identity or essence dependence

One approach that has found favour with many with regard to initial cases described is to develop a notion of identity or existence dependence appealing to essence. For example, E. J. Lowe and Tuomas Tahko have suggested that

x depends for its identity upon $y =_{df}$ There is two-place predicate 'F' such that it is part of the essence of x that x is related by F to y (Tahko and Lowe (2015), 4.2) (a slight variant is Koslicki's talk of y being a constituent of x 's essence).

(see Koslicki (2012), p. 190)

Similarly Fine has argued that

x (essence) depends upon $y =_{df}$ It is part of the essence of x that it exists only if y exists.

(Fine (1995), pp. 272–273)

To apply the former to the case of Socrates and {Socrates}, the two-place predicate is '– has as a member –', x is {Socrates} and y is Socrates (see also Lowe (1998), p. 149). It is plausible that my existence is not identity dependent upon the number 2. Part of the essence of Socrates' life is that it is lived by Socrates, and part of the essence of Socrates' humanity is that it is possessed by Socrates. Thus, Lowe's account of identity dependence deals with many of the cases listed earlier. Similar claims about the essence of these things will be the basis for corresponding claims about

essence dependence in the formulation given by Fine. Both of these are examples of necessary dependence because they talk of *part* of the essence of x being such and such. So we don't as yet have an account of sufficient dependency appealing to essence. As we shall shortly see, this proves more problematic.

The definitions also have some surprising consequences. Many non-reductive physicalists who are proponents of a powers ontology hold that for each mental property M_i , its causal powers are a subset of the causal powers of the specific arrangement of the narrowly physical properties, $A_i(p_1, p_2, \dots p_n)$, that realise them. Although we shall see later that the subset claim is problematic, the point for now is that it follows that physical properties are identity and essence dependent upon the mental properties they putatively realise. This is the opposite of what was required for the non-reductive physicalist. More generally, suppose that the instantiation of M_i is part of the causal profile of $A_i(p_1, p_2, \dots p_n)$, then $A_i(p_1, p_2, \dots p_n)$ is *identity* dependent upon M_i . Let $A_i(t, p_1, p_2, \dots p_n)$ be the causal basis for M_i , where t is the trigger for $A_i(p_1, p_2, \dots p_n)$ to instantiate M_i . It is part of the essence of $A_i(t, p_1, p_2, \dots p_n)$ that M_i is instantiated. In which case, the causal basis of M_i is essence dependent upon M_i . Again, this is the opposite of what is required.

So while these notions may capture the idea that water depends for its existence and identity on hydrogen, say, because part of the essence of water includes hydrogen, these notions do not help with the characterisation of non-reductive physicalism in a powers ontology.

Grounding

The grounding relation has typically been taken to include two elements. First, the grounding entities are somehow explanatory of the grounded entities (Rosen (2010), pp. 122–126; Dasgupta (2015), p. 558). Indeed, Paul Audi argues for the existence of the grounding relation from the observation that there are *non-causal explanations* of why certain facts are the case; e.g. the fact his shirt is maroon grounds the fact his shirt is red (Audi (2012a), pp. 688, 693). Second, the grounding entities are ontologically more fundamental ('prior' to the grounded) (e.g. see Schaffer (2012), p. 122; Barnes (2012), pp. 875–876; Audi (2012a), p. 686). The grounded entities are derivative. However, Elizabeth Barnes explicitly dissociates fundamentality from explanatoriness, so these two elements are not to be taken as an inevitable package (Barnes (2012), pp. 897–899).

As it is standardly envisaged, grounding is a case of sufficient dependency. Thus, Gideon Rose writes that suppose the fact that p , written $[p]$, is grounded, then typically several facts together ground $[p]$. The general form of the grounding claim is $[g_1]$ and $[g_2]$ and $[g_3] \dots$ ground $[p]$. The notion of a partial ground is of a member of the set that grounds $[p]$ (Rosen (2010), p. 115). Grounding is taken to imply metaphysical necessitation but involve either or both of the additional features mentioned earlier (Rosen (2010), p. 118).

In contrast to supervenience, grounding is generally taken to be asymmetric and irreflexive (e.g. Audi (2012b), p. 102). A third plausible feature is transitivity. If $[p]$ grounds $[q]$ and $[q]$ grounds $[r]$, then $[p]$ grounds $[r]$. Jonathan Schaffer offers counterexamples to transitivity, but his counterexamples appeal to partial grounding rather than grounding, whereas those, like Rosen, asserting transitivity have full grounding in mind (Schaffer (2012); Rosen (2010), p. 116).

What in addition to metaphysical necessitation is required for grounding? Just as in the case of identity or essence dependence characterised earlier, there has been an appeal to essence. Fine argues that the following will be *true of the essence* of grounded properties, say the grounded property A :

$B_1(x_1, x_2 \dots), B_2(x_1, x_2 \dots)$ is a ground for the truth C whenever $A(x_1, x_2 \dots), B_1(x_1, x_2 \dots), B_2(x_1, x_2 \dots)$ (where $A(x_1, x_2 \dots), B_1(x_1, x_2 \dots), B_2(x_1, x_2 \dots)$ hold of an object a , say) (Fine

(2012), p. 75, a similar view is adopted in Audi (2012b), p. 109, except the latter also allows such truths to be part of the essence of grounding property where Fine does not).

Here the truth C will be either attributing A to an object or the claim that something is A. Since facts involving property A may be grounded in facts involving different properties – for example, something is coloured may be grounded in facts about objects being red, green, blue, etc. – there will be a host of these grounding truths that are part of the essence of A. Because they hold of the essence of colour, it is appropriate to say that something is coloured in virtue of having one colour or another (Fine (2012), p. 77).

This relates grounding to the essence of properties by brute force. With essence dependence, a property was dependent on another property if that property was part of the essence. Dependence was analysed by reference to essence. This relationship is not available in the case of grounding because, due to variable realisation, no particular ground is part of the essence of a property. So, instead, it is suggested that it is part of the essence of a property that it should be grounded in such and such a way, depending upon what holds. This does not explain grounding in terms of essence. It takes grounding to be part of what characterises the essence. Mention of grounding cannot be excised. If, instead of the envisaged formula, we just appealed to a conditional relating the putative grounds to the putative grounded, then it is just as plausible to say that this kind of conditional is part of the essence of the grounding properties too, in which case, we would have no basis for the asymmetry of grounding. If part of the nature of $B_1(x_1, x_2 \dots)$, $B_2(x_1, x_2 \dots)$ is the fact that $A(x_1, x_2 \dots)$, then the former would depend on the latter. That's why, as Fine acknowledges, there must be explicit reference to grounding (Fine (2012), p. 78).

Fine, then, is committed to claiming that part of the essence of pain is that, if a subject has c-fibre firing, then c-fibre firing is a *ground* for pain. But there is little evidence that this is so (Rosen (2010), p. 132). While it might be part of the essence of colour that there are various ways of being colour-wise that ground it, it does not seem to be true of pain that there are different physical ways of being in pain that are part of the essence of pain – for example, that it is c-fibre firing. Of course, this may be offered as a conjecture. An alternative is that it is part of the essence of various different physical conditions that they should be grounds of pain. Paul Audi envisages it is both part of the essence of the grounding *and* the grounded properties that the former ground the latter (Audi (2012b), p. 109). A cost of either of these other options is that the grounding properties then become essence or identity dependent upon the grounded properties in the sense specified in the previous section. They are instantiated in virtue of grounding certain facts about the mental, in which case, the alignment is lost between the fact that *p* is grounded in the fact that *q* and the fact that *q* does not hold *in virtue of* the fact that *p* but vice versa.

Although Fine's position avoids this last consequence, it has a further cost. Consider

(P) The fact that S's brain instantiates $A(p_1, p_2, p_3 \dots p_n)$ grounds S's being in pain.

Is (P) itself grounded in arrangements of narrowly physical properties or not? Fine's preferred approach suggests not. The explanation at least partly involves a fact about the essence of being in pain (Dasgupta (2015) develops the point generally, pp. 565–576). In this case, how does grounding serve to differentiate itself from other connections between the mental and the physical, for example, nomological necessitation, metaphysical necessitation and the like, in attributing *priority* to arrangements of physical properties? All appeal to explanatory principles relating facts at different levels and grounding appeals to facts about mental properties such as being in pain. It seems that the proponents of grounding must argue that their relation is special. Although appeal might be made to the essence of pain, since this essence involves various ways in which

pain is *grounded* in arrangements of narrowly physical, such an appeal is unproblematic. It is not sufficient to argue, as Shamik Dasgupta does, that principles based on essences (or real definitions) are not apt to be grounded because the issue is whether the essence of pain (for example) to which the putatively ungroundable (P) appeals is of an acceptably physical thing (cf. Dasgupta (2015), pp. 577–580). So grounding plays a primitive role in the characterisation of essence and, it must be assumed, a primitive role in the explanation of why inter-level grounding claims are acceptable to the physicalist without claiming that this is because the essence of pain is grounded in the physical. Truly, the *sui generis* is coming in aid of the theoretically problematic!

For some, grounding is just a certain kind of non-causal explanatory relation between worldly facts. It is not meant to capture the idea that the grounded involve *nothing over and above* what they are grounded in (Audi (2012a), pp. 708–710). However, this threatens the motivation for considering grounding to be distinct from metaphysical necessitation and, thus, its putative role in distinguishing between non-reductive physicalism and emergentism. More, thus, are tempted to see the matter as follows. In the case of non-reductive physicalism, facts about mental properties are *grounded* in facts about arrangements of narrowly physical properties, but not vice versa (e.g. Bliss and Trogon (2014), 6.1; Dasgupta (2015)). In the case of emergentism, they are not. Instead the relationship is either nomological or metaphysical necessity depending upon whether the emergent properties are non-physical or physical but with emergent causal powers.

Nevertheless, the characterisation has a substantial drawback. It mistakenly classifies a weak version of non-reductive physicalism as a form of emergentism. Without the aid of God to ensure that one property metaphysically necessitates another, the claim that one property metaphysically necessitates another indicates that the nature of the former is intimately connected with, and exhausts in character, the latter. Otherwise, there would still be a way the world could fail to be, given the instantiation of the former. Consider a position that makes the following three claims; first, that arrangements of narrowly physical properties metaphysically necessitate mental properties; second, that there are no emergent causal powers; and, third, we should not recognise a distinction between fundamental and derivative properties. This deserves to be classified as a version of non-reductive physicalism, which we might call harmony physicalism (cf. Noordhof (2003), p. 106). It recognises a layered world in the sense given earlier, from the subject matter of physics upwards, with the requirement of harmony between the layers characterised by metaphysical necessitation. I don't deny that many non-reductive physicalists want the additional fundamentality claim. However, we should not allow their preferences to dictate the most general characterisation of the doctrine of non-reductive physicalism.

This suggests the following picture of various kinds of non-emergent physicalism and emergence (Figure 2.2).

A related approach put forward by Elizabeth Barnes holds that emergent entities are *dependent* fundamental entities. She characterises dependence as follows:

- (OD) An entity x is dependent if for all possible worlds w and times t at which a duplicate of x exists, that duplicate is accompanied by other concrete, contingent objects in w at t .
(Barnes (2012), p. 880)

Independent entities are capable of lonely existence, that is, existence in possible worlds without other objects. The notion of a fundamental entity is taken to be a primitive. An entity is fundamental if its existence is not derivative from any other entities (Barnes (2012), p. 876). Or, as one might say, its existence is ungrounded.

(OD) is a purely modal characterisation of dependence. It is not meant to have any implications about what is fundamental and what is not. We have already noted that a standard

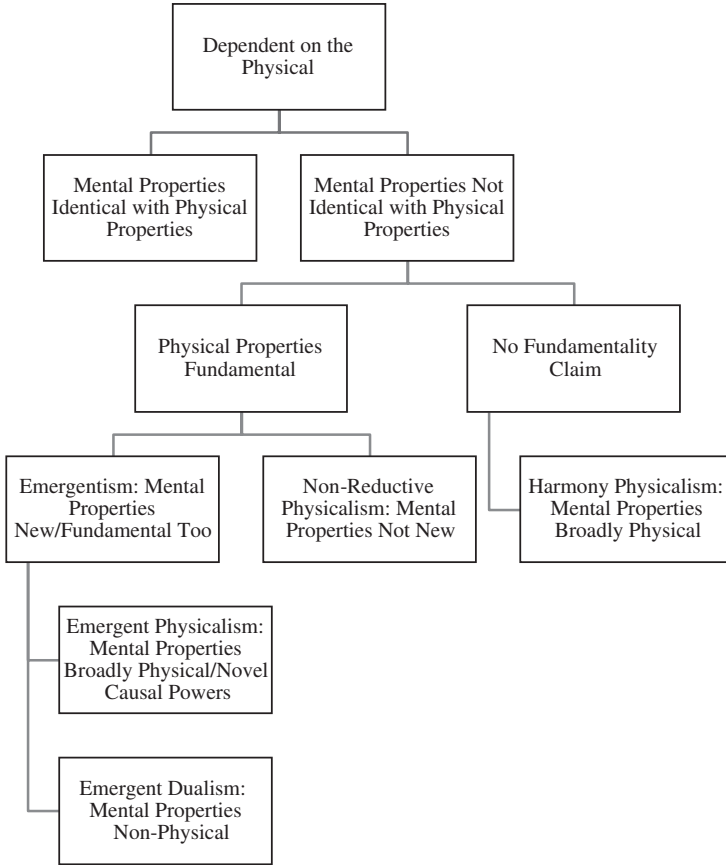


Figure 2.2 Various kinds of mental dependence upon the physical.

understanding of emergence is that arrangements of narrowly physical properties nomologically, but not metaphysically, necessitate non-physical mental properties. Do the mental properties come out as dependent on this picture?

The answer might seem to be straightforward. If the connection is only one of nomological necessity, then there will be possible worlds in which it does not hold. In which case, mental properties turn out not to be dependent by (OD), which requires that there must be some entity or other in addition to the instances of mental properties from which these mental properties emerge. The standard understanding of emergentism fails to be accommodated.¹ However, that's not quite right. Although the nomological necessitation of mental properties may be contingent, that there is some nomologically necessary relationship or another may be metaphysically necessary. If that is correct, the immediate problem is avoided.

Instead, the answer would seem to turn on whether the brain, or the arrangements of narrowly physical properties that constitute it, is a distinct concrete contingent object accompanying the instances of mental properties. Suppose the brain (to fix ideas) possesses both the arrangements of narrowly physical properties and the non-physical mental properties, which are nomically related to them. Then it isn't a distinct concrete contingent object. In the absence of an alternative viable candidate, the non-physical mental properties would fail to be classified as emergent, which is counterintuitive.

Perhaps Barnes takes non-physical mental properties to be instantiated in an object distinct from the brain. If that is the case, then there seems no reason why there couldn't be a world in which instances of the mental properties are instantiated without the brain. Mental properties would fail the analysis of dependence and so not count as emergent, which is also a counterintuitive result.

Barnes might respond that she is providing a characterisation of emergence, not defending it as a doctrine in the mental case. However, she seems to lose a distinctive feature of emergence. It doesn't have to be claimed that emergent entities are dependent in all possible worlds. It is simply that, in this world (for example), they are so dependent.²

Suppose, instead, that arrangements of physical properties metaphysically necessitate mental properties. If mental property instances are distinct objects from the arrangements of physical property instances, then this would make these arrangements of physical property instances dependent entities. Moreover, if these arrangements of physical properties are also fundamental, then the resulting position seems to be classified as a case of narrowly physical properties emergent from mental properties. In contrast with typical cases of emergence, these arrangements of physical properties would be dependent upon entities that might not, themselves, be fundamental, viz the mental properties. So not only does a standard characterisation of non-reductive physicalism get classified as physical emergence, but, in addition, we have a new bifurcation in the characterisation of emergence turning upon whether or not the entities upon which target emergent entities are dependent are fundamental.

The alternative is for Barnes to deny that mental property instances are objects distinct from the arrangements of narrowly physical properties that metaphysically necessitate them. But this would undermine the motivation for her position. Metaphysical necessitation would rule out the necessitated properties being something over and above the necessitating properties, just as proponents of a purely modal account require.

It is time to take a step back. Proponents of grounding accounts take themselves to be postulating a tighter, more explanatory, relationship between entities than metaphysical necessitation. An alternative is to deny that there is a tighter relationship but place the emphasis instead on characterising entities on the necessitating side as fundamental. If the latter works, the motivation for grounding is significantly undermined. $[p]$ holds in virtue of $[g_1]$ and $[g_2]$ not because of the nature of the grounding relation between $[p]$ and $[g_1]$ and $[g_2]$ but because $[g_1]$ and $[g_2]$ are fundamental and metaphysically necessitate $[p]$. Thus, for example, non-reductive physicalism with the fundamentality claim will be characterised in terms of supervenience, plus the claim that narrowly physical properties are fundamental (see Bricker (2006), pp. 270–272).

Given that proponents of grounding take grounding to be a primitive, it is within the rights of this alternative position to, as Philip Bricker recommends, take *fundamentality* as a primitive notion. However, there are features to which we might appeal to provide some flesh to the notion of fundamentality.

First, suppose, for some target property, M , P metaphysically necessitates M but not vice versa. Instead, at best, there is some disjunctive property P_1 or P_2 or $P_3 \dots$ or P_n such that, metaphysically necessarily, if M is instantiated, then P_1 or P_2 or $P_3 \dots$ or P_n is instantiated. The fact that M fails to settle the detail of the world with respect to which P_i necessitates it but that some P_i does settle the detail of the world M -wise indicates a way in which the P properties are more fundamental. Call this *differential determination*. Second, and relatedly, suppose laws relating the P properties will explain why M s are instantiated, given P s metaphysically necessitate M s, but the reverse does not hold. That doesn't mean that emergence is impossible. I have described conditions under which it holds earlier. However, these require special claims about which laws are fundamental, etc. In their absence, the default will be that P properties have a certain priority

for the reason just given. Call this *complete coverage*. Third, although there are some P properties that necessitate Ms, there are other P properties that do not, whereas the reverse is not the case. There are no M properties without the P properties that necessitate them. Thus, P properties constitute an additional level of detail about the world. Call this *extra specificity*. Fourth, if there are relationships of the following sort

$$\Box_m (x)(A(g_1, g_2) x \leftrightarrow (Fx))$$

then the left side is fundamental seems more fundamental because it is made up of an arrangement of properties, for at least some of which properties such relationships don't hold, but not vice versa. Call this *decompositional extra specificity*. Fourth, the P properties may be identified as purely natural properties that capture facts about resemblance and duplication in objects and, as a result of which, figure in laws of nature. Let's dub this *naturalness*.

All of these features support the idea that the target properties, or facts about them, hold *in virtue of* properties with these features. However, there is one way in which the relationship between the target properties and the necessitating properties may be made tighter without abandoning the guiding idea of a purely modal account. That is, to identify the minimal metaphysical necessitation base of the target properties rather than any old necessitation base, however supplemented (see e.g. Noordhof (1999a), p. 307). The minimal necessitation base will have no redundant elements. The target properties should have relative necessary dependence upon them (to deal with the issue identified by Fine (2012), p. 57). With this final adjustment in place, the issue is whether there is any further need for an appeal to grounding. We shall examine this in two ways in the final section.

Modality and construction

The first few cases discussed in the second section show that there are additional dependence relations to one characterised purely modally. But they needn't show that these are appropriate for the characterisation of the distinction between non-reductive physicalism and emergence, and they don't undermine the status of a purely modal account as one kind of dependence relation. Let me go through the cases in turn.

In the case of Socrates and {Socrates}, it is clear that the latter essence depends upon the former. It is part of the essence of {Socrates} that it has Socrates as a member but not part of the essence of Socrates that he figure in the unit set of Socrates. By contrast, because my essence does not include the number 2, or vice versa, neither I nor the number 2 essence depends upon the other. In the case of Socrates' humanity or life, each essence depends upon Socrates, but it is not part of the essence of Socrates that it is characterised by a particular case of humanity or living a certain life (Lowe (1998), p. 153).

As we have already seen, essence dependence is not the proper way to characterise the dependence of mental properties on physical properties. Indeed, it threatens to get the priority relations the wrong way round in the case of a powers ontology. Here purely modal accounts fare better. They also capture an important notion of dependence in themselves, namely the strength of correlations between the existence and/or features of different entities.

Some limit this dependency to contingent existences (e.g. Simons (1987), p. 295). However, we might take purely modal dependencies between, say my existence and the number 2, to be a merely trivial but harmless case, because 2 is a necessary existent. Another option is to deny that necessary existents are independent existents. Rather, they are existents that depend upon the conditions for the existence of any possible world. So, while I am not sufficient dependent for

my existence on the number 2, the number 2 is sufficient dependent upon my existence (as part of the world in general) from which its existence derives.

This brings me to the case of distinguishing between non-reductive physicalism and emergentism given a powers ontology. There are at least two relevant kinds of emergentism. A non-physical emergentism – emergentist dualism – holds that arrangements of narrowly physical properties generate novel non-physical qualities. A physicalist emergentism holds that no non-physical qualities are generated. Instead, certain highly distinctive arrangements of narrowly physical properties give rise to novel causal powers.

It is not obvious that a powers ontology has to recognise the first kind of emergentism. A typical motivation for emergentist dualism is that the felt qualities of experience – qualia – are neither physical properties nor functional properties realised by physical properties. Many proponents of a powers ontology hold a functionalist view of all properties – taking their nature to be exhausted by their causal profile – and thus a functionalist view of qualia too, which is compatible with physicalism. Even those who do allow an internal, qualitative aspect to powers do not view this as specifically non-physical. It is said to be identical to, or entail, the causal profile (e.g. Martin (1997), pp. 215–217). So we can just set this case aside. Nevertheless, it is also worth noting that the move I'm about to make regarding the second kind of emergentism could be developed with respect to the first.

How are we to make sense of the idea of novel causal powers in the context of physicalist emergentism? The *collapse objection* is that this is not possible either. If physicalist emergentism is true, then M (an emergent non-physical mental property) has a novel causal power F. $A_1(P_1, P_2, P_3)$ metaphysically necessitates M. This is conceded even by those who deny that metaphysical necessitation is sufficient for physicalism. So $A_1(P_1, P_2, P_3)$ has F. Properties, or arrangements of properties, have the causal powers of the properties they metaphysically necessitate. A variant of this argument would say that P_1 has F in circumstances $A_1(P_1, P_2, P_3)$. Either way, F is not a novel causal power of M after all.

The only answer that seems available is that the causal powers relating to M are relatively isolated and exceptional when compared with the rest of the causal framework. The laws responsible for them are independent of the laws relating to the rest of the framework. In this case, it is reasonable to argue that narrowly physical properties may lack this exceptional part of their causal profile in other possible worlds and still be instantiated. It is not essential to their essence in the way powers related to the broader network of narrowly physical properties are. So the very considerations that favour emergence undermine the motivation for insisting that the relevant arrangements of narrowly physical properties *metaphysically necessitate* novel causal powers. In this case, the same way of differentiating between dualistic emergentism and non-reductive physicalism can be applied to the difference between the latter and physicalist emergentism. The connection between the arrangements of narrowly physical properties and their emergent causal powers is nomologically rather than metaphysically necessary. The mistake is to suppose that physicalist emergentism must be characterised in terms of causal powers $A_1(P_1, P_2, P_3)$ does not have, as opposed to having them but via independent fundamental laws.

Other responses to the collapse objection provide further support for the move I have just made. One response is to argue that characterisation of powers reflects the forces in which they are grounded. Many of the powers of $A_1(P_1, P_2, P_3)$ are reflections of fundamental narrowly physical forces like electromagnetic interaction or gravitation (Wilson (2002)). If there are novel emergent powers, these will be grounded in novel forces. However, this reinforces the point that there may be worlds in which $A_1(P_1, P_2, P_3)$ fails to have the powers associated with M. If there are genuinely novel forces, they will be unrelated to the other forces and, hence, these other forces, and the powers they ground, may occur independently.

A second response is to argue that emergent properties must be instantiated in new objects and thus that the emergent causal powers are not possessed by $A_1(P_1, P_2, P_3)$ but by this new object. As Umut Baysan and Jessica Wilson note, there are various ways in which this claim may be motivated (Baysan and Wilson (2017)). The remaining question is how these objects may be characterised as new – that is something over and above $A_1(P_1, P_2, P_3)$ from which they arise – and yet dependent upon $A_1(P_1, P_2, P_3)$ or other arrangements of narrowly physical properties so that they cannot occur without some such arrangement.

Tensions in the position seem exacerbated by Baysan's, at least, preferred motivation for postulating a new object, namely that a property's causal powers are derived from their possession by objects. If the new object is dependent upon $A_1(P_1, P_2, P_3)$, the latter metaphysically necessitating the new object having the causal power F then how can it be denied that F is derived from an object's possessing $A_1(P_1, P_2, P_3)$ too? What extra strict notion of *derivation* is the basis for the distinction? On the other hand, any weaker connection between $A_1(P_1, P_2, P_3)$ and the new object allows us to draw the distinction between non-reductive physicalism and physicalist emergentism in terms of the difference between nomological and metaphysical necessity once more.

In place of an appeal to the modal difference I have defended, many proponents of a powers ontology appeal to what has been dubbed the *subset thesis*. It holds that

An instance of P realises an instance of M if and only if the token causal powers of m on a given occasion are a non-empty subset of the token causal powers of p (where ' m ', ' p ' are instances of M, P).

(Wilson (2011), p. 128)

If the subset thesis holds for all mental properties, non-reductive physicalism is true. If the causal powers of some mental properties are not a subset of any narrowly physical properties or arrangements thereof, then emergent physicalism is true. The treatment of the collapse objection demonstration already indicates that this proposal is problematic. However, my argument will be that it is problematic even if the objection can be met.

The subset thesis rests upon the idea of one kind of entity being constructed from, and nothing over and above, another entity or entities without any assumption about or appeal to modal consequences. There are a number of other potential cases:

Set Formation: For any objects, $x, y, z \dots$, there is a set $\{x, y, z \dots\}$

Part-Whole: A whole is the mereological sum of its parts.

Constitution: Matter and form together constitute an object (Fine (1999))

Micro-basing: A property P by O instantiated as a result of properties of entities that are a part of O (Kim (1998), pp. 113–114)

Event Constitution: An event occurs if O has P at t (Kim (1976), pp. 160–161)

Object Formation: Objects are *bundles* of properties at times (all mentioned by Bennett (2011), pp. 83–84)

Modal consequences are not ruled out, but if they hold, they hold as a result of the nature of the constructed entity and not as a result of the construction. Consider the case of realisation given earlier. Suppose that an instance of M has causal powers that are a subset of the causal powers of an instance of P . It doesn't follow that metaphysically necessarily, if P then M unless, in every possible world, M has the same causal powers or its causal powers are always a subset of P 's causal powers. This may be so, but it doesn't fall out from the construction relation.

The characterisation of event constitution given a moment ago is another illustration. According to Jaegwon Kim, events are constituted from objects having properties at times. Nevertheless, he denied that the constitutive object, property or time of an event is among its essential properties (Kim (1976), pp. 171–173). Others have disagreed, arguing that events need some or all of these as essential properties in order for reference to events to play the appropriate role in causal explanations (Yablo (1992), pp. 414–419). I think this is mistaken, but it is not a point I want to emphasise here (Noordhof (1998c)). Rather, the point is that the modal properties of events are not argued to follow from how they are constructed. Similarly, opinions differ over constitution. Lynne Rudder Baker emphasises that it is a contingent matter whether those things that constitute an object entail its existence, Kit Fine would, I presume, claim it is necessary (Baker (2000), p. 34; Fine (1999), pp. 73–74).

Although these various forms of construction are a way in which one entity may be dependent upon other entities, it is not immediately helpful to the characterisation of the difference between emergence and non-reductive physicalism. The relevant notion of construction – the subset thesis – fails to provide the required demarcation.

Here is one way of developing the argument I advertised. Suppose that a particular type of pain, P , is variably realised in creatures with different biologies – humans and some rather strange creatures from Alpha Centauri VI – and it is also realised in robots: by $A_1(N_1, N_2, N_3)$, $A_2(P_1, P_2, P_3)$ and $A_3(S_1, S_2, S_3)$, respectively. Each of these states gives rise to a certain distinctive kind of pain behaviour – B_N , B_P and B_S – corresponding to the differences in constitution of the creatures in question. The non-reductive physicalist is committed to instances of P being capable of causing each of these types of pain behaviour when realised in these different ways. Their causal powers include, then, causing in different circumstances B_N , B_P and B_S . However, the *realisations* of P aren't capable of causing the pain behaviours of the different types but just their own type. Therefore, the causal powers of P exceed those of its realisers (Noordhof (1997), p. 246, repeated in Noordhof (1999b), pp. 113–114, and developed at greater length in Noordhof (2013), pp. 98–106). Some proponents of grounding have made a similar, but more general, point by saying that a grounded property's commitments about the nature of fundamental reality are not less than, but indeed exceed, those of its grounds. This is because the commitments of the grounded property derive from each of its grounds and not just one of them (Trogon (2013), p. 114).

This is not to deny that the subset thesis may hold for certain properties. For example, pain in humans may be realised by $A_1(N_1, N_2, N_3)$. The former's causal powers don't outstrip those of its realisation base because it does not have distinct realisation bases. It fails to be identical with its realisation base because the neurophysiological base has additional causal powers not associated with pain. Non-reductive physicalism, though, is supposed to take the variable realisation of mental properties seriously. It holds that these properties are not reducible to other properties but are genuine properties in their own right. These features of the non-reductive physicalist position are responsible for the failure of the subset thesis.

By contrast, the purely modal characterisation of the relationship between mental properties and arrangements of narrowly physical properties is well placed to characterise the relationship between their causal powers. According to the non-reductive physicalist, the causal powers of mental properties are the union of a subset of the causal powers of each of their minimal supervenience-bases. Thus, failure for one property to be locally constructed from other properties is insufficient for emergence to be true, as it is generally understood. It is an interesting fact that non-reductive physicalists seem to be committed to the failure of certain local constructive relations holding as a result of a more global modal relationship.

Concluding remarks

We have seen that dependency relations come in various sorts. First, there are purely modal dependency relations. We saw how they may be used to characterise emergence. Second, there are constructive relations. These are of significant interest but appear insufficient to characterise emergence because they group non-reductive physicalism along with it.

Many of the classic cases cited to motivate talk of grounding only required a notion of necessary dependence rooted in essences. The sufficient dependence notion of grounding faced technical difficulties relating to how grounding drew on an appeal to essence and appeared unnecessary to the formulation of the difference between emergence and non-reductive physicalism. Indeed, a combination of a purely modal characterisation of the connection plus a characterisation of entities on one side of the dependency as fundamental had a better claim to capture what some folk have in mind.

Although essence dependence appears to capture a distinctive kind of necessary dependence relation even here, it is unclear whether the appeal to essence is doing significant work. An alternative is that this kind of dependence is a consequence of a particular combination of construction and a purely modal account. Thus, to illustrate, {Socrates} is constructed from Socrates by the set membership construction relation. The connection between Socrates and {Socrates} has modal force because it is metaphysically necessary to {Socrates} that it is constructed in this way. If that's right, modality is not to be understood in terms of essence, but rather essences are ways it is metaphysically necessary for certain entities to be constructed. If constructive relations and modality have priority, then the case of non-reductive physicalism shows that we must look to modal differences to understand emergence.

Notes

- 1 A paper I discovered subsequent to developing the argument of this part of the chapter makes this point (Pearson (2017), p. 8).
- 2 See Pearson (2017, p. 7) for the same objection developed independently.

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