Philosophy 148 — Announcements & Such

- HW #4 grades posted ($\mu = 75$). [This one was tougher than I thought.]
- **New Plan for HW #5** (owing to my flu)
  - It will be due on the last day of class — next Thursday 5/8.
  - Our HW #5 discussion will be Tuesday 5/6 @ 6pm @ **110 Wheeler**.
- I will also be preparing some final extra-credit problems. They will be distributed next week, and due at the final exam (5/20 @ 8am).
- The final exam is **Tuesday, May 20 @ 8am @ 20 Barrows**.
  - I will hold a review session the day before the final (May 19). Would a time in the afternoon (say 4-6pm) work for people? Pencil it in.
- Today's Agenda
  - The Raven Paradox (cont'd)
  - Next: The Grue Paradox

- The traditional, Bayesian "comparative" assumptions are as follows (protocol: for each object in the universe, write a true description in terms of R/B, and then throw slips into a giant urn, which is mixed and then sampled):

(1) $\Pr(\sim Ba \mid K_\alpha) > \Pr(Ra \mid K_\alpha)$

(2) $\Pr(Ra \mid H \,\&\, K_\alpha) = \Pr(Ra \mid K_\alpha)$ $[\therefore \sim Ra \perp\!\!\!\perp H \mid K_\alpha$ (!)]

(3) $\Pr(\sim Ba \mid H \,\&\, K_\alpha) = \Pr(\sim Ba \mid K_\alpha)$ $[\therefore Ba \perp\!\!\!\perp H \mid K_\alpha$ (!)]

Theorem (HW #5!). Any Pr satisfying (1), (2) and (3) will also be such that:

(4) $\Pr(H \mid Ra \,\&\, Ba \,\&\, K_\alpha) > \Pr(H \mid \sim Ba \,\&\, \sim Ra \,\&\, K_\alpha)$.

- Assumption (1) is uncontroversial. But, assumptions (2) and (3) are not. They are quite un-Hempelian, since they rule-out Hempel's "indirect confirmation" effect for $\sim Ra$ and Ba. They also entail *many* claims, *e.g.*:

(5) $\Pr(H \mid Ra \,\&\, Ba \,\&\, K_\alpha) > \Pr(H \mid K_\alpha)$

(6) $\Pr(H \mid \sim Ba \,\&\, \sim Ra \,\&\, K_\alpha) > \Pr(H \mid K_\alpha)$

(7) $\Pr(H \mid Ba \,\&\, \sim Ra \,\&\, K_\alpha) < \Pr(H \mid K_\alpha)$

- A *purely comparative* approach should be *neutral* — *especially* on (7)!

- So (i) this cannot undergird a *purely comparative* approach – one that is *consistent with* a qualitative$_\alpha$ approach, and (ii) it entails (7), which is bad.
- It would be nice to have a *purely comparative* approach ... to wit:
- (2) and (3) can be replaced by the following, *strictly weaker* assumption:

(‡) $\Pr(H \mid Ra \,\&\, K_\alpha) = \Pr(H \mid {\sim}Ba \,\&\, K_\alpha)$

☞ (1) & (‡) $\Rightarrow \Pr(H \mid Ra \,\&\, Ba \,\&\, K_\alpha) > \Pr(H \mid {\sim}Ba \,\&\, {\sim}Ra \,\&\, K_\alpha)$.

- Thus, all one *needs* for a purely comparative approach are (1) and (‡).
- Our alternative, purely comparative approach has many virtues.
  - (1) & (‡) do *not* entail (5), (6), *or* (7) [or their negations]. In this sense, they capture the "*purely comparative* part" of the desired Theorem.
  - Recall Hempel's intuition about (PC) and (PC*). In Bayesian terms, it is:

  ($\star$) $\mathfrak{c}(H, {\sim}Ba \,\&\, {\sim}Ra \mid \top) > \mathfrak{c}(H, {\sim}Ba \mid {\sim}Ra) = 0$

  - **Fact.** The standard Bayesian (1)–(3) *entail* that Hempel's ($\star$) is *false*!
  - But, our (1) & (‡) are perfectly compatible with Hempel's ($\star$).
  - Thus, a Bayesian can have their Hempelian cake and eat it too!

- Views about (PC): Does $\sim Ba \,\&\, \sim Ra$ [E] confirm $(\forall x)(\sim Bx \supset \sim Rx)$ [H]?
  - **Hempel**: *Yes*, relative to T. But, don't conflate this with the claim (PC*) of confirmation relative to $\sim Ra$, which is *intuitively* false. That's a nice intuition, but, unfortunately, it contradicts Hempel's theory [(M_K)].
  - **Scheffler**: *Yes*, but this does not imply that E confirms $(\forall x)(Rx \supset Bx)$, since E is also a positive instance of the *contrary* of $(\forall x)(Rx \supset Bx)$.
  - **Quine**: *No* [relative to T] because (NC_{T}) *does not apply* to $\sim Ba$, $\sim Ra$, since they are not "natural kinds," despite the fact that Ra and Ba *are* "NKs". For Quine, "NKs" must have "sufficiently similar instances".
  - **Maher** (2004): *No*, not even relative to T, since (NC_{T}) is demonstrably *false* within a Carnapian theory of "confirmation relative to T". Note: the falsity of (NC_{T}) does not depend on "naturalness" of F and G.
  - **Bayesians**: *Depends* on whether $\Pr(H \mid E \,\&\, K_\alpha) > \Pr(H \mid K_\alpha)$, where K_α is our *actual* background knowledge. Bayesians think that (NC_{T}) is *irrelevant*, epistemically, and so *they don't care* whether it's true. And, *even if* the K_α version is true, we can still give a *comparative* account.

Goodman's "Grue" Paradox: Basic Linguistic Structures and Facts I

- Let $Ox \stackrel{\text{def}}{=} x$ is observed prior to t, $Gx \stackrel{\text{def}}{=} x$ is green, and $Bx \stackrel{\text{def}}{=} x$ is blue.
- "Grue": $\mathcal{G}x \stackrel{\text{def}}{=} x$ is either observed prior to t and green or x is not observed prior to t and blue. That is, $\mathcal{G}x \stackrel{\text{def}}{=} (Ox \,\&\, Gx) \vee (\sim Ox \,\&\, Bx)$.
- We can also define "Bleen" as: $\mathcal{B}x \stackrel{\text{def}}{=} (Ox \,\&\, Bx) \vee (\sim Ox \,\&\, Gx)$.
- **Two Facts.**
  - Gx is logically equivalent to $(Ox \,\&\, \mathcal{G}x) \vee (\sim Ox \,\&\, \mathcal{B}x)$.
  - Bx is logically equivalent to $(Ox \,\&\, \mathcal{B}x) \vee (\sim Ox \,\&\, \mathcal{G}x)$.
- So, from the point of view of the Green/Blue language, "Grue" and "Bleen" are "gerrymandered" or "positional" or "non-qualitative".
- But, from the point of view of the Grue/Bleen language, "Green" and "Blue" are "gerrymandered" or "positional" or "non-qualitative".
- So, no appeal to syntax will forge an asymmetry here, unless one assumes a *privileged language*. Note: the languages are expressively equivalent.

Goodman's "Grue" Paradox: Basic Linguistic Structures and Facts II

- I'm going to simplify things by re-defining "grue" using green and non-green. Quine wouldn't have liked this, but Goodman/Hempel wouldn't have minded. It will make the subsequent discussion easier.
- Thus, "Grue" becomes: $\mathcal{G}x \overset{\text{def}}{=} Ox \equiv Gx$. Now, consider the following two universal generalizations, and three singular evidential claims:
  - H_1: All emeralds are green. $(\forall x)(Ex \supset Gx)$.
  - H_2: All emeralds are grue. $(\forall x)(Ex \supset \mathcal{G}x)$. *I.e.*, $(\forall x)[Ex \supset (Ox \equiv Gx)]$.
  - E_1: a is a green emerald. $Ea \,\&\, Ga$.
  - E_2: a is a grue emerald. $Ea \,\&\, \mathcal{G}a$. *I.e.*, $Ea \,\&\, (Oa \equiv Ga)$.
  - $\mathcal{E}$: a is a *grue and green* emerald. $Ea \,\&\, (Oa \,\&\, Ga)$.
- The first part of Goodman's argument involves identifying an evidential claim that Hempel-confirms H_1 *and* H_2. E_1/E_2 do not fit the bill. Why?
- As Goodman points out (more detail later), $\mathcal{E}$ Hempel-confirms both H_1 and H_2. Goodman thinks this is "bad news" for Hempel's theory. *Why?*

- Here is a "*reductio*" of classical deductive logic (this is naïve and oversimplified, but I'll re-examine it on the next slide):
  (1) For all sets of statements X and all statements p, if X is inconsistent, then p is a logical consequence of X.
  (2) If an agent S's belief set B entails p (and S *knows* $B \vDash p$), then it would be reasonable for S to infer/believe p.
  (3) *Even if* S knows their belief set B is inconsistent (and, hence, that $B \vDash p$, for *any* p), there are still *some* p's such that it would *not* be reasonable for S to infer/believe p.
  (4) ∴ Since (1)–(3) lead to absurdity, our initial assumption (1) must have been false — *reductio* of the "explosion" rule (1).
- Harman [8] would concede that (1)–(3) are inconsistent, and (as a result) that *something* is wrong with premises (1)–(3).
- But, he would reject the relevantists' diagnosis that (1) must be rejected. I take it he'd say it's (2) that is to blame here.

☞ (2) is a *bridge principle* [12] linking *entailment* and *inference*.

- (2) is correct *only* for *consistent* B's. [*Even if* B is consistent, the correct response *may* rather be to *reject* some B_i's in B.]

- Note: the choice of *deductive* contexts in which S's belief set B is (known by S to be) *inconsistent* is intentional here.
- In such contexts, there is a *deep disconnect* between (known) *entailment* relations and (kosher) *inferential* relations.
- One might try a more sophisticated deductive bridge principle (2′) here. But, I conjecture a *dilemma*. *Either*:
  - (2′) will be *too weak* to yield a (classically) *valid* "reductio".

    or
  - (2′) will be *false*. [Our original BP (2) falls under this horn.]
- Let B be S's belief set, and let q be the conjunction of the elements B_i of B. Here are two more candidate BP's:

  ($2'_1$) If S knows that $B \vDash p$, then S should *not* be such that *both*: S believes q, *and* S does not believe p.

  ($2'_2$) If S knows that $B \vDash p$, then S should *not* be such that *both*: S believes each of the $B_i \in B$, *and* S does not believe p.
- ($2'_2$) is *false* (preface paradox) *and* too weak (it's wide scope).
- ($2'_1$) *may* be true, but it is also *too weak*. [It's wide scope, and the agent can reasonably disbelieve *both* q *and* p].

- So, I think Harman is *right* about such "relevantist" arguments.
- Next, I will argue that Goodman's "grue" argument against CIL fails for analogous reasons (indeed, I'll argue it's *even worse*!).
- I'll begin by discussing the IL's of Hempel and Carnap.
- Hempelian IL (confirmation theory) uses *entailment* to explicate "inductive logical support" (confirmation) — a logical relation between statements. [*i.e.*, E confirms H iff $E \vDash \text{dev}_E(H)$]
- Hempel's theory has the following three key consequences:

(EQC) If E confirms H and $E \dashv\vDash E'$, then E' confirms H.

(NC) For all constants x and all (consistent) predicates ϕ and ψ: $\ulcorner \phi x \,\&\, \psi x \urcorner$ confirms $\ulcorner (\forall y)(\phi y \supset \psi y) \urcorner$.

(M) For all x, for all (consistent) ϕ and ψ, and all statements H: If $\ulcorner \phi x \urcorner$ confirms H, then $\ulcorner \phi x \,\&\, \psi x \urcorner$ confirms H.

- These three properties are the crucial ones needed to reconstruct Goodman's "grue" argument against Hempel.
- Before giving a precise reconstruction of Goodman's "grue" argument, we'll look at the essentials of Carnapian IL/CT.

- Carnapian confirmation (*i.e.*, *later* Carnapian theory [13] — see "Extras") is based on *probabilistic relevance*, not entailment:
  - E confirms H, relative to K iff $\Pr(H \mid E \,\&\, K) > \Pr(H \mid K)$, for some "suitable" conditional probability function $\Pr(\cdot \mid \cdot)$.
    - Note how this is an *explicitly 3*-place relation. Hempel's was only *2*-place. This is because Pr (unlike $\vDash$) is *non-monotonic*.
    - Carnap thought that "suitable Pr" meant "logical Pr" in a rather strong sense (see "Extras"). However, Goodman's argument will work against *any* probability function Pr.
- ☞ Carnap's theory implies *only 1* of our 3 Hempelian claims: (EQC). It does *not* imply (NC) *or* (M) (see "Extras" & [3]/[13]).
  - This will allow Carnapian IL to avoid facing the full brunt of Goodman's "grue" (but, it will still face a serious challenge).
- For Carnap, confirmation is a *logical* relation (akin to entailment). Like entailment, confirmation can be *applied*, but this requires *epistemic bridge principles* [akin to (2)].
- Carnap [1] discusses various bridge principles. The most well-known of these is the *requirement of total evidence*.

- **The Requirement of Total Evidence**. In the application of IL to a given knowledge situation, the total evidence available must be taken as a basis for determining the degree of confirmation.
- This *sounds* like a plausible principle. But, once it is made more precise, it will actually turn out to be subtly defective.
- More precisely, we have the following *bridge principle* connecting *confirmation* and *evidential support*:

(RTE) E evidentially supports H *for* S *in* C iff E confirms H, relative to K, where K is S's *total evidence in* C.

- The (RTE) has often been (implicitly) presupposed by Bayesian epistemologists (both subjective and objective).
- However, as we will soon see, the (RTE) is not a tenable bridge principle, and for reasons independent of "grue".
- ☞ Moreover, Goodman's "grue" argument will rely *more heavily* on (RTE) than the relevantists' argument relies on (2). In this sense, Goodman's argument will be *even worse*.
- Before reconstructing the argument, a brief "grue" primer.

- Let $Gx \stackrel{\text{def}}{=} x$ is green, $Ox \stackrel{\text{def}}{=} x$ is examined prior to t, and $Ex \stackrel{\text{def}}{=} x$ is an emerald. Goodman introduces a predicate "grue"

$$\mathcal{G}x \stackrel{\text{def}}{=} x \text{ is grue} \stackrel{\text{def}}{=} Ox \equiv Gx.$$

- Consider the following two universal generalizations
  - (H_1) All emeralds are green. $[(\forall x)(Ex \supset Gx)]$
  - (H_2) All emeralds are grue. $[(\forall x)[Ex \supset (Ox \equiv Gx)]]$
- And, consider the following instantial evidential statement
  - ($\mathcal{E}$) $Ea \,\&\, Oa \,\&\, Ga$
- Hempel's confirmation theory [(EQC) & (NC) & (M)] entails:
  - (†) $\mathcal{E}$ confirms H_1, *and* $\mathcal{E}$ confirms H_2. [proof]
- As a result, his theory entails the following weaker claim
  - (‡) $\mathcal{E}$ confirms H_1 *if and only if* $\mathcal{E}$ confirms H_2.
- What about (later) Carnapian theory? Does *it* entail even (‡)?
- ☞ Interestingly, NO! There are (later) Carnapian Pr-models in which $\mathcal{E}$ confirms H_1 but $\mathcal{E}$ *dis*confirms H_2 (see "Extras").
- In this sense, Hempel was an easier target for Goodman than Carnap (Goodman claims to be attacking both).
- Now, we're ready to reconstruct Goodman's argument.

A Proof of (†) From Hempel's (NC), (M), and (EQC)

$$
\begin{tikzcd}
(\forall x)(Ex \supset Gx) & & (\forall x)[Ex \supset (Ox \equiv Gx)] \\
Ea \,\&\, Ga \arrow[u, "\text{(NC)}"'] & & Ea \,\&\, (Oa \equiv Ga) \arrow[u, "\text{(NC)}"'] \\
(Ea \,\&\, Ga) \,\&\, Oa \arrow[u, Rightarrow] \arrow[uu, bend left, "\text{(M)}"] & & (Ea \,\&\, (Oa \equiv Ga)) \,\&\, Oa \arrow[u, Rightarrow] \arrow[uu, bend right, "\text{(M)}"'] \\
& Ea \,\&\, Oa \,\&\, Ga = \mathcal{E} \arrow[ul, Leftrightarrow] \arrow[ur, Leftrightarrow] \arrow[uuul] \arrow[uuur, "\text{(EQC)}"'] &
\end{tikzcd}
$$

back

- There is just one more ingredient in Goodman's argument:
  - The agent S who is assessing the evidential support that $\mathcal{E}$ provides for H_1 *vs* H_2 in a Goodmanian "grue" context $C_{\mathcal{G}}$ has Oa as part of their total evidence in $C_{\mathcal{G}}$. (*e.g.*, [14].)
- Now, we can run the following Goodmanian *reductio*:
  (i) E confirms H, relative to K iff $\Pr(H \mid E \,\&\, K) > \Pr(H \mid K)$.
  (ii) E evidentially supports H *for* S *in* C iff E confirms H, relative to K, where K is S's *total evidence in* C.
  (iii) The agent S who is assessing the evidential support $\mathcal{E}$ provides for H_1 *vs* H_2 in a Goodmanian "grue" context $C_{\mathcal{G}}$ has Oa as part of their total evidence in $C_{\mathcal{G}}$ [*i.e.*, $K \vDash Oa$].
  (iv) *If* $K \vDash Oa$, *then—c.p.—*$\mathcal{E}$ confirms H_1 relative to K iff $\mathcal{E}$ confirms H_2 relative to K, for ***any*** Pr [*i.e.*, (‡) holds, ∀ Pr's].
  (v) Therefore, $\mathcal{E}$ evidentially supports H_1 for S in $C_{\mathcal{G}}$ if and only if $\mathcal{E}$ evidentially supports H_2 for S in $C_{\mathcal{G}}$.
  (vi) $\mathcal{E}$ evidentially supports H_1 for S in $C_{\mathcal{G}}$, but $\mathcal{E}$ does *not* evidentially support H_2 for S in $C_{\mathcal{G}}$.
- ∴ (i)–(vi) lead to an absurdity. Hence, our initial assumption (i) must have been false. Carnapian inductive logic refuted?

- Premise (vi) is based on Goodman's *epistemic intuition* that, in "grue" contexts, $\mathcal{E}$ evidentially supports H_1 but *not* H_2.
- Premise (v) follows logically from premises (i)–(iv).
- Premise (iv) is a theorem of probability calculus (***any*** Pr!).
    - The *c.p.* clause needed is $\Pr(Ea \mid H_1 \,\&\, K) = \Pr(Ea \mid H_2 \,\&\, K)$, which is assumed in all probabilistic renditions of "grue".
- Premise (iii) is an assumption about the agent's background knowledge K that's implicit in Goodman's set-up. See [14].
- Premise (ii) is (RTE). It's the *bridge principle*, akin to (2) in the relevantists' *reductio*. This is the premise I will focus on.
- Here are my two main points about Goodman's argument:
    - (ii) must be rejected by Bayesians for independent reasons.
    - Carnapian confirmation theory *doesn't even entail* (‡). [Hempel's theory does, just as deductive logic entails (1).]
- This suggests Goodman's argument is *even less* a *reductio* of (i) than the relevantists' argument is a *reductio* of (1).
- Next, I will explain why Carnapians/Bayesians should reject (ii) on *independent* grounds: The Problem of Old Evidence.

- As Tim Willimson points out [16, ch. 9], Carnap's (RTE) must be rejected, because of the problem of old evidence [2].
- If S's total evidence in C (K) entails E, then, according to (RTE), E cannot evidentially support *any* H for S in C.
- As a result, one cannot (in all contexts) use $\Pr(\cdot \mid K)$ — for *any* Pr — when assessing the *evidential import of* E.
- There are (basically) two kinds of strategies for revising (RTE). Carnap [1, p. 472] & Williamson [16, ch. 9] propose:

(RTE$_\top$) E evidentially supports H for S in C iff S possesses E as evidence in C and $\Pr_\top(H \mid E \,\&\, K_\top) > \Pr_\top(H \mid K_\top)$. [$K_\top$ is *a priori*, $\Pr_\top$ is "inductive" [13]/"evidential" [16]/"logical" [1].]

- Note: Hempel explicitly *required* that confirmation be taken "*relative to* $K_\top$" in all treatments of the paradoxes [9, 10]. (RTE$_\top$) is a charitable Carnapian reconstruction of Hempel.
- A more "standard" way to revise (RTE) is [(RTE′)] to use $\Pr_{S'}(\cdot \mid K')$, where $K \vDash K' \nvDash E$, and $\Pr_{S'}$ is the credence function of a "counterpart" S' of S with total evidence K'.

- Carnap never re-wrote the part of LFP [1] that discusses the (RTE), in light of a probabilistic *relevance* ("increase in firmness" [1]) notion of confirmation. This is too bad.
- If Carnap had discussed this ("old evidence") issue, I suspect he would have used something like Williamson's ($\mathrm{RTE}_{\top}$) as his bridge principle connecting confirmation and evidence.
- Various other philosophers have proposed similar accounts of "support" as some probabilistic relation, taken relative to an "informationless" or "*a priori*" background/probability.
  - Richard Fumerton (who, unlike Williamson, is an epistemological *internalist*) proposes such a view in his [4].
  - Patrick Maher [13] applies such relations extensively in his recent (neo-Carnapian) work on confirmation theory.
  - Brian Weatherson [15] uses a similar, "Keynesian" [11] inductive-probability approach to evidential support.
- So, many Bayesians *already* reject (RTE). [Of course, "grue" gives Bayesians another important reason to reject (RTE).]

- So far, I have left open (precisely) what I think Bayesian confirmation theorists *should* say (*logically* & *epistemically*) in light of Goodman's "grue" paradox (but, see "Extras").
- Clearly, BCTs will need to revise (RTE) in light of "grue". But, the standard (RTE′) way of doing this to cope with "old evidence" isn't powerful enough to avoid *both* problems.
- Williamson's (RTE$_\top$) revision of (RTE) — also suggested by Carnap — avoids both problems, from a *logical* point of view (*if* "inductive"/"logical"/"evidential" probabilities *exist*!). But, what should BCTs say on the *epistemic* side?
- I don't have a fully satisfactory answer to this question (yet). But, I remain unconvinced that the epistemic problem (if there is one) is caused by the "non-naturalness" of "grue".
- The problem, I suspect, may involve an *observation selection effect*: we know something about the "grue" observation process that *undermines* (or *defeats*) evidence it produces.
- I hope we can discuss this (and IL) in the Q&A (see "Extras").

[1] R. Carnap, *Logical Foundations of Probability*, 2nd *ed.*, Chicago Univ. Press, 1962.

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[4] R. Fumerton, *Metaepistemology and Skepticism*, Rowman & Littlefield, 1995.

[5] C. Glymour, *Theory and Evidence*, Princeton University Press, 1980.

[6] I.J. Good, *The white shoe is a red herring*, *BJPS* **17** (1967), 322.

[7] N. Goodman, *Fact, Fiction, and Forecast*, Harvard University Press, 1955.

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[10] ______, *The white shoe: no red herring*, *BJPS* **18** (1967), 239–240.

[11] J. Keynes, *A Treatise on Probability*, Macmillan, 1921.

[12] J. MacFarlane, *In what sense (if any) is logic normative for thought?*, 2004.

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[14] E. Sober, *No model, no inference: A Bayesian primer on the grue problem*, in *grue! The New Riddle of Induction* (D. Stalker *ed.*), Open Court, Chicago, 1994.

[15] B. Weatherson, *The Bayesian and the Dogmatist*, manuscript, 2007. URL: `http://brian.weatherson.org/tbatd.pdf`.

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"Carnapian" Counterexamples to (NC) and (M)

(*K*) Either: (*H*) there are 100 black ravens, no nonblack ravens, and 1 million other things, or ($\sim H$) there are 1,000 black ravens, 1 white raven, and 1 million other things.

- Let $E \stackrel{\text{def}}{=} Ra \,\&\, Ba$ (a randomly sampled from universe). Then:

$$\Pr(E \mid H \,\&\, K) = \frac{100}{1000100} \ll \frac{1000}{1001001} = \Pr(E \mid {\sim}H \,\&\, K)$$

- $\therefore$ This $K/\Pr$ constitute a counterexample to (NC), assuming a "Carnapian" theory of confirmation. This model can be emulated in the later Carnapian λ/γ-systems [13].

- Let $Bx \stackrel{\text{def}}{=} x$ is a black card, $Ax \stackrel{\text{def}}{=} x$ is the ace of spades, $Jx \stackrel{\text{def}}{=} x$ is the jack of clubs, and $K \stackrel{\text{def}}{=}$ a card a is sampled at random from a standard deck (where Pr is also standard):
  - $\Pr(Aa \mid Ba \,\&\, K) = \frac{1}{26} > \frac{1}{52} = \Pr(Aa \mid K)$.
  - $\Pr(Aa \mid Ba \,\&\, Ja \,\&\, K) = 0 < \frac{1}{52} = \Pr(Aa \mid K)$.

A "Carnapian" Counterexample to (‡)

(K) Either: (H_1) there are 1000 green emeralds 900 of which have been examined before t, no non-green emeralds, and 1 million other things in the universe, or (H_2) there are 100 green emeralds that have been examined before t, no green emeralds that have not been examined before t, 900 non-green emeralds that have not been examined before t, and 1 million other things.

- Imagine an urn containing true descriptions of each object in the universe (Pr $\overset{\text{def}}{=}$ urn model). Let $\mathcal{E} \overset{\text{def}}{=}$ "$Ea \,\&\, Oa \,\&\, Ga$" be drawn. $\mathcal{E}$ confirms H_1 but $\mathcal{E}$ *dis*confirms H_2, relative to K:

$$\Pr(\mathcal{E} \mid H_1 \,\&\, K) = \frac{900}{1001000} > \frac{100}{1001000} = \Pr(\mathcal{E} \mid H_2 \,\&\, K)$$

- This $K/\Pr$ constitute a counterexample to (‡), assuming a "Carnapian" theory of confirmation. This probability model can be emulated in the later Carnapian λ/γ-systems [13].

Is "Grue" an Observation Selection Effect? Part I

- **Canonical Example of an OSE**: I use a fishing net to capture samples of fish from various (randomly selected) parts of a lake. Let E be the claim that all of the sampled fish were over one foot in length. Let H be the hypothesis that all the fish in the lake are over one foot $[(\forall x)((Fx \,\&\, Lx) \supset Ox))]$.
- Intuitively, one might think E should evidentially support H. This may be so for an agent who knows *only* the above information (K) about the observation process. That is, it seems plausible that $\Pr(E \mid H \,\&\, K) > \Pr(E \mid {\sim}H \,\&\, K)$, where Pr is taken to be "evidential" (or "epistemic") probability.
- But, what if I *also* tell you that (D) the net I used to sample the fish from the lake (which generated E) has holes that are all over one foot in diameter? It seems that D *defeats* the support E provides for H (relative to K), because D *ensures* O. Thus, intuitively, $\Pr(E \mid H \,\&\, D \,\&\, K) = \Pr(E \mid {\sim}H \,\&\, D \,\&\, K)$.

Is "Grue" an Observation Selection Effect? Part II

- Note: the "grue" hypothesis (H_2) entails the following claim, which is not entailed by the green hypothesis (H_1):
  (H') All green emeralds have been (or will have been) examined prior to t. $[(\forall x)((Ex \,\&\, Gx) \supset Ox))]$.
- Now, consider the following two observation processes:
  - **Process 1**. For each green emerald in the universe, a slip of paper is created, on which is written a true description of that object as to whether it has property O. All the slips are placed in an urn, and one slip is sampled at random from the urn. By *this* process, we learn ($\mathcal{E}$) that $Ea \,\&\, Ga \,\&\, Oa$.
  - **Process 2**. Suppose all the green emeralds in the universe are placed in an urn. We sample an emerald (a) at random from this urn, and we examine it. [We know *antecedently* that the examination of a will take place prior to t, *i.e.*, that Oa is true.] By *this* process, we learn ($\mathcal{E}$) that $Ea \,\&\, Ga \,\&\, Oa$.
- Goodman seems to presuppose Process 2 in his set-up.

What Could "Carnapian" Inductive Logic Be? Part I

- The early Carnap dreamt that probabilistic inductive logic (confirmation theory) could be formulated in such a way that it *supervenes* on deductive logic in a *very strong* sense.
  - **Strong Supervenience** (SS). All confirmation relations involving sentences of a first-order language $\mathcal{L}$ supervene on the deductive relations involving sentences ***of*** $\boldsymbol{\mathcal{L}}$.
- Hempel clearly saw (SS) as a *desideratum* for confirmation theory. The early Carnap also seems to have (SS) in mind.
- I think it is fair to say that Carnap's project — understood as requiring (SS) — was unsuccessful. [I think *this* is true for reasons that are *independent* of "grue" considerations.]
- The later Carnap seems to be aware of this. Most commentators interpret this shift as the later Carnap simply *giving up* on inductive logic (*qua logic*) altogether.
- I want to resist this "standard" reading of the history.

What Could "Carnapian" Inductive Logic Be? Part II

- I propose a different reading of the later Carnap, which makes him much more coherent with the early Carnap.
- I propose *weakening* the supervenience requirement in such a way that it (a) ensures this coherence, and (b) maintains the "logicality" of confirmation relations in Carnap's sense.
- Let $\mathfrak{L}$ be a formal language strong enough to express the fragment of probability theory Carnap needs for his later, more sophisticated confirmation-theoretic framework.
  - **Weak Supervenience** (WS). All confirmation relations involving sentences of a first-order language $\mathcal{L}$ supervene on the deductive relations involving sentences ***of*** $\mathfrak{L}$.
- As it turns out, $\mathfrak{L}$ needn't be very strong (in fact, one can get away with PRA!). So, even by early (*logicist*) Carnapian lights, satisfying (WS) is all that is *really* required for "logicality".
- The specific (WS) approach I propose takes confirmation to be a *four*-place relation: between E, H, K, *and a function* Pr.

What Could "Carnapian" Inductive Logic Be? Part III

- Consequences of moving to a 4-place confirmation relation:
  - We need not try to "construct" "logical" probability functions from the syntax of $\mathcal{L}$. This is a dead-end anyhow.
  - Indeed, on this view, inductive logic has nothing to say about the *interpretation/origin* of Pr. That is *not* a *logical* question, but a question about the *application* of logic.
    - Analogy: Deductive logicians don't owe us a "logical interpretation" of the truth value assignment function v.
  - Moreover, this leads to a vast increase in the *generality* of inductive logic. Carnap was stuck with an impoverished set of "logical" probability functions (in his λ/γ-continuum).
    - On my approach, *any* probability function can be part of a confirmation relation. Which functions are "suitable" or "appropriate" or "interesting" will depend on *applications*.
    - So, some confirmation relations will not be "interesting", *etc.* But, this is (already) true of *entailments*, as Harman showed.
  - Questions: Now, what *is* the job of the inductive logician, and how (if at all) do they interact with *epistemologists*?

What Could "Carnapian" Inductive Logic Be? Part IV

- The inductive logician must explain how it is that inductive logic can satisfy the following Carnapian *desiderata*.
  - The confirmation function $\mathfrak{c}(H, E \mid K)$ quantifies a *logical* (in a Carnapian sense) relation among statements E, H, and K.

  ($\mathcal{D}_1$) One aspect of "logicality" is ensured by moving from (SS) to (WS) [from an $\mathcal{L}$-determinate to an $\mathfrak{L}$-determinate concept].

  ($\mathcal{D}_2$) Another aspect of "logicality" insisted upon by Carnap is that $\mathfrak{c}(H, E \mid K)$ should *generalize* the entailment relation.

    - This means (at least) that we need $\mathfrak{c}(H, E \mid K)$ to take a maximum (minimum) value when $E \,\&\, K \vDash H$ ($E \,\&\, K \vDash {\sim}H$).
    - Very few *relevance* measures $\mathfrak{c}$ satisfy this "generalizing $\vDash$" requirement. That's another job for the inductive logician.

($\mathcal{D}_3$) There must be *some* interesting "bridge principles" linking $\mathfrak{c}$ and *some* relations of evidential support, in *some* contexts.

  - ($\mathcal{D}_2$) implies that *if* there are any such bridge principles linking *entailment* and *conclusive evidence*, these should be *inherited by* $\mathfrak{c}$. This brings us back to Harman's problem!

Three Salient Quotes from Goodman [7]

☞ The "new riddle" is *about* inductive *logic* (*not epistemology*).

Quote #1 (page 67): "Just as deductive logic is concerned primarily with a relation between statements — namely the consequence relation — that is independent of their truth or falsity, so inductive logic . . . is concerned primarily with a comparable relation of confirmation between statements. Thus the problem is to define the relation that obtains between any statement S_1 and another S_2 if and only if S_1 may properly be said to confirm S_2 in any degree."

Quote #2 (73): "Confirmation of a hypothesis by an instance depends . . . upon features of the hypothesis other than its syntactical form".

☞ But, Goodman's *methodology* appeals to *epistemic* intuitions.

Quote #3 (page 73): ". . . the fact that a given man now in this room is a third son *does not increase the credibility of* statements asserting that other men now in this room are third sons, *and so does not confirm* the hypothesis that all men now in this room are third sons."