# Supervenience in Metaphysics

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*Abstract:* Supervenience is a topic-neutral, broadly logical relation between classes of properties or facts. In a slogan, *A* supervenes on *B* if and only if there cannot be an A-difference without a *B*-difference. The first part of this paper considers different ways in which that slogan has been cashed out. The second part discusses applications of concepts of supervenience, focussing on the question whether they may provide an explication of determination theses such as physicalism.

Supervenience is a topic-neutral, broadly logical relation between classes of properties or facts. While it has been invoked most prominently in the metaphysics of mind, it is helpful in articulating views, and constraints on views, about a wide variety of topics, such as the relationship between the dispositional and the categorical, the modal and the non-modal, the general and the particular, or the extrinsic and the intrinsic.

Roughly, *A* supervenes on *B* if and only if there cannot be an *A*-difference without a *B*-difference. Or slightly more precisely, if no two possibilities differ with respect to *A* while being alike with respect to *B*.[1]

The paper is in two parts. First, I consider various ways in which the above slogan has been cashed out. I introduce the standard varieties (1.1) and their cousins with restricted quantifiers (1.2), and generalize their formulation to apply to relations as well (1.3). Secondly, I survey philosophical uses of the concept. A typical use is to explicate certain determination theses, such as physicalism (2.1). However, it is debatable whether such explications are successful. I consider objections to the effect that supervenience theses are not strong enough (2.2) or not weak enough (2.3) for that purpose. Finally, I mention some less controversial uses of the concept of supervenience in argumentation and classification (2.4).


# 1 Different Versions of Supervenience

Supervenience has been taken to relate classes of entities of different categories, typically facts and properties, but also particulars, states, predicates, and sentences. Like most of the literature, I take supervenience as a relation between classes of properties as my main focus.

The slogan "no A-differences without B-differences" has been cashed out in different ways. This led David Lewis to complain, in a much-cited passage, about an "unlovely proliferation of non-equivalent definitions," because of which a "useful notion threatens to fade away into confusion" [Lewis, 1986a, p.14]. Indeed, the variety may be bewildering to the uninitiated. The survey article Bennett and McLaughlin [2005] lists 15 different formulations, which represent only a selection of those to be found in the literature. None of these formulations are equivalent in general, although particular assumptions about the classes *A* and *B* may entail equivalences. I here focus on the main varieties.


## 1.1   The Standard Triad

Following Kim [1984], discussions of supervenience standardly start by distinguishing between three versions: *weak, strong,* and *global* supervenience. The definitions of weak and of strong supervenience deploy a notion of indiscernibility of individuals relative to a class of properties: $x$ in world $w$ is $A$-indiscernible from $x'$ in $w'$ if for every property $F \in A$, $x$ has $F$ in $w$ if and only if $x'$ has $F$ in $w'$. (We may then also say that $x$ has $F$ and $x'$ in $w'$ are $A$-duplicates.)

*Weak Supervenience* $A$ weakly supervenes on $B \Leftrightarrow$ in all possible worlds $w$, all individuals $x$ and $y$ that are $B$-indiscernible in $w$ are $A$-indiscernible in $w$.

*Strong Supervenience* $A$ strongly supervenes on $B \Leftrightarrow$ for all possible worlds $w$ and $w'$ and individuals $x$ in $w$ and $x'$ in $w'$, if $x$ in $w$ and $x'$ in $w'$ are $B$-indiscernible, then they are also $A$-indiscernible.

Let us stipulate that the property *Tallness* is had in $w$ by any $x$ that is a person and taller than the average in $w$. *Tallness* weakly, but not strongly supervenes on height. Any two worldmates of equal height will be either both above, both at, or both below the average, and thus also agree on Tallness. Therefore, the condition for weak supervenience is met. However, the average presumably varies from world to world, and hence some individuals in different worlds differ in *Tallness* while having the same height. As a result, *Tallness* does not strongly supervene on height.

Weak and strong supervenience are species of *individual* supervenience. Sometimes we are interested in whether whole worlds, rather than individuals within worlds, could differ in one respect without differing in another respect. For example, some physicalists allow that physically indiscernible individuals differ with respect to the content of their thoughts, but insist that individuals can only so differ if their environments are physically different. They thus accept a thesis of global supervenience, whose rough-and-ready formulation is as follows:

*Global Supervenience* $A$ globally supervenes on $B \Leftrightarrow$ if two possible worlds have the same distribution of $B$, they have the same distribution of $A$.

It is not straightforward to make this notion precise. Suppose that in both world $w$ and $w'$, there are exactly two individuals: a red cube and a blue sphere in $w$, and a blue cube and a red sphere in $w'$. Are $w$ and $w'$ alike with respect to color-properties, and with respect to shape-properties? The answers seem to depend on how we compare $w$ and $w'$. If we pair up the two cubes and the two

spheres, respectively, for the purposes of comparison, we will conclude that $w$ and $w'$ are alike with respect to shapes, but different with respect to colors. If, on the other hand, we pair up the two blue things and the two red things, respectively, we will conclude that the worlds are alike with respect to colors, but different with respect to shapes.

This talk of pairing up individuals is cashed out in terms of a function between the domains of different worlds [Paull and Sider, 1992]: an $A$-isomorphism from $w$ to $w'$ is a one-one function $\mu$ from the domain of $w$ onto the domain of $w'$ such that for all $F \in A$ ($R \in A$), $x$ has $F$ in $w$ if and only if $\mu(x)$ has $F$ in $w'$ ($R$ holds of $x_1,...,x_n$ in $w$ if and only if $R$ holds of $\mu(x_1),...,\mu(x_n)$ in $w'$). If we take two possible worlds to have the same distribution of $B$ if and only if there is a $B$-isomorphism between them, the rough-and-ready formulation above yields what is called "weak global supervenience":

*Weak Global Supervenience*   $A$ weakly globally supervenes on $B \Leftrightarrow$ for any possible worlds $w$ to

> $w'$, if there is a B-isomorphism between $w$ and $w'$, there is also an A-isomorphism between $w$ and $w'$.

Several authors have argued that weak global supervenience is too weak to capture what philosophers typically have in mind when they invoke global supervenience [e.g. Stalnaker 1996]. The possibility of a physical duplicate of our world in which mental properties are permuted among the individuals, relative to the actual world, is compatible with the weak global supervenience of the mental on the physical properties [Bennett 2004, Shagrir 2002]. Therefore, a stronger explanans has been proposed:

*Strong Global Supervenience*   $A$ strongly globally supervenes on $B \Leftrightarrow$ for any possible worlds $w$ to

> $w'$, every $B$-isomorphism between $w$ and $w'$ is also an $A$-isomorphism.

Arguably, strong global supervenience is too strong to capture the concept of global supervenience [Bennett 2004]. Further candidates are being proposed, and it remains an open question how global supervenience is best cashed out.[2]

What logical relationships are there between the four notions defined here? It is easy to verify that strong supervenience entails both weak supervenience and strong global supervenience, and that strong global supervenience in turn entails weak global supervenience. For relata $A$ and $B$ that consist exclusively of monadic properties, strong global supervenience entails weak

supervenience.[3] In all of these cases, the converse entailment fails.[4] Weak supervenience and weak global supervenience are logically independent from each other.[5]

## 1.2 Restricted Versions

Weak, strong, and global supervenience involve quantifications over possible individuals or possible worlds. When considering broadly modal claims, we are not always quantifying over all possible worlds. The concepts of necessity and possibility come in families, whose members correspond to different delineations of the class of worlds quantified over. Examples include nomological, technological, practical, and historical necessity and possibility. Just as we sometimes consider such restricted modalities, we may sometimes wish to consider restricted varieties of supervenience. Those are typically contingent.

In schematic formulations of supervenience claims, it is thus useful to relativize both sides of the biconditional to a possible world. The amended formulation of, for example, strong supervenience reads as follows: $A$ strongly supervenes on $B$ in world $w^*$ if for all worlds $w$ and $w'$ that are possible relative to $w^*$, and all individuals $x$ in $w$ and $x'$ in $w'$, if $x$ in $w$ and $x'$ in $w'$ are $B$-indiscernible, then they are $A$-indiscernible.

Sometimes, we may wish to speak of nomological supervenience (strong or global), quantifying only over worlds in which the actual laws of nature are true. For example, Chalmers [1996] accepts the nomological while denying the metaphysical supervenience of the phenomenal on the physical. Lewis formulated two particularly influential restricted supervenience thesis, which he called "minimal materialism" [Lewis, 1983] and "Humean supervenience" [Lewis, 1986b]. They exclude worlds with so-called "aliens," fundamental properties or relations that are not actually instantiated (ectoplasmic properties, perhaps), from the domain of quantification. Minimal materialism is then true at world $w$ if everything globally supervenes, among worlds in which there are no aliens relative to $w$, on the physical properties and relations. Humean supervenience is true at world $w$ if everything globally supervenes, among worlds in which there are no aliens relative to $w$, on spatiotemporal relations and intrinsic, categorical properties of point-sized things.

## 1.3 Generalization to Relations

As characterized, weak, strong, and global supervenience are three families of relations between a world and two classes of properties. However, not every supervenience claim that we may wish to make fits one of the templates provided so far. The above formulations of individual supervenience in a crucial respect lack generality: they are only defined for classes $A$ and $B$ of monadic properties.

Just as logic neglected predicates of more than one argument place for much of its history, so the literature on supervenience has largely neglected polyadic relations.[6]

An example: Let *Richness* include the property of owning the equivalent of $x$ million dollars, for every dollar amount $x$. Then the relation of having a larger fortune, *Richer*, supervenes on *Richness*. The template for global supervenience claims provided allows us to say that *Richer* globally supervenes on *Richness*. But this does not capture what we want to assert. The supervenience relation that holds between *Richer* and *Richness* is not merely global. Intuitively, this is because we do not need to look at the distribution of *Richness* in the whole world to determine whether one individual is richer than another. In this respect, *Richer* is different from the relation that holds between two things if and only if there is just one person intermediate in richness.

There are more interesting examples of supervenience claims about relations. A relation is standardly classified as internal if it supervenes on the intrinsic properties of its relata. (Examples presumably include being taller than, and having the same mass.) We do not have any problems in understanding such a non-global supervenience conditions involving relations, even though the above templates of weak and strong supervenience are of no help. The fact that we can extrapolate it beyond the usual realm of application, without having to take recourse to stipulative definition, suggests that individual supervenience is a concept in good standing.

The notion of an isomorphism preserving instantiation structure, which we encountered in the brief discussion of global supervenience above, is also suited to analyze how individual supervenience applies to relations of any adicity. Let a *partial A-isomorphism from $w$ to $w'$* be any one-one mapping μ from a subclass $D_1$ of the domain of $w$ to a subclass $D_2$ of the domain of $w'$ such that for all $R \in A$ and all $x_1,...,x_n$ in $D_1$, $R$ holds of $x_1,...,x_n$ in $w$ if and only if $R$ holds of $μ(x_1),...,μ(x_n)$ in $w'$. The concept of a partial *A*-isomorphism is more general than that of an A-isomorphism used to characterize global supervenience. We obtain the latter as a special case: an *A*-isomorphism is a partial *A*-isomorphism that relates improper subclasses of the respective domains, that is, the domains themselves.

We can now formulate a more general schema for individual supervenience. I focus on strong supervenience:

*Strong Supervenience (generalized)* A strongly supervenes on B if for all possible worlds $w$ and $w'$, every partial B-isomorphism from $w$ and $w'$ is a partial A-isomorphism.[7]

This generalized formulation has the welcome feature of coinciding with the original one in the case where both *A* and *B* exclusively consist of monadic properties. Too see this, suppose first that

*A* strongly supervenes on *B* according to the original definition, and that µ is a partial *B*-isomorphism from *w* to *w'*. Then for every *x* in the domain of µ, *x* and µ(x) are *B*-indiscernible, and by the assumption of strong supervenience, they are also *A*-indiscernible. Hence µ is a partial *A*-isomorphism from *w* to *w'* as well, and strong supervenience according to the generalized definition holds. For the other direction of the equivalence, suppose now that *A* does not strongly supervene on *B* according to the original definition. Then there are *B*-duplicates *x* in *w* and *x'* in *w'* that differ in some *A*-property. Hence a function from {*x*} to {*x'*} is a partial *B*-isomorphism from *w* to *w* but not a partial *A*-isomorphism, and hence strong supervenience according to the generalized definition fails too.

It is a further welcome feature of this generalized formulation of strong supervenience that it immediately implies strong global supervenience. Suppose every partial A-isomorphism between *w* and *w'* is a partial *B*-isomorphism. Then since isomorphisms are a special case of partial isomorphisms, every *B*-isomorphism between these worlds is an *A*-isomorphism, and *A* strongly globally supervenes on *B*.

How does the characterizations of internal relations fit the regimented form for supervenience claims involving relations? Instead of saying that internal relations supervene on the intrinsic properties of their relata, we can, using the regimented vocabulary, say that they strongly supervene on intrinsic properties. The relata need not be mentioned any more.

## 2   Applications

A list of ways in which a topic-neutral, broadly logical concept can be deployed is presumably open-ended. Here I select a few examples from three types of uses: in explication, in argumentation, and in classification.

### 2.1   Uses in Explication

Supervenience is often regarded as a regimented cousin, or an explication, of an informally grasped concept. Regardless of the truth or falsity of particular supervenience claims, it is a disputed question whether supervenience succeeds as an explication. To discuss this question, we need to know more about what I call the target thesis, the claim that *A* supervenes on *B* is meant to explicate. So far, I pretended that the target thesis is that *A*-facts are determined by *B*-facts. However, there is not one pre-theoretical locution that fully expresses the target claim, and hence this is merely a first approximation. More needs to be said.[8]

A paradigmatic target thesis is physicalism about the mind, putatively explicated by the claim that mental properties and relations supervene on physical ones. Further partial elucidation of

the target thesis is provided by each of the locutions that *A* entirely depends on *B*, and that *A* is nothing over and above *B*. We can also say that the target thesis is a reductionism in spirit but not in letter.[9]

> A supervenience thesis is, in broad sense, reductionist. But it is a stripped-down form of reductionism, unencumbered by dubious denials of existence, claims of ontological priority, or claims of translatability. One might wish to say that in some sense the beauty of statues is nothing over and above the shape and size and colour that beholders appreciate, but without denying that there is such a thing as beauty, without claiming that beauty exists only in less-than-fundamental way, and without undertaking to paraphrase ascriptions of beauty in terms of shape etc. A supervenience thesis seems to capture what the cautious reductionist wishes to say. [Lewis, 1998, p. 29]

## 2.2 Is Supervenience Too Weak?

Is the thesis that *A* supervenes on *B* apt to explicate the target thesis, as just characterized? One way in which it may fail is by lacking certain implications of the target thesis—roughly, supervenience may fail to be a sufficient condition for determination.[10] I discuss three types of objections to that effect: that supervenience, but not the target thesis, is compatible with certain substantive necessities, and that it is compatible with disproportional variation, and that the supervenience relation has the wrong logical features.

First, the *objection from strong necessities*. This objection can be presented most strikingly for global supervenience with sets of facts rather than properties as relata. That relation is defined as follows: *A*-facts globally supervene on *B*-facts if and only if there are no two possible worlds where the same *B*-facts but different *A*-facts hold. It then follows that any necessary facts globally supervene on any facts: the continuum hypothesis globally supervenes on facts about what I had for breakfast today. However, it sounds odd to say the former facts are determined by, or are nothing over and above, the latter.

In response, one can argue that oddity is not falsity. Perhaps it is true that the facts about my breakfast determine the continuum hypothesis, but odd to assert it, for pragmatic, broadly Gricean reasons. Presumably, a debate about that response would to some extent be parallel to the debate about whether all conditionals with necessary consequents are true, and whether necessary propositions are entailed by anything. This debate is beyond the scope of this paper. But the response just mentioned would in any case be unpromising if there are "brute" or "strong" necessities, that is, necessities whose denial is perfectly coherent and conceivable.

To illustrate this, consider physicalism, the target thesis for the claim that all properties and relations supervene on physical properties and relations. Traditionally, physicalism is taken to be incompatible with theism. It is likewise incompatible with an emergentist view of some early 20th

century British philosophers, according to which non-physical configurational forces emerge if physical aggregates reach a certain complexity. Yet global supervenience claims for facts that are supposed to capture physicalism are compatible with the necessity of both theism and emergentism [Wilson, 2005], and *a fortiori* with their truth.

A defender of the adequacy of the explications in terms of supervenience may argue that there are no necessities of the troublesome sort: it is possible that there is no God, and it is possible that there are no emergent configurational forces. Perhaps this is inferred from certain combinatorial principles, or from our conceiving that there is no God, and that there are no configurational forces. If these modal facts can be established, the objection can be answered. When assessing what implications supervenience theses have, we should be able to use background knowledge about possibilities and necessities as well. If we are, we can conclude that supervenience theses are incompatible with theism and emergentism after all. For given plausible assumptions, contingent theist and emergentist claims are incompatible with supervenience on the physical; and being necessarily false, non-contingent theist and emergentist claims are trivially incompatible with any claim, in particular a supervenience thesis.

Of course, this is not the end of the debate. A story about how we can know the pertinent possibility claims is needed. After all, it is not obvious that combinatorial principles are true, and that what we can conceive is indeed possible. Why should there not be brute necessities? Whether such a story can be given is a question well beyond the scope of this survey article. Still, we can draw the following lesson from the problem of strong necessities: the question whether supervenience claims explicate their targets and whether we can have knowledge of possibility and necessity are closely related.

Second, the objection from *disproportional variation*. Supervenience is the claim that there are no diferences of one sort without differences of another sort. However, some philosophers take the target thesis also to imply that there are no large differences of one sort without large differences of another sort. Variation in *A* must be proportional with variation in *B*. For example, Kim urges that physicalism is incompatible with there being a world *w* that differs from ours only in Saturn's ring having one more ammonia molecule, but in which plants, but no creatures with brains are conscious [Kim, 1987]. Clearly, though, that possibility is compatible with the global supervenience of mental on physical properties: the actual world and w are physically discernible, after all. Individual supervenience is likewise vulnerable to examples of that sort, for it is compatible with you having a zombie twin that is physically like you apart from the presence of an extra neutrino.

A concessive response is to amend supervenience claims in order to rule out disproportional variation *by fiat*. Kim [1987] suggests that physicalists help themselves to a relation he calls

"similarity-based supervenience" of *A* on *B*, which may be defined as follows: for every degree of similarity *c*, if two possibilities are *B*-similar to at least degree *c*, they are *A*-similar to at least degree *c*.[11] Since indiscernibility is similarity to the maximal degree, this defined relation implies supervenience ordinarily construed.

It is unclear whether it could be satisfactorily spelt out what when two things are *A*-similar to the same degree as they are *B*-similar. But in any case, the concession that disproportionalities need to be ruled out might have been premature. McLaughlin [1995, p. 35] and Post [1995, p. 86] have argued that there may be cases where a small *B*-difference makes for a large *A*-difference, compatibly with *A*-facts being determined by *B*-facts.

It is not clear whether their point fully answers the objection, though. Perhaps the target thesis is compatible with some disproportionalities and incompatible with others. The supervenience claim is still a bad explication if it is compatible with all of them. But perhaps the assumption that there are no strong necessities comes to the rescue again. Unexplainable disproportionalities are a species of strong necessities. In the example above, it is supposed to be necessary that if there is an extra ammonia molecule in Saturn's ring, but otherwise things are as they actually are physically, then plants are conscious and brains are not. There is no explanation for why brains could not be conscious, or why plants could not be unconscious, given the antecedent. To be sure, there are some disanalogies to the supposed strong necessities considered before, the existence of God and the laws about configurational forces. Nonetheless, the strategy may provide an answer to the objection from disproportionalities that do not saddle the defender of the explication with additional commitments.

Third, the *objections from irreflexivity and asymmetry*. Supervenience is reflexive, and neither symmetric nor asymmetric. In contrast, the target relation of determination or reducibility is apparently irreflexive and asymmetric [e.g. Kim 1984]. The objections from irreflexivity and asymmetry are related, for asymmetry implies irreflexivity.

There is room to dispute that the target relation is asymmetric. While it is not typically the case that both *A* determines *B* and *B* determines *A*, we should not be too quick to conclude that such a case is logically impossible. Perhaps there is a version of the Leibnizian doctrine of pre-established harmony according to which the mental properties determine the physical ones, and also vice versa.

Pragmatic mechanisms may be used to explain why it would often be odd to assert that *A* determines *A*. Moreover, we may note that it sounds true, if uninteresting, to say that *A* is nothing over above *A*. The plausibility of the objection from irreflexivity is thus sensitive to what pre-theoretical locution we are using to approximate the target thesis.

Of course, there are other objections against the adequacy of supervenience as an explication besides those from strong necessities, disproportional variation, irreflexivity and asymmetry. Some of them apply only to particular formulations of supervenience. Others dismiss wholesale the idea that the target thesis could be captured with a broadly modal concept such as supervenience: the target thesis may require a connection between the domains of $A$-facts and $B$-facts that is not implied by any claim about covariation patterns in modal space. For some objectors, what is missing is a metaphysical connection, perhaps by a relation expressed by the locution "in virtue of."[12] For other objectors, what is missing is some explanatory connection, to be articulated in epistemic rather than modal terms. Both these sorts of objections are beyond the scope of this essay.[13]

## 2.3 Is Supervenience Too Strong?

Supervenience claims have also been accused of having surplus implications, which are not shared by the target claims. I briefly discuss the objection that supervenience theses imply the letter and not just the spirit of reductionism, and that being necessary, they have a diferent modal status than the contingent target thesis. Whether one is moved by these objections will be sensitive to how exactly one construes the target thesis.

The objection from irreducibility insists that a supervenience claim implies more than just the cautious, bridled version of reductionism as which it is often advertised. If $A$ supervenes on $B$, then given sufficiently rich logical resources (infinite Boolean operators, quantifiers, identity), any member of $A$ can be defined in terms of the members of $B$ (Kim [1984]; Glanzberg [2001]). Under the further assumption that $B$ is closed under definability by these logical resources, it follows that any $F \in A$ is itself already a member of $B$. For example, given strong enough closure condition on the class of physical properties, the claim that mental properties supervene on physical properties implies the identity theory, according to which every mental property just is a physical property.

One response is to deny a commitment to the pertinent closure principles about $B$. Another response is to accept them, but deny that the resulting reductionism is of an implausible kind. In the example of the mind-body identity theory, what seems incredible is that there is a reasonably short way of expressing mental properties in terms of the simple predicates of the language of physics. Whether they can be expressed given infinite resources is not something about which our plausibility judgements should be trusted. A third response starts from the observation that if the supervenience thesis does not quantify over all metaphysically possible worlds, it does not imply that every property in A is definable in terms of properties in B. There are independent reasons for trying to explicate the target thesis with a contingent supervenience claim, as suggested by the next objection.

The *objection from contingency* is that supervenience claims are non-contingent, while the target thesis is contingent. Take again physicalism as an example. Plausibly, there could be ectoplasmic and other non-physical fundamental properties, even though they are not actual according to the physicalist. Then two individuals or worlds may differ with respect to such an alien property *F*, but display the same distribution of physical properties of relations. It follows that *F* does not supervene on the physical properties, and hence that the claim that all properties supervene on the physical properties is false. Still, physicalism may intuitively be true in the actual world (Lewis [1998], Jackson [1994], Chalmers [1996]). The standard move in response is to have the target thesis explicated by a contingent supervenience that does not quantify over worlds with alien fundamental properties, such as Lewis's minimal materialism introduced in 1.2.

## 2.4   Uses in Argumentation and Classification

Supervenience may be a useful concept even if it does not provide explications of a target thesis. It has also argumentative uses. Suppose *p* is a claim under dispute. If one can establish that *p* implies the supervenience of *A* on *B*, and that *A* does not supervene on *B*, one can infer that *p* is false. In McLaughlin's phrase, *p* then falls to a FIST, or "Failure of Implied Supervenience Thesis" [McLaughlin, 1984]. The "Conceivability Argument" or "Zombie Argument" against physicalism, championed by Chalmers [1996], implements this strategy. From the premises that physicalism implies the supervenience of phenomenal consciousness on physical properties, and that the conceivability of zombies is incompatible with the holding of that supervenience relation, it concludes that physicalism is false.

There are also argumentative uses that do not require that supervenience is a necessary condition for a claim under discussion. Rather, they require that supervenience is incompatible with such a claim *p*. While in the FIST strategy, a supervenience claim is denied, it is here asserted in the course of disputing *p*. If one can establish that *p* is incompatible with the supervenience of *A* on *B*, and that *A* does supervene on B, one can infer that *p* is false. That strategy, which is still in need of a punchy label, is strategy is often heralded by the slogan that "truth supervenes on being" [Bigelow, 1988] and directed at views according to which dispositions and counterfactual conditionals do not supervene on categorical properties and relations, such as certain versions of phenomenalism and behaviorism [Lewis, 2001, p. 609].

The strategy is also implemented by the so-called "Supervenience Argument" against coincidentalism [e.g. Zimmerman 1995]. According to coincidentalism, spatiotemporally coincident entities may differ in their modal properties. The major premise of the supervenience argument is that if there are coincident entities, they would differ modally without differing non-

modally.  The minor premise is that modal properties strongly supervene on non-modal properties. Together, they entail that there are no coincident entities.

In some debates, it is useful to separate two parties according to whether they accept a certain supervenience thesis. Internalism about mental content concerns intentional properties, such as believing $p$, for some proposition $p$. We might try to characterize this kind of internalism as the thesis that intentional properties are intrinsic to thinkers. However, there is no consensus about what intrinsic properties are, and even about whether there actually are any intrinsic properties. The debate about internalism can abstract from these difficulties, and one way to do this is to take internalism as the claim that intentional properties strongly supervene on some specified class of properties, say neurophysiological ones. The argumentative and the classificatory uses are related: a position characterized by accepting a supervenience claim becomes vulnerable to a FIST. A pertinent example is provided by Putnam's and Burge's thought experiments against meaning internalism and content internalism.

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[1] Some authors prefer to state the schema with the roles of the letters *'A'* and *'B'* reversed. To remember the convention followed here, it helps to associate *'B'* with 'basic' or 'base'.

[2] Recent contributions to the debate about how to formulate global supervenience include Bennett [2004] and Shagrir [2002]; Bennett and McLaughlin [2005] give an overview.

[3] Suppose that A does not weakly supervene on B. Then there is a world w in which two individuals x and y are B-indiscernible but not A-indiscernible. Then if $\mu(x) = y$, $\mu(y) = x$, and $\mu(z) = z$ for all z distinct from x and y, $\mu$ is a B-isomorphism from from w to itself. Since x and $\mu(x)$ are not A-indiscernible, it is not an A-isomorphism, and A does not strongly globally supervene on B. (This argument does not go through if there are non-monadic relations in A or B, and indeed, the entailment does not generally hold in that case. Since I discuss non-global supervenience for relations only briefly in section 1.3, I cannot elaborate on this issue here.

[4] The main text sketches examples that show that weak does not imply strong supervenience, and that weak global does not imply strong global supervenience.

An example that shows that strong global supervenience does not entail strong supervenience: there are only two possible worlds with different domain sizes, all individuals in both worlds are *B*-indiscernible, and the individuals in a world are *A*-indiscernible from each other, but *B*-discernible from those in the other world. Then *A* strongly globally, but not strongly supervenes on *B*.

From the fact that weak supervenience does not imply weak global supervenience (note 5), and the fact that weak global supervenience is implied by strong global supervenience, it follows that weak supervenience does not imply strong global supervenience either.

[5] For a given world *w*, the property of belonging to *w* weakly, but not weakly globally supervenes on the property of self-identity. Thus weak supervenience does not imply weak global global supervenience. If there is just one possible world *w*, and if two individuals are *B*-indiscernible but not *A*-indiscernible, then *A* weakly globally, but not weakly supervenes on *B*.

[6] An exception is Kim [1993a], who concludes that "many interesting issues arise when relations are explicitly brought into supervenience, and they are deserving of further study" (p. 165).

[7] If we want to discuss the supervenience claims involving cross-world relations, we need to allow the domain and the range of the partial A-isomorphism to draw individuals from different worlds.

[8] No doubt, different philosophers who use supervenience for purposes of explication do not construe the target thesis in exactly the same way. I have to abstract from this complicating factor in my discussion.

[9] This is controversial since supervenience has often been invoked by self-described "non-reductive physicalists." Davidson was particularly influential for this conception. The question how non-reductive physicalism ought to be understood is beyond the scope of this article.

[10] The titles of this and of the next section buy brevity at the price of imprecision. For all we know, supervenience claims may lack certain implications of the target thesis and yet have implications that the target claim does not. In that case, it would be neither weaker nor stronger than the target claim, but still inadequate.

[11] The formulation differs from Kim's, but I think it captures the spirit of his proposal. How this proposal is made precise depends on whether possibilities are individuals or worlds, and whether the relata are sets of facts or properties.

[12] Such objections would need to be discussed in the larger context of a debate between intensionalist and hyperintensionalist approaches to metaphysics. For a classic anti-intensionalist paper, see Fine [1994]. For an anti-intensionalist line particularly with respect to determination relations, see Keller [2007].

[13] I also cannot discuss the thesis that physicalists are committed to superdupervenience rather than just supervenience, where superdupervenience is "ontological supervenience that is robustly explainable in a materialistically acceptable way" [Horgan, 1993, p.566] Superdupervenience may be proposed as an explication of the target thesis in my sense, or as a doxastic or pragmatic constraint: that one ought not to believe, or assert, a supervenience claim unless one can also believe, or assert, the superdupervenience claim.