Peer Disagreement in Belief Revision

A Procedure for Conciliation, based on the Equal Weight View?

Christian Ittner

Munich Center for Mathematical Philosophy
LMU Munich

mail@christian-ittner.de

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Disagreement

between **equally reliable** agents (epistemic peers)

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Structure of This Talk

1. **Equal Weight View** as rational response to disagreement
2. Dialogue between two Equal Weight Viewers
3. Formal Model
4. Next Steps

The Equal Weight View

- How ought one behave if an equally rational agent arrives at an opinion different to one's own, while assessing the same evidence?
- Can it be rational for epistemic peers to knowingly disagree?

Equal Weight View (EWV): One is rationally required to revise his beliefs in light of peer disagreement and to do so by giving equal weight to the view of any epistemic peer and one's own.

The Equal Weight View

Analogy: Disagreeing Watches

The EWV & Suspension of Judgement

- EWV calls for suspension of judgement in light of (peer) disagreement
- Suspension of judgement is non-trivial manipulation of agent's belief state

  - (How) can the EWV be made precise?
  - What are consequences of the EWV?
  - Is the EWV a successful strategy for settling multiple disagreements?

The EWV Put to Use: A Model

- Two agents
- exchange beliefs in some order
- and update their belief states on each step (according to EWV).

  - Do they reach consensus?
  - Does the consensus reflect their initial beliefs?

How do they update?

Case 1: If the agents are in disagreement about p_i, both should suspend judgement on whether or not p_i.

Case 2: If one agent believes p_i while the other is agnostic about whether or not p_i, the agnostic agent should also accept p_i.

Case 3: Otherwise, no revision is necessary.

Terminology

- $\mathcal{L}$ finite propositional language
- Call a (finite or countably infinite) sequence (φ_n) of formulae an **agenda**
- $(\varphi_n)_{n\in\mathcal{N}}$ **exhaustive** iff $\mathcal{L} \subseteq \{\varphi_n \mid n \in \mathcal{N}\}$
- For two consistent sets of formulae $X, Y \subseteq \mathcal{L}$, define the set of **disagreements between** X **and** Y as follows:

$$\mathcal{D}(X,Y) = \{\varphi \in \mathcal{L} \mid (\ \ \varphi \in Cn(X) \text{ and } \neg\varphi \in Cn(Y)) \text{ or } (\neg\varphi \in Cn(X) \text{ and } \ \ \varphi \in Cn(Y))\}$$

Definition (Equal-Weight Viewer's sequential revision procedure (EWV-SR))

Let $\dot{-}_A, \dot{-}_B$ be two global AGM contraction operators on $\mathcal{L}$. Let A_0 and B_0 be two consistent theories in $\mathcal{L}$, representing the initial belief states of two agents. For an agenda $(\varphi_n)_{n \in \mathcal{N}}$, define recursively A_n and B_n as follows:

Case 1: If $\varphi_n \in \mathcal{D}(A_n, B_n)$, then $A_{n+1} = (A_n \dot{-}_A \varphi_n) \dot{-}_A \neg\varphi_n$ and $B_{n+1} = (B_n \dot{-}_B \varphi_n) \dot{-}_B \neg\varphi_n$.

Case 2: Suppose $\varphi_n \notin \mathcal{D}(A_n, B_n)$ and $\varphi_n \in Cn(A_n) \cup Cn(B_n)$. Then let $A_{n+1} = Cn(A_n \cup \{\varphi_n\})$ and $B_{n+1} = Cn(B_n \cup \{\varphi_n\})$.

Case 3: Otherwise, let $A_{n+1} = A_n$ and $B_{n+1} = B_n$.

Consensus: Suppose $A_0, B_0 \subseteq \mathcal{L}$ are consistent theories, and let $(\varphi_n)_{n\in\mathbb{N}}$ be an exhaustive agenda for $\mathcal{L}$. Let A_n, B_n, $n \in \mathbb{N}$ be as defined by EWV-SR. Then there is some $N \in \mathbb{N}$ such that $A_m = B_m$ for all $m \geq N$.

Theorem (No Consensus Guaranteed)

In the language of classical propositional logic with at least two propositional variables Consensus *is false.*

Theorem (Almost Arbitrary Consensus)

If $\mathcal{L}$ has at least two propositional variables, the following holds: Suppose $\mathcal{D}(A_0, B_0) \neq \emptyset$. Let $c \in L$ be a satisfiable proposition that comes out false under more than one variable assignment. Then there exists an agenda $(x_0, \ldots, x_m)$, and contraction operators $\dot{-}_A, \dot{-}_B$, such that $A_m = B_m = Cn(c)$.

What to change?

- Abandon learning: Change *Case 2* of procedure such that agents do not learn from each others belief
- Explore further restrictions for iterated contraction
- **Find the class of contraction operations where convergence to a (reasonable) consensus is guaranteed**

Existing approaches for disagreement in BR

- Conciliation Operators/Iterated Merge-Then-Revise constructions

  O. Gauwin, S. Konieczny, P. Marquis, 2005. Conciliation and Consensus in Iterated Belief Merging, in *Symbolic and Quantitative Approaches to Reasoning with Uncertainty*, 514–526

- Social Contractions

  R. Booth, 2006. Social Contraction and Belief Negotiation, *Information Fusion 7*, 19–34

- Mutual Belief Revision & Negotiation

  D. Zhang et al, 2004. Negotiation as Mutual Belief Revision, AAAI-04, 317–322

References (EWV)

- D. Christensen, 2009. Disagreement as Evidence: The Epistemology of Controversy, *Philosophy Compass*, 756–767
- A. Elga, 2007. Reflection and Disagreement, Noûs, 478–502
- R. Feldman, 2006. Epistemological Puzzles About Disagreement, in *Epistemology Futures*, Oxford University Press, 216–236
- T. Kelly, 2010. Peer Disagreement and Higher Order Evidence, in *Social Epistemology: Essential Readings*, Oxford University Press, 183–217

Summary

- The EWV is a currently popular recommendation in Philosophy
- I explore possible formalizations in BR
- Wanted: Further restrictions on contraction to achieve consensus in iterated application

Epistemic Peerhood

Examples (Kelly, 2010, p. 183):

- "You and I are attentive members of a jury charged with determining whether the accused is guilty. The prosecution, following the defense, has just rested its case."
- "You and I are weather forecasters attempting to determine whether it will rain tomorrow. We both have access to the same meteorological data."

Peer Disagreement

"You and I are each attempting to determine the current temperature by consulting our own personal thermometers. In the past, the two thermometers have been equally reliable. At time t_0, I consult my thermometer, find that it reads 68 degrees, and so immediately take up the corresponding belief. Meanwhile, you consult your thermometer, find that it reads 72 degrees, and so immediately take up that belief. At time t_1, you and I compare notes and discover that our thermometers have disagreed. How, if at all, should we revise our original opinions about the temperature in the light of this new information?" (Kelly, 2010)

The Equal Weight View

"[C]onsider those cases in which the reasonable thing to think is that another person, every bit as sensible, serious, and careful as oneself, has reviewed the same information as oneself and has come to a contrary conclusion to ones own. [..] An honest description of the situation acknowledges its symmetry. [..] In those cases, I think, the skeptical conclusion is the reasonable one: it is not the case that both points of view are reasonable, and it is not the case that ones own point of view is somehow privileged. Rather, suspension of judgement is called for." (Feldman, 2006)