Confidence in Belief, Weight of Evidence and Uncertainty Reporting

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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.

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

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

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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

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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

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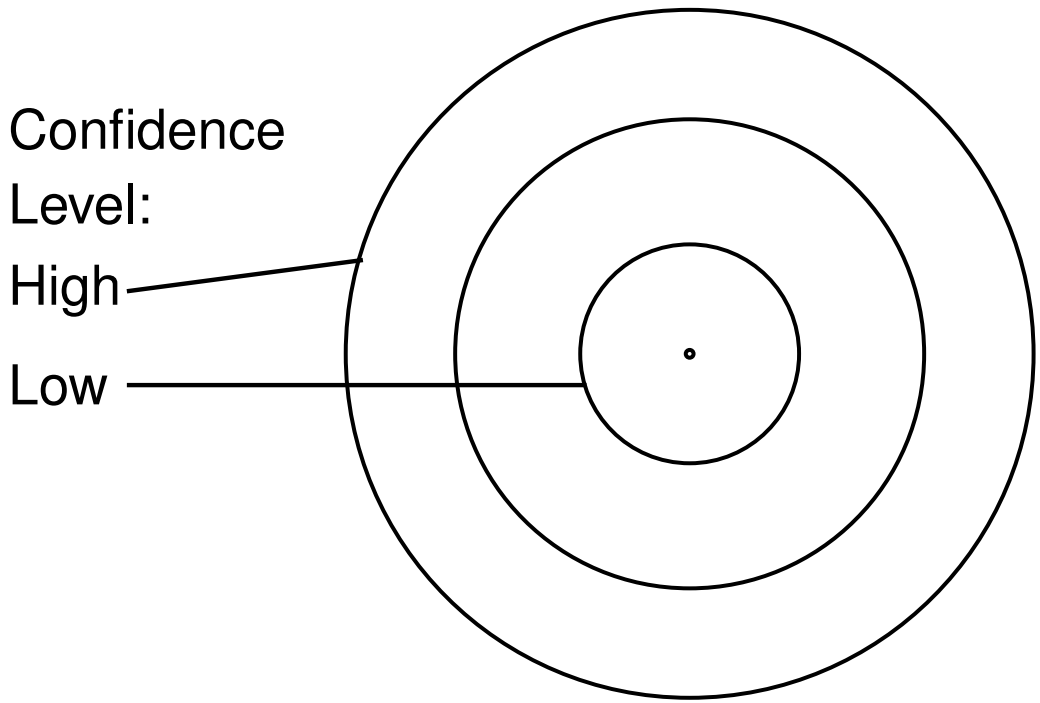
This paper:

- 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**

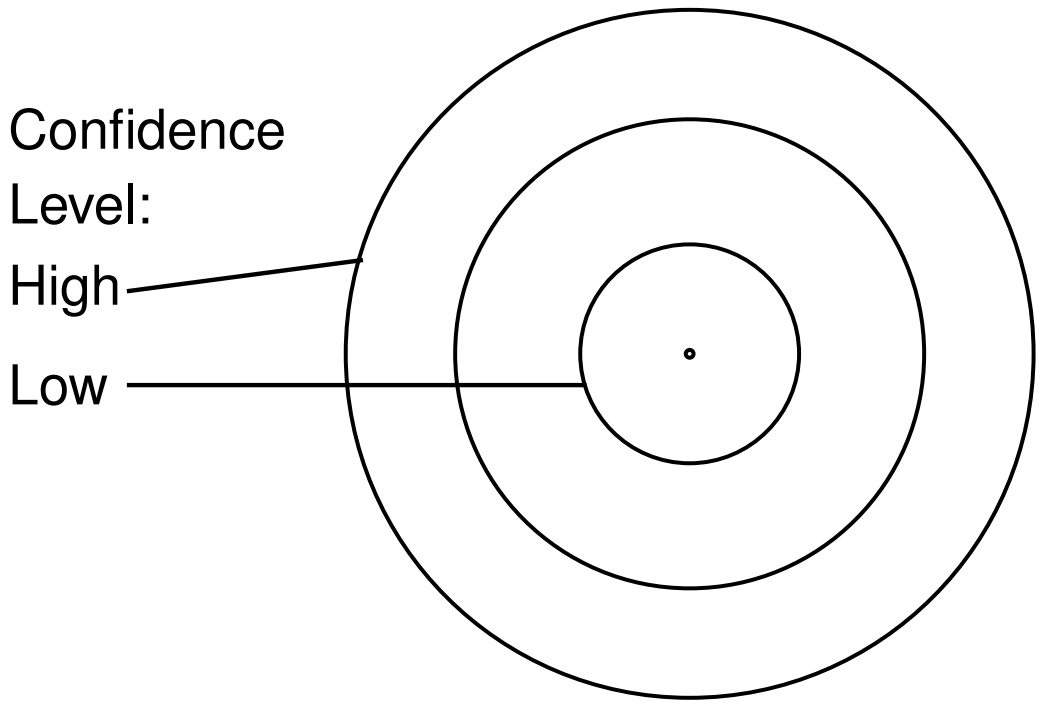


$\Delta(S)$

Confidence in beliefs / Weight of Evidence

Model

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



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  - portrays precision / weight trade-off
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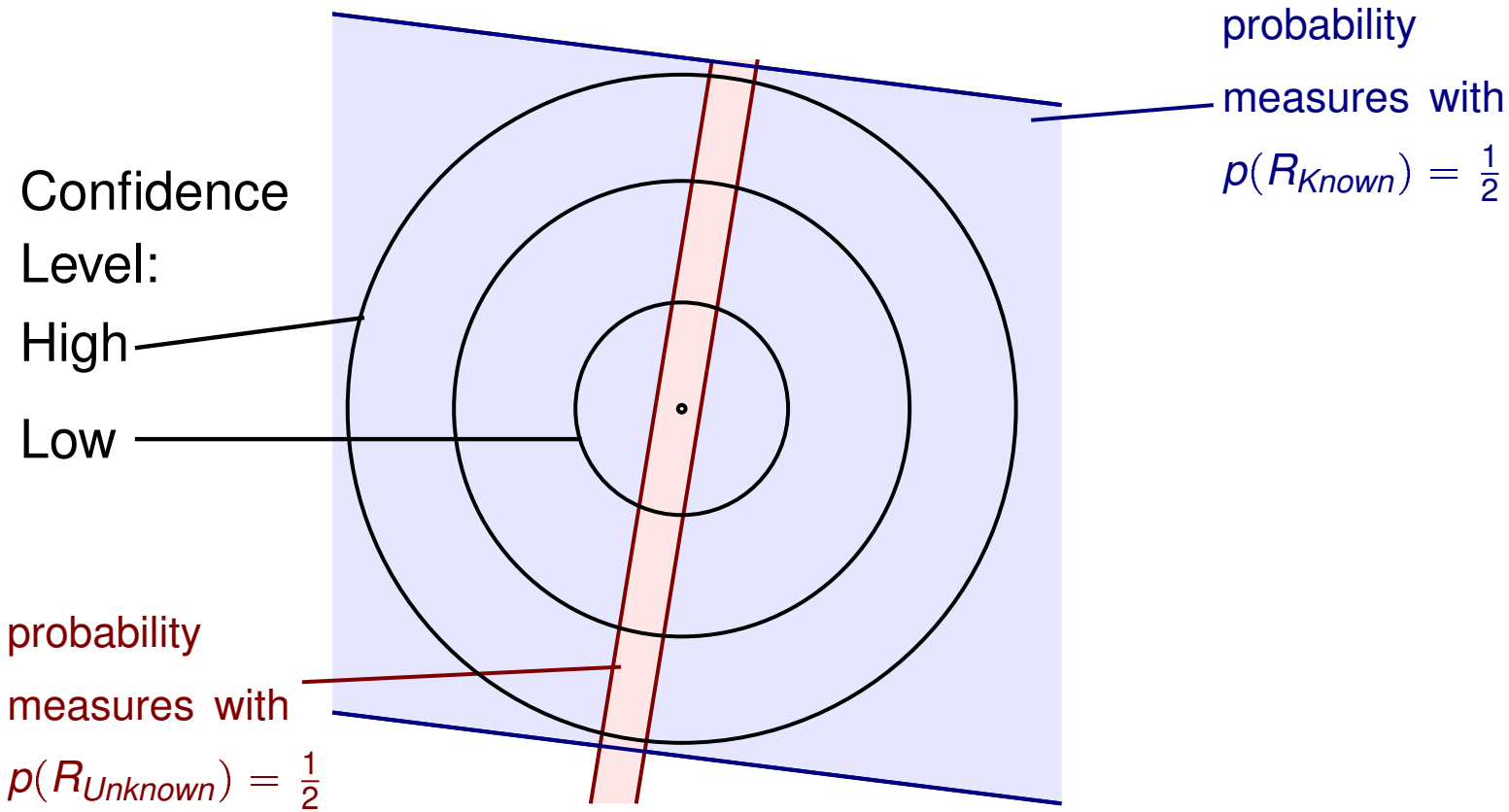

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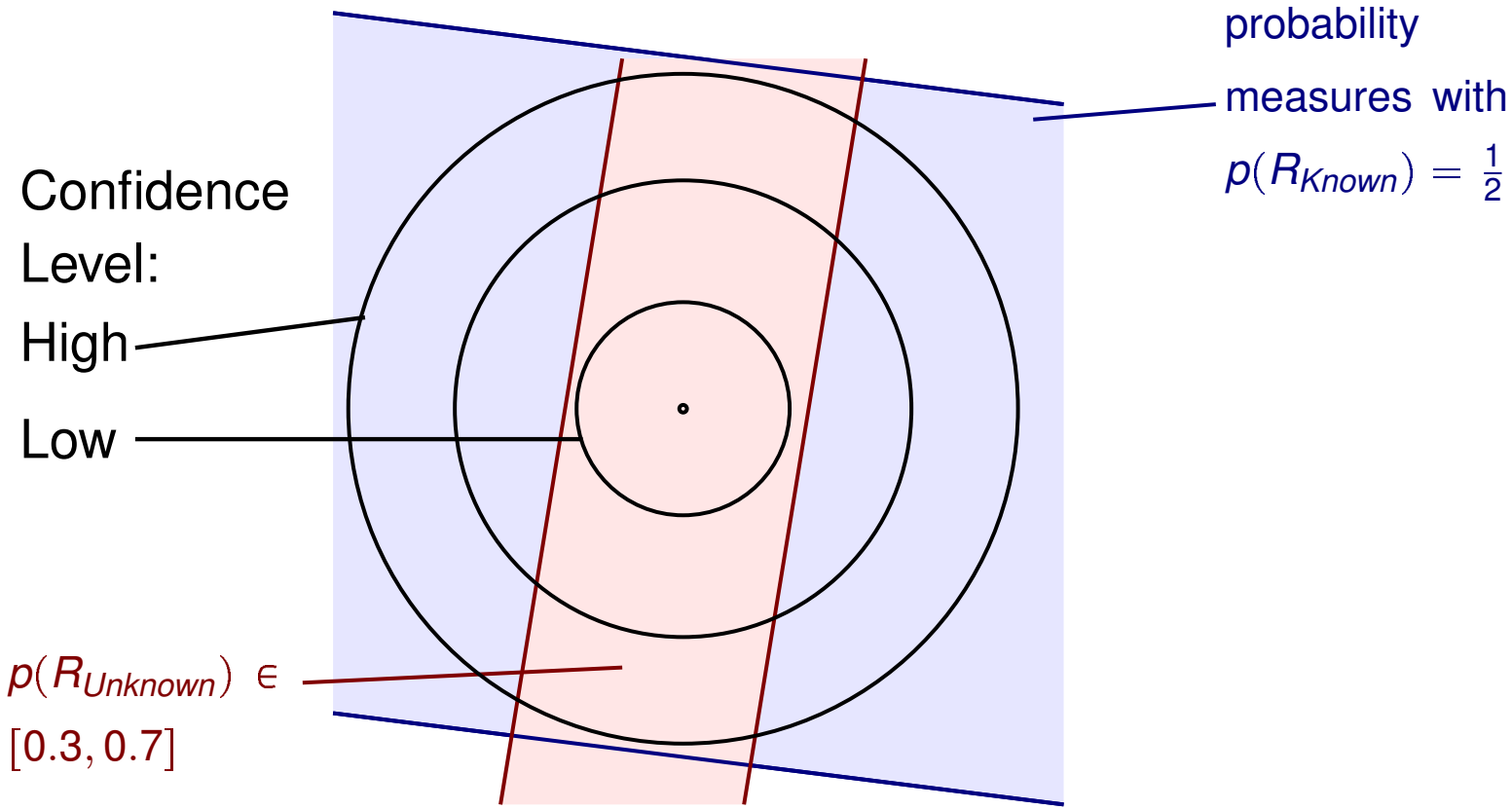
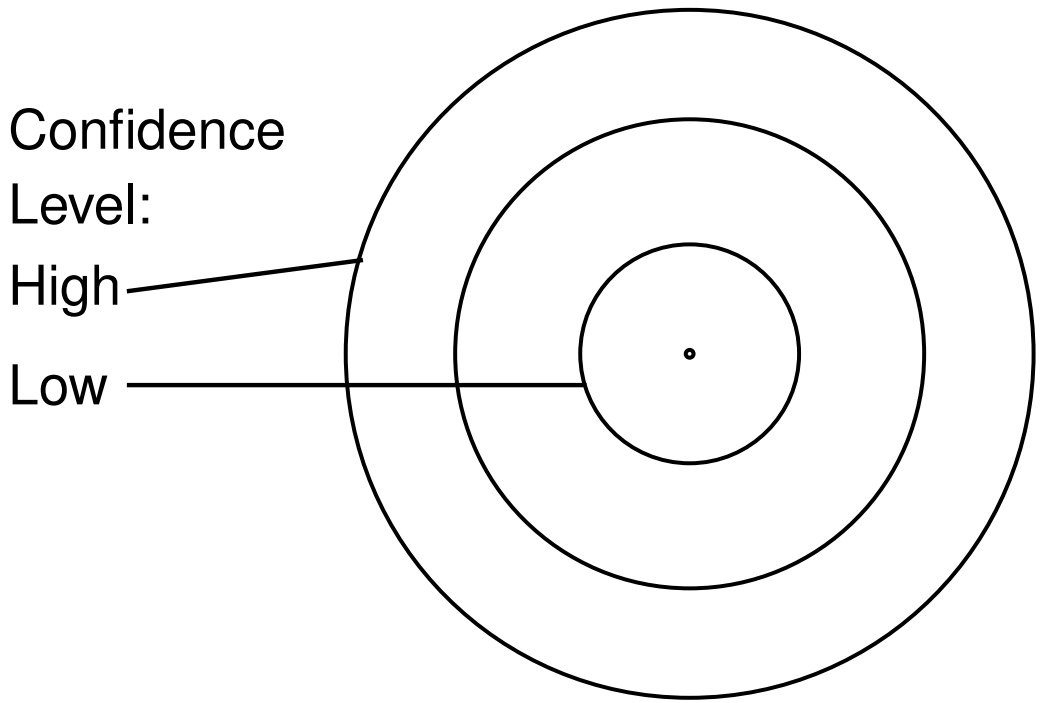


Confidence in beliefs / Weight of Evidence

Model

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



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Uncertainty Reporting

Desiderata

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

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Bayesian **Clean Separation**:

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

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

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

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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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- on “objectively uncertain / chance” events.

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In fact:
Principal Principle (ordinal version)

$\Longrightarrow$ "Objective uncertainty" set of events calibrate probability levels across (rational) agents.

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

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In fact:
Weight-of-Evidence Principal Principle

$\Longrightarrow$ "Objective weight-of-evidence" set of probability judgements calibrate confidence levels across (rational) agents.

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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

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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.

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Further details:

- Confidence and Decision, *Games and Economic Behavior*, 82: 675–692, 2013.
- Incomplete Preferences and Confidence, *Journal of Mathematical Economics*, 65: 83-103, 2016.
- Confidence in Beliefs and Rational Decision Making, *Economics and Philosophy*, 32: 223-258, 2019.
- Climate Change Assessments: Confidence, Probability and Decision, *Philosophy of Science*, 84: 500-522, 2017 (with R. Bradley, C. Helgeson).
- Combining probability with qualitative degree-of-certainty metrics in assessment, *Climatic Change* 149: 517-525, 2018 (with R. Bradley, C. Helgeson).

Web tool:

- http://confidence.hec.fr/app/.