

Thomas Kuhn's Concept of Incommensurability and the Stegmüller/Sneed Program as a Formal Approach to that Concept

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Overview

- The formal approach to scientific theories
- The historical approach (Kuhn)
- Stegmüller's approach (Kuhn Sneedified)
- Feyerabend's criticism of Stegmüller
- Stegmüller's reaction
- Conclusion

The formal approach I:

the 'statement view' (Carnap etc.)

- A scientific theory is a set of statements
- There is empirical vocabulary (observable things) and theoretical vocabulary (unobservable things)
- There are some correspondence rules that allow us to reduce the theoretical vocabulary to the empirical vocabulary

The formal approach II:
the 'non-statement view'
(Suppes, Sneed, Stegmüller, etc.)

- A scientific theory is a pair (K,I) that consists of a structure core K and a class of intended applications I
- K is a class of semantic structures which is axiomatically defined
- I is a class of fragments or substructures of elements of K
- I represents the empirical world

The formal approach III

statement view vs non-statement view

- The statement view and the non-statement view are not *theories* about theories but different forms of formal *notation* for theories
- We have a question of different *formal frameworks* here and not a question of different scientific *views*

The historical approach I

a role for the history of science

- A scientific theory is not merely a formal thing, but a thing with psychological, historical and sociological aspects.
- If we analyze not only formal caricatures of scientific theories but theories in their historical context we obtain substantial changes of our picture of scientific theories:

Paradigms and normal science

- Theories are *paradigms* that are shared by a whole scientific community
- In *normal science* the scientific community is concerned only with *puzzle solving* in the realm of a fixed scientific paradigm
- Failure of an experiment does not lead to the immediate rejection of the whole paradigm

The historical approach III

scientific worldviews

- The empirical vocabulary of a scientific theory is *theory-laden*, because it is constituted by the theoretical paradigm that the observer holds
- A paradigm forms a *scientific worldview* of a highly unique nature, including formal, psychological and methodological aspects

The historical approach IV

Incommensurability

(Kuhn, according to Feyerabend)

- (A) „different paradigms use *concepts* that cannot be brought into the usual logical relations of inclusion, exclusion, overlap“ (formal)
- (B) „different paradigms make us see things differently“ (psychological)
- (C) „different paradigms contain different *methods* for setting up research and evaluating its results“ (methodological) (CPR, 363)

Stegmüller's approach I

- The following ideas were developed in their formal aspects essentially by Joseph Sneed („The Logical Structure of Mathematical Physics“ (1971), Ch. VIII)
- Wolfgang Stegmüller added numerous philosophical interpretations and refinements of the formal apparatus in:
 - „Theorienstrukturen und Theoriendynamik“ (1973)
 - „Structure and Dynamic of Theories“ (1975)
 - „Accidental („Non-substantial“) Theory Change and Theory Dislodgment“ (1976, 1977)
 - „A Combined Approach to the Dynamic of Theories. How to Improve Historical Interpretations of Theory Change by Applying Set Theoretic Structures“ (1977)

Stegmüller's approach II

- From 1973 until 1978 Stegmüller almost exclusively was concerned with his program of a „Sneedification of Kuhn“
- In 1975 he added a chapter on Kuhn to his introductory book „Main Currents in Contemporary Philosophy“, where he also introduces his formal reconstruction („Sneedification“) of Kuhn
- But only in 1978 Stegmüller added an own chapter on Sneed and theory-„structuralism“
- This supports the thesis that before 1978 Sneed was merely a tool for Stegmüller that allowed him to close a “rationality gap” in Kuhn’s theory

Stegmüller's approach III

the strategy

- Extend the semantic picture of a theory to a notion of „holding a theory“
- This formal framework allows a formalization of paradigms:
- A paradigm is a theory that is held by a particular person or scientific community
- Here “theory” and “holding a theory” are understood in the formal sense just suggested

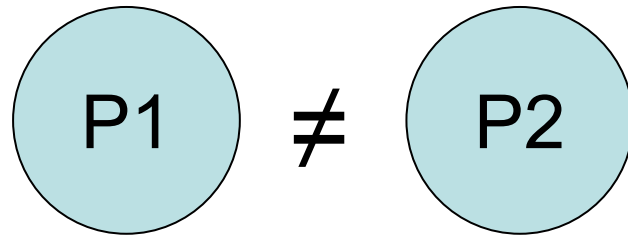
Consequences for paradigms

- Different paradigms (in the sense of Sneed/Stegmüller) may have disjoint and overlapping theoretical parts
- Different paradigms may be (partially) *empirically equivalent* at the same time
- One paradigm may be part of another, paradigms may overlap or may be disjoint
- Every (theoretical or empirical) concept of paradigm x has a clearly defined relation to every (theoretical or empirical) concept of paradigm y

Consequences for Incommensurability

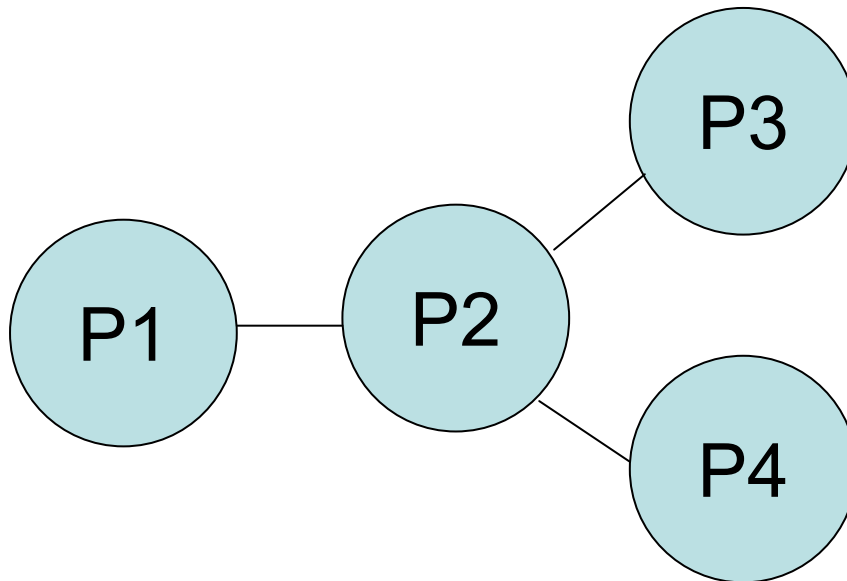
- Different paradigms are not at all incommensurable
- There is progress in the sciences
- The formal approach (“Kuhn Sneedified”) allows us to close a “rationality gap” in Kuhn’s account

Kuhn



There is no formalizable relation at all between different paradigms

Sneed
Stegmüller



Paradigms form a partial order with aspects of inclusion and exclusion disjunction and overlap

Feyerabend's criticism I

- In a detailed review “Changing Patterns of Reconstruction”, BJPS 28, 1977 Paul Feyerabend criticized Stegmüller's program of a “Sneedification of Kuhn” (Feyerabend)
- This is probably the only detailed critical review that takes into account both the formal and the non-formal side of the problem
- I mention three points of criticism

Feyerabend's criticism II

Overformalization

- Stegmüller's account is full of unnecessary formalizations

“there are informal informal explanations followed by informal formal explanations followed by formal formal explanations and I often did not see the point of a formal definition [...] hardly any of the definitions are used as a starting point for the derivation of novel theorems and thus of fruitful knowledge; the most we get are lemmas for further definitions” (p. 363)

restriction to non-statement view

- It is not true that we necessarily have to adopt the non-statement view, in order to express the formal aspects of paradigm-change that Stegmüller wants to express
- The statement view may do also a good job here

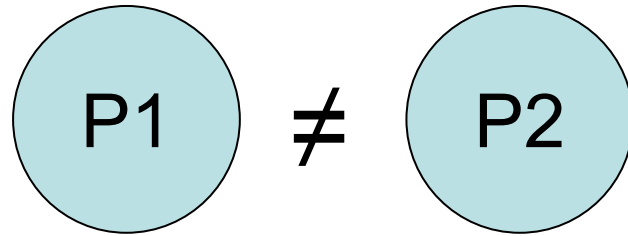
Only incommensurability (A)

“Stegmüller discusses only area (A) [of incommensurability in the sense of Kuhn], shows that there can be comparability despite conceptual disparity and seems to assume that incommensurability in Kuhn's sense has now been done away with. [...] His discussion of Kuhn is therefore defective at a decisive point”. (p. 364)

Only incommensurability (A)

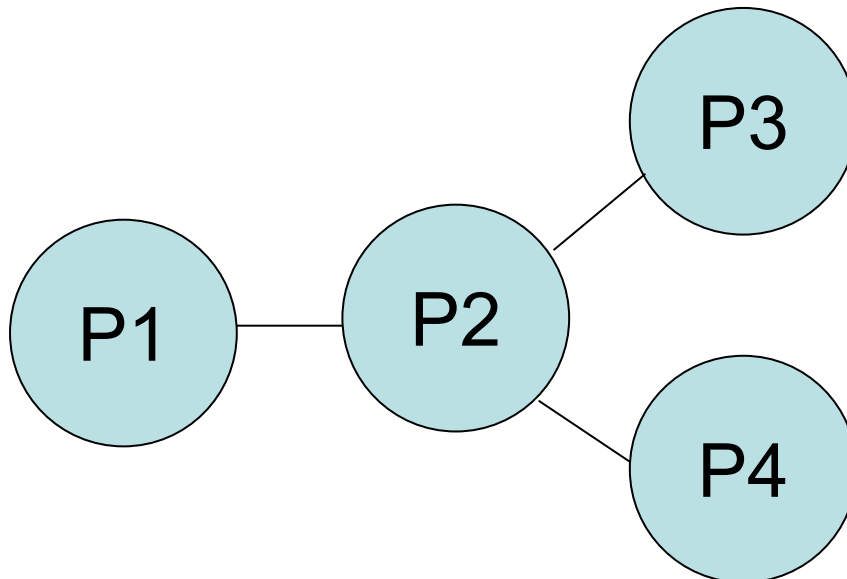
- This is a serious shortcoming of Stegmüller's theory
- But interestingly Feyerabend (and even Kuhn) seem to buy Stegmüller's claim that there is no incommensurability (A)
- Thus, one only had to *complete* the analysis by considering both the commensurable paradigms (in the formal sense) and the incommensurable paradigms (in the psychological and methodological sense):

Kuhn B, C



Paradigms *are*
incommensurable
in a psychological and
in a methodological sense
(the empirical perspective)

Kuhn A



Paradigms are
commensurable
if we understand them
as items of a formal
language
(the formal perspective)

Stegmüller's paradoxical reaction

- Stegmüller wrote a whole book („The Structuralist View of Theories“, 1979) as a reply to Feyerabend
- Stegmüller did not refine his account, in order to clarify the relation between the formal and the psychological and methodological aspects of the sciences
- Instead, he played down the relevance of Kuhn's approach to his „structuralism“ (as being „a side-effect only“, p. 1)
- And he purified his account as a restrictively and exclusively *formal* business without any aspect of “naturalization”

Conclusions

- In the seventieth there were efforts to combine the new historical approach to the sciences with the older formal approach
- These efforts did not fail systematically but were given up for pragmatic and strategic reasons
- Looking back to these efforts may help us to find a way out of the recent unfortunate situation of purified historical/sociological accounts and purified formal accounts of the sciences