Schoenfield 2012 on precision

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I. Reacting to Precision

Schoenfield illustrates a different type of reaction to the (over)precision of Bayesian models: loosen the constraints!

To motivate/defend this move, she wants to distinguish between
(1) what the evidence supports (?= *ideal* rationality), and
(2) what you should believe, given your evidence.

Latter is sensitive to cognitive limits.

II. Against Precision

Precision: We can represent rational degrees of confidence with a (single) probability function P.
$\rightarrow$ You are more confident of q than r, written $q \succ r$, iff $P(q) > P(r)$.

Why? No smallest number your confidence can be sensitive to. Fair vs. 0.51-biased coin. Vs. 0.501 coin. Vs. 0.5001 coin. Etc.

Precision implies **complete comparisons:** for any two propositions q, r, either you are more confident of q than r, more confident of r than q, or (exactly) equally confident in the two.

For any $x, y \in \mathbb{R}$, either $x > y$ or $x < y$ or $x = y$.

E.g. Let B = last Sunday 24 Bulgarian men did headstands, and

- C_1 = this coin that is 0.001-likely to land heads will do so.
- C_2 = this coin that is 0.002-likely to land heads will do so.
- ...

There must be an n such that you are more confident of B than C_n but less confident of B than C_{n+2}.

Possible response: it's just hard to know!

Easwaran and blood pressure.

Schoenfield's argument: Insensitivity to mild sweetening.

> **Detective Confuso**
> You are a confused detective trying to figure out whether Smith or Jones committed the crime. You have an enormous body of evidence that you need to evaluate. Here is some of it: You know that 68 out of the 103 eyewitnesses claim that Smith did it but Jones' footprints were found at the crime scene. Smith has an alibi, and Jones doesn?t. But Jones has a clear record while Smith has committed crimes in the past. The gun that killed the victim belonged to Smith. But the lie detector, which is accurate 71% percent of the time, suggests that Jones did it. After you have gotten all of this evidence, you have no idea who committed the crime. You are no more confident that Jones committed the crime than that Smith committed the crime, nor are you more confident that Smith committed the crime than that Jones committed the crime.

Now you learn that there was one more eyewitness who claimed Smith did it. Presumably you should *still* be no more confident of Smith than Jones.

Argument: imagine we started the story with 69 witnesses instead of 68; order doesn't matter!

This is inconsistent with Precision, since you are *insensitive to mild evidential sweetening*:

1) You are no more confident of S than $\neg S$, nor vice versa.
2) There is a piece of evidence E which supports S over $\neg S$
3) After learning E, you are *still* no more confident of S than $\neg S$.

Given Precision, (1) $\Rightarrow P(S) = 0.5 = P(\neg S)$; (2) entails that $P(S|E) > P(S)$, which implies that $P(S|E) > 0.5 > P(\neg S|E)$, contradicting (3).

III. Alternative: Imprecise Bayesianism

aka **mushy credences**

Instead of representing your confidence with a *single* probability function P, we should represent it with a *set* of probability functions $\mathbb{P}$—your **representer**. E.g.:

$P_1(S) = 0.4$ and $P_1(\neg S) = 0.6$, while
$P_2(S) = 0.6$ and $P_2(S) = 0.4$, and
$\mathbb{P} = \{P_1, P_2\}$.

Usually constrained to be *convex* sets, which when focusing on a single proposition means *intervals* like $[0.4, 0.6]$; $\mathbb{P} = \{P_i : 0.4 \leq P_i(q) \leq 0.6\}$.

Imprecision: You are more confident of q than r iff for *every* probability function $P_i \in \mathbb{P}$, $P_i(q) > P_i(r)$.

Imprecision allows **incomplete comparisons**. *Four* options:

- More confident: $q \succ r$
- Less confident: $q \prec r$
- Equally confident: $q \equiv r$
- On a par: $q \approx r$

Chang (2002); Hare (2010)

You *have no clue* about whether S because $S \approx \neg S$.

Since $P_1(S) > P_1(\neg S)$ but $P_2(S) < P_2(\neg S)$.

And you are insensitive to mild evidential sweetening because, for example letting E = *one additional eyewitness testified that it was Smith*, we could have:

$P_1(S|E) = 0.45 > 0.4 = P_1(S)$, and $P_2(S|E) = 0.65 > 0.6 = P_2(S)$.

So:

1) Initially, $S \approx \neg S$.
2) For all $P_i \in \mathbb{P}$, $P(S|E) > P(S)$, so E supports S over $\neg S$.
3) Yet after learning E, still $S \approx \neg S$.

Since $P_1(S|E) < P_1(\neg S|E)$ but $P_2(S|E) > P_2(\neg S|E)$.

IV. Objections

<u>Easwaran:</u>

- Must specify *what* we're measuring?
- What we're measuring is fluctuating quickly/chaotically.

Q: Does this differ from Schoenfield?

Q: How different is this alternative?

<u>Reflection failure:</u>

- Suppose Smith or Jones put in cell 1 determined by flip of a coin.
- Now, you should be 50% confident that the person in Cell 1 guilty
- If a witness *now* comes forward in favor of Cell 1, you should be more confident in Cell 1 than Cell 2.

- But you *know* that once you learn who's in Cell 1, you'll revert to being no more confident in Cell 1 than Cell 2, violating "Reflection"-principle.

Schoenfield's response: Reflection motivated from *deference*, and you shouldn't defer to your messy-evidence-future self. Rather, defer to *what the evidence supports*.

Carr (2019):

- Distinguish "more confident in q than r" from "believe (sure/confident) the you should be more confident of q than r".
- In Detective Confuso case, you are not sure whether you should be more confident of S than $\neg S$ both before an after getting the evidence.

$P(P(S) < 0.5) > 0$ & $P(P(S) > 0.5) > 0$. Moreover, letting $P_E = P(\cdot|E)$: $P_E(P_E(S) < 0.5) > 0$ and $P_E(P_E(S) > 0.5) > 0$.

References

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