Confidence in Belief, Weight of Evidence and Uncertainty Reporting

Brian Hill
hill@hec.fr
www.hec.fr/hill

GREGHEC, CNRS & HEC Paris

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Weight of Evidence & Confidence in beliefs

- Unknown urn: 100 balls, each red or black.
- Known urn: 100 balls, 50 red, 50 black.

Keynes: Your beliefs about the colour of the next ball drawn?
- Balance of evidence: same
- Weight of evidence: different

Bayesian decision: indifferent.
Weight of Evidence & Confidence in beliefs

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Bayesian belief: same ($\frac{1}{2}$).
Weight of Evidence & Confidence in beliefs

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**Keynes** Your beliefs about the colour of the next ball drawn?

- Balance of evidence: same
- Weight of evidence: different

Bayesian belief: same \( \left( \frac{1}{2} \right) \).

**Ellsberg** Which urn would you rather bet on?

- Known urn

Bayesian decision: indifferent.
Weight of Evidence & Confidence in beliefs

Ellsberg preferences justified by:

- higher weight of evidence for known urn
- more confidence in probability $\frac{1}{2}$ judgement for that urn

Moral

Bayesianism denies any role for confidence in beliefs or weight of evidence in choice
Weight of Evidence & Confidence in beliefs

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Moral

Bayesianism denies any role for confidence in beliefs or weight of evidence in choice

However confidence in probability judgements reported by the IPCC, US DIA etc.
Confidence in Beliefs

Belief state:

- **Beliefs or Credal judgements**
  - probability judgements reflecting direction evidence is pointing
- **Confidence in beliefs**
  - subjective appraisal of the support for them
Confidence in Beliefs

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This paper:

- Formal model of weight of evidence (via confidence)
- Support effective uncertainty reporting
Confidence in beliefs / Weight of Evidence

Model

- A nested family of sets of probability measures
Confidence in beliefs / Weight of Evidence

Model

- A nested family of sets of probability measures
  - generalisation of credal sets

Confidence Level:
- High
- Low

\[ \Delta(S) \]
Confidence in beliefs / Weight of Evidence

Model

- A nested family of sets of probability measures
  - portrays precision / weight trade-off
  - without requiring the agent to settle on a single set.

\[ p(R_{\text{Known}}) = \frac{1}{2} \]

\[ p(R_{\text{Unknown}}) = \frac{1}{2} \]

\[ \Delta(S) \]
Confidence in beliefs / Weight of Evidence

Model

- A nested family of sets of probability measures
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\[ p(R_{Unknown}) \in [0.3, 0.7] \]

\[ p(R_{Known}) = \frac{1}{2} \]

\( \Delta(S) \)
Confidence in beliefs / Weight of Evidence

Model

- A nested family of sets of probability measures
  - has solid connections to decision, which carry over to weight of evidence

Confidence Level:
- High
- Low

\[ \Delta(S) \]
Uncertainty Reporting

Desiderata

1. Clean belief / value separation
2. Unambiguous uncertainty language
Uncertainty Reporting

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Bayesian Clean Separation:

- probability (beliefs) vs. utility (desires / values)

Gilboa, Marinacci, “Ambiguity and the Bayesian Paradigm”, 2013; “Confidence in Beliefs and Rational Decision Making” Economics & Philosophy, 2019
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Bayesian **Clean Separation:**

- probability (beliefs) vs. utility (desires / values)

**Credal sets / multiple priors** **No Clean Separation:**

- Set of priors can reflect **both** beliefs and attitudes to / taste for uncertainty

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Bayesian Clean Separation:
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Credal sets / multiple priors No Clean Separation:
- Set of priors can reflect both beliefs and attitudes to / taste for uncertainty

Confidence approach Clean Separation:
- Nested family: beliefs & confidence in beliefs
- Uncertainty attitudes: another parameter

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Challenge: calibrate confidence levels across agents.
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How are probabilities calibrated?

- on “objectively uncertain / chance” events.
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Challenge: calibrate confidence levels across agents.

How are probabilities calibrated?
- on “objectively uncertain / chance” events.

In fact:
Principal Principle (ordinal version)

“Objective uncertainty” set of events calibrate probability levels across (rational) agents.
Uncertainty Reporting

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Challenge: calibrate confidence levels across agents.

Idea: use “objective” comparisons of weight of evidence.
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Challenge: calibrate confidence levels across agents.

Idea: use “objective” comparisons of weight of evidence.

In fact:
Weight-of-Evidence Principal Principle

\[ \text{“Objective weight-of-evidence” set of probability judgements calibrate confidence levels across (rational) agents.} \]
Uncertainty Reporting

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1. Clean belief / value separation
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Challenge: calibrate confidence levels across agents.

Idea: use "objective" comparisons of weight of evidence.

In fact:
Weight-of-Evidence Principal Principle

\[ \text{"Objective weight-of-evidence" set of probability} \]
\[ \text{judgements calibrate confidence levels across (rational) agents.} \]

Confidence Elicitation Web Tool
http://confidence.hec.fr/app/
Confidence in Beliefs

This paper:
- Use to model weight of evidence
- Support effective uncertainty reporting

General Project
- Model of confidence in beliefs
- Role in decision making
- Solid normative credentials
- Application to IPCC uncertainty language
- Belief updating
- Elicitation . . .
Thank you.

hill@hec.fr
www.hec.fr/hill

Further details:


Web tool:

- [http://confidence.hec.fr/app/](http://confidence.hec.fr/app/)