

Wissenschaftslogik Erneuert

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A modest proposal for reinvigorating

- logically rigorous
- perspicuous
- tractible
- relevant

philosophy of science

precis of a forthcoming book

H. Halvorson, *The Logic in Philosophy of Science*. Cambridge University Press

Big thanks to Thomas Barrett and Neil Dewar

www.princeton.edu/~hhalvors/main.pdf

biased historical overview

- ▶ c 1900. the new logic
- ▶ c 1935. Carnap's syntax program
- ▶ c 1965. RIP syntax program

biased historical overview

- ▶ c 1975. the semantic view of theories
- ▶ c 1995. RIP general philosophy of science
- ▶ c 2009. philosophy of X proceeds on basis of semantic view

Carnap's syntax program

- ▶ Non-Euclidean geometry and de-interpretation (abstraction)
- ▶ Philosophical stances clarified
- ▶ What are *syntactic* concepts?

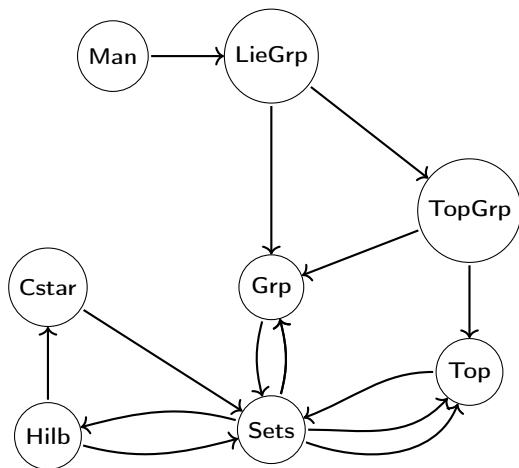
second semantic ascent

1. What structure do theories have?
2. What structure does the universe of theories have?

category-theoretic analogy

material	formal	2-formal
$\mathbb{Z}$	Grp	Cat
Hund	"Hund"	word
argument	modus ponens	valid forms

the universe of theories



baby steps: propositional theories

Henkin algebra of T : equivalence classes of sentences under T -provable equivalence

Th	Bool
equivalence	isomorphism
reduction	monomorphism
strengthening	epimorphism

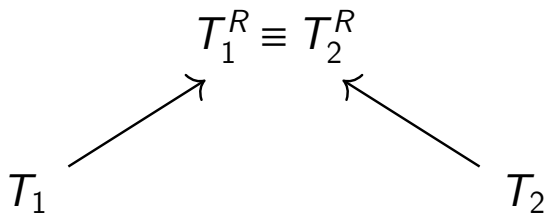
Hamiltonian and Lagrangian mechanics

- ▶ North (2009): H and L cannot be equivalent because their models are not isomorphic
- ▶ Model Isomorphism Criterion of Theoretical Equivalence: T and T' are equivalent only if each model M of T is isomorphic to a model M' of T' .

believing a scientific theory

- ▶ Semantic Account of Belief (van Fraassen, Giere): to accept T means to believe that one of its models M is isomorphic to the world.
- ▶ Stipulation: If T and T' are equivalent, then any reason to accept T is a reason to accept T' .
- ▶ Corollary: If $\neg\text{MIC}$ then $\neg\text{SB}$

Ramsey equivalence (Dewar)



Full semantics: Empirical-E $\Leftrightarrow$ Ramsey-E

Frame semantics: Definitional-E $\nRightarrow$

Ramsey-E

wavefunction realism

The wave function simply represents reality directly. (Sean Carroll)

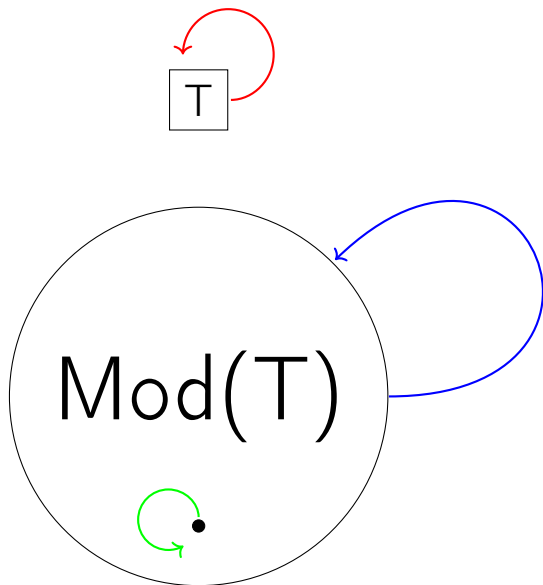
The quantum state is a mere calculation device. (Carlo Rovelli)

flat vs. structured views of theories

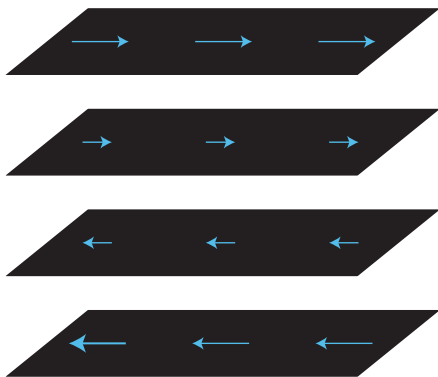
	flat	structured
syntactic	Quine	
semantic	van Fraassen	

Claim: Flat views of theories entail immoderate views of theoretical equivalence.

varieties of symmetry



counting possibilities



Does a shift generate a new possibility?

counting possibilities

shiftless isomorphic models represent same possibility (Saunders, Baker)

shifty distinct models represent distinct possibilities (Belot)

category of models



Models are objects in a category (and nothing more) $\Rightarrow$ possibilities cannot be counted

ethics of Wissenschaftslogik

- ▶ Hegel: after all analyses are complete, no remaining freedom of choice
- ▶ Carnap: in logic there are no morals
- ▶ Quine: no place for value judgments
- ▶ Carnap⁺: logic in the service of morals