Is Bayesian Coherentism Impossible?

On Bovens and Hartmann's Impossibility Result

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1. background and B&H's impossibility result
   - the intuition
   - bayesian coherentism
   - "ceteris paribus"
   - notation
   - the impossibility result
2. a case study - Shogenji's work on coherence
   - Shogenji's measure
   - ...and b&h's ceteris paribus conditions
   - two questions
3. a possibility result for bayesian coherentism
   - the "expectedness of reports" condition
   - an end around the impossibility result
4. implications

Coherence??

- Traditional epistemology - coherence theories of truth and justification.

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Three other witnesses give us reports ($S' = \{R'_1, R'_2, R'_3\}$)

R'_1 = "The culprit was a woman"
R'_2 = "The culprit had a Danish accent"
R'_3 = "The culprit drove a Ford"

Three Fundamental Tenets of Bayesian Coherentism:

- *Separability*: (BC_1): For all information sets S, $S' \in \mathbf{S}$, if S is no less coherent than S' ($S \succcurlyeq S'$), then our degree of confidence that the content of S is true is no less than our degree of confidence that the content of S' is true, ceteris paribus.

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- *Probabilism*: ($BC_{2[i]}$): The binary relation of "...being no less coherent than..." [i.e., $\succcurlyeq$] over $\mathbf{S}$ is fully determined by the probabilistic features of the information sets contained in $\mathbf{S}$.
- *Ordering*: ($BC_{2[ii]}$): The binary relation of "...being no less coherent than..." [i.e., $\succcurlyeq$] is an ordering; i.e., the relation $\succcurlyeq$ is transitive and complete.

**Note: Following Bovens & Hartmann's (B&H) example, I will refer to the conjunction of ($BC_{2[i]}$) and ($BC_{2[ii]}$) as (BC_2).

B&H's Taxonomy of Epistemically Relevant Factors:

1. *Expectedness of the information set* (i.e., of the conjunction of the information in the set):

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**Note: B&H's discussion of Bayesian Coherentism assumes the general prerequisite that the witnesses are independent: "R$_i$ *screens off* REPR$_i$ from all other fact variables R$_j$ and from all other report variables REPR$_j$."

Definition

A *weight vector* $< a_0, a_1, ..., a_n >$ for each n-membered information set specifies that set's probabilistic information, where each element of the weight vector a_i is the sum of the joint probabilities of all combinations of i negative values and $n - i$ positive values of the variables R_1,..., R_n.

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Example

for information triple $\{R_1, R_2, R_3\}$,
$a_2 = P(\neg R_1, \neg R_2, R_3) + P(\neg R_1, R_2, \neg R_3) + P(R_1, \neg R_2, \neg R_3)$

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Given the independence of witnesses, B&H rewrite Bayes's Theorem:

$$P(R_1, ..., R_n | REPR_1, ...REPR_n) = P^*(R_1, \ldots, R_n) = \frac{a_0}{a_0 + a_1 \bar{r} + ... + a_n \bar{r}^n}.$$

B&H's Impossibility Result

- The impossibility result seeks to show that "there cannot exist a measure of coherence that is probabilistic and induces a coherence ordering for information triples (BC_2) and that simultaneously makes it the case that the more coherent the information set, the more confident we are that the information is true, ceteris paribus (BC_1)."

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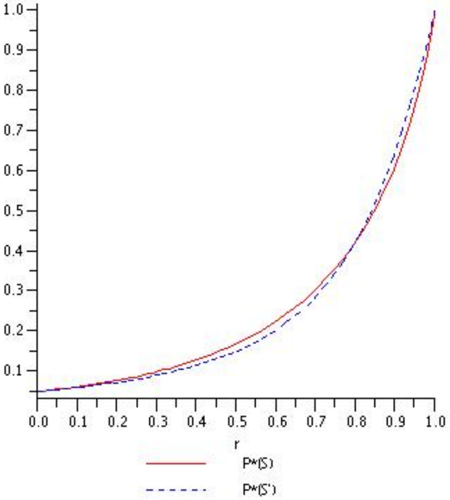
- Take two information triples $S = \{R_1, R_2, R_3\}$ and $S' = \{R'_1, R'_2, R'_3\}$ with the respective weight vectors:

$$< a_0, a_1, a_2, a_3 >=< .05, .30, .10, .55 >$$

$$< a'_0, a'_1, a'_2, a'_3 >=< .05, .20, .70, .05 >$$

** Note: B&H's "expectedness of the information" ceteris paribus condition is explicitly being enforced in this specification of the weight vectors.

Graphically:



Consequences

- If our chosen coherence measure gives the result that coh(S')≥coh(S): For r∈(.8,1), (BC_1) is violated; i.e., P*(R'_1, R'_2, R'_3)<P*(R_1, R_2, R_3) even though coh(S')≥coh(S) and the ceteris paribus conditions are enforced.

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Upshot

(BC_1) and (BC_2) are inconsistent for triples (and B&H note that the impossibility result applies to information sets of size $n \geq 3$). Thus, if coherence can be formalized using a complete probabilistic ordering, then coherence cannot be separable from reliability.

A Case Study - Shogenji's Work on Coherence

Shogenji's coherence measure:

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a different taxonomy:

1. "total individual strength" as a measure of the number and specificity of pieces of information in the set: $P(R_1) \times \ldots \times P(R_n)$. Total individual strength is negatively correlated with our level of confidence in an information set. The more information a set contains, and the more specific that information, the less our confidence.

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2. coherence

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What if one supports Shogenji's measure and accepts B&H's taxonomy?

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- According to B&H's taxonomy, we need to include the expectedness of the information $P(R_1, ..., R_n)$ in our ceteris paribus conditions; thus, the numerators of Shogenji's measure are equal under ceteris paribus.

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- As Shogenji argues, denominators are also held equal when enforcing the ceteris paribus conditions.
- Accepting both B&H's taxonomy and Shogenji's measure (along with Shogenji's "total individual strength" condition), we can only compare information sets of equal coherence ceteris paribus!

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- Only intended to show that acceptance of Shogenji's measure calls for a rejection of B&H's $P(R_1, \ldots, R_n)$ ceteris paribus condition.

$$\frac{P(R_1,\ldots,R_n)}{P(R_1)\times\ldots\times P(R_n)} = \frac{P(R_1',\ldots,R_n')}{P(R_1')\times\ldots\times P(R_n')}$$

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Two consequent questions:

1. Which of these accounts, if any, is enforcing the correct set of conditions?

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Two consequent questions:

1. Which of these accounts, if any, is enforcing the correct set of conditions?
2. Can a different set of ceteris paribus conditions (e.g., Shogenji's) allow one to sidestep the impossibility result?

** *I am only interested in this talk in answering the second question*

An Additional Condition and a New Taxonomy

Intuitively, the expectedness of reports $P(REPR_1, ..., REPR_n)$ is distinct from coherence; coherence - being a virtue of information sets *purely on the information level* - should not be affected by considerations having to do with the reporting of that information (including reliability of the sources and expectedness of the reports).

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"ceteris paribus": factors (1), (2), and (3) need to be equal between sets.

A Possibility Result for Bayesian Coherentism

Theorem

If one enforces this set of ceteris paribus conditions and Shogenji's measure, there can be no counter-examples to (BC_1) *and* (BC_2).

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Consider the simple form of Bayes's Theorem:

$$P^*(R_1, \ldots, R_n) = \frac{P(R_1, ..., R_n) \times P(REPR_1, \ldots, REPR_n | R_1, \ldots, R_n)}{P(REPR_1, \ldots, REPR_n)}$$

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Given that it is a general prerequisite of B&H's discussion of Bayesian Coherentism that information sources are independent - in the sense that "R_i *screens off* $REPR_i$ from all other fact variables R_j and from all other report variables $REPR_j$":

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Result 1

Ceteris paribus, relative values of posterior probability will be directly proportional to those of the expectedness of the information.

Utilizing Shogenji's measure, and by ceteris paribus condition (1):

Result 2

Ceteris paribus, $C(S) = \frac{P(R_1,...R_n)}{P(R_1)\times...\times P(R_n)} > \frac{P(R'_1,...R'_n)}{P(R'_1)\times...\times P(R'_n)} = C(S')$ iff $P(R_1, ..., R_n) > P(R'_1, ..., R'_n)$ - and more generally, ceteris paribus, relative values of coherence between sets will be directly proportional to those of the expectedness of the information.

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Putting result 1 and result 2 together, we get *separability* (BC_1): For all information sets S, $S' \in \mathbf{S}$, if S is no less coherent than S' ($S \succcurlyeq S'$), then our degree of confidence that the content of S is true is no less than our degree of confidence that the content of S' is true, ceteris paribus.

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Fact

Thus, there exist sets of ceteris paribus conditions that are intuitively appealing and do allow one to avoid B&H's impossibility result.

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3. Before their impossibility result can be deemed successful or unsuccessful, B&H need to convince us that their ceteris paribus conditions - as opposed to other seemingly plausible options - are the appropriate ones. Such convincing must go beyond the typical intuition-based taxonomies of epistemically relevant factors.