



University
of Glasgow

Leuenberger, S. (2013) *From grounding to supervenience?* *Erkenntnis*, 79
(1). pp. 227-240. ISSN 0165-0106

Copyright © 2013 Springer

<http://eprints.gla.ac.uk/81960/>

Deposited on: 04 July 2013

From Grounding to Supervenience?*

Stephan Leuenberger

1 Explicating determination claims

Philosophers are in the business of formulating hypotheses of dependence and determination between various realms of reality, or various kinds of facts. For example, physicalists and naturalists wish to claim, respectively, that the mental is determined by the physical, and that the moral is determined by the natural. To make such hypotheses precise and amenable for rigorous discussion, philosophers have sought to express them in a regimented idiom. The question what idiom is suitable for that purpose has become an important philosophical topic in its own right. This article aims to clarify the relationship between two relations that are often invoked in this context: grounding and supervenience.

During the heyday of modal metaphysics, the language of supervenience was the idiom of choice for many. It appears to be precise and ideologically unproblematic.¹ It is flexible, and can accommodate a variety of different relations, notably properties and facts.

In recent years, that use of supervenience has widely gone out of favour. The complaints are familiar. I shall rehearse what I take to be the two main ones. First, the target notions of determination and dependence are hyperintensional, while supervenience is not. As a consequence, supervenience fails to make any discrimination in the realm of the non-contingent. Second, the target notions are asymmetric. Supervenience, in contrast, fails to be asymmetric. Indeed, it even satisfies the condition of reflexivity, which precludes asymmetry.

*Thanks to an anonymous referee, whose suggestions led to a number of improvements.

¹Whether or not it presupposes any extravagant ontology is a disputed question that I shall leave aside.

Few sustained attempts at defending the use of supervenience have been undertaken.² In my view, the jury is still out on the question whether the complaints can be answered.

Instead of being modified, supervenience-theoretic approaches to dependence and determination among facts have been widely abandoned. Efforts have been directed at rehabilitating a primitive notion of determination. That notion typically goes under the label of “grounding”.³

In this article, I shall investigate the relationship between grounding and supervenience—or more precisely, global supervenience of facts. I shall claim that there is a deeper ideological schism between supervenience and grounding than meets the eye. While they do indeed differ with respect to asymmetry and hyperintensionality, they also differ in a further, and arguably deeper, respect. The difference concerns the first relata: for grounding, they are *pluralities* or *classes* of facts; for global supervenience, they are *types* of facts.

I shall explain what I mean by types of facts in due course. But one clarification is required immediately. Since ‘supervenience’ is a term of art, one could argue that it is a matter of stipulation and not of discovery what the relata are. However, not all stipulations are equally fruitful. My claim is that distinctive and interesting global supervenience claims have different relata than grounding claims.

This thesis will emerge from consideration of the following question: are there any corresponding supervenience claims that are entailed by grounding claims? The often-heard complaint that supervenience claims are too weak to capture grounding claims suggests that there are. But the question is not typically posed explicitly. In this respect, it differs from the question whether the converse entailment holds. Friends of grounding are explicit that it does not, and the counterexamples relate to the complaints rehearsed above: every fact supervenes on itself, but is not grounded by itself; necessary facts supervene on, but are not grounded by, the fact that it is sunny today.

An answer to the question whether there are corresponding supervenience claims entailed by grounding claims should be of interest to several groups of philosophers.

Friends of grounding can use it to articulate the relationship between

²Though see Post (1999) for an argument that non-asymmetry is a virtue of supervenience.

³By now, the literature on grounding is too large to cite fully here. For a sample of influential contributions, see Rosen (2010), Fine (2012), and Schaffer (2009).

grounding and another, more familiar concept. In conjunction with paradigms, foils, and logical features, such conceptual links are crucial in helping us grasp theoretically useful primitives.

Skeptics about grounding may take a negative answer to be further confirmation of their suspicion that grounding is insufficiently constrained. They may also feel vindicated in their complaint that we are not told how to evaluate grounding claims. If grounding claims did entail supervenience, then we would at least know how they can be attacked: by what Brian McLaughlin (1984) calls a “FIST”, a failure of implied supervenience thesis. Philosophers are adept at describing pairs of putatively possible worlds that purport to falsify supervenience claims.

Theorists of supervenience may see the answer as contributing to clarify how global supervenience applies to fact-like entities. So far, theoretical attention has focussed on global supervenience for properties.⁴ This is surprising, since many of the informal uses of supervenience, outside the specialized literature, take the relata to be facts. For example, David Papineau (2008, p. 127) takes the basic content of physicalism to be the claim that “[a]ll facts metaphysically supervene on the physical facts”.

Finally, neutrals may appreciate being in a better position to contrast and compare the claims that have been expressed in the idiom of supervenience in the last decades with the claims that are now being expressed in the idiom of grounding. If they have a firmer grasp on supervenience than on grounding, they can use entailment theses to extract a “cash value” from grounding claims.

2 A candidate entailment thesis

Grounding claims come in a variety of logical forms. Those that I shall be concerned with are of the form ‘ B_1, B_2, \dots ground A , where ‘ A ’, ‘ B_1 ’, etc denote facts. So grounding claims are to be expressed by a predicate to be flanked by a plural term on the left and a singular term on the right.⁵

Instead of enumerating the grounds in a list, I shall often use Greek capitals to stand for such a list, and say ‘ Γ grounds A ’ instead of the above

⁴Bricker (2006) is an exception.

⁵Alternatively, grounding can be construed as a binary sentential operator, like ‘because’ in English. I shall not pursue the interesting question how this alternative choice would affect the discussion.

(where Γ stands for $\{B_1, B_2, \dots\}$). For convenience and familiarity, I shall also take Γ to be a class rather than a list; but when a class has just one member, I will talk of the member as the ground, rather than its unit class.

On the conception of facts used here, facts do not exist at a world unless they obtain at that world. The expression ‘ Γ grounds A ’ is taken to be false in a possible world where A or some member of Γ does not exist.

The term ‘entailment’ is here used in the sense of strict implication: Φ entails ψ iff in all possible worlds where all members of Φ are true, ψ is true too. In an extended sense, ‘entailment’ applies to facts. For a fact A , let $O(A)$ mean that A obtains. Then Γ entails A iff $\{O(C) : C \in \Gamma\}$ entails $O(A)$.

Given classical logic, a great many supervenience claims will be entailed by the claim that Γ grounds A . For example, the claim that A supervenes on itself will be entailed by any proposition, and a fortiori by any that happens to be about grounding. Of course, we are interested in the putative entailment of distinctive supervenience theses involving Γ and A .

Say that worlds w and w' are *A-indiscernible*, for a fact A , if either A obtains in both or fails to obtain in both. If Γ is a class of facts, worlds w and w' are *Γ -indiscernible* iff they are *A-indiscernible* for every $A \in \Gamma$. We can then say that Δ *supervenes* on Γ iff any worlds that are Γ -indiscernible are also Δ -indiscernible. In this paper, we shall mostly be interested in the special case where Δ is a unit class $\{A\}$. To avoid clutter, I shall abbreviate ‘ $\{A\}$ supervenes on Γ ’ to ‘ A supervenes on Γ ’.

Using the notion just defined, we might hypothesize the following (‘S’ for ‘supervenience’):

S If Γ grounds A , then A supervenes on Γ .

S formulates an entailment thesis linking grounding and supervenience. It can be read in two ways: as helping us to tease out broadly modal consequence from a grounding claim, or as formulating a broadly modal constraint on grounding.

Before discussing the tenability of S, I would like to draw attention to one of its presuppositions: that a fact generates a partition of the class of possible worlds into those in which it obtains, and those in which it does not obtain. This presupposition is fairly unproblematic if facts have individuals as constituents, and if those individuals, along with all other constituents, can exist in more than one world. The fact that a is F then obtains in exactly

those worlds in which a and F both exist and in which the former exemplifies the latter.

However, the presupposition may fail on some other metaphysical conceptions of facts and their constituents. Suppose, for example, that individuals are world-bound, and that the fact that a is F has a as a constituent. It is then natural to invoke counterpart theory in stating the conditions under which that fact obtains. But if a thing can have more than one counterpart in a given world, no account may be intuitively satisfactory. Should we say that the fact that a is F does obtain in a world in which a has one counterpart that is F and one that is not, or should we say that it does not?⁶ Moreover, there may be more than one salient counterpart relation, leading to further indeterminacy. So a counterpart theorist may not even be able to make sense of S or its cousins to be considered later.⁷ But I shall leave this worry about S aside in the following. It seems to be largely orthogonal to the issues to be considered here.

3 The problem of multiple realizers

As it turns out, S is untenable. To see this, let B and C be modally independent, and such that B obtains and C does not. Consider now the disjunctive fact $B \vee C$. Given that disjunctive facts are grounded by each true disjunct—a principle typically assumed by friends of grounding— B grounds $B \vee C$. Given the modal independence of B and C , there is a world w where C obtains and B does not, and there is a world w' where neither B nor C obtains. So w and w' are B -indiscernible without being $B \vee C$ -indiscernible. Hence $B \vee C$ does not supervene on B , and S is false.⁸

⁶For discussion of the analogous problem for propositions, see Dorr (2005). Note that Dorr's recommendation to the counterpart theorist—to adopt Russellian propositions—would not solve the problem of associating a fact with a partition of modal space.

⁷Counterpart theorists may try to associate grounding claims with supervenience claims with properties rather than facts as relata. But if the relata of grounding are facts, possibly with a quantificational structure, it is not clear what those associated claims would be. Furthermore, there is little reason to believe that the problems I raise for the fact-versions would not carry over. However, a detailed discussion of that option is beyond the scope of this paper.

⁸A structurally analogous counterexample involving *being a brother* and *being a sibling* is used in McLaughlin and Bennett (2006) to show that property entailment is not sufficient for supervenience among properties.

One might question the assumption that there are disjunctive facts such as $B \vee C$. Perhaps facts are sparse, and just as disjunctive properties are typically not countenanced in a theory that takes properties to be sparse, so disjunctive facts may not be admitted in a theory of sparse facts. This reply, however, is ineffective for two reasons.

First, the reply is hardly available to a theorist of grounding, who presumably wishes to explain sparseness in terms of grounding, and to claim that the less sparse facts are grounded by the sparse ones. Second, the objection to S need not rely on facts that are disjunctive in any intuitive sense. They need not have two other facts and disjunction as constituents, and their canonical description need not involve the word “or” or a synonym. What is required is merely that A has multiple realizers: in some world where one of its actual grounds does not obtain, it still has a ground.⁹

For a plausible example, suppose that A_T is a contingent thermodynamic fact—the fact that the gas in a given container is at a temperature of 300° Kelvin, say. Further, suppose that B_M is a complex fact about the kinetic energy of every molecule in the container. For good measure, let B_M also include the laws of nature, and a totality fact to the effect that there are no further molecules in the container. Then B_M entails A_T , and B_M and A_T would appear to provide a paradigmatic instance of the grounding relation. Yet A_T does not entail B_M : A_T may have a different realizer—it may hold in a world w even though the gas is in a different microstate in w . Then S is falsified by w together with a world in which neither B_M nor A_T obtains.

In cases of multiple realizers, the worlds that jointly falsify the supervenience claim are ones where the grounding fact B fails to obtain. So it is tempting to save supervenience by restricting it to worlds that are indiscernible from the actual world with respect to B . To be precise: A *actuality-sensitively supervenes* on Γ iff any world that is Γ -indiscernible from @ (the actual world) is also A -indiscernible from it.¹⁰ So-defined, actuality-sensitive

⁹This alternative ground of A may or may not be one that actually obtains. So A may or may not have multiple realizers, or grounds, in the actual world.

¹⁰Actuality-sensitive supervenience is often invoked in the literature, although not under that name. Bricker (2006) calls it “local”, as opposed to “global”, supervenience. I shall avoid that terminology, since Kim has established the use of that pair of words to mark a different contrast between supervenience relations. Another alternative would be to call the relation “contingent supervenience”, since it allows for supervenience to hold contingently. But the relation also holds non-contingently between some relata, such as any fact and itself. It would sound odd to say that some contingent supervenience claims are non-contingent.

supervenience is weaker than supervenience.

The proposal, then, is to replace S by $S_{@}$:

$S_{@}$ If Γ grounds A , then A actuality-sensitively supervenes on Γ .

Since grounding is factive, that A grounds $A \vee B$ entails that A is true, and hence every world that is A -indiscernible from the actual world is one in which A is true. Since A is false in both members of the pair of worlds that provided a counterexample to S, that pair does not threaten $S_{@}$.

However, $S_{@}$ is not a thesis in which the concept of supervenience plays a distinctive role. For among actually obtaining facts, the relation of actuality-sensitive supervenience is coextensive with the relation of entailment defined earlier.¹¹

Given that grounding is factive, and thus holds only among obtaining facts, $S_{@}$ is equivalent to E:

E If Γ grounds A , then Γ entails A .

In contrast to the link between grounding and supervenience, E has received some discussion in the literature. It expresses what we may call a “necessitarian” view of grounding, and is endorsed by Correia (2005) and Rosen (2010), for example. Necessitarians can therefore accept a link between grounding and supervenience, in the form of $S_{@}$.

But E has come under attack by what we may call “contingentists” about grounding (e.g. Dancy (2004), Skiles (2012) and Leuenberger (forthcoming)). Hence $S_{@}$ is likewise controversial. A full evaluation of E and $S_{@}$ is beyond the scope of this article. My next question will be conditional: supposing that we reject $S_{@}$, do grounding claims still entail significant supervenience claims? The answer to that question will also be relevant for necessitarians, in a sense to be explained.

¹¹ Assume that A and all members of Γ obtain and that A actuality-sensitively supervenes on Γ . Now suppose that all members of Γ obtain in w . Then w is Γ -indiscernible from $@$. By actuality-sensitive supervenience, w and $@$ are A -indiscernible. Since A obtains in $@$, it does so in w . So Γ entails A .

For the other direction, assume that A and all members of Γ actually obtain, and that Γ entails A . Let w be any world that is Γ -indiscernible from $@$. Since all members of Γ obtain in $@$, they all obtain in w . Hence A , which is entailed by Γ , obtains in w . So $@$ and w are A -indiscernible, and A actuality-sensitively supervenes on Γ .

4 The problem of blockers

To motivate the rejection of $S_{@}$, I shall consider a case discussed in detail by Bricker (2006): the relationship between particular facts—e.g. that Harry is a black raven—and general facts—e.g. that all ravens are black. Bricker argues that there is a sense in which the general facts are determined by the particular facts:

[A]re the general facts *determined* by the particular facts? ... Perhaps it is of some help to note that the determination relation in question is non-causal, and holds of necessity. ... [I]f the atomic truths *determine* the general truths, in the relevant sense, then the general propositions hold or fail to hold *in virtue of*, or *because of*, the holding or failing to hold of the atomic propositions. (Bricker, 2006, p. 255)

Bricker does not use the regimented idiom of grounding. He is among the philosophers who prefer to express claims of determination and dependence in terms of supervenience, rather than introducing a new primitive. But a friend of primitive grounding could take the quote to provide a reason to hold that any given general fact A is grounded by the class of its particular instances.

But, as is well-known since the days of Russell, general facts are not entailed by the class of their particular instances. The instances may all hold in another world and the general fact yet be falsified by a particular that is *alien*, i.e. does not actually exist. So E, and hence $S_{@}$ fail.

We may call this the *problem of blockers* for $S_{@}$. The counterinstance in world w is a blocker for the general fact—it prevents it from obtaining in w . More generally, B is a blocker for A relative to Γ iff Γ grounds A in the actual world, and there is a possible world where all members of Γ obtain, and B , or B together with some members of Γ , grounds $\neg A$ (the negation of A).

Bricker, however, claims that the general facts do supervene on the particular facts. This gives rise to a *prima facie* puzzle: how can he uphold that claim in the face of Russell's observation?

The resolution of the puzzle consists in noting that Bricker's supervenience claim is not the same as the one I have considered. Suppose that Γ rigidly designates the class of actual particular facts. Then my denial of the supervenience of the general on the particular can be expressed by saying

that general facts fail to actuality-sensitively supervene on Γ . Bricker, in contrast, claims that general facts supervene on the particular facts—allowing that in other possible worlds, there are particular facts that do not actually exist. If a is an individual that exists in w but not in the actual world, then facts about a will be among the particular facts of world w , but not of the actual world.

Earlier, I defined worlds w and w' to be Γ -indiscernible iff for every member of Γ , w and w' are A -indiscernible. We can now see that this definition has two readings. On the reading of the previous section, which is not Bricker's, Γ is a class that has its membership necessarily. On Bricker's reading, Γ stands for a type of facts, with potentially varying membership across worlds. Thus worlds w and w' are Γ -indiscernible if every Γ -fact that exists—and therefore obtains—in world w also obtains in w' , and every Γ -fact that exists in w' also obtains in w .

It is clear what the contrast between the readings is. It is less clear how to label it. I prefer to say that we have two different first relata of supervenience: classes of facts and types of facts, respectively.

For our purposes, a type T_Γ —can be modeled by a function that maps a world to a class of facts that obtain in that world. We can then say that worlds w and w' are T_Γ -indiscernible iff $T_\Gamma(w) = T_\Gamma(w')$, that is, if the function returns the same value for these two worlds. Since every member of $T_\Gamma(w)$ obtains in w , and likewise for $T_\Gamma(w')$ and w' , the T_Γ -indiscernibility of w and w' has the consequence that every $A \in T_\Gamma(w)$ obtains in w' , and every $A \in T_\Gamma(w')$ obtains in w .

Supervenience is defined in terms of indiscernibility as before: T_Δ supervenes on T_Γ iff any T_Γ -indiscernible worlds are T_Δ -indiscernible. It is straightforward to modify this definition in such a way that the first relatum is a class and the second a type, or vice versa.

If we did not wish to speak of types, we might alternatively hold that there are two kinds of classes: classes of one kind have their membership essentially, while classes of the other have it accidentally.¹² Note that it would be terminologically unfortunate to contrast “class” with “property”, “attribute”, or “intension”, as is natural in analogous contexts. For Bricker's intended claim is not that the property *being a general fact* supervenes on the property *being a particular fact*. That latter claim might be true even if—per

¹²Compare the temporal rather than modal case: “The class of billionaires has been growing every year.” For relevant discussion, see Sharvy (1968) and Fine (1981).

impossible—different general facts held in two worlds that are indiscernible with respect to the particular facts.

As explained above, the first reading of the supervenience thesis does not yield an interesting and distinctive claim: actuality-sensitive supervenience is just entailment, or strict implication, under yet another name. But Bricker’s reading does provide an interesting claim. He is surely right that we want to say that general facts supervene on the particular facts. The expression “the particular facts” denotes what I call a type of facts.

Let us return to our question whether grounding claims entail supervenience claims. We may try the following, where T_Γ denotes the type of facts to which all members of Γ belong, and to which no other actual facts belong:

TS If Γ grounds A , then A supervenes on T_Γ .

Alternatively, we could replace A in the consequent of TS by $T_A(= T_{\{A\}})$. I shall only discuss that variant separately if the difference matters.

TS seems to solve the problem of blockers we have encountered. In the example above, a certain particular fact B of w involving an alien particular blocks a general fact that obtains in the actual world. But even though B is not in Γ (it is not an actual particular fact) it is in T_Γ (it belongs to the same fact-type as all the actual particular facts). So @ and w are T_Γ -discernible, and there is no counterinstance to TS.

What is more, TS can also deal with the instance of the problem of multiple realizers upon which S floundered. The worlds w and w' , as described, are indiscernible with respect to the microfact B_M that actually grounds the thermodynamic fact A_T — B_M fails to obtain in both of them—but discernible with respect to A_T . But they differ with respect to the type that B_M belongs to—in w but not in w' , some such microfact obtains.

We may note that the possibility of blockers also threatens another supervenience claim involving facts and their grounds (suggested by an anonymous referee): that any non-fundamental fact A supervenes on the class of all its possible grounds. Or, more precisely, that if A is necessarily non-fundamental, then A supervenes on $G(A)$, where $G(A)$ is the class of all facts B such that for some world w and some Γ , $\{B\} \cup \Gamma$ grounds A in w . That supervenience claim is immune to the problem of multiple realizers. It may fail, however, in blocking scenarios. For in such a scenario, the crucial difference between w and the actual world concerns the blocking fact. But presumably, that fact is not among the grounds of A in any possible world,

and is thus not in $G(A)$. So w and the actual world are A -discernible without being $G(A)$ -discernible.

5 The reference type problem

For all its virtues, TS faces an important objection: if Γ is simply a class of actual facts, we are not entitled to use the definite description “the type of Γ ”. There may be more than one type of facts such that Γ consists of all and only its actual instances, and a given fact A may supervene on some of these types but not on others. TS is not well-defined. This is what I call the “reference type problem”.

The function T_Γ which models the type of Γ needs to satisfy some constraints. The first one is that $T_\Gamma(@) = \Gamma$: the actual members of the type of Γ are all and only the members of Γ . A second constraint we may wish to impose is that membership in a given type is essential to a fact, such that if A obtains in both w and w' , then $A \in T_\Gamma(w)$ iff $A \in T_\Gamma(w')$. Together, these constraints ensure that $T_\Gamma(w)$ includes all Γ -facts that obtain in w , and does not include any actual facts that are not in Γ . But consider a world w , and any fact obtaining at w that is alien, in the sense of not obtaining in the actual world. An alien fact may be a fact whose negation obtains in the actual world, or it may be a fact constituted by alien properties or particulars. Then if a function T_Γ with $A \in T_\Gamma(w)$ satisfies the two constraints, so does T'_Γ , which is like T_Γ except that $A \notin T'_\Gamma(w)$. Conversely, if T'_Γ satisfies the constraint, so does T_Γ . The most inclusive such function includes every alien fact at every world; the least inclusive includes no alien fact at any world. In between, there are countless other functions. This means that for all that has been said, there are a huge number of different types associated with a given class of facts Γ .

A related problem for formulating claims of grounding or reduction in terms of supervenience has been noted in passing by Kit Fine (2001, p. 11), and called the “reference class problem”, after a well-known challenge for frequentist accounts of single-case probability. A reference class problem for supervenience arises, for example, if we wish to say that a fact A reduces to a fact B iff every member of the reference class of A supervenes on the reference class of B . The two problems are distinct: in one case, we are to associate a fact with a class of facts; in the other case, we are to associate a class of facts with a function from possible worlds to classes of facts. I do

not wish to discuss the reference class problem here.¹³

Is the reference type problem fatal for TS? This depends on whether we are prepared to accept a certain version of inegalitarianism about fact types, in analogy to the more familiar inegalitarianism about properties (Lewis, 1983). Indeed, inegalitarianism seems quite plausible. Some of the functions that satisfy the constraints are more natural than others, and have a better claim to correspond to types. The type of particular facts is naturally associated with the class of actual particular facts. For another example, let Γ_m be the class that consists of all actual mass facts—instantiations of some determinate of mass by some individual. Then some alien facts have a much better claim to belong to the type of Γ_m than others. For example, the fact that alien individual a has a mass of 1 gram has a better claim to be in $T_{\Gamma_m}(w)$ than certain other facts of world w —say, that a has unit positive charge, or that Vienna is the capital of the United States. Nor does this appear to be a consequence of me describing Γ_m as the “class of actual mass facts”. Rather, it seems to be a matter of the objective resemblance among facts.

But while it is plausible that some functions have a better claim to represent a type than others, it is unclear whether there is a unique privileged one, which deserves the definite description “the type of Γ ”. One may think that T is defined for some Γ but not others, and hence that TS is defined for some Γ but not others. For simplicity, I shall often speak of accepting or rejecting TS without considering more discriminating attitudes.

The reference type problem does not, of course, cast doubt on whether supervenience is a well-defined relation. It only casts doubt on whether there is a path from grounding to supervenience.

For the sake of the argument, I shall assume in the next two sections that there is a privileged type, and hence that T is defined and TS meaningful.

¹³Fine’s discussion is highly compressed. He considers the proposal—call it “ S_F ”—that “[o]ne class of propositions will reduce to—or supervene upon—another if, necessarily, any truth from the one is entailed by truths from the other”. According to Fine, S_F “faces the . . . problem of the ‘reference class,’ for whether one proposition is reducible to others will depend upon the classes of proposition with which they are associated”. In fact, this problem does not arise for S_F : the supervenience-condition it gives is perfectly well-defined and does not suffer from any reference-class or reference-type problem. S_F , as opposed to the example given in the main text here, is not a suitable example to illustrate the issue.

6 The problem of heterogeneous realizers

As noted at the end of section 4, TS is compatible with the case of multiple realizers that I used as a counterexample to S. However, it appears to be incompatible with *heterogeneous* realizers: different realizers that do not belong to the same type. If the fact that Hilary believes that p is actually grounded by physical facts, but is grounded by ectoplasmic facts in some other world, it has a heterogeneous realizer in that world. Suppose that Γ actually grounds A , and that Γ' is a heterogeneous realizer of A in w . Then barring brute necessary connections, there is a world w' where neither A nor any of its potential realizers obtains. Then w and w' are T_Γ -indiscernible—because no facts of the type of Γ obtain in either world, say—and yet A -discernible.

This problem also arises for the cousin of TS, mentioned briefly before, according to which T_A supervenes on T_Γ if Γ grounds A . Plausibly, the type T_A associated with a single fact A is a function that maps a world w to A if A obtains in w , and to the empty class otherwise. If so, TS and its cousin are equivalent. But at any rate, the constraint that type membership is essential ensures that in the example from the last paragraph, $A \in T_A(w)$. Since A does not obtain in w' , $A \notin T_A(w')$, and hence w and w' are T_A -discernible.

A variant of the problem of heterogeneous realization is the *problem of floaters*. Roughly, a fact could be a floater if it is contingently non-fundamental in the actual world. More precisely, A is a floater in world w iff A is grounded in the actual world, but obtains without being grounded in w . If the fact that René is in pain is physically grounded, but is ungrounded in another world, then it is a floater in that world.¹⁴

TS can be argued to be incompatible with the possibility of floaters. Surely, if A is a floater in w , there is a world w' that is T_Γ -indiscernible from w where A does not obtain. Otherwise, we would have necessities that are not in any way derived from grounding relations, and are thus brute.

Some philosophers may have theoretical commitments that allow them to accept the possibility of heterogeneous realizers, but not of floaters. David

¹⁴Note that if some ungrounded facts are contingently ungrounded, the type (in the sense of section 5) of the class of actually ungrounded facts will not be captured by the function that maps every world to the class of facts that are ungrounded in that world. The type will track a more intrinsic property of those facts, intuitively. If microphysicalism is true, the type might be captured by a function that maps every world to the microphysical facts of that world.

Lewis, for example, defines materialism and Humean supervenience as supervenience theses restricted to what he calls an “inner sphere of possibility” around the actual world, consisting of those worlds in which no alien fundamental property is instantiated. Materialism is then the claim that among worlds in the inner sphere, no two differ without differing physically (Lewis, 1983); and Humean supervenience is the claim that among worlds in the inner sphere, no two differ without differing in the arrangement local matters of particular facts (Lewis, 1994). A world with a heterogeneous realizer of an actual fact will presumably be in the outer sphere, since the realizer will involve the instantiation of alien fundamental properties. So it is compatible with these supervenience claims. But a world in which an actual fact is a floater need not be in the outer sphere, on the face of it. It does not involve the instantiation of an alien fundamental property; rather it involves the fundamentality of a non-alien property. So that possibility appears to falsify the supervenience theses. Since the possibility is intuitively compatible with the truth of materialism and Humean supervenience in the actual world, a defender of those analyses needs to be able to rule out floaters.¹⁵

Since $S_{@}$ is compatible with the possibility of heterogeneous realizers and floaters, the considerations in this section show that $S_{@}$ does not entail TS. Hence a necessitarian about grounding who is also an inegalitarian about fact types can use both $S_{@}$ and TS to articulate the link between grounding and supervenience, provided that she rejects the possibility of heterogeneous realizers and floaters.

Are these possibilities still compatible with some link between grounding and supervenience? We can replace TS by a claim that stands to it as $S_{@}$ stands to S:

TS_@ If Γ grounds A , then A actuality-sensitively supervenes on T_{Γ} .

TS_@ is immune from the threat of heterogeneous realizers and floaters.

Clearly, TS_@ is entailed by TS. Given the plausible condition that $O(\Gamma)$ entails $\Gamma \subseteq T_{\Gamma}$ —the condition that if a fact belongs to a type, it does so necessarily—TS_@ is also entailed by $S_{@}$.

¹⁵Lewis himself takes perfectly natural properties to be necessarily fundamental. But this is a commitment that goes beyond inegalitarianism.

7 The problem of heterogeneous blockers

Weak as it is, $TS_{@}$ still rules out scenarios that are *prima facie* possible. For it is incompatible with heterogeneous blockers. A fact B is a heterogeneous blocker of A in w relative to Γ iff it is a blocker of A in w relative to Γ , and does not belong to $T_{\Gamma}(w)$. If there is a world where B is a heterogeneous blocker of A , then barring brute necessities, it is possible that there is a world w' that is T_{Γ} -indiscernible (and not just Γ -indiscernible) from $@$ and in which A fails to obtain.

Could there be heterogeneous blockers? Here is a potential example: Γ_P consists of the actual physical facts, and A_R is a phenomenal fact—that David has an experience of a particular shade of phenomenal redness, say. A physicalist will wish to say that Γ_P grounds A_R . But perhaps the instantiation of a non-physical alien fundamental property, which we might call “chromoplasm”, would prevent David’s physical duplicate in another world from having that experience.¹⁶ Together with Γ , that fact B would ground the negation of A . If physicalists are right, and if this scenario is possible, the instantiation of chromoplasm is a blocker in the technical sense defined earlier. Clearly, though, B , as a non-physical fundamental fact, is not of the same type as Γ , so that it is a heterogeneous blocker.

The claim that heterogeneous blockers are possible is, I take it, the most controversial of the possibility claims that have been seen to make trouble for putative entailments between grounding and supervenience. A philosopher who is prepared to reject it, and who is an egalitarian about fact types, may use $TS_{@}$ to capture an important link between grounding and supervenience.

8 Conclusion

It is often assumed that there are logically weaker supervenience claims corresponding to grounding claims. In this paper, I have shown this assumption to be problematic in more than one way. In particular, I have discussed the following four entailment theses:

S If Γ grounds A , then A supervenes on Γ .

S_@ If Γ grounds A , then A actuality-sensitively supervenes on Γ .

¹⁶Hawthorne (2002), which introduces blockers into the literature, argues that their possibility to be incompatible with physicalism. Leuenberger (2008) disagrees.

TS If Γ grounds A , then A supervenes on T_Γ .

TS_@ If Γ grounds A , then A actuality-sensitively supervenes on T_Γ .

The first of these entailment theses, S, has been shown to be untenable. The third, TS, may be rejected for two different reasons: the reference type problem, if unsolved, will leave T_Γ undefined; and the possibility of either heterogeneous realization, of floaters, or of heterogeneous blockers will falsify it. Philosophers who reject the possibility of any blockers can accept S_@ as a fall-back position. Those who think that the reference type problem can be solved, and accept the possibility of either heterogeneous realization or floaters, can accept TS_@ as long as they reject the possibility of heterogeneous blockers; if they think the latter are possible, they are committed to reject all four entailment theses.

The table below summarizes the compatibility of the above four claims with the reference type problem remaining unsolved, and with various possibilities: multiple realizability, heterogeneous realizability, blockers, and heterogeneous blockers. A tick indicates compatibility, a cross incompatibility.

	ref. type	mult. real.	het. real.	blockers	het. blockers
S	✓	×	×	×	×
S _@	✓	✓	✓	×	×
TS	×	✓	×	✓	×
TS _@	×	✓	✓	✓	×

It is beyond the scope of this paper to settle any of the substantive issues upon which the seriousness of the reference type problem and the truth of these possibility claims depend. Note that if the reference type problem can be solved, and if all all the possibility claims are true, then supervenience claims are typically logically independent from the grounding claims to which they correspond. Rather than providing rival regimentations of the same pre-theoretical concept, grounding and supervenience, having different relata, can then be seen as complementary.

References

Phillip Bricker. The relationship between the general and particular: Entailment vs. supervenience. In Dean Zimmerman, editor, *Oxford Studies*

- in Metaphysics*, volume 2, pages 251–87. Oxford University Press, Oxford, 2006.
- Fabrice Correia. *Existential Dependence and Cognate Notions*. Philosophia, München, 2005.
- Jonathan Dancy. *Ethics without Principles*. Oxford University Press, Oxford, 2004.
- Cian Dorr. Propositions and counterpart theory. *Analysis*, 65:210–218, 2005.
- Kit Fine. First-order modal theories I–sets. *Nous*, 15:177–205, 1981.
- Kit Fine. The question of realism. *Philosophers’ Imprint*, 1:1–30, 2001.
- Kit Fine. A guide to ground. In Fabrice Correia and Benjamin Schnieder, editors, *Metaphysical Grounding: Understanding the Structure of Reality*, pages 37–80. Cambridge University Press, Cambridge, 2012.
- John Hawthorne. Blocking Definitions of Materialism. *Philosophical Studies*, 110:103–113, 2002.
- Stephan Leuenberger. *Ceteris absentibus* physicalism. In Dean Zimmerman, editor, *Oxford Studies in Metaphysics*, volume 4, pages 145–170. Oxford University Press, Oxford, 2008.
- Stephan Leuenberger. Grounding and necessity. *Inquiry*, forthcoming.
- David Lewis. New work for a theory of universals. *Australasian Journal of Philosophy*, 61:343–377, 1983.
- David Lewis. Humean supervenience debugged. *Mind*, 103:473–490, 1994.
- Brian P. McLaughlin. Perception, causation, and supervenience. *Midwest Studies in Philosophy*, 9:569–592, 1984.
- Brian P. McLaughlin and Karen Bennett. Supervenience. *Stanford Encyclopedia of Philosophy*, 2006.
- David Papineau. Must a physicalist be a microphysicalist? In Jakob Hohwy and Jesper Kallestrup, editors, *Being Reduced*, pages 126–148. Oxford University Press, Oxford, 2008.

- John F. Post. Is supervenience asymmetric? *Manuscript*, 22:305–344, 1999.
- Gideon Rosen. Metaphysical dependence: Grounding and reduction. In Bob Hale and Aviv Hoffmann, editors, *Modality. Metaphysics, Logic, and Epistemology*, pages 109–35. Oxford University Press, Oxford, 2010.
- Jonathan Schaffer. On what grounds what. In *Metametaphysics. New Essays on the Foundations of Ontology*, pages 347–383. Oxford University Press, Oxford, 2009.
- Richard Sharvy. Why a class can't change its members. *Nous*, 2:303–314, 1968.
- Alexander Skiles. *Getting Grounded: Essays on the Metaphysics of Fundamentality*. PhD thesis, Notre Dame University, 2012.