Learning & Value Change

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Center for Formal Epistemology
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Please interrupt when I stop making sense.

Daniel & Melissa

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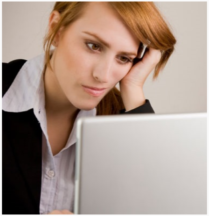
If there's a Democratic scandal, Daniel is disposed to believe that the Democrat's actions were permissible.

Daniel & Melissa

If there's a Republican scandal, Daniel is disposed to believe that the Republican's actions were impermissible.

Daniel & Melissa

He doesn't think that the actions of Democrats and Republicans give evidence of moral permissibility.



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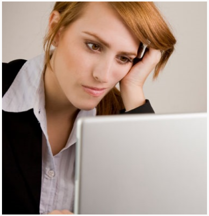

Melissa is disposed to have the same reaction to political scandals, whether the politicians are Democrats or Republicans.

Daniel & Melissa

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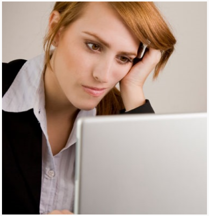

She sometimes thinks that the actions of Democrats are impermissible, and sometimes thinks that the actions of Republicans are impermissible.

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- But there still should be *some* connection between rationality and truth.

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- Melissa is more rational than Daniel.
- But suppose that Daniel's beliefs are all true, whereas many of Melissa's are false.
- Even so, Melissa is more rational than Daniel; rational belief need not be true, nor need true belief be rational.
- But there still should be *some* connection between rationality and truth.
- It is tempting to say: Melissa's beliefs are *more likely* to be true than Daniel's.

Accuracy-first epistemology

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- Accuracy firsters:
    - Melissa adopts those beliefs which she expects to be most accurate.
    - Daniel adopts beliefs which he expects to be less accurate than other beliefs he could have adopted instead.

Accuracy-first epistemology

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- It is therefore a form of *epistemic consequentialism*, with the sole epistemic good of accuracy.

Looking forward

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- Alternative approaches are needed.
- I have one to offer.

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Bayesianism

Bayesian Rationality

- The Bayesian has a diagnosis of what's gone wrong with Daniel.
- Either Daniel's opinions are not probabilistically coherent, or Daniel is not a conditionalizer.

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Credal States

- At any time t, your opinions are representable with a *credal state* $< \mathscr{W}, \mathscr{A}, c_t >$
  - $\mathscr{W} = \{w_1, w_2, \ldots, w_N\}$ is a finite set of doxastically possible worlds;
  - $A \subseteq \mathscr{W}$ is a *proposition*;
  - $\mathscr{A} \subseteq \wp(\mathscr{W})$ is the *set* of propositions about which you are opinionated;
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Bayesianism

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At all times t, c_t should be a probability function.

Bayesianism

Conditionalization

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- Use '$c_{t,E}$' for the credence function you are disposed to adopt, at t, upon receiving the total evidence E.

Conditionalization

There should be some credence function c such that, for all times t and all $A, E \in \mathscr{A}$ such that E could be your total time t evidence,

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Bayesianism

- The Bayesian account of rational learning: you should be a probabilistic conditionalizer.

Daniel is not a probabilistic conditionalizer

1. $c_{\text{a Dem. } \phi\text{-ed}}(\ \phi\text{-ing is wrong}\ )$ is low.
2. $c_{\text{a Rep. } \phi\text{-ed}}(\ \phi\text{-ing is wrong}\ )$ is high.

If Daniel were a conditionalizer, then

$$c(\phi\text{-ing is wrong} \mid \text{ a Dem. } \phi\text{-ed}) \text{ is low}$$

$$\text{and } c(\phi\text{-ing is wrong} \mid \text{ a Rep. } \phi\text{-ed}) \text{ is high}$$

But Daniel thinks whether ϕ-ing is wrong is independent of whether a Dem. or a Rep. ϕ-ed. So

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Epistemic Value

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- Write the epistemic value of a credence function c, under the supposition that w is actual, as:

$$\mathcal{V}(c, w)$$

- For the accuracy-firster, $\mathcal{V}(c, w)$ is entirely a function of the *accuracy* of c in w.
- E.g., one accuracy measure is the quadratic or 'Brier' measure, $\mathcal{Q}$

$$\mathcal{Q}(c, w) \stackrel{\text{def}}{=} -\sum_{A \in \mathscr{A}} (v_A(w) - c(A))^2$$

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Other Accuracy Measures

- The *Euclidean distance* measure

$$\mathcal{E}(c, w) \stackrel{\text{def}}{=} -\sqrt{\sum_{A \in \mathscr{A}} (v_A(w) - c(A))^2}$$

- The *Absolute Value* measure

$$\mathcal{A}(c, w) \stackrel{\text{def}}{=} \sum_{A \in \mathscr{A}} |\, v_A(w) - c(A) \,|$$

- The *Logarithmic* measure

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Evaluating credence functions

- Use '$\mathcal{V}_c(c^*)$' to represent how valuable the credence function c^* is, according to the credence function c.
- LEITGEB & PETTIGREW: if your credence function is a probability, p, then, for all c, $\mathcal{V}_p(c)$ should be p's *expectation* of c's epistemic value.

$$\mathcal{V}_p(c) \stackrel{!}{=} \sum_{w \in \mathscr{W}} \mathcal{V}(c, w) \cdot p(w)$$

  - This is a general decision-theoretic norm: epistemic acts are choiceworthy to the degree that they maximize expected value.

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Valuing Accuracy Properly

PROPRIETY

The epistemic value function $\mathcal{V}$ is *proper* iff, for every probability p and every credence function $c \neq p$,

$$\mathcal{V}_p(c) < \mathcal{V}_p(p)$$

- $\mathcal{Q}$ is proper ☺
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Why Propriety? Epistemic Conservativism

P1. For any probability *p*, there is some evidence you could have that would make it permissible to have *p* as your credence function.

P2. If another credence function *c* is at least as valuable as your own, then it is permissible to adopt *c* as your credence function, even without receiving any evidence.

P3. It is impermissible to change your credences without receiving evidence.

C1. So, epistemic value must be proper.

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C1. So, epistemic value must be proper.

Why Propriety? Epistemic Conservativism

P1. For any probability *p*, there is some evidence you could have that would make it permissible to have *p* as your credence function.

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Propriety & Probabilism

- If $\mathcal{V}$ is a proper measure of accuracy, then every non-probabilistic credence function is *accuracy dominated* by a probabilistic credence function, and no probabilistic credence function is so dominated. (Predd et al, 2009)
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Conditionalization & Accuracy

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Take 1

Propriety & Conditionalization

- Leitgeb & Pettigrew (2010): Upon learning that *E*, you should be disposed to adopt a new credence function which maximizes your expected epistemic value in all possibilities consistent with *E*.

$$p_E \stackrel{!}{=} \arg\max_c \left\{ \sum_{w \in E} p(w) \cdot \mathcal{V}(c, w) \right\}$$

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Theorem 1 (Generalized from Leitgeb & Pettigrew, 2010)

If $\mathcal{V}$ is a proper accuracy measure, then, for any probability p and any proposition E,

$$\arg\max_c \left\{ \sum_{w \in E} p(w) \cdot \mathcal{V}(c, w) \right\} = p(- \mid E)$$

If $\mathcal{V}$ is a proper accuracy measure, then $p_E \stackrel{!}{=} p(- \mid E)$.

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- A 2-stage theory of rational learning:
  - Stage 1: upon learning *E*, you eliminate worlds incompatible with *E* from $\mathscr{W}$;
  - Stage 2: use your prior (no longer probabilistic) credences to pick a posterior which maximizes expected epistemic value in the remaining worlds.

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- Why eliminate worlds at stage 1?
  - Because they are incompatible with your evidence.
- This answer relies upon a norm like "do not treat a world as epistemically possible if it is incompatible with your evidence"
  - This is a distinctively *evidential norm*
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- Suppose $\mathcal{V}$ is proper, your prior is p, and c_E is any credence function which assigns credence zero to worlds incompatible with E.
- Then,

$$\mathcal{V}_p(c_E) < \mathcal{V}_p(p)$$

- If you care about accuracy and accuracy alone, you evaluate credal state by their expected accuracy, and you measure accuracy properly, then you will never learn from experience.

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Conditionalization & Accuracy

Take 2

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- Leitgeb & Pettigrew: upon learning that E, you should be disposed to adopt a new credence function which maximizes your expected epistemic value *amongst those credence functions consistent with your evidence*.

$$p_E \overset{!}{=} \underset{\substack{c\,:\,c(E)=1,\\ c(\neg E)=0}}{\arg\max} \left\{ \sum_{w \in \mathscr{W}} p(w) \cdot \mathcal{V}(c, w) \right\}$$

Theorem 2 (Leitgeb & Pettigrew, 2010)

If $\mathcal{V} = \mathcal{Q}$, then the solution to the maximization problem above is:

$$p(A \mid\mid E) = p(AE) + \frac{||AE||}{||E||} \cdot [1 - p(E)]$$

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- Levinstein (2012): We should favor the evidential constraint approach, but we should *not* use the quadratic $\mathcal{Q}$. Instead, we should use the logarithmic

$$\mathcal{L}'(c, w) \stackrel{\text{def}}{=} \ln[c(w)]$$

- Then, it turns out that

$$\operatorname*{arg\,max}_{\substack{c\,:\,c(E)=1,\\ c(\neg E)=0}} \left\{ \sum_{w \in \mathscr{W}} \mathcal{L}'(c, w) \cdot p(w) \right\} = p(- \mid E)$$

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- All probability functions are (at least weakly) $\mathcal{L}'$-dominated by non-probability functions.
- Consider 'the credulous function', $c^\dagger$ which gives credence 1 to every world. At every world, this function gets an $\mathcal{L}'$-value of 0, which is as high as $\mathcal{L}'$-value goes.

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- But this epistemic value function no longer vindicates CONDITIONALIZATION. And what it does vindicate is not epistemically defensible.

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Epistemic Value Change

What went wrong?

- Leitgeb & Pettigrew give a model of rational belief with three components:
    - a credal state;
    - an epistemic value function; and
    - a dynamical law—rational credences travel in the direction of highest expected accuracy
- If the epistemic value function is proper, then this model will always be in equilibrium.
- So, if there is to be a rational *change* of belief, then there must be an exogenous change to one of these three components.

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Exogenous Change to Credal State?

- Either the change to the credal state is rationally evaluable or it is not.
- If it is not, then we take on counterintuitive consequences.
  - It is not irrational to become certain that climate change is a hoax perpetrated by the Chinese upon seeing snow.
- If it is, then the accuracy-first project has failed.
  - there are norms governing changes in credal states which are not and cannot be justified in terms of the single-minded pursuit of accuracy.

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Exogenous Change to the Dynamics?

- For instance, while most of the time, rational believers attempt to maximize the accuracy of their beliefs—sometimes, they attempt to meet the constraints placed upon them by their evidence.
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Exogenous Change to the Epistemic Value Function?

- In general, an expected accuracy maximizer will not value accuracy at all worlds equally.
    - The accuracy of c at world w, $\mathcal{V}(c, w)$, is *weighted* by your credence that w is actual, $p(w)$.
- After a learning experience, you come to value accuracy at worlds differently.
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- My proposal is to reverse the order of explanation.
- You don't rationally stop valuing accuracy at $\neg E$-possibilities *because* it is rational for you to become certain of E.
- Rather, it is rational for you to become certain of E *because* it is rational for you to stop valuing accuracy at $\neg E$-possibilities.

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Epistemic Value Change

Conditionalization

Rational Value Change and Conditionalization

- Suppose that learning E rationalizes not caring at all about accuracy at worlds $w \notin E$
- if '$\mathcal{V}^E$' is the epistemic value function which is rational after learning that E, then

$$\mathcal{V}^E(c, w) = \begin{cases} \mathcal{V}(c, w) & \text{if } w \in E \\ \kappa_w & \text{if } w \notin E \end{cases}$$

  - κ_w is some constant.
  - So, at $w \notin E$, you value accurate credences as much as you value inaccurate ones.
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Epistemic Value Change

Propriety

Why Propriety? Epistemic Conservativism

P1. For any probability p, there is some evidence you could have that would make it permissible to have p as your credence function.

P2. If another credence function c is at least as valuable as your own, then it is permissible to adopt c as your credence function, even without receiving any evidence.

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In Summation

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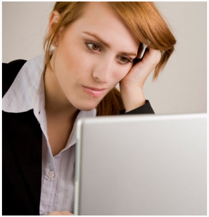

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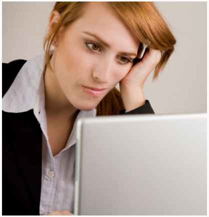

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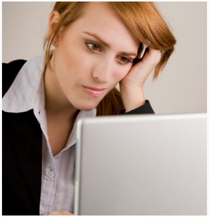

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Questions?