

## Lecture 7: Supervenience and Reduction

### 1. Introduction

### 2. Supervenience

### 3. Reduction

#### ...3.1. What is Reduction?

#### ...3.2. The Unity of Science Hypothesis

## Lecture 7: Supervenience and Reduction

### 1. Introduction

- In this lecture we turn to the first in a series of applications of our recently discussed modal concepts: the relations of supervenience and reduction.
- Supervenience and reduction are special kinds of relations that are sometimes said to hold between various different families of properties, or alternatively between different scientific theories.
- If you have been exposed to *any* contemporary anglo-american philosophy – whether it be ethics, aesthetics, philosophy of science or philosophy of mind - chances are that you have already come across the terms. You may have read people claiming that economic properties supervene on agent-level properties, that genetics reduces to physics, or again that moral properties supervene on natural properties. (in fact you also hear about reduction outside philosophy, particularly in the sciences; supervenience, however, has yet to gain currency outside the discipline)
- This lecture provides a very basic overview of some of the relevant concepts and issues.

## Lecture 7: Supervenience and Reduction

### 2. Supervenience

- Consider a sculptor chiseling away at a block of granite. This is hard work, but thankfully *all* the work that the sculptor has to put into his piece of art. Once the physical work is finished, the work of art itself is finished: there is no need to subsequently undertake any aesthetic work, adding aesthetic qualities (such as beauty, life-likeness or whatnot) to the finished physical piece. The physical makeup of the piece fixes, so to speak, the aesthetic qualities of the piece.
- There is a philosophical term for the kind of relation that holds between the physical properties of the sculpture and its aesthetic ones: 'supervenience'.
- In fact, there are a number of distinct relations of supervenience, differing in terms of their logical properties. Due to time considerations, and to spare you some very tedious technicalities, I will just mention the two varieties that crop up the most frequently in the literature.

## Lecture 7: Supervenience and Reduction

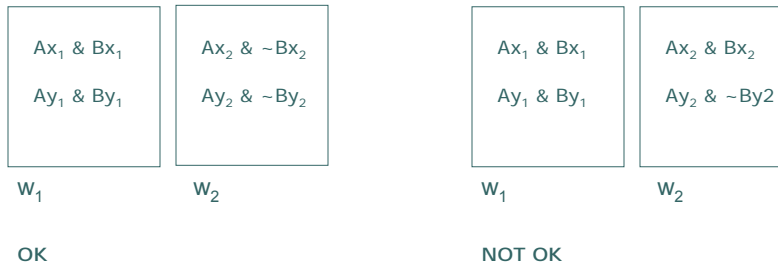
### 2. Supervenience

- Let's first introduce the notion of P-indiscernibility: where P is a set of properties, x and y are P-indiscernible iff  $Fx \rightarrow Fy$  for all F's belonging to P.
- *Weak supervenience*:  $P_2$ -properties weakly supervene on  $P_1$ -properties iff, for any two entities x and y that belong to the same possible world w, if x and y are  $P_1$ -indiscernible in w, then they are also  $P_2$ -indiscernible in w.
- Pay careful attention to what weak supervenience does and doesn't entail. Weak supervenience of  $P_2$ -properties on  $P_1$ -properties means that sameness with respect to  $P_1$ -properties entails sameness with respect to  $P_2$ -properties in any given world. *However*, this does leave room for the precise mapping of  $P_1$ -properties onto  $P_2$ -properties to vary from one world to the next. Let me illustrate...

## Lecture 7: Supervenience and Reduction

### 2. Supervenience

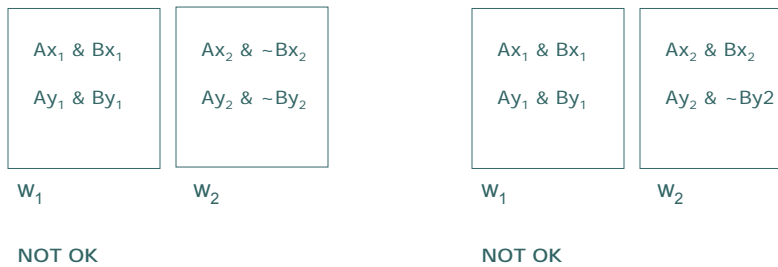
- Say that I make a statue with physical characteristic A and you make a physical replica of that statue. Both our statues are, let's say, beautiful (B). If B were to only weakly supervene on A, it would have been possible for our statues to both be A but also both be non-B. All that is prohibited is for them to both be A (or non-A), but one of them be B whilst the other one not.



## Lecture 7: Supervenience and Reduction

### 2. Supervenience

- *Strong supervenience*:  $P_2$ -properties strongly supervene on  $P_1$ -properties iff, for any two entities  $x$  and  $y$ , *whether or not  $x$  and  $y$  belong to the same possible world*, if  $x$  and  $y$  are  $P_1$ -indiscernible, then they are also  $P_2$ -indiscernible. (Note that strong supervenience entails weak supervenience.)
- Strong supervenience clearly rules out, not only the right-hand scenario, but the left hand scenario as well: we have  $x_1$  being A and B but  $x_2$  being A and not B.



## Lecture 7: Supervenience and Reduction

### 2. Supervenience

- Interestingly, one can construct different types of strong supervenience, by restricting the range of possible worlds from which x and y can be picked (nomologically possible worlds, logically possible worlds, etc.).
- Say, for instance, that being in pain strongly supervenes on a set of properties that includes, amongst other things, having one's C-fibers fire (the neurological correlate for pain in humans). In particular, say that in all relevant possible worlds, if x's C-fibers are firing, then x is in pain. What we mean by 'relevant' clearly has a huge impact on our proposal. We could be claiming that, in all worlds *that have the same laws of nature as our world*, C-fibers firing → pain, or we could be making the substantially more ambitious proposal that the entailment holds in all worlds *simpliciter*.
- There is a large literature in various branches of philosophy concerning which range of possible worlds is relevant to which particular putative supervenience relation.

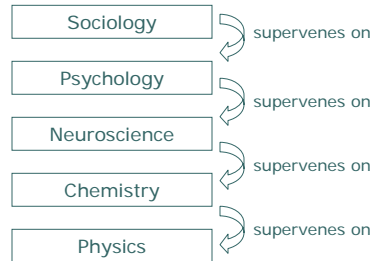
## Lecture 7: Supervenience and Reduction

### 2. Supervenience

- Most philosophers are happy to grant the existence of supervenience relations between a large number of domains. It is extremely common, for instance, to hold that moral, aesthetic and even mental properties are supervenient on physical properties. (generally strongly supervenient, although some authors do insist on mere weak supervenience)
- Supervenience is also the structuring principle behind the popular hierarchical picture of the sciences, with disciplines such as economics or sociology as 'higher-level' sciences and disciplines such as physics or chemistry as 'lower level', or 'basic' sciences: higher-level properties are taken to supervene on lower-level ones (but not the other way round).

## Lecture 7: Supervenience and Reduction

### 2. Supervenience



- Supervenience – even strong supervenience - is however a relatively weak relation (that's why everyone is happy to grant supervenience between many domains). Many philosophers have higher aspirations with regards to inter-domain relations: they want to claim that certain disciplines or sets of properties *reduce* to various other disciplines or sets of properties.

## Lecture 7: Supervenience and Reduction

### 3. Reduction > 3.1. What Is Reduction?

- Whilst 'supervenience' is a rather technical philosophical term of art, we seem to have at least an approximate layperson's grasp of the notion of 'reduction': to claim that X 'reduces' to Y is, roughly, to claim that that X 'is nothing but' or 'simply amounts to' Y.
- Can we make this notion any more precise?
- There are now a large number of accounts of intertheoretic reduction on the market (the set reading mentioned two, but there are many more). For our present purposes, however, we can stick to just two of these: the bridge-law account (associated with Nagel (1961)) and the identity account (associated with Sklar (1967), amongst others).

## Lecture 7: Supervenience and Reduction

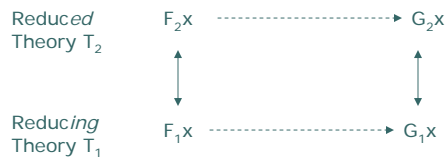
### 3. Reduction > 3.1. What Is Reduction?

- *Bridge-law account.*  $T_2$  reduces to  $T_1$  iff the following conditions hold:
  - (i) *Connectibility condition:* for every n-adic property  $F_2$  referred to in  $T_2$ , there is a true 'bridge law' stating that there exists an n-adic property  $F_1$  referred to in  $T_1$ , such that it is nomologically necessary that  $F_2(x, \dots, x_n)$  iff  $F_1(x, \dots, x_n)$ , for all  $x, \dots, x_n$ .
  - (ii) *Derivability condition.*  $L_{T_1} \& B \rightarrow L_{T_2}$  (where:  $L_{T_1}$  stands for the conjunction of the laws referred to in  $T_1$ ,  $L_{T_2}$  stands for the conjunction of the laws referred to in  $T_2$  and  $B$  stands for the conjunction of the bridge laws mentioned above)
- Note that, just like supervenience, reduction is non-symmetric: it isn't the case that  $T_2$  reduces to  $T_1$  iff  $T_1$  reduces to  $T_2$ . But again, just as it is the case with supervenience, it is perfectly possible for the relation to go both ways. *However*, in most interesting cases, the relation runs in just one direction. This is because, in these cases, the reducing theory refers to properties that don't have counterparts in the reduced theory.

## Lecture 7: Supervenience and Reduction

### 3. Reduction > 3.1. What Is Reduction?

- Graphically, a successful reduction looks something like this, according to Nagel:



↔ Inter-theoretical Bridge Law

..... Intra-theoretical Law

## Lecture 7: Supervenience and Reduction

### 3. Reduction > 3.1. What Is Reduction?

▪ Nagel's account has come under fire for a variety of different reasons that I won't discuss here. One important point however, is that mere coextensionality in nomologically possible worlds seems to be just too weak a relation to do justice to our pretheoretical notion of reduction. For this reason, some have urged the following modification:

▪ *Identity account.*  $T_2$  reduces to  $T_1$  iff the following conditions hold:

(i) *Connectibility condition (identity version):* for every n-place property  $F_2$  referred to in  $T_2$ , there exists an n-place property  $F_1$  referred to in  $T_1$ , such that  $F_1 = F_2$ .

(ii) *Derivability condition.*  $LT_1 \& B \rightarrow LT_2$  (where:  $LT_1$  stands for the conjunction of the laws referred to in  $T_1$ ,  $LT_2$  stands for the conjunction of the laws referred to in  $T_2$  and  $B$  stands for the conjunction of the bridge laws mentioned above)

▪ Just how this relates to the previous account hinges on the view that one takes of property identity. As we have seen in a number of our lectures (e.g. when discussing Lewis' set-theoretic account of properties), this is a tricky topic.

## Lecture 7: Supervenience and Reduction

### 3. Reduction > 3.2. The Unity of Science Hypothesis

▪ The 50s and 60s constituted somewhat of a golden age for reductionism, with the publication of Putnam and Oppenheim's 'The Unity of Science as a Working Hypothesis' in 1958. This article was a programmatic piece of reductionist optimism, conjecturing that the disparate phenomena currently studied in various different disciplines would ultimately be accounted for under a single scientific framework, namely a completed physics (the conjecture is sometimes phrased as the claim that there are no 'special' sciences).

▪ The mood, however, radically changed in the late 1960s. Since then, the received view amongst philosophers has been that the Unity of Science Program was simply a case of wishful thinking.

▪ What brought about this mood change? The culprit is an argument known as the 'Multiple Realisability' argument, due to Putnam (1967) and Fodor (1974). It was originally introduced as an objection to the reduction of folk psychology to physics but quickly found its way into debates concerning other putative reductions (e.g. genetics to biochemistry).

## Lecture 7: Supervenience and Reduction

### 3. Reduction > 3.2. The Unity of Science Hypothesis

- **The Multiple Realisability argument against the Unity of Science Hypothesis.** [1] According to the Unity of Science Hypothesis, every special science meets the connectivity requirement with respect to physics (i.e. for every property mentioned in every special science, there must be a corresponding nomologically necessarily coextensive physical property). [2] Whilst every special science may be said to supervene, and even strongly supervene on physics, not every special science meets the stronger connectivity requirement with respect to physics. Therefore [3] the Unity of Science Hypothesis is false. (Note that this argument is framed in terms of Nagel's version of the connectivity condition. The criticism, however, carries over to the identity version of that condition: Nagel's connectivity requirement is weaker than its identity-based counterpart, and hence if a would-be reduction fails to meet the former, ipso facto it fails to meet the latter.) The crucial premise here is obviously premise [2]...

## Lecture 7: Supervenience and Reduction

### 3. Reduction > 3.2. The Unity of Science Hypothesis

- Why believe that [2] is true? Because, proponents of the argument say, many special science properties can be possessed by entities that are so bewilderingly diverse that it seems unlikely for them to have any physical property in common. Consider:
  - What, if anything, is physically in common to all and only those entities – actual or possible (including silicon-based androids, aliens, etc.) - that believe that Christmas was originally a Pagan celebration?
  - Similarly, consider the incredible variety of organisms that can be said to have a high Darwinian fitness: we have fit parrots, fit squids, and even – arguably - fit clay crystals. Is it really plausible to claim that they have some physical characteristic in common that other creatures lack?

## Lecture 7: Supervenience and Reduction

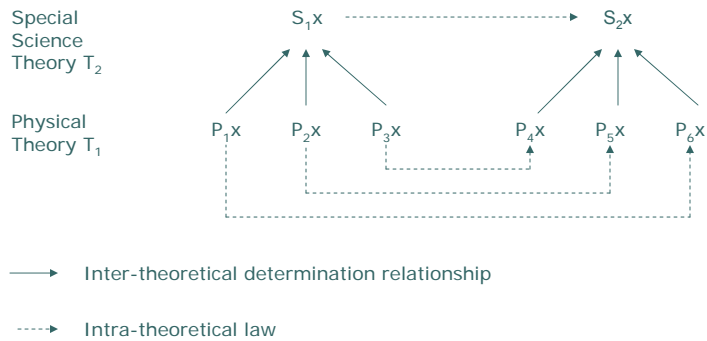
### 3. Reduction > 3.2. The Unity of Science Hypothesis

- Some people attempt to provide an explanation of the physical heterogeneity of the bearers of certain special science properties. The idea is that (i) certain special science predicates refer to dispositional properties, (ii) the physical sciences deal in non-dispositional properties ('categorical' properties) and (iii) dispositional properties are such that they can be had by entities in virtue of a multitude of different physical properties (e.g. there are many specific physical properties by virtue of which something can have the dispositional property of being a poison).

## Lecture 7: Supervenience and Reduction

### 3. Reduction > 3.2. The Unity of Science Hypothesis

- Graphically, according to proponents of the Multiple Realisability argument, the situation with respect to physics and the special sciences looks like this:



## Lecture 7: Supervenience and Reduction

### 3. Reduction > 3.2. The Unity of Science Hypothesis

- How can the reductionist reply to this argument? Well there are many different lines of response in the literature. I will focus on just two of these for now, both of which focus on premise [2] of the argument.
- *Reply (1): deny the many-to-one mapping.* To establish her claim, the anti-reductionist needs to have observed a number of entities such that (i) all those entities have a certain special science property and (ii) none of those entities share a physical science property. So there are essentially two ways of challenging the observational report that supports the many-to-one mapping: (i) claim that all the relevant entities have different special science properties, or (ii) claim that that all the relevant entities have a physical property in common. Both routes have been taken. With regards to (i), for instance, in the context of cognitive science, some have claimed that we should be wary of attributing the same kinds of mental states to physically different creatures (e.g. we should be cautious in claiming that, say, squids could feel pain or at least the same kind of pain as we feel – see Polger (2002)).

## Lecture 7: Supervenience and Reduction

### 3. Reduction > 3.2. The Unity of Science Hypothesis

- *Reply (2): allow for an additional one-to-one mapping, by appealing to disjunctive properties.* In the above diagram, we have three physical properties –  $P_1$ ,  $P_2$  and  $P_3$  - determining the special science property  $S_1$ . One obvious proposal is this: why not have a bridge law or an identity statement connecting  $S_1$  and a disjunctive property  $P_1 \vee P_2 \vee P_3$ ?
- One counter-response here would be to deny that there are any genuine disjunctive properties. Sentences that apparently attribute disjunctive properties to entities can be rephrased as disjunctions of attributions of non-disjunctive properties (e.g. 'Janne is Finnish or Norwegian' really means 'Janne is Finnish or Janne is Norwegian'; there is no such thing as being-Finnish-or-Norwegian). Fodor, however, thinks that *even* if we grant the existence of disjunctive properties, there remains a problem.
- The problem isn't that disjunctive properties can *never* figure in scientific laws. Indeed, consider the law that water, at a certain pressure, will boil at a temperature  $t$ , such that  $t > 100^\circ\text{C}$ . It is plausible to take this to be a law involving a disjunctive property: being at a temperature of  $100^\circ\text{C} \vee$  being at a temperature of  $100^\circ\text{C} \vee$  etc...

## Lecture 7: Supervenience and Reduction

### 3. Reduction > 3.2. The Unity of Science Hypothesis

- The problem, according to Fodor, is that the *particular kind* of disjunctive property that  $P_1 \vee P_2 \vee P_3$  makes it unsuitable for figuring in scientific laws. Fodor tells us that  $P_1 \vee P_2 \vee P_3$  cannot figure in scientific laws because it isn't a 'natural' property.
- Is this a good argument?
- Well, as it stands, no, it isn't. We need reasons to hold that certain properties ('non-natural' properties) cannot figure in scientific laws and we need reasons to think that  $P_1 \vee P_2 \vee P_3$  may be one of those properties.
- Kim kindly comes to the rescue and offers the following argument on Fodor's behalf (Kim 1992)...

## Lecture 7: Supervenience and Reduction

### 3. Reduction > 3.2. The Unity of Science Hypothesis

- **Confirmation-theoretic argument for the unsuitability of certain disjunctive properties for use in scientific laws.** [1] *Scientific laws are true universal generalisations that (a) support counterfactuals, and (b) are evidentially supported by their positive instances.* [2] *True universal generalisations involving certain kinds of disjunctive properties fail to meet condition (b) (although they do meet (a)).* Therefore [3] *there are certain kinds of disjunctive properties that cannot figure in scientific laws.*

This looks like an interesting argument, but why does Kim think that [2] is true? Here's the sub-argument...

## Lecture 7: Supervenience and Reduction

### 3. Reduction > 3.2. The Unity of Science Hypothesis

▪ Sub-argument in support of [2]. Let H1 stand for 'all things that are made of jade or emerald are green', H2 stand for 'all things that are made of emerald are green' and E stand for 'x is made of jade and is green'.

[i] H1 entails H2.

[ii] For any item of evidence E and any hypotheses H1 and H2, if (a) E evidentially supports H1, and (b) H1 entails H2, then (c) E evidentially supports H2. (informally: if something is evidence for something else, it is also evidence for the consequences of that something else).

[iii] if H1 were evidentially supported by its positive instances, then E, which is a positive instance of H1, would evidentially support not only H1, but H2 as well.

[iv] E does not evidentially support H2.

-----  
[v] H1 isn't evidentially supported by its positive instances.

## Lecture 7: Supervenience and Reduction

### 3. Reduction > 3.2. The Unity of Science Hypothesis

▪ This is a tidy piece of reasoning, however, it suffers from a number of major flaws (I don't blame Kim for not spotting them, as the philosophy of evidential support isn't his field of specialisation).

▪ Kim's argument makes use of two premises that were long considered to be true:

▪ Premise [1](b) of the main argument (aka the 'Nicod Condition'): the claim that laws are always supported by their positive instances.

▪ Premise [ii] of the supporting argument for premise [2] of the main argument: the claim that if something is evidence for something else, it is also evidence for the consequences of that something else (aka the 'Special Consequence Condition' or SCC)

▪ However, according to the current consensus (i.e. Bayesian Confirmation Theory), both these premises are demonstrably *false* (with regards to [1](b), see Good (1967) and with regards to [ii], see Carnap (1950)). Kim's argument therefore fails.

## Lecture 7: Supervenience and Reduction

### References

- Carnap, R. (1950), *Logical foundations of probability*, 1st ed., U. Chicago Press.
- Fodor, J.A. (1974) 'Special Sciences - or the Disunity of Science as a Working Hypothesis', *Synthese* 28: 97-115.
- Good, I.J. (1967) 'The White Shoe is a Red Herring'. *BJPS* 17(4): 322.
- Kim, J. (1992) 'Multiple Realization and the Metaphysics of Reduction', *Philosophy and Phenomenological Research* 52: 1-26.
- Nagel, E. (1961) *The Structure of Science*, New York: Harcourt Brace. Ch 11.
- Polger, T. (2002) 'Putnam's Intuition', *Philosophical Studies* 109: 143-170.
- Putnam, H. (1967) "The Nature of Mental States." Reprinted in his *Mind, Language, and Reality: Philosophical Papers*, Vol. 2, 429-440. New York: Cambridge University Press, 1975.
- Sklar, L. (1967) 'Types of Intertheoretic Reduction' *BJPS* 18: 109-124.

## Lecture 7: Supervenience and Reduction

### Next week... Counterfactual Conditionals

- Set reading: Doring F. (1998) 'Counterfactual conditionals'. In E. Craig (Ed.), *Routledge Encyclopedia of Philosophy*. London: Routledge (available on course webpage)