

Supervenience without boxes and diamonds

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Abstract

I argue that constraining, the intuitive notion motivating attempts to capture technical notions of supervenience, is not usefully analysed in modal terms: all modal characterisations of constraining on the market share some important drawbacks and face counterexamples. In a second, positive, part, I articulate a non-modal concept of constraining: instead of explaining it in terms of modal covariance, I explain it in terms of essential ties between properties, taking the determinate/determinable relation as my paradigm case. Essence, not modality, is our clue to constraining.

The intuitive idea: constraining

“What is the connection between the natural fact that an action is a piece of deliberate cruelty [...] and the moral fact that it is wrong? It cannot be an entailment, a logical or semantic necessity. Yet it is not merely that the two features occur together. The wrongness must somehow be “consequential” or “supervenient”: it is wrong because it is a piece of deliberate cruelty. But just what *in the world* is signified by this “because?” (Mackie 1977: 44)

“Supervenience”, though a philosophers’ notion, has a venerable history (cf. Horgan 1993). It was used by Leibniz to say that relations are nothing over and above the intrinsic properties of their relata, by the British emergentists to characterise the special sciences (cf. McLaughlin 1992), by Sidgwick to say that moral characteristics covary with non-moral ones, by Moore (1922: 261) to say that the former are grounded in the latter, by Hare (1952: 80–81) to say that they stand in some relation of strict implication and by Davidson (1970: 214) to say that “mental characteristics are in some sense dependent, or supervenient, on physical characteristics” (cf. Kim 1990: 136–138). Here is what Robert Stalnaker (1996) says about the “intuitive ideas that motivate the attempts to articulate concepts of supervenience”:

To say that the *A*-properties or facts are supervenient on the *B*-properties or facts is to say that the *A*-facts are, in a sense, redundant, since they are already implicitly specified when one has specified all the *B*-facts. *A*-facts are not fact ‘over and above’ the *B*-facts, not something ‘separate’. To state an *A*-fact, or ascribe an *A*-property, is to describe the same reality in a different way, at a different level of abstraction, by carving the same world at different joints. (Stalnaker 1996: 87)

Kim (1990: 140) identifies three key features of our concept of supervenience: covariance, dependency and non-reducibility (where “non-reducibility” means that the supervenience of *A*-features on *B*-features is consistent with the former not being reducible to the latter).¹

Supervenience claims are not by themselves explanatory: a supervenience thesis asserts co-variation, but does not itself explain why this covariation holds.

Apart from its intrinsic interest, the concept of supervenience is useful to formulate a lot of different philosophical theses, as for example:

1. that mental properties supervene on physical ones (materialism or physicalism) (cf. e.g. Davidson 1970);

¹Later 1993a: 165, n. 5, he gave up on the third condition of non-reducibility.

2. that everything supervenes on the distribution of a select few natural properties over space-time points (the thesis of ‘Humean supervenience’, defended in particular by David Lewis;²
3. that the future supervenes on the past and natural laws (determinism);
4. that the content of mental states supervenes on intrinsic properties of the person who has them (internalism about content);
5. that moral properties supervene on non-moral ones (cf. e.g. Moore 1922: 261);
6. that aesthetic properties supervene on physical ones (cf. e.g. Levinson 1984);
7. that epistemic justification must eventually be cashed out in non-epistemic terms (Sosa 1980: 551).

In all these cases, the presence of the metaphysical supervenience relation is compatible with different epistemological relations between the respective domains:

“...the thesis that a given domain supervenes on another is a metaphysical thesis about an objectively existent dependency relation between the two domains; it says nothing about whether or how the details of the dependency relation will become known so as to enable us to formulate explanations, reductions, or definitions.” (Kim 1984: 76)

“The concept of supervenience is supposed to be a concept that helps to isolate the metaphysical part of a reductionist claim – to separate it from claims about the conceptual resources and explicit expressive power of theories we use to describe the world.” (Stalnaker 1996: 89).

Intra-world supervenience: nonreductionism without covariance

A first notion of supervenience, also called “weak”, is what (Jackson 1998: 9) calls “*intra-world supervenience*”:

Definition 1 (Intra-world supervenience). *A set of properties A intra-worldly supervenes upon a set of properties B iff, for any possible world w, if x and y are B-indiscernible in w, then they are A-indiscernible in w.*³

Kim (1984: 64) shows that under some conditions⁴, (1) is equivalent to the following:

$$(1) \quad \Box \forall x \forall F \in A (Fx \rightarrow \exists G \in B (Gx \wedge \forall y (Gy \rightarrow Fy)))$$

Intra-world supervenience (1), as Jackson (1998: 10) notes, is clearly too weak: it does not capture relational dependencies and does therefore not secure that the *B*-nature of something *alone* secures its *A*-nature. The property of being among the tallest things intra-worldly supervenes on the individual height some object has, but something’s being among the tallest things does not just depend on its height, but also on the heights of his world-mates. It falls short of the condition that “fixing the base properties of an object fixes its supervenient properties” (Kim 1984: 60). It does not support counterfactuals: we cannot say that if something had the subvening properties, it would also have the supervening ones. The covariance might be purely accidental.

²Cf.: “We have geometry: a system of external relations of spatiotemporal distance between points. ...And at the points we have local qualities: perfectly natural intrinsic properties which need nothing bigger than a point at which to be instantiated. ...All else supervenes on that.” (Lewis 1986: 3-4)

³This is also the version of Stalnaker (1996: 91). Two objects are *X*-indiscernible iff they share all the properties in *X*: $\forall F \in X (Fx \leftrightarrow Fy)$.

⁴We have to assume that the set *B* is ‘closed’ under negation and (possibly infinite) conjunction. A set of is ‘closed’ under an operation if everything we get by applying the operation to a member of the set is itself a member of the set. In our example, *B* is closed under negation and infinite conjunction iff (i) if $P_1, \dots, P_n, \dots \in B$, then $\neg P_i \in B$ (for every *i*) and (ii) if $P_1, \dots, P_n, \dots \in B$, then $\bigwedge_{i=1}^{\infty} P_i \in B$.

Inter-world supervenience: covariance without non-reductionism

Weak supervenience is clearly too weak: it does not give us a reductionist thesis, but it does not rule out that the covariance in question is purely accidental. We therefore strengthen weak to strong supervenience and say that a set of properties *A* *inter-worldly supervenes* upon a set of properties *B* iff, for any possible individuals *x* and *y*, if they are *B*-indiscernible, then they are *A*-indiscernible.

Instead of quantifying just over possible worlds we now quantify possible individuals, instead of indiscernability with respect to some possible world, we now have indiscernability *tout court*. If we say that two possible individuals are indiscernible iff they have the same properties in their respective worlds, we get:

Definition 2 (Inter-world supervenience). *A set of properties A inter-worldly supervenes upon a set of properties B iff, for any worlds w and v and any individuals x and y, if x has the same B-properties in w than y has in w, then x has in w the same A-properties than y has in w.*⁵

Strong, inter-world, supervenience entails, but is not entailed by, weak, intra-world, supervenience.

The main difference between weak (1) and strong supervenience (2) is that we strengthen the notion of sameness of properties from co-extensiveness to necessary co-extensiveness. Kim (1984: 65) and Kim (1987: 81) show that strong supervenience comes to the following, if the subvening set of properties is closed under infinite conjunctions and disjunctions:

$$(2) \quad \Box \forall x \forall F \in A (Fx \rightarrow \exists G \in B (Gx \wedge \Box \forall y (Gy \rightarrow Fy)))$$

This means that a thesis of inter-world supervenience commits us to the existence of necessary entailments from *A*- to *B*-properties and hence to reductionism.

Global supervenience: covariance & nonreductionism without dependency

Definition 3 (Global supervenience). *A set of properties A globally supervenes upon a set of properties B iff all possible worlds that are B-indiscernible are A-indiscernible.*⁶

Global supervenience logically follows from, but does not logically entail, strong supervenience.

Kim (1987: 85–86) argues global supervenience, in the absence of strong supervenience, is of little use in metaphysics. Independent of assumptions about the realm of possibilities, it does not rule out worlds containing *B*-indiscernibles that are *A*-discernible; neither does not specify property-to-property correlations and does not say of any one individual that *its* *A*-properties depend on or are exemplified in virtue of *its* *B*-properties.

Global supervenience is too general, too coarse-grained a notion to provide an interesting analysis of constraining. Independent of assumptions about the realm of possibilities, it does not even imply weak supervenience: it does not rule out worlds containing *B*-indiscernibles that are *A*-discernible; neither does not specify property-to-property correlations and does not say of any one individual that *its* *A*-properties depend on or are exemplified in virtue of *its* *B*-properties. In the opinion of Kim (1990: 159), that the fact that specific property correlations are our best evidential grounds for supervenience theses “shows why a global supervenience claim *unaccompanied by the corresponding strong supervenience (or covariance) claim* can be so unsatisfying: we are being asked, it seems to me, to accept a sweeping claim about *all possible worlds* [...] as a brute fact.”

⁵Definitions of strong supervenience equivalent to (2) have been given by Kim (1984: 65), Kim (1987: 81) (who also cites an unpublished paper by Brian McLaughlin), Paull and Sider (1992: 834) and Stalnaker (1996: 89).

⁶Essentially this definition is given by Hellman and Thompson (1975), Haugeland (1982), Horgan (1982), Lewis (1983: 29), Kim (1984: 68), Kim (1987: 82) and (Stalnaker 1996: 91). Horgan and Lewis think it is the appropriate notion.

Clearly, something is wrong. If *strong* supervenience isn't strong enough to be an adequate dependency relation, no supervenience relation is. (Paull and Sider 1992: 842)

World isomorphisms to the rescue?

What does it mean that two worlds are indiscernible with respect to some properties?

What does it mean for a supervenience thesis to hold across different domains?

It has turned out very difficult to cash out these notions.⁷

The upshot is a negative one:

Global supervenience is of little independent value. [(9)] has certain rhetorical and epistemic virtues, but no metaphysically distinctive function, and neither [middling supervenience] nor [(8)] is strong enough to capture any interesting dependencies. [...] In order to capture the real dependence of *A* on *B*, even when those properties are instantiated by entirely different sets of things, there has to be some kind of tie between the distribution of *B*-properties and the distribution of *A*-properties. (Bennett 2004: 22)

⁷A first stab is the following:

Definition 4 (Multiple domain supervenience). $\langle A, D_1 \rangle$ supervenes on $\langle B, D_2 \rangle$ iff every complete distribution of *B* over D_2 entails a unique complete distribution of *A* over D_1 .

How do we individuate distributions?

Definition 5 (Φ -preserving isomorphisms between worlds). For some set of properties Φ and worlds w and w' , some function $f : |w| \rightarrow |w'|$ is a Φ -preserving isomorphism iff it is one-one and for every $F \in \Phi$: $F(x)$ in w iff $F(f(x))$ in w' .

The domains are thus assumed to have the same cardinality:

Even for worlds with domains of different sizes it should be meaningful, and sometimes true, to say that they are "alike" in physical, or psychological, respects, in a sense of "alike" that is relevant to claims of supervenience [...] we would want to say that a large and a small cube of sugar are both water-soluble in virtue of the fact that their respective parts (molecules) are in 'the same micro-state.' (Kim 1988: 119, 125)

Switching from functions to relations?

Definition 6 (Weak coordinated domains supervenience). $\langle A, D_1 \rangle$ supervenes on $\langle B, D_2 \rangle$ relative to relation R iff, for every x and y in D_1 , if $R|x$ is *B*-indiscernible from $R|y$, then x is *A*-indiscernible from y .

Definition 7 (Strong coordinated domains supervenience). $\langle A, D_1 \rangle$ supervenes on $\langle B, D_2 \rangle$ relative to relation R iff, for every x and y in D_1 and any worlds w and v , if $R|x$ in w is *B*-indiscernible from $R|y$ in v , then x in w is *A*-indiscernible from y in v .

With the notion of Φ -preserving isomorphism in place, we can distinguish weak and strong global supervenience (cf. Stalnaker (1996: 227), McLaughlin (1997: 214), Sider (1999: 917)), depending on whether we require every *B*-preserving isomorphism between x and y to be itself an *A*-isomorphism or just to entail the existence of a *A*-isomorphism:

Definition 8 (Weak global supervenience). A set of properties *A* weakly globally supervenes upon a set of properties *B* iff, for all possible worlds w and w' , if there is a *B*-preserving isomorphism between w and w' , then there is a *A*-preserving isomorphism between w and w' .

Definition 9 (Strong global supervenience). A set of properties *A* strongly globally supervenes upon a set of properties *B* iff, for all possible worlds w and w' , every *B*-preserving isomorphism between w and w' is *A*-preserving.

Bennett (2004: 26–31) proves that they come out equivalent if the supervening set contains only intrinsic properties and the subvening set does not contain any haecceistic properties (properties that distinguish between any counterparts). (9) is equivalent to strong supervenience if the subvening set is closed under Boolean operators, quantification and identity.

Modal covariance is not sufficient for constraining: the symmetry problem

Dependence and determination are asymmetric relations – supervenience, according to all definitions above, is not: not only do properties of the singleton {Socrates} supervene on those of Socrates, but also do properties of Socrates supervene on those of his singleton.

All this points to the conclusion that the idea of dependence, whether causal or supervenient, is metaphysically deeper and richer than what can be captured by property covariance, even when the latter is supplemented with the usual modal notions. [...] ...property covariation by itself does not warrant the use of “because”, “in virtue of”, etc., in describing the relationship any more than it warrants the attribution of dependence. (Kim 1990: 147)

Modal covariance is not sufficient for constraining because it may or may not hold in virtue of a grounding relation. Weak supervenience is not sufficient because it does not capture relational dependencies (the property of being among the tallest things weakly supervenes on height but is not determined by it) and does not support counterfactuals. Strong supervenience is not sufficient because it is symmetric in cases where determination is not (e.g. the surface area of a sphere determines its volume, and not conversely), while the cardinality of worlds globally supervenes on every set of properties whatsoever.

Modal covariance is not necessary for constraining: the contingency problem

Many supervenience claims, and most of the prominent ones, are usually taken to hold contingently:

Materialism is meant to be a contingent thesis, a merit of our world that not all other worlds share. Two worlds could indeed differ without differing physically, if at least one of them is a world where Materialism is false. (Lewis 1983: 35)
...physicalism is not a claim about every possible world, but only a claim about *our* world to the effect that its physical nature exhausts all its nature. (Jackson 1998: 11)

To account for this feature, many analyses of e.g. materialism/physicalism – the thesis that everything qualitative is determined by the physical, mental properties constrained by physical ones – have characterised it as modal covariance across a restricted range of possible worlds, i.e. in terms of conditional necessity:

Among worlds where no natural properties alien to our world are instantiated, no two differ without differing physically; any two such worlds that are exactly alike physically are duplicates. (Lewis 1983: 37)
Any world which is a minimal physical duplicate of our world is a duplicate simpliciter of our world, where a minimal physical duplicate is what you get if you ‘stop right there’. (Jackson 1998: 12)

As Hawthorne (2002: 112, fn. 8) has remarked, the two accounts are not equivalent, at least assuming an indexical reading of ‘actual world’ in Lewis’ criterion. Lewis’ but not Jackson’s account rules out a scenario where we have two worlds in which no alien properties are exemplified, which are not minimal duplicates of the actual worlds, but which are physical duplicates, though not duplicates simpliciter, of each other.

Lewis' and Jackson's definitions, however, do not capture what the physicalist wants to say. They oblige him to claim that the world about which Descartes is right is not a *physical* duplicate or contains *alien* properties. But the physicalist does not have to burden Descartes with these extra claims. What he and Descartes disagree about is whether the actually existing link between brain- and mental states is a determining one; both can agree that in some other possible world it might be absent, without there being extra properties of either the physical nor the mental kind. For Descartes asserted no such thing: he is not committed to the claim that a world where we are Cartesian egos differs in its distribution of *physical* properties, nor to the claim that in such a world properties are exemplified that are not exemplified in the actual world.

...what is interesting, and disquieting, about this way of solving the problem [of making supervenience hold contingently] is that the concept of supervenience is no longer what is doing the work of formulating the reductionist thesis in a way that isolates its metaphysical component. On this account, the materialist's global supervenience thesis is this: relative to all possible worlds that have the same total set of properties and relations as our world, the mental globally supervenes on the physical. But this thesis is a trivial consequence of the materialist thesis that was stated without the notion of supervenience: that the set of all basic properties and relations of our world is the set of physical properties and relations. (Stalnaker 1996: 98)

Supervenience as dependence

Whenever some properties *A* supervene on other properties *B*, what makes that something has a *B*-property *ipso facto* makes it true that it has a *A*-property. There is just one truthmaking involved, nothing further is required: the physicalists' commitment is "to the physical nature of the world making true the psychological account of the world" (Jackson 1998: 68).

Some authors, most notably Armstrong, have talked of supervenience between objects, suggesting that the supervenient comes as an free ontological lunch (Armstrong 1997: 12). Though they have taken supervenience to be entailment, what they meant is existential dependence. The difference between these two concepts parallels the one between necessary covariance and supervenience:

"Suppose that one considers a certain subset of worlds, where each member of the subset has certain features in common. For instance, suppose that in each such world, the individuals in that world are distributed according to the same pattern, having exactly the same properties and relations. It may appear a plausible claim that, in each such world, certain further, or ostensibly further, features are fixed. For instance, in the case just considered, it appears that the *resemblances* of all individuals do not differ from world to world. The resemblances are then *supervenient* on the original features, the pattern of qualities and relations, which each world had in common. [...] The conclusion I wish to draw [...] is that the supervenient is not really a feature of the world distinct from the features it supervenes on. The resemblances of things, for instance, are not really distinct from the properties and relations of things." (Armstrong 1989: 6-7)

"...I take it as a cardinal principle in ontology that *supervenient 'additions' to ontology are pseudo-additions*. No new being is involved. In the Creation metaphor, to bring supervenients into being calls for no separate and additional act on God's part." (Campbell 1990: 37)

But this is too good to be true:

“But it’s all to clear that for philosophers, at least, there ain’t no such thing as a free lunch.” (Lewis 1983: 23)

“Since supervenient entities exist and are not identical to the entities upon which they supervene, they *must* be an ontological addition.” (Oliver 1996: 31, fn. 30)

“as we know from everyday life, the cardinal rule is that if you think you’re getting a free lunch, that means you’ve already paid for it somewhere else” (Nolan 2009: 288)

Determinates and determinables

The determinable COLOUR is determined by the determinate RED, which in turn is determined by the (lower) determinate LIGHT RED, which is just to say that “light red” is a precisification of “red”. The co-exemplification of determinables makes for less resemblance than the co-exemplification of any particular of their determinates, and they qualify their exemplifications less determinately.

Colors vary according to hue, saturation and brightness, and these variations are independent of one another. If hue, saturation, and brightness are determinables, they are not separate, since they depend on each other. There cannot be saturation without hue, for example, even though no determination of saturation requires any particular determination of hue. Johnson says that the determinable COLOUR is “single, though complex, in the sense that the several constituent characters upon whose variations its variability depends are inseparable.” (Johnson 1921: 183)

Determinates are related to their determinables by a relation of determination. The determinate property is a way of having the determinable property, it determines it. As Prior (1949: 13) and Funkhouser (2006: 550) have noted, this determination relation is importantly different from the one holding between a conjunction and its conjuncts. It differs from it in that the determinate determines the determinable *along a certain dimension*. Funkhouser (2006: 551) calls the value-ranges of the independent variables in which a property may be further determined the “determination dimensions” of that property. Determinates under the same determinable differ in particular ways – i.e. along the determination dimensions of their common determinable. In many cases, it is an open question what the determination dimensions of some determinable are (consider e.g. the properties of being brave, intelligent or beautiful) – this does not show, however, that they do not have any. Some determination dimensions are continuous, some are discrete, some bounded, some unbounded, some have infinite and some only have two “points” or values.

Whenever we have different determination dimensions, we can picture property instances as points within a three- or higher-dimensional space. Glueing together such spaces, we get “qualitative locations” with respect to two or more properties. Combining the determination dimensions of all fundamental properties, we arrive at a “property space”, in which every property bearer is uniquely located and within which indiscernibles share the same location. Within that property space, determinates are (or correspond to) subregions of their determinables, giving us an ontological account of how a determinate is a way of having its determinable.

If we think of the qualitative characteristics of (actual and possible) things as locations within a property-space of as many dimensions as they are respects of independent variation among properties, the determination relation is topological inclusion with respect to that space. The determinable is literally ‘composed out’ of its determinates. The supervenience of the determinable on its determinates is then accounted for in robust ontological terms.

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