Belief: Partial & Full

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Introduction

Two Models of Belief

Epistemology is divided by two conceptions of belief:

- Full belief: "Jill believes Jack is in Boston".
  - Qualitative: an on/off state.
  - Dominant in "traditional" epistemology.
- Partial Belief: "Jill is 90% sure Jack is in Boston".
  - Quantitative: a matter of degree.
  - Dominant in "formal" epistemology and philosophy of science.

The Question

How are full and partial belief related?

- It's not as simple as you might think.
- A puzzle suggesting the notion of full belief is problematic:

The Preface Paradox (Makinson 1965)

Suppose you write a carefully and cautiously researched almanac. You believe each claim in the book, but you also recognize there must be some errors.

- A puzzle suggesting the notion of full belief is disposable:

The Bayesian Challenge (Stalnaker 1984; Frankish 2009)

Once we have the Bayesian theory of partial belief (probability axioms, conditionalization, expected utility), full belief is extraneous. What work can it do for us?

Some Popular Views

- Reductionism: one kind of belief can be reduced to the other.
  - E.g., to fully believe P is to be at least 95% sure that P.
  - Locke, Foley, Sturgeon.
- Eliminativism: only one kind of belief is real, the other is just loose talk or a passé concept.
  - E.g., the notion of partial belief is a refinement of the old-fashioned, clunky notion of full belief. We should embrace the former and abandon the latter.
  - Jeffrey, Christensen (sort of), Earman (?)

My View

Pluralism: we should embrace and theorize about both kinds of belief.

- Both are real: each is part of an accompanying body of legitimate psychological and epistemological theory.
- They are metaphysically independent: one cannot reduce either kind of belief to the other.
- Both should be incorporated in our theorizing: each body of theory has its distinctive virtues, applications, and interest.
  - Perhaps most interesting: these two bodies of theory complement each other.

Outline: Plan of Attack

1. Preliminary motivations: why be a pluralist?
2. Elaborate the metaphysical picture: two special sciences of belief.
3. Applications: how does partial belief help the theory of full belief?
4. Applications: how does full belief help the theory of partial belief?

Motivations

Motivations: Why Be a Pluralist?

- Argument from inertia:
  - Both notions of belief are deeply embedded in our day-to-day discourse and reasoning.
    - If it aint broke, don't fix it.
  - Full belief may even be hard-coded into our cognition.
    - If you can't fix it, it aint broke.
- Argument from theoretical success:
  - we use both notions successfully to predict and explain behavior.
  - Best explanation: they track reality.

Motivations: Why Be a Pluralist? (Part 2)

- Argument by elimination: the alternatives are lame.
  - Reductionism:
    - No proposed reduction has succeeded yet.
    - Conceptual analysis never works.
  - Eliminativism:
    - Successful as they are, theories of partial belief repeatedly run into the same mess of problems: overly idealized, computationally intractable/cognitively unrealistic, etc.
    - Full belief promises to help with some of these problems.
    - Besides, shouldn't eliminativism be a last-ditch move? We don't respond to the sorites paradox by saying, "well, so much the worse for the concept of a heap."

Motivations: Why Be a Pluralist? (Part 3)

- Argument from symmetry:
  - Reasons to think we have one mental state tend to be reasons for thinking we have the other.
    - Introspection.
    - Folk discourse.
    - Theoretical utility/success.
- Argument from flexibility:
  - More ways of talking and theorizing about a subject-matter mean more flexibility and power in our predictions and explanations.
  - Why handycap ourselves?
    - There's no ontological cost (see the metaphysics).
    - There's no cognitive cost (we're already proficient in theorizing with full-belief).

Metaphysics

Two Special Sciences of Belief

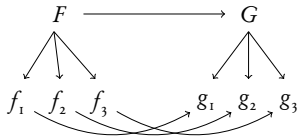
I said the concepts of full and partial belief each come with their own body of theory. What did I mean?

- Some full belief theory:
  - Modus Ponens: If S believes $A \rightarrow B$ and she learns A, she will come to believe B.
  - Practical Syllogism: If S desires D, and believes A is a way to get D, then she will A.
- Some partial belief theory:
  - Conditionalization: if S has conditional credence $p(B|A) = x$ and learns A, her new credence in B will be $q(B) = x$.
  - Expected Utility Maximization: if S's credences are given by p_i and her utilities by u_i, she will choose an actions that maximizes $\sum_i p_i u_i$.

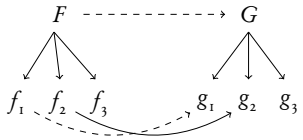
Fodor on Special Sciences

A classic view about such laws/truisms in special sciences.

- They capture robust, law-like patterns at a useful level of abstraction.



- But they have exceptions, because the low-level realizers don't always follow the pattern:



Kitcher on Special Sciences

We can simultaneously endorse two independent, coordinating theories that, in some sense, deal with the same subject-matter.

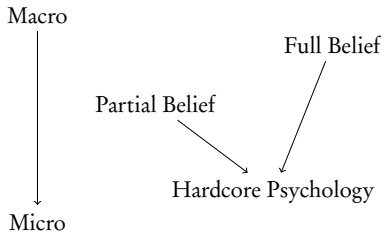
- Classical genetics (genes, alleles, punnett squares, etc.) and cytological genetics (chromosomal segments, crossing over, meiosis, etc.) both cover the passage of genetic material.
- Underlying both bodies of theory is the same microphysical story of molecular genetics: DNA, mRNA, transcription, etc.
- One cannot reduce the concepts and explanations of one theory to the other.
- In fact, some explanations draw on two levels of theory: coordination.

Summary of My Metaphysical View

- The two theories are useful abstractions over a variety of psychological mechanisms of reasoning and decision.
  - Modules with different mechanisms, representational systems, and domains.
  - Competing heuristics generating judgments/actions in different ways, sometimes even contradictory outputs.
  - Coordinating systems, like System I and System II, working in tandem to generate judgment and action.
- Each theory is incomplete and faces exceptions.
  - It's a mess under the hood, so attempts to systematize by abstraction cannot succeed perfectly.
- But each theory serves its purposes well, balancing the virtues of scope and accuracy in a useful way.
- Moreover, the two theories can cover for one another; they can even coordinate, allowing mixed explanations.

Picture of My Metaphysical View

So the overall picture looks like this:



Motivations: Why Be My Kind of Pluralist?

- Explains why we have both concepts/bodies of theory, despite the apparent redundancy.
- Lets us be pluralists on the ontological cheap.
- Accounts for the following puzzle:
  - Full and partial belief seem closely bound:
    - Absolutely certain $\Longrightarrow$ fully believe.
    - Fully believe $\Longrightarrow$ at least 50% confident.
  - And yet, reductive attempts always fail.
  - Explanation:
    - The two theories are designed to explain/predict much of the same phenomena, and their supervenience-bases overlap. Hence the tight connections.
    - But they don't overlap perfectly, hence the failure of reducibility.
- Provides a framework for understanding how the two theories can complement one another.

Applications I

Applications: Pluralism in Action

- Let's start by seeing what partial belief can do for the theory of full belief.
  - We'll ask what full belief can do for the theory of partial belief later.
- Classically, belief has three definitive roles in cognition.
  1. Inference: believe $P \Longrightarrow$ willing to use P as a
  2. Action: believe $P \Longrightarrow$ act on the assumption that P.
  3. Assertion: believe $P \Longrightarrow$ willing to assert P. premise.
- Each role leads to puzzles; let's start with the ones to do with inference — they're the most familiar in epistemology.

Three Puzzles of Inference

1. The Preface Paradox
2. The Harman-Vogel Paradox
3. The Super Bootstrapping Puzzle

The Preface Paradox

The Preface Paradox (Makinson 1965)

Suppose you write an almanac, taking the usual care to find reliable sources and draw on them judiciously. You believe each claim in the book, but when you write the preface, you say something like "the errors to be found in this book are my own fault."

- Common sense says that careful research justifies belief.
- Common sense also says that justified beliefs can be used to justify other beliefs.
  - Multi-Premise Closure: if you are justified in believing $P_1, \ldots, P_n$ and they entail Q, you can infer Q.
- So you should infer that there are no errors in your book.
- But that's ridiculous.

The Harman-Vogel Paradox

The Harman-Vogel Paradox (Harman 1986; Vogel 1990)

You and Mary plan to meet for lunch in New York tomorrow. You know that Mary holds a lottery ticket and, if it wins, she will be in Trenton instead to collect her winnings.

- Common sense says you are justified in believing Mary will meet you for lunch tomorrow.
- Common sense also says that a justified belief can be used to justify a further belief.
  - Single-Premise Closure: if you are justified in believing P and P entails Q, you can infer Q.
- But you aren't justified in concluding she won't win: her ticket is like any other, you don't know it's not the winner.

Super Bootstrapping

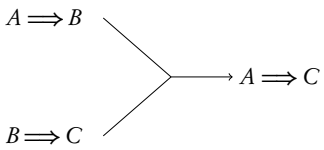
Super Bootstrapping (adapted from Vogel 2000)

Roxanne knows her gas gauge is reliable, but she's unsure just how reliable. She reads the gauge and it says 'full', so she concludes the tank is full. She reads the gauge another day and it says 'empty', so she concludes the tank is empty. After many, many repetitions, she notes that in each instance the tank is as the gauge says. She concludes that the gauge is super-reliable.

- Common sense says she is justified in believing the tank is as the gauge says in each instance.
- Common sense also says that justified beliefs can be used to justify other beliefs.
  - Multi-Premise Inductive Closure: if you are justified in believing $P_1, \ldots, P_n$ and Q follows inductively, infer Q.
- But she can't conclude that her gauge is super-reliable!

Diagnosis: Transitivity and Deduction

Deductive entailment is *transitive*: if A entails B and B entails C, then A entails C.



Diagnosis: Transitivity and Induction

But inductive support is *not* transitive: sometimes A makes B probable and B makes C probable, but A does *not* make C probable.

- If I wear a seatbelt, I'm more likely to drive faster.
- If I drive faster, I'm more likely to get injured.
- But if I wear a seatbelt, I'm not more likely to get injured.

Inductive support isn't even transitive when "mixed" with deduction: sometimes A makes B probable and B entails C, but A doesn't support C at all.

- The famous "hands" example.

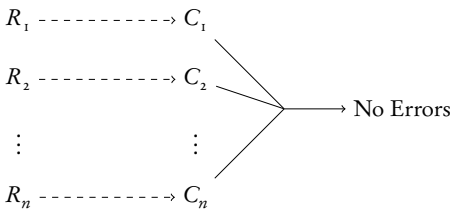
My Diagnosis

Suggestion: our three puzzles are symptoms of transitivity failure.

- Each paradox begins with some premises that support some intermediate conclusions.
- Those intermediate conclusions support some ultimate conclusion.
- But the beginning premises do not support the ultimate conclusion.

To handle the paradoxes, we just have to acknowledge that the intermediate conclusions do not justify the ultimate conclusions.

The Preface



but

$$R_1 \& \ldots \& R_n \not\dashrightarrow \text{No Errors}$$

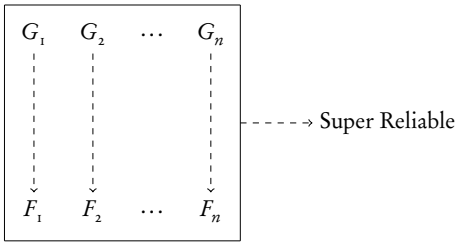
Harman-Vogel

Agreed to Meet ⇢ Will Meet ⟶ Will Lose Lottery

but

Agreed to Meet $\not\dashrightarrow$ Will Lose Lottery

Super-bootstrapping



but

$$G_1 \& \ldots \& G_n \not\dashrightarrow \text{Super Reliable}$$

The Moral: Source-Dependence

- Ordinarily we think: if you are justified in believing A, and A supports B, then you are justified in believing B.
- But this is not always so: whether a justified belief in A justifies belief in B depends on where A came from.
  - Do A's sources support B?
  - If not, then you can't infer B from A.
- So, partial belief aids full belief by keeping full-belief-based reasoning *accurate*.
  - Partial believe provides a way of tracking exceptions to truisms like closure principles.

Same Goes For Decision and Assertion

A similar application for full belief's role in decision:

- Justified beliefs also support decisions: if you are justified in believing P, you are justified in acting on the assumption that P.
  - If you are justified in believing that it will rain, you are justified in bringing an umbrella.
- But the power of a justified belief to justify a decision is bound by the implications of its sources.
  - You are justified in believing that it will rain, but not justified in betting your life for \$1 that it will rain.
  - Your basis for thinking it will rain only makes that 90% probable, and betting your life for a dollar at 9:1 odds is irrational.

The same seems to hold for belief's third role, assertion.

Applications II

Applications: Pluralism in Action (Part 2)

Now let's see what full belief can contribute to the theory of partial belief.

- Famously, the theory of partial belief faces problems to do with hyper-idealization:
  1. Computation and storage appear intractable.
  2. No account of evidence/what to conditionalize on.
  3. Actual cognitive practice departs from Bayesian ideals.
- My proposal: full belief serves to lighten the cognitive load, simplifying or replacing partial belief where appropriate.

Applications: First Example

Full beliefs serve as premises when forming a partial belief.

- How likely is it that our picnic will be rained out?
  - It's been dark and cloudy all morning.
  - One website predicted 70% chance of rain last night.
  - A less reliable site said 50%.
  - So roughly 60-65%, let's say.
- Ordinarily, we don't question our assumptions here.
- We could though, and if we did we'd have to revise our conclusion:
  - We'd have to weight the support of each premise by our confidence that it's true.
- But that's a major headache, very cognitively expensive.
  - Why bother? The result is accurate enough for present purposes.

Applications: Second Example

Full beliefs simplify the possibility space in a decision problem. Consider a typical, toy decision problem:

- Should you bring an umbrella tomorrow?
- The forecaster predicts a 40% chance of rain.
- Your utilities (let's suppose) are roughly as follows:

	Rain	Dry
Umbrella	0	-1
Commando	-5	+5

- So the expected utilities are:

$$EU(\text{Umbrella}) = (.4 \times 0) + (.6 \times -1) = -.6$$
$$EU(\text{Commando}) = (.4 \times -5) + (.6 \times 5) = 1$$

- So you should go commado.

Applications: Second Example (Part 2)

How did full belief simplify that decision problem?

- There were possible outcomes you didn't consider — snow, hail, tsunami, etc — things you fully believe won't happen.
  - Suggestion: full belief simplifies decision problems by dismissing such possibilities from consideration.
- Moreover, the space of possibilities could have been considered at a much finer grain:
  - There are many ways to go commando; you could have worn a garbage bag, gone truly commando, gone naked, etc.
  - There are many kinds of rain: hard rain, light rain, long rain, short rain, etc.
  - Suggestion: full belief simplifies the decision problem by lumping possibilities together, *viz.* those possibilities you believe aren't worth distinguishing.

Applications: Third Example

Full belief does *all* the work in some modes of reasoning.

- People often use very simple, non-quantitative decision strategies (Gigerenzer 1999):
  - The "one-reason" stopping rule: search til you find a reason favoring one option, then go with that option.
  - The "tally" stopping rule: search for reasons til one option accrues a certain tally, then go with that option.
- Suggestion: full beliefs serve to identify reasons when employing these stopping rules.
- Example: should we go to the Thai or the Indian restaurant? The Thai place has better beer, let's go there.
  - You fully believe the Thai place has better beer.

Conclusions

Summing Up

- Full and partial belief share the cognitive load, balancing the twin goals of efficiency and accuracy.
- Full belief provides efficiency through simplification:
  - Simplifying with full belief saves storage and computation when performing probabilistic inferences/decisions.
  - Using only full beliefs can simplify even further.
- Partial belief provides accuracy through fineness of grain:
  - The availability of partial judgment keeps full belief from drawing wildly inaccurate conclusions (bootstrapping).
  - It also keeps full belief from making ridiculously disastrous decisions.
- Conclusion: it's a twofer!