An Optimality-Argument for Equal Weighting

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Project Information

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Talk(s):

- Feldbacher-Escamilla, Christian J. (2019-07-19/2017-07-21). *The Optimality of Equal Weighting*. Conference. Presentation (contributed). Joint Session of the Aristotelian Society and the Mind Association: The Open Session. University of Durham: Aristotelian Society, Mind Association.

- Brössl, Peter and Feldbacher-Escamilla, Christian J. (2014-09-04/2014-09-04). *The Veritistic Value of Social Practices in Science: Peers Disagreement*. Workshop. Presentation (contributed). Social Epistemology and Joint Action in Science. University of Salzburg: Düsseldorf Centre for Logic and Philosophy of Science (DCLPS).

Poster(s):

- Feldbacher-Escamilla, Christian J. (2019-09-11/2019-09-14). *An Optimality-Argument for Equal Weighting*. Conference. Presentation (poster). EPSA19. Conference of the European Philosophy of Science Association (EPSA). University of Geneva: EPSA.

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Introduction

The Problem of Epistemic Peer Disagreement: How to incorporate higher order evidence about disagreement among peers?

There are several approaches, amongst others the so-called: Equal Weight View (EWV)

One main argument in favour of EWV: Epistemic Indifference

However, indifference arguments/principles are often quite weak.

Aim of this talk: Provide a strong optimality argument

Contents

Approaches to Epistemic Peer Disagreement

Peer Disagreement and the Traditional Approaches

A B

Epistemic Disagreement:

A believes p, B believes $\neg p$ or $Pr_A(p) \neq Pr_B(p)$ or   . . .

Epistemic Peers: A and B

- share all relevant evidence e
- have equal inferential skills regarding e

Problem: How to update, given one learns about such a disagreement?

$$Pr_A(p) = r_A \text{ and } Pr_A(p \mid \underbrace{Pr_B(p) = r_B}_{\text{higher-order evidence}}) = ?$$

The Equal Weight View

In general, we assume here that updating can be described as a form of linear weighting:

$$Pr_A(p|Pr_B(p) = r_B) = w_A \cdot Pr_A(p) + w_B \cdot Pr_B(p)$$

The equal weight view (EWV) suggests:

$$w_A = w_B$$

So, given $Pr_A(p) = r_A$, it holds: $Pr_A(p|Pr_B(p) = r_B) = \frac{r_A + r_B}{2}$

- **Adherents:** Christensen (2007), Elga (2007)
- **Argument +** epistemic indifference
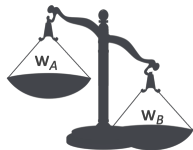- **Argument −** spineless, lack of self-trust, etc.

The Steadfast View

The remain steadfast view (RSV) suggests:

$$w_A = 1 \ (\text{hence } w_B = 0)$$

So, given $Pr_A(p) = r_A$, it holds: $Pr_A(p|Pr_B(p) = r_B) = r_A$

- **Adherents:** Rosen (2001)
- **Argument $+$** vs. spinelessness and lack of self-trust
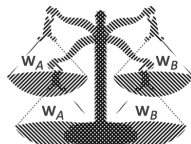- **Argument $-$** bootstrapping, etc.

The Total Evidence View

The total evidence view (TEV) suggests:

There is no fixed rule for determining w_A, w_B

$Pr_B(p) = r_B$ is just like any other form of evidence to be incorporated.

- **Adherents:** Kelly (2011)
- **Argument $+$** flexibility in handling counter-e.g.s
- **Argument $-$** no systematic account, etc.

Spectrum of positions:

$$w_A = 1 \qquad\qquad w_A \xrightarrow[n\uparrow]{} 0$$

RSV $\quad \longleftarrow$ TEV $\longrightarrow$ EWV

Operationalising the Notion of Peerhood

Shared Evidence

That all relevant evidence regarding p is shared, is hard-coded in the model.

We do not ask for:

$$Pr_A(p|Pr_B(p) = r_B, e_A) = ?$$

$$Pr_B(p|Pr_A(p) = r_A, e_B) = ?$$

Rather, A and B are assumed to incorporate higher-order evidence at the same stage—they updated already on shared e_A, e_B.

Inferential Skills

How about the equality of inferential skills?

We want to operationalise inferential skills via a reliability track record.

So, we need to switch to a dynamic setting, and keep track of the agents' performance regarding similar tasks as p.

We do so, by considering a sequence of . . .

$$p^1, p^2, \ldots$$

. . . and keep track of $Pr_{A/B}(p^t)$ in comparison with the true state $val(p^t)$

Technically, we do so by defining for each agent a reliability measure:

$$s_{A/B}^t \propto \sum_{0 < u \leq t} 1 - (val(p^u) - Pr_{A/B}^u(p^u))^2$$

Epistemic Peer Disagreement

The problem of epistemic peer disagreement can be specified then as the question:

$$Pr_A(p^t|Pr_B(p^t) = r_B) \; = \; ? \; \text{ given } s_A^{t-1} = s_B^{t-1}$$

The Optimality of Equal Weighting

Social Sources and Social Methods

Now, note that incorporating evidence about peer disagreement amounts to making use of a social source of knowledge.

So:

EWV: dismiss individual source, rely only on social source

(note that higher-order evidence is not only about r_B, but also r_A, so, strictly speaking, the question is:

$Pr_A(p|Pr_B(p) = r_B, Pr_A(p) = r_A) = ?$)

RSV: dismiss social source, rely only on individual source

TEV: be flexible in balancing social and individual sources

Keep in mind that this holds only for the case: $s_A = s_B$.

We will outline now, that relying on social sources only allows for optimality, whereas relying on individual sources, does not.

The Meta-Inductive Algorithm and Its Optimality

There is a method that relies only on social sources, namely meta-induction (cf. Schurz 2008).

The main idea of meta-induction is to overcome the problem of induction by pooling predictions of competing methods. It does so in such a way that, whatever the outcome, it wont be outperformed by its competitors.

Frequently used at stock market: hedging and *regret* minimisation

Here is, how meta-induction proceeds: For each query in the sequence
$$p^1, p^2, \ldots$$

it pools
$$Pr_A(p^t) \text{ and } Pr_B(p^t)$$

proportionally (via linear weighting) to
$$s_A^{t-1} \text{ and } s_B^{t-1}$$

Main Result: In the long run, $s_{pooled\{A,B\}} \geq s_A, s_B$ is optimal.

The Optimality of Equal Weighting

Meta-induction is long-run optimal and it is a method relying on social sources only.

Note that meta-induction is very general, inasmuch as it incorporates higher-order evidence for any combination of agents: peers, experts, laymen, etc.

In contrast to this, EWV is conditioned on peerhood.

Now, it is easy to see that EWV is just about a particular case of meta-inductive incorporation of higher-order evidence, namely the case where

$$s_A = s_B$$

And EWV's handling by $w_A = w_B$ matches exactly the meta-inductive handling for such a case: $\frac{r_A + r_B}{2}$.

Hence, EWV is an instance of optimal meta-induction, i.e. it provides an optimal response to peer disagreement.

The Suboptimality of the Alternatives

Things are different w.r.t. RSV and TEV: Due to their deviation from the meta-inductive response, they are prone to perform suboptimally only.

	u	$u+1$	$u+2$	$\cdots$
$val(p^t)$	1.0	1.0	1.0	$\cdots$
$Pr_A(p^t)$	$1-\sqrt{1-.5}$	$1-\sqrt{1-.5}$	$1-\sqrt{1-.5}$	$\cdots$
$Pr_B(p^t)$	$1-\sqrt{1-.51}$	$1-\sqrt{1-.5}$	$1-\sqrt{1-.48}$	$\cdots$
s_A^t	.50	.50	.50	$\cdots$
s_B^t	.51	.50	.48	$\cdots$
			peer disagreement	

Table: Example of the suboptimality of RSV and TEV due to not weighting equally among one's epistemic peers in case of epistemic peer disagreement: Pr_1 gets the inferences in 50% of the cases right, whereas Pr_2 is sometimes slightly better, then Pr_1 catches up and then, in the case of a peer disagreement, strategy Pr_2 of remaining steadfast or incorporating total evidence looses. Peer disagreement consists in equal reliabilities in round $u+1$ and different predictions in round $u+2$ (the relevant parameters are marked grey).

Summary

- Problem of epistemic peer disagreement: How to incorporate higher-order evidence of such a disagreement?

- Three traditional approaches:
    - EWV Equal weight view: $w_A = w_B$
    - RSV Remain steadfast view: $w_A = 1$, $w_B = 0$
    - TEV Total evidence view: flexible assignment of weights w_A, w_B

- We have operationalised peerhood via a reliability measure (s)

- We have seen that EWV is an instance of a social method, namely meta-induction.

- Meta-induction is optimal, and, hence, EWV provides an optimal response to peer disagreement.

- RSV and TEV are shown to be suboptimal and, hence, fall behind EWV.

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