Earman & Salmon, "Confirmation of Scientific Hypotheses" 2.1–2.4

2.1 Empirical Evidence

Obervations: $\underbrace{\text{veridical}}_{\text{correct}}$ or $\underbrace{\text{illusory}}_{\text{not correct}}$

Entities: (i) observed directly by unaided senses (ii) observed indirectly by instrument (iii) existence established by theoretical inference

Terms: observational vocabulary theoretical vocabulary

Need for ampliative = inductive inference

2.2. Hypothetico-Deductive Method

		e.g.
IF	H (test hypothesis) ←	Boyle's Law $PV = \text{const.}$
	A (auxiliary hypothesis) ←	Instruments work
	I (initial conditions) ←	$P_1 = 1$, $V_1 = 1$, $V_2 = \frac{1}{2}$, T constant
	Deduce	
	O (observational prediction) ←	$P_2 = 2$

THEN $\dfrac{O}{H}$ HD confirms with A, I

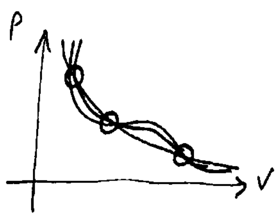
Refutation $H \vdash O, \sim O$ then $\sim H$

2.3 Problems with Hypothetico-Deductive method

Problem of alternate hypotheses

Infinitely many other H's entail same O.

All equally confirmed? Prefer simplest? Why?



Problem of statistical hypotheses

"Drug probably cures" logically compatible with "All 100 patients died." ← i.e. does not entail that patients are cured, only that it is likely

2.4 Other Approaches to Confirmation

Enumerative induction in syllogistic logic

$$\frac{\text{Some A's are B}}{\text{All A's are B}}$$

[Extend to predicate logic $\Longrightarrow$

Nicod

$Ra \cdot Ba$ confirms $H: (x)(Rx \supset Bx)$

Hempel: No! Not invariant under logical equivalence

$H \equiv (x)(\sim Bx \supset \sim Rx)$ etc.

Hempel's Conditions of Adequacy for qualitative confirmation

Danger! All satisfied by $\vdash$

Entailment Condition — If $E \vdash H$, then E confirms H

Consistency Condition — if E confirms H and also H', then H and H' are logically consistent.

Special consequence condition — If E confirms H and $H \vdash H'$ then E confirms H'

e.g.

$$\frac{E \text{ confirms } A \& B}{\begin{array}{l} E \text{ confirms } A \\ E \text{ confirms } B \end{array}}$$

But NOT Converse Consequence Condition — If E confirms H and $H' \vdash H$, then E confirms H'.

since SCC + CCC $\Rightarrow$ E confirms everything, if it confirms anything

$$E \text{ confirms } H \xrightarrow{CCC} E \text{ confirms } H \& X \xrightarrow{SCC} E \text{ confirms } X$$

Hempel's Essential Innovation: Logically robust notion of instance of hypothesis in predicate logic

$Dev_I(H)$ = Development of hypothesis H for individuals I $\approx$ what H would say if individuals I were the only ones

Defined by

Rules

H is $(x)B(x) \Longrightarrow Dev_{\{a,b,\cdots\}}H = B(a) \cdot B(b) \cdot \cdots$

H is $(\exists x)R(x) \Longrightarrow Dev_{\{a,b,\cdots\}}H = R(a) \vee R(b) \vee \cdots$

& MORE

Applied recursively ← Hence work for arbitrarily complicated formulae.

"Everybody loves somebody"

$$\underbrace{(x)\,(\exists y)(Lxy) = (x)\,\text{Formula}(x)}$$

$$\Big\downarrow Dev_{\{a,b\}}$$

$$\underbrace{Dev(\text{Formula}(a))} \cdot \underbrace{Dev(\text{Formula}(b))}$$

$$(Laa \vee Lab) \cdot (Lba \vee Lbb)$$

$\boxed{\text{The rest is mechanical, with a lot of "buts..."}}$

$\boxed{Dev_I H \text{ confirms } H}$ ← $Ra \supset Ba$ confirms $(x)(Rx \supset Bx)$

but...

$\boxed{\begin{array}{c} E \text{ directly confirms } H \\ \text{just if} \\ E \vdash Dev_I H \end{array}}$ ← $Ra . Ba \vdash Ra \supset Ba$ confirms $(x)(Rx \supset Bx)$

but...

$\boxed{\begin{array}{l} E \text{ Hempel confirms } H \\ \quad\text{just if} \\ E \text{ directly confirms} \\ \text{every member of a set} \\ \text{of sentences } K \text{ such} \\ \text{that } K \vdash H \end{array}}$ ← Hence $Ra . Ba$ confirms $Rb \supset Bb$

but...

Lots more fussy, nuisance problems

e.g. Some sentences in arithmetic have no developments for finite sets of individuals.

(e.g. Every number has a successor.)

Paradox of the Ravens

Informally: $(x)(Rx \supset Bx) \equiv (x)(\sim Bx \supset \sim Rx)$

$\Uparrow$ confirms $\qquad\qquad$ $\Uparrow$ confirms

$Ra \cdot Ba$ $\qquad\qquad$ $\sim Bb \cdot \sim Rb$

"white shoe"

Also from Hempel's Definitions

"White shoe" confirms "All Ravens are Black"

Grue

Later.

Glymour's Bootstrap

E Hempel confirms H

must have same vocabulary

Motion of planets confirms Newtonian Forces

Different vocabularies

so try:

Evidence

Theory

Instance of hypothesis

Theory allows us to translate observation predicates into theoretical predicates

Theory may include Hypothesis at issue

∴ Commence long saga of extra conditions designed to block "theory does all the work"