

Confirmation Theory (Continued)

- Sad News: David Lewis died suddenly on Sunday evening.
- Administrative: let's talk about paper topics.
- Early (Qualitative) Accounts of Confirmation
 - Hypothetico-Deductivism (re-cap)
 - Instance Confirmation (continued)
 - Classic Constraints on Qualitative Confirmation
 - * EC, SCC, CC, CCC, NTC, ...
- Problems & Paradoxes for the H-D and Hempelian Accounts
 - Raven Paradox
 - Grue Paradox
 - Other Problematic Cases

The Hypothetico-Deductive (H-D) Method (Re-Cap)

- The general form of a deductive (*i.e.*, H-D) prediction is:
 - H . Hypothesis under test.
 - K . Background assumptions (initial conditions, *etc.*).

 - E . Observational (deductive) prediction.
- We can also look at the “reverse inference”, *from* the observation E to the hypothesis H (*given* K). NOTE: this direction is *inductive*!
 - E . Observational (deductive) prediction.
 - K . Background assumptions (initial conditions, *etc.*).

 - H . Hypothesis under test.
- Of course, an H-D theorist in *not* claiming that E *conclusively* supports (or even *strongly* supports) H , given K . They would concede that the support provided by E (given K) may *not* be strong.
- This is merely a *qualitative* claim, that E confirms H , relative to K .

The Hypothetico-Deductive (H-D) Method (Re-Cap)

- What happens if $\sim E$ is observed? Where should we place the *blame*? Why doesn't the $\sim E$ disconfirm K , and leave H unscathed?
- This problem of *locating the blame* in cases of H-D-disconfirmation is known as the *Quine-Duhem Problem*. Quine and Duhem both shoed that hypotheses only entail predictions *in conjunction with auxiliaries*.
- This seems to be an insurmountable problem for the H-D theory. But, in a Bayesian (or probabilistic) account of confirmation, this problem can be addressed (if not overcome) in an interesting way.
- Example: We may have overwhelming (independent) evidence supporting the high accuracy of some test (say, an HIV test). And, although it is highly unlikely (*pre-test*) that someone has HIV, a positive test result (E) should (in such a case) be viewed as evidence in favor of HIV (H), not as evidence against the accuracy of the test (K).

The Hypothetico-Deductive (H-D) Method (Re-Cap)

- Other Problems with the H-D Theory of Confirmation
 - The Problem of Alternative Hypotheses (underdetermination)
 - * For any (finite) collection of evidence E , there are infinitely many inconsistent hypotheses which (together with K) entail E . The H-D account gives us no way to favor any of these.
 - The Problem of Statistical Hypotheses (*non-deductive* prediction)
 - * Most (if not all) hypotheses in science are statistical in nature. They do not *entail* observational data (but only *confer a probability on* them). H-D (falsely) assumes that all prediction (and testing) is *deductive*.
 - The Problem of Irrelevant Conjunction (tacking problem)
 - * According to H-D, if E confirms H , then E confirms $H \& X$ for *any* X — even for *irrelevant* (or *negatively relevant!*) X 's.
 - The Problem of Quantitative Generalization (*degrees* of confirmation)

Hempel's "Instance" Confirmation I

- In Hempel's classic "Studies in the Logic of Confirmation" (in reader), he outlines an alternative to H-D (qualitative) confirmation.
- The basic idea (or slogan!) behind this account is:
 "Hypotheses are confirmed by their positive instances."
- What this means, precisely, is not so easy to say!
- Before Hempel, Nicod tried to explain the notion of "positive instance" for universal conditionals (H) having the following logical form:

$$H : (\forall x)(Rx \rightarrow Bx) \quad [e.g., \text{all ravens are black}]$$

- According to Nicod, E is an instance of such an H just in case E satisfies both the antecedent and consequent of H (e.g., $Ra \ \& \ Ba$).
- When applied to confirmation, this leads to absurd results ...

Hempel's "Instance" Confirmation II

$$H' : (\forall x)(\sim Bx \rightarrow \sim Rx) \quad [e.g., \text{all non-black things are non-ravens}]$$

- According to Nicod, $Ra \ \& \ Ba$ confirms H but not H' . This is *absurd*, since H and H' are *logically equivalent* (they say the same thing)!
- This suggests the following *desideratum* for accounts of confirmation:
Equivalence Condition (EQC). If E confirms H , and H is logically equivalent to H' ($H \Leftrightarrow H'$), then E confirms H' .^a
- Things get *even worse* for Nicod! Consider the following hypothesis:

$$H'' : (\forall x)[(Rx \ \& \ \sim Bx) \rightarrow (Px \ \& \ \sim Px)]$$

- *Nothing* can satisfy the consequent of H'' . Therefore, on Nicod's account, *nothing* can confirm H'' . But, $H \Leftrightarrow H''$!

^aStrictly speaking, we should always be saying "confirms *relative to K*", "entails *relative to K*", etc. But, since all the K 's must be the same in these sorts of *desiderata* (*why?*), we will just omit the "relative to K "s from their definitions. Don't forget they are there!

Hempel's "Instance" Confirmation III

- After giving-up on Nicod's instance account, Hempel laid down the following *desiderata* (in addition to the Equivalence Condition).

Entailment Condition (EC). If E entails H , then E confirms H . ☺

Special Consequence Condition (SCC). If E confirms H , and H entails H' , then E confirms H' .^a ⚠

Consistency Condition (CC). If E confirms H , and E confirms H' , then H and H' are logically consistent. ☺

Non-Triviality Condition (NTC). For all H , there exists an E which does *not* confirm H . ☺

- Because Hempel accepts these desiderata, he *must* reject:

Converse Consequence Condition (CCC). If E confirms H , and H' entails H , then E confirms H' . ⚠

^aSee Dretske's "Epistemic Operators". SCC claims that confirmation is *penetrating*.

More on Hempel's Desiderata

- In the new paper topics, I include a question which involves careful analysis and thought concerning these conditions.
- The EQC, the EC, and the NTC all seem quite intuitive.
- The CC is *not* obvious (as Jeff pointed out last time). Typically, competing theories will *not* be consistent. Nonetheless, we might think that our evidence confirms both theories — it just confirms one *more strongly* than the other (we will see examples in Bayesian framework).
- The SCC and the CCC are not as straightforward. I think Dretskean considerations can be raised in connection with SCC. But, giving clear, concrete counterexamples to these principles will require an alternative theory of confirmation — Bayesian confirmation, for instance ...
- Questions: Is confirmation *transitive* (if X confirms Y , and Y confirms Z , must X confirm Z)? Is confirmation *symmetric* (if X confirms Y must Y confirm X)? Which properties (EQC, ...) does H-D have?

Hempelian “Instance” Confirmation IV

- Hempel then gave an account satisfying his 5 desiderata. The key definition behind his “instance” account is as follows:
- The *development of a hypothesis H for a set of individuals I* [$dev_I(H)$] is (intuitively) “what H says (*extensionally*) about the members of I .”
- Formally, $dev_I(H)$ is obtained by (i) *conjoining* all the I -instances (in the naive, Nicod sense) of H , if H is a *universal* (\forall) claim, and (ii) *disjoining* all the I -instances of H , if H is an *existential* (\exists) claim.
- Examples: Let $I = \{a, b\}$, then we have:
 - If $H = (\forall x)Bx$, then $dev_I(H) = Ba \ \& \ Bb$.
 - If $H = (\exists x)Rx$, then $dev_I(H) = Ra \ \vee \ Rb$.
 - If $H = (\forall x)(\exists y)Lxy$, then (working from the outside-in):

$$dev_I(H) = (\exists y)Lay \ \& \ (\exists y)Lby \\ = (Laa \ \vee \ Lab) \ \& \ (Lba \ \vee \ Lbb)$$

Hempelian “Instance” Confirmation V

- Now, we’re ready for the definition(s) of *Hempel-confirmation*.
- E *directly-Hempel-confirms* H , relative to background K , just in case $E \ \& \ K \models dev_I(H)$ for the class I of individuals mentioned in E .
- E *Hempel-confirms* H , relative to K , iff E directly-Hempel-confirms (rel. to K) every member of a set of sentences S such that $S \ \& \ K \models H$.
- Why the two definitions? $Ra \ \& \ Ba$ does *not directly* Hempel-confirm $Rb \rightarrow Bb$, but $Ra \ \& \ Ba$ *does* Hempel-confirm $Rb \rightarrow Bb$ (α -variants).
- Problematic Examples for Hempel’s Theory:
 - Let $I = \{a, b\}$, $H = (\forall x)Rxy$, $E = Raa \ \& \ Rab \ \& \ Rbb \ \& \ Rba$, and $E' = Raa \ \& \ Rab \ \& \ Rbb$. E Hempel-confirms H , but E' does not.
 - *No consistent E* can confirm the following, which is *true* on \mathbb{N} ,
 $(H) \ (\forall x)(\exists y)x < y \ \& \ (\forall x)x \not< x \ \& \ (\forall x)(\forall y)(\forall z)[(x < y \ \& \ y < z) \rightarrow x < z]$
 since $dev_I(H)$ is *inconsistent*, for any finite I ! Prove this!

Hempelian “Instance” Confirmation VI

- Two Deeper, Philosophical Problems with Hempel’s Account:
 - Paradox of the Ravens: Consider the hypothesis that all ravens are black, $H: (\forall x)(Rx \rightarrow Bx)$. Which of these Hempel-confirms H ?

$E_1: Ra_1 \ \& \ Ba_1$	$E_2: \sim Ra_2$	$E_3: Ba_3$
$E_4: \sim Ra_4 \ \& \ \sim Ba_4$	$E_5: \sim Ra_5 \ \& \ Ba_5$	$E_6: Ra_6 \ \& \ \sim Ba_6$

Answer: *All but E_6 Hempel-confirm H! Red Herrings confirm H?!*

- Goodman’s Grue Paradox: Consider the hypothesis that all ravens are “blite”, where the predicate “blite” (B) is defined as follows:
 - x is blite iff *either* (i) x is examined before (the end of) today, and x is black *or* (ii) x is examined after today, and x is white.
 On Hempel’s theory, $Ra \ \& \ Ba$ confirms H . But, this means that a black raven observed today confirms the hypothesis that ravens observed tomorrow (and thereafter) will be white!^a

^aSee Rosenkrantz’s “Does the Philosophy of Induction Rest on a Mistake” for insights.

Prelude to Probabilistic Accounts of Confirmation

- Historically, there have been two kinds of probabilistic confirmation:
 1. **Absolute:** E confirms H (relative to K) if $\Pr(H \mid E \ \& \ K) > \tau$, for some “threshold value” τ (*i.e.*, if $\frac{E \ \& \ K}{\therefore H}$ is “*inductively strong*”).
 2. **Incremental:** E confirms H (rel. to K) if $\Pr(H \mid E \ \& \ K) > \Pr(H \mid K)$ (*i.e.*, if E is *positively stochastically relevant* to H , given K).
 Incremental confirmation has become more popular in recent years.
- As we will see, these accounts behave much differently than either H-D or Hempel confirmation (and much differently than each other). For instance, these accounts do not satisfy either SCC or CCC. Moreover, on *neither* of these accounts is confirmation *transitive*. On the incremental (but *not* on the absolute!), confirmation is *symmetric*.
- Before we move on to such issues, we will have to talk a bit more about *probability* and its *interpretation*. We will start there next time ...