

Reductionism in Philosophy of Science and the Problem of Mental Properties

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Introduction: 3 Questions

One of the most disputed issues in philosophy of mind is the issue of reducibility of the mental to the physical.

This issue involves at least three questions:


- i Are mental **predicates** reducible to physical predicates?
- ii Are mental **properties** identical with physical properties?
- iii What are the **ontological consequences** of the answers to i and ii?

Different answers to these questions correspond to different philosophical positions.

Introduction: Reductive vs. Non-Reductive Physicalism

Reductive vs. non-reductive physicalism:

	①: reducibility	②: identity
reductive physicalism	✓	✓
non-reductive physicalism	×	✓ / ×


characteristic

The disagreement between reductive and non-reductive physicalists, as well as the disagreement between reductive physicalists who give different answers to question ③, can be elucidated by a relevant discussion of the concept of **reduction in philosophy of science**.

Introduction: Examples



Positive answer to (i):

reductive physicalism: **type-identity theories**.

- Mental predicates refer to 'types' or 'kinds' of properties, to which some corresponding physical predicates also refer. Early proponents of reductive physicalism (Ryle 1949; J. Smart 1959), currently defended by the disjunctive physicalists (Clapp 2001; Walter 2006).

Negative answer to (i):

non-reductive physicalism: **token-identity theories**.

- Mental predicates refer to 'types' or 'kinds' of properties, but no corresponding physical predicates also refer to these kinds of properties (cf. Stoljar 2010). However, token-identity theories still answer (ii) in the affirmative: while the reduction of predicates is impossible, each particular instantiation of a mental property is identical to some particular instantiation of a (complex) physical property.

Introduction: Aim

Reductive talk has a long tradition in the philosophy of science.

Historically, logical empiricists took the case of psychological theorizing as a paradigm case for discussing scientific reductions

However, the discussions in philosophy of science and philosophy of mind have diverged quite a bit and lost relevant points of interaction.

In this talk, we aim at better interrelating the discussions.




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- 2 Reductionism in Philosophy of Mind: Reductive Physicalism
- 3 Reductionism in Philosophy of Mind: Non-Reductive Physicalism

Reductionism in Philosophy of Science

Context of Reductionism

Reductionism is one of the three pillars of logical positivism:

-  reductionism
-  analytic/synthetic distinction
-  verificationism

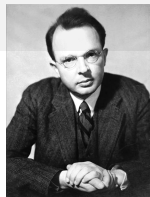
Skipping of verificationism: logical positivism \Rightarrow logical empiricism

What remained were the “Two Dogmas of Empiricism” (Quine 1951)

E.g. for reductionism regarding the mental in early philosophy of science:

- Carnap’s account of “Psychology in Physical Language” (Carnap 1932)
- No need to account for a psycho-physical parallelism, because asking for such an account is a pseudo-problem in terms of his constitution theory.

Different Forms of Reduction



We take Carnap's account as a proxy for a general development.

Carnap's reductionism comes in three stages (cf. Kutschera 1991):

- 1928: Aufbau
⇒ explicit definition
- 1936/37: Testability and Meaning
⇒ bilateral reduction
- 1950s and 60s (particularly his replies in the Schilpp volume from 1963):
Logical Theory of Probabilities/Confirmation Theory
⇒ empirical confirmability

So, in philosophy of science, constraints for reductionism were increasingly weakened.

Reduction 1: Explicit Definability



The strongest form of reduction is that of ...

Explicit Definability

A mental predicate M is reducible₁ to physical predicates P_1, \dots, P_n iff M is explicitly definable by the help of P_1, \dots, P_n .

Properties of this form of reduction:

- ⊕ non-creativity of M
the way we reduce or introduce M does not add anything new to the P -domain
- ⊕ eliminability of M
 M can be replaced in all contexts by the respective physical predicates
- ⊕ extended reducibility
term-by-terms reductions allow for sentence-by-sentences reductions, which in turn allow for theory-by-theory reductions
- ⊖ very hard to achieve
one needs to find individually necessary and jointly sufficient conditions

Reduction 2: Bilateral Reducibility



A weaker form of reduction is that of ...

Bilateral Reducibility

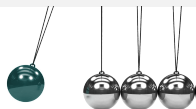
A mental predicate M is reducible₂ to physical predicates P_1, \dots, P_n iff M can be linked to P_1, \dots, P_n by the help of bilateral reduction sentences (containing test-reaction pairs).

Properties of this form of reduction:

- ⊕ favourable creativity of M
the way we reduce or introduce M produces new test-conditions for the P -domain
- ⊕ partial eliminability of M
 M can be replaced in some contexts by the respective physical predicates
- ⊖ hard to achieve completeness
one needs to find many adequate test-reaction pairs
- ⊖ no extended reducibility
no term-by-term reductions, so also no sentence-by-sentences reductions

Reduction 3: Empirical Confirmability

An even weaker form of reduction is that of ...



Empirical Confirmability

A mental predicate M is reducible₃ to physical predicates P_1, \dots, P_n iff M -statements can be confirmed by evidence stated in terms of P_1, \dots, P_n only.

Properties of this form of reduction:

- ⊕ easy to achieve
praxis of psychology
- ⊖ hard to spell out the confirmatory methodology

Slogan: reducibility of M to P if P has some **impact** on M

Toy Examples

A “reduction” of the notion of *aggression*

- **Explicit definition:** x is aggressive iff x 's serotonin level passes the for her/his type characteristic level significantly.

$$M(x) \leftrightarrow P_1(x) \wp P_2(x) \wp \dots \wp P_n(x)$$

- **Bilateral reduction:** If x is tested by P_T at t , then x is aggressive iff x reacts the way P_R at t .

$$P_T(x, t) \rightarrow M(x) \leftrightarrow P_R(x, t)$$

- **Empirical confirmability:** there is physical evidence P_E confirming that x is aggressive.

$$\text{conf}(M(x)|P_E) > \text{some threshold}$$

Reductionism in Philosophy of Mind: Reductive Physicalism

Reductive Physicalism: Strong concept of reduction



Both type- and token-identity versions of physicalism use a very **strong** concept of reduction: a complete reduction of all mental predicates to physical predicates (Fodor 1982; Kim 1993).

Thus, the affirmative answer to ① presupposes that in order for reduction to go through, **all** mental **predicates** must be either **reduced** to physical predicates or **eliminated**.

The connection between ① and ② is based on a related ontological claim: because the mental predicates are reducible to the physical predicates, the mental properties denoted by these reduced mental predicates are identical to the physical properties denoted by the reducing physical predicates.

Reductive Physicalism: Strong concept of reduction

According to van Riel (2014), the concept of reduction presupposes 'strong unity', i.e., the **unity of identity**:

$$\text{predicate } M \text{ is reducible to predicate } P \Rightarrow \mathcal{I}(M) = \mathcal{I}(P)$$

Persuasive, but it has not been the standard interpretation of this concept throughout the debate. In fact, there has not been one standard interpretation of reduction at all.

Moreover, the discussions of reduction and **reductionism in philosophy of mind** and **philosophy of science** have considerably diverged since the introduction of this term by logical positivists.

We are going to compare the usage of this concept in these different strands of debate, and offer a new, and potentially fruitful classification of types of reduction actually used in the debate.

Reductive Physicalism: Identification or Elimination?

The answer to ③ is not yet settled by the answers to ① and ②. Even after ① and ② are answered affirmatively, a reductive physicalist can take either a realist or an anti-realist stance.

According to the **realist** stance, the successful reduction of mental predicates to physical predicates proves that mental properties are real: they just are those physical properties which are picked out by the reducing physical predicates.

According to the **anti-realist**, or **eliminativist**, stance, the successful reduction proves that mental properties are not real: what is really out there are the physical properties. The use of mental predicates is just a pre-theoretic, scientifically un-informed way of speaking about these physical properties.

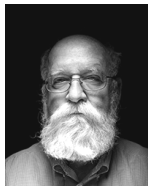
Reductive Physicalism: Identification or Elimination?

An anti-realist can retain the mental terms, if they are practically useful, but this does not mean that these terms refer to something real out there.

These two different answers to (iii) seem to be the main reason of controversy between Paul Churchland (1996) and Daniel Dennett (1991; 2015).

Churchland: eliminativism.

Dennett: functionalism, although our mental talk is just a way of speaking about the physical phenomena. Both folk- and scientific psychology presuppose an 'intentional stance': the attitude we take towards some (sufficiently complex) physical systems (Dennett 1991).



Reductive Physicalism: Identification or Elimination?



KEEP
CALM

Everyone

IS

REPLACEABLE

What exactly is disputed?

A Replaceability of mental concepts:

- The difference between functionalism and eliminativism is in **how many** of the mentalistic, folk-psychological concepts can be successfully replaced by the neuroscientific concepts.
- Analogy for functionalism: **instrumentalist** take on theoretical terms: nothing real, but useful
- Eliminativism: all mental concepts are (in principle) replaceable and will/should be replaced.
- Our **criticism**: the 'replacement in principle' claim is not necessary for the main arguments of this position to go through: while it might be true that a mentalistic lexicon will eventually be replaced, it might also be false.
- Moreover, the truth or falsity of this claim is a purely empirical question, and does not help to decide what the correct answer to (iii) is.

Reductive Physicalism: Identification or Elimination?

What exactly is disputed?



B Reducibility of mental concepts:

- Eliminativist materialist: mental predicates are not reducible to the physical predicates, because they are **too vague** and/or self-contradictory.
- Analogy: the concept of a '**witch**' cannot be reduced to any complex physical predicate, because the properties ascribed to witches do not correspond to anything real (unlike temperature/mean kinetic energy).
- According to B, eliminative materialism would be a version of **non-reductive physicalism**.
- Our **criticism**: It is unlikely that our mental predicates do not cut the reality in any useful way at all. These concepts seem to have evolved for a reason, and work pretty well for us in our everyday life (Dennett 1991; Millikan 2005).

Reductive Physicalism: Identification or Elimination?



What exactly is disputed?

C Ontology of mental concepts:

- The realist/eliminativist controversy as a disagreement about ontology, i.e., as differences in answering question ③ after ① and ② are answered in the affirmative.
- This difference of ontological interpretation has an interesting correlation with different philosophy of science concepts of reduction:
- In philosophy of science, one distinguishes further between:
 - **theoretical reduction** (our reduction₁, reduction₂, and partly also reduction₃)
 - **methodological reduction** (partly reduction₃)
 - **ontological reduction**
- Eliminativist: ontological reduction
- Realist: theoretical or methodological reduction

Reductive Physicalism: Identification or Elimination?

Reductive physicalism typically uses a **strong concept of reduction**: a complete reduction of all mental predicates to physical predicates.

In our philosophy of science framework, this amounts to a reduction by the help of **explicit definability**.

This is particularly clear in the **replaceability**-approach (A above): eliminativism aims at replacing all M by P .

So, the strategy is:

$$M \Leftrightarrow P$$

Reductionism in Philosophy of Mind: Non-Reductive Physicalism

Non-Reductive Physicalism: A paradox of Non-Identity

Recall:

- ❧ Are mental properties identical to the physical properties?
 - Yes: reductive physicalism/non-reductive physicalism
 - No: non-reductive physicalism

How can one answer ❧ in the negative, and still claim to be a physicalist?

Paradox of Non-Identity (posed by physicalists for non-physicalists):

- Physicalism is understood as a metaphysical position which asserts that all individuals and properties are physical.
- If mental properties are non-identical to physical properties, then they are something non-physical.
- Conclusion: physicalism is false.

Non-Reductive Physicalism: Hempel's Dilemma

“Resolution” of the paradox: two problems for physicalism:
Hempel's dilemma and multiple realizability

Non-reductive physicalists claim:

- We can only find out what properties are ‘physical’ by means of the physical predicates which pick out these physical properties.
- But ‘physical predicates’ are either
 - the predicates used by the actual physics, and in this case not all properties are picked out by physical predicates (unless a reductive account of mind is presupposed).
 - the predicates used by a more developed physics of the future, in this case we do not know what properties these future predicates will pick out (because we do not know either meaning or reference of these predicates).

This claim is a variation of Hempel's dilemma (Hempel 1969; Stoljar 2010).

Non-Reductive Physicalism: Physicalist Criticism

Reductive physicalist responses to this objection:

- 1 Current physics is advanced enough to understand what type of properties are fundamental and to reject any other types of properties (for example, essentially subjective 'phenomenal' properties or qualia) as possible candidates to be the properties referred to by a more advanced physics of the future (Lewis 1999; J. J. Smart 1978).
- 2 Physical properties are the properties which typical physical objects in fact have, even if we do not yet possess the theory which would completely describe these properties (Feigl 1958; Jackson 1982).

The discussion is still ongoing: there are objections to these responses (cf. Stoljar 2010), but there are also answers to these objections (cf. Hohwy and Kallestrup 2008).

Non-Reductive Physicalism: Multiple realizability

Multiple realizability is a well-known problem for reductive physicalists

It is the widely shared assumption that the same mental property can be realized by different physical properties (cf. Kim 2005).

The problem for reductive physicalists:

if the physical properties that can realize some particular mental property are **very different** from each other, then this mental property is not identical to those physical properties.

There are several possible reactions to this problem.

We will consider four of these reactions.

Non-Reductive Physicalism: Multiple realizability

Reaction 1. To agree that multiple realizability is a problem for reductive physicalism, and that therefore reductive physicalism should be replaced by some other (**non-reductive**) version of physicalism, for example:

- a realization physicalism, which claims that while mental properties are not identical to first-order physical properties, they are realized by those properties, and are, therefore, second-order physical properties (Melnik 2003), or
- necessitation physicalism, which claims that while mental properties are not identical to physical properties, they are metaphysically necessitated by them (Stoljar 2010).

Reaction 1 is based on a strong concept of reduction: since multiple realizability is seen as violating strong reduction, it is seen as a reason to accept non-reductive physicalism.

Non-Reductive Physicalism: Multiple realizability

Our conclusion: Reaction 1 has serious ontological implications.

Even though realization or metaphysical necessitation is assumed to hold with some sort of strong necessity (metaphysical or nomological), it is still not as strong as the necessity of identity, in a sense that it:

- 1 Allows at least a logical possibility of there being mental properties which are not physical;
- 2 Leaves open the question of why it is the case that mental properties are realized or necessitated by the physical properties;
- 3 Creates the problem of causal exclusion of mental properties (Kim 1992, 2000, 2005; Walter 2010).

Non-Reductive Physicalism: Multiple realizability

Reaction 2. To deny that multiple realizability is a problem for reductive physicalism, and to subscribe to disjunctive physicalism (Clapp 2001; Walter 2006).

According to disjunctive physicalists, mental properties are disjunctive:

Definition of 'mental': to be a mental property of a kind M just is to be identical to one of the disjuncts of a (possibly infinite) disjunction

$$P_1 \vee P_2 \vee P_3 \vee \dots \vee P_n \vee \dots$$

where each disjunct is a particular (complex) physical property that is a possible instantiation of a mental property of a kind M .

Thus, disjunctive physicalists are reductive physicalists who subscribe to type identity.

Non-Reductive Physicalism: Multiple realizability

One objection to their position is that these **disjunctive kinds** are too heterogeneous to be natural kinds (cf. Stoljar 2010), but whether this is true, or even if it is true, whether it is a decisive argument against disjunctivism, is an open question.

For defense of disjunctive approach to identity of mental and physical properties, see (Clapp 2001; Walter 2006, 2010).

In terms of the philosophy of science reductionist framework outlined above, the disjunctive approach still falls under the account of **explicit definability** (presupposed: finite n):

$$M \Leftrightarrow P$$

Non-Reductive Physicalism: Multiple realizability

Reaction 3. To agree that multiple realizability is a problem for reductive physicalism, and that therefore reductive physicalism should be replaced by **functionalism**, which sees mental properties as essentially functional.

What are the costs?

It has been argued that functionalism is compatible with ontological identity of physical and functional properties, because functional properties just are those physical properties which play some particular functional role (Lewis 1972; van Riel 2014).

But this is not a universally accepted understanding of functionalism (cf. Chalmers 1996).

Our conclusion: as long as functionalism is seen as an analysis of mental properties which does not presuppose at least the token identity of these properties with their physical realizers, the same three questions arise as in the case of realization or necessitation physicalism.

Non-Reductive Physicalism: Multiple realizability

Can **functionalism** be located in our philosophy of science framework of reduction?

We think: Yes!

Here is, in which sense:

- Like **dispositional concepts** introduced by bilateral reduction sentences (test-reaction pairs), functionalism stresses the **functional role** of M (input-output)
- dispositions have an **empirical as well as a theoretical component**, as do M according to functionalism (empirical: input-output; theoretical: function)
- both stress **different instantiations** of one and the same concept in different physical setups; e.g. dispositions: several test-reaction pairs: solubility: sugar, salt, etc.; functionalism: pain is instantiated as C-fibers firing in humans, as opening of D-valves in Martians, and as something else in octopi.

So, the strategy is:

$$P_T \Rightarrow M \Leftrightarrow P_R$$

Non-Reductive Physicalism: Multiple realizability

Reaction 4. To weaken the connection between the mental and the physical even further, and to maintain that mental properties **supervene** on physical properties,

where supervenience is understood as a relation between two sets of properties, supervenient A-properties and the base B-properties B, such that A-properties strongly supervene on B-properties just in case things that are alike in B-properties (here: physical properties), are alike in A-properties (here: mental properties), but the converse is not necessarily true: supervenience is non-symmetric (Kim 2005).

This allows multiple realizability and naturalistic ontology without reductionism in the sense of strong reduction.

Non-Reductive Physicalism: Multiple realizability

Our conclusion: Supervenience has to answer the same three questions as the first and second replies.

Supervenience is even less explanatory than metaphysical necessitation: it is simply a declaration about how things are (in the actual world), without some kind of an explanation why things are this way and whether they could be some other way.

Metaphysical necessitation, at least, claims that they could not be any other way, but mere supervenience does not imply this. In this sense, supervenience is not at all an answer to ②: it is, at most, a starting point for finding the answer.

Non-Reductive Physicalism: Multiple realizability

Some non-reductive physicalists might want to assert that supervenience is a brute fact, or is explained by some kind of psycho-physical laws.

The important thing is that supervenience seems to provide some kind of ontological autonomy to mental properties in a physicalist world without postulating dualism.

The downside, of course, is the threat of epiphenomenalism (Kim 2005; Walter 2010).

However, despite the fact that supervenience is one of the strongest anti-reductionist presuppositions of non-reductive physicalism, it is still compatible with theories of reduction proposed in the [philosophy of science](#).

Non-Reductive Physicalism: Multiple realizability

Here is, where and how we think that non-reductive physicalism can be located in the the outlined philosophy of science framework:

Recall, the weakest form of reduction (reducibility_3): M -statements can be confirmed by evidence (P -statements)

We expressed the hard to spell out confirmatory methodology as P having some **impact** on M (slogan).

Supervenience can be considered as just such a form of **impact**:



$$m_{1s,t} \neq m_{2s,t} \Rightarrow p_{1s,t} \neq p_{2s,t}$$

Conclusion

We have seen that in **philosophy of science** several forms of reductionism can be differentiated:

- strong: explicit definability
- medium: bilateral reducibility
- weak: empirical confirmability

Applied to our discussion of **physicalism in the philosophy of mind**:

- reductive physicalism: replaceability-elimination: explicit definability \Leftrightarrow
- disjunctive reductive physicalism: explicit definability \Leftrightarrow
- functionalism: bilateral reducibility \Rightarrow
- supervenience: empirical confirmability *impact*

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