Contrastive evidence in the AGM framework

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Why not AGM?

- Two varieties of model of rational belief:
  (1) Quantitative models (e.g. Bayesianism)
    - Trade in *numerical* 'degrees of belief'
    - Ubiquitous in contemporary formal epistemology
  (2) Qualitative models (e.g. AGM theory)
    - Trade in *binary* beliefs
    - Mainly confined to logic and computer science
- AGM deserves *much* greater popularity:
  - AGM is an extremely elegant and powerful framework
  - Philosophy has itself traditionally traded in binary beliefs
- Major stumbling block: no treatment of evidential support.

Evidence in the AGM framework

- In 'Transmission-Failure, AGM-style' (Chandler 2012):
  - Very first AGM-based account of reasoning about evidence
  - Application of account to transmission-failure debate
- Here:
  - Brief presentation of 2012 material
  - Extension of account to cover 'contrastive' evidence
  - Use of extension to complement previous handling of transmission-failure

Outline

The basic AGM model

Expanding the model I: evidential beliefs

Expanding the model II: contrastive evidential beliefs

Beliefs

- Beliefs represented by a set of sentences K (a belief set).

  '$A \in K$' = 'A is believed'.
- Belief sets are taken to be:
  - Consistent and deductively closed
  - Drawn from a standard Boolean propositional language.

Beliefs dynamics

- 2 types of change in view are countenanced.
- Revision: adjustment of K to accommodate acquisition of new belief, possibly inconsistent with K.

  $K * A$ = posterior belief set resulting from revision of prior belief set K by A.
- Contraction: adjustment of K to accommodate the retraction of a previously held belief.

  $K \dot{-} A$ = posterior belief set resulting from contraction of prior belief set K by A.
- Two degenerate cases: if $A \in K$, then $K * A = K$ and if $A \notin K$, then $K \dot{-} A = K$.

Beliefs dynamics (ctd.)

- Standard sets of rationality constraints on these operations: AGM and DP postulates (Gärdenfors 1984; Darwiche & Pearl 1997).
- These encode various principles of *parsimony* in belief change.

The basic AGM model

Expanding the model I: evidential beliefs

Expanding the model II: contrastive evidential beliefs

Expanding the language

- Evidential support is non-truth-functional:
- We augment the base language with an evidential binary connective $\rhd$.

  ‘$A \rhd B$’ = ‘A is evidence that B’.
- Note: I follow Achinstein (2001) in understanding being *evidence for* as being *sufficient reason to believe*.

Evidence and belief dynamics

- Clear normative connection between evidential beliefs and changes in views.
- In Chandler (2012), I argued that it amounts to:

  (BEV) $A \rhd B \in K$ iff $B \in (K \dot{-} B) * A$

  (Rational agents believe that A is evidence for B iff they are commited to believe that B upon first contracting by B and then subsequently revising by A.)
- (BEV) has many attractive properties. (Obs1) (Obs2)
- But here is one truly remarkable feature. . .

The principle of transmission

- A recently widely-discussed informal principle:

  If A is evidence for B and B entails C, then A is thereby evidence for C.
- Some unclarity over precise meaning but *at least* states that:

  (TR1) If $C \in \text{Cn}(B)$, then $A \rhd C \in \text{Cn}(A \rhd B)$.
- For present purposes, we assume that it states *exactly* that.
- (TR1) makes no mention of belief sets, but given certain constraints, it is equivalent to:

  (TR1’) If $C \in \text{Cn}(B)$ and $A \rhd B \in K$, then $A \rhd C \in K$.

Transmission failure

- But (TR1'), and hence (TR1), should be resisted (Wright 2002):

  A The animal in the enclosure looks like a zebra.

  B The animal in the enclosure is a zebra.

  C The animal in the enclosure is not a mule painted to look like a zebra.

  Reasonable belief set K: $A \rhd B \in K$ but $A \rhd C \notin K$.
- So (TR1') intuitively doesn't hold in general.
- Fact: Given some weak assumptions, (TR1') is inconsistent with (BEV), on pains of triviality. (Obs3)
- But can we say more about when (TR1') holds and when it doesn't?

When (TR1') fails

- Much-discussed observation regarding Zebra-style cases (Wright 1985):

  $$A \rhd B \notin K \dot{-} C$$

  (Our agent would not believe that $A \rhd B$ if she were not *already* committed to C)
- In these cases, offering an argument for C from A, via B, would amount to *begging the question*.
- Intuitively: this condition is *necessary and sufficient* for failure of (TR1'), given $C \in \mathrm{Cn}(B)$ and $A \rhd B \in K$.

(BEV) and (TR1')

- It turns out that (BEV) enables us to recover precisely this intuition.
- Given some weak assumptions, it can be shown to entail:

  (INT1) If $C \in \mathrm{Cn}(B)$ and $A \rhd B \in K$, then $A \rhd C \notin K$ iff $A \rhd B \notin K \dot{-} C$. (Obs4)
- Note: Arguably, *no* Bayesian analysis to date has managed to vindicate this intuition (incl. Okasha 2004; Chandler 2010).

Contrastive support

- Many evidential statements have an explicitly ternary, contrastive structure:

  'A positive test for quick clay on his garments would be evidence that he spent the last few days in Bergen *rather than in Devon*, but not that he spent them there *rather than in Helsinki*.'

- Evidential support seems to at least sometimes involve a *ternary* relation between evidence and *two* hypotheses (Chandler 2007, 2010; Fitelson 2007, 2012; Sober 1994;...).
- Bayesians already have a well-know proposal on the table ('Law of Likelihood': probability-raising conditional on disjunction of hypotheses).
- Can AGM follow suit?

Expanding the language, again

- We now take $\rhd$ to have an optional third argument:

  '$A \rhd_C B$' = 'A is evidence that B rather than C'.
- What about the connection to belief dynamics?
- We offer, where B and C are mutually exclusive:

  (TEV) $A \rhd_C B \in K$ iff $B \in ((K \dot{-} \neg C) * B \vee C) * A$

  (Rational agents believe that A is evidence for B rather than C iff they are commited to believe that B upon contracting by $\neg C$, revising by $B \vee C$ and then revising by A.)
- Note that, given very weak assumptions, we recover (BEV) as the special case in which $C = \neg B$. (Obs5)

Expanding the language, again (ctd.)

- But what is wrong with

  (TEV*) $A \rhd_C B \in K$ iff $B \in ((K \dot{-} B) * B \vee C) * A$?
- It too yields (BEV) as a special case...
- Well, it yields acceptability conditions for $A \rhd_C B$ that are intuitively too weak:

  A The test for quick clay came out positive.

  B He spent the last few days in Bergen.

  C He spent the last few days in Helsinki.

  D It would have been too dangerous for him to be in Helsinki.

  Assume that $D, \neg C \in K$ but $A, \neg A, B, \neg B, \notin K$.

  Plausibly: $A \rhd_C B \notin K$, but
  $B \in ((K \dot{-} B) * B \vee C) * A = (K * B \vee C) * A$, contra (TEV*).

Expanding the language, again

- (TEV) has a number of attractive properties, including belief that $A \rhd_C B$ being preserved upon finding out that $B \vee C$ (a constraint argued for in Chandler 2010)
- But there are also some very interesting connections between contrastive evidence and transmission failure...

Contrastive evidence and transmission failure

- Another observation regarding Zebra-style cases:

  $A \rhd_{\neg C} B \notin K$

  (Our agent does not believe that A would be evidence that B rather than $\neg C$)
- Intuitively: this condition is *necessary and sufficient* for failure of (TR1'), given $C \in \mathrm{Cn}(B)$ and $A \rhd B \in K$.
- It turns out that (TEV) enables us to recover precisely this intuition.
- Given some weak assumptions, it can be shown to entail:

  (INT2) If $C \in \mathrm{Cn}(B)$ and $A \rhd B \in K$, then $A \rhd B \notin K \dot{-} C$ iff $A \rhd_{\neg C} B \notin K$. (Obs6)

  which, given (INT1), yields just what we were after.

Thank you for your time and attention

Questions and comments welcome:
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