

Laws of Nature?

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Seminar: Philosophy of Science — Vera Hoffmann & Markus Eronen

Hempel & Oppenheim (1948)

- laws are **true** lawlike (i.e. universal) sentences
- analytical and empirical
- reference to no particular object

- fundamental – infinite in scope
- derivate – follows from fundamental laws

problem: not all such statements are laws of nature

The Clash

Hempel & Oppenheim:

- laws as **universal truths**
- $\forall x(Fx \supset Gx)$

Dretske:

- **singular statements** about **relations between universals**
- *F-ness* \rightarrow *G-ness* (read: "yields")

Preliminaries

- singular claim vs. generalization
- particulars vs. universals
- universal laws
- purely qualitative (i.e. non-propositional)

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Outline

- 1 Introduction
- 2 Objections to H&O
- 3 Reductionist Account
- 4 Dretke's Account
- 5 Conclusion
- 6 Discussion

Overview

- there are laws of nature (assumption)
 - **conditions** on laws:
 - opacity
 - independence of knowledge
 - confirmation, prediction & explanation
 - counterfactuals & “why”-questions
 - law \neq universal truth (from **opacity**)
 - law = universal truth + X (reductionism)
 - possible X : “epistemologically and functionally **useless**” (p. 254)
 - hence, the **reductionist's equation is false**
 - laws as extensional **relations between intensions** (Dretske)
 - such laws fulfill conditions
- ∴ laws require **ontological ascent**: $F\text{-ness} \rightarrow G\text{-ness}$

Things go “beyond our epistemological grasp” (p. 249)

- finite number of observations
- not the right kind of evidence

→ nomic necessity rather needs analyticity

Problems with Co-Extensive Substitution

- law: All animals having a thyroid gland produce thyroxine.
- “have a thyroid gland” is coextensive with “have a spine”
- All vertebrates produce thyroxine.
→ **not lawlike**, though universally true

→ **different concepts** of law and universal truth

Differing Concepts

- “It is universally true that Fs are G.”
→ truth value unaffected by substitution
- “It is a law that Fs are G.”
→ operator confers **opacity**

positions of descriptive terms are
transparent in universal truths, but **opaque** in laws

Giving it a start ...

How to account for Opacity in Laws?

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The Reductionist's Explanation

- merely **functional** difference
- law = universal truth + **X** – where possible *X*s are
 - (1) high degree of confirmation
 - (2) wide acceptance
 - (3) explanatory potential
 - (4) deductive integration
 - (5) predictive use
- opacity as a **symptom** of epistemic condition

(1) & (2) – epistemological considerations

- laws exist prior to their discovery

→ both **useless**

(3) – explanatory potential

- laws explain their instances
- no X such that counterfactuals are supported
- universal generalizations might be accidental

To be told that all dogs born at sea have been and will be cocker spaniels is not to be told that we would get cocker spaniel pups (or no pups at all) if we arranged to breed dachshunds at sea. (p. 255)

→ need to exploit **additional knowledge/ laws**

Confirmation

- instances raise probability of hypothesis (not of next case)
- example from marble drawing:
 - $H = \text{"all marbles are blue"} , p_{blue} = 0.5, p_{red} = 0.5$
 - draw n times, independently $\rightarrow p_{blue}, p_{red}$ constant
 - H 's probability raises with blue marbles drawn

VS.

- **confirmation**: instances raise probability of next encounter
- must exceed instances encountered

Explanation

- mere universal generalizations cannot be confirmed by instances (cf. marbles)
- confirmation as converse of explanation

[Y]ou cannot make a generalization, not even a purely universal generalization, explain its instances. (p. 262)

$\forall x(Fx \supset Gx)$ implies all F s encountered are G .
But **why** is it the case?

(4) – deductive integration

- deducibility from higher level hypothesis
→ problem **postponed**

(5) – predictive use

- use for prediction does not make a law
- predictions derived from laws

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Dretske: ontologically austere but “utterly **hopeless**” (p. 245)

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- hence, the **reductionist's equation is false**

What Features to Expect of a Law?

- (a) descriptive terms in opaque positions
problems with co-extensive substitution
- (b) independence of human knowledge
epistemic independence argument (against (1) & (2))
- (c) confirmation by instances, tool for prediction
instances cannot confirm mere universal generalizations (cf. coins)
- (d) figure in explanations (not mere summaries)
non-limed scope of application (cf. H&O)
- (e) 'support' counterfactuals
universal generalizations can be mere accidents (cf. dogs)
- (f) say what must happen (answer "why"-questions)
relations are strict, specified at higher level

→ "manifestations of **ontological ascent**" (p. 262)

Giving it a start ...

How to account for Opacity in Laws?

Dretske's Explanation of Opacity

- “it is a law ...” operator **changes reference** of “*F*” and “*G*”
- ~~predicate extensions~~
- singular statement about universals
- even if *F*s and *K*s are co-extensive, *F-ness* might relate to *G-ness* differently from how *K-ness* does

→ there is an **intrinsic**—not just a functional—difference

What Universal Truths Can't Do

- universal truths $\not\approx$ laws
- explanation & prediction
- counterfactuals
- become well-established
- transform into laws

→ they “cannot be made to perform a service they are **wholly unequipped** to provide” (p. 254)

What Then Are Laws?

- ~~intensional relation between extensions~~
- extensional **relations between intensions**
- modal character → ontological ascent
 - "*F-ness* → *G-ness*" not necessary, though
 - necessity between law and observed particular

→ laws are **not about instances** and thus more powerful

An Analogy: Constitution

“[The] modality at level n is generated by the set of relationships existing between the entities at level $n + 1$.” (p. 256)

- laws themselves not necessary (**modality-free framework**)
- yet impose legal constraints on people in offices (“must”)
- tell us something about “presidency”
only indirectly about particular presidents

→ laws extend to to sets of things in **possible worlds**

→ support counterfactuals

See How Well it Works ...

- co-extensive substitution: preserves lawhood for universals
- counterfactuals:
hypothetically alter extensions, derive consequent
 - what we talk about remains the same
 - different and additional *F*s (possible worlds) covered
- testing hypotheses on novel data
→ prediction & confirmation

... And Here We Are!

- ✓ descriptive terms in opaque positions
- ✓ independence of human knowledge
- ✓ confirmation by instances, tool for prediction
- ✓ figure in explanations (not mere summaries)
- ✓ 'support' counterfactuals
- ✓ say what must happen (answer "why"-questions)

→ law = **relation between universals**

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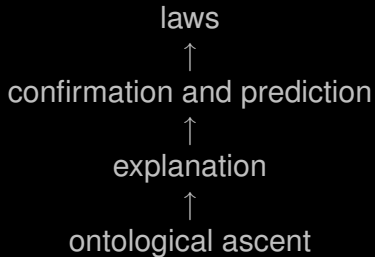
Summary

- laws assert more than universal truths
- if they don't they cannot explain
hence: no confirmation, no predictions
- therefore we need ontological ascent

→ laws express **relations between universals**

Take Home Message

F-ness → *G-ness*



Discussion

Do you find the argument from opacity convincing?

- law: All animals having a thyroid gland produce thyroxine.
- “have a thyroid gland” is coextensive with “have a spine”
- All vertebrates produce thyroxine.
→ **not lawlike**, though universally true

Discussion

- How do we ever get to statements like “*F-ness* → *G-ness*”?
- Do such relations really answer the “why”-question?

Discussion

All Dretske claims is that there has to be ontological ascent if we want laws of nature to exist.

Could we not do **without** them?

problem: no grounds for **inductive reasoning**

Thank You!

References:

- Hempel, C. and Oppenheim, P. Studies in the logic of explanation. *Philosophy of Science*, 15, 135-175.
- Dretske, F. (1977). Laws of nature. *Philosophy of Science*, 44, 248-268.