Knowledge Centered Epistemic Utility Theory

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Outline

1. Prelude: Two Examples and an Overview of the Talk

2. Truth & The Old Lockeanism

3. Knowledge & A New Lockeanism

4. Extras: Some Supplementary Slides (hopefully useful in discussion)
• **Miners** [34, 26]. You are standing in front of two mine shafts (A and B). Flood waters are approaching. You know that ten miners are in one of the shafts, but you don’t know which (e.g., their location was determined by the result of a fair coin toss). You have enough sand bags to block one of the shafts. If the miners are in A, then blocking A saves all 10 miners (and, hence, minimizes disutility, *i.e.*, # of dead miners). If the miners are in B, then blocking B minimizes disutility. If you block neither A nor B, the water will be divided, and only the lowest miner in the shaft will die. 

**Claim.** *It is rationally permissible to block neither A nor B.*

• **Gibbard’s Coin** [14, 30]. A fair coin has been tossed (and you have no information about how it landed). If it landed Heads (H), then believing H is the attitude which minimizes (epistemic) disutility (*viz.*, inaccuracy). If it landed Tails (T), then believing T is the attitude which minimizes inaccuracy. 

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*Dutant & Fitelson* 
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*It can be rationally permissible to (knowingly) occupy a state, which does not minimize disutility — in any possible world.*
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Today’s talk is about (i) formal, (ii) synchronic, (iii) epistemic (iv) coherence (v) requirements (of ideal rationality).

(i) *Formal* coherence is to be distinguished from other sorts of coherence discussed in contemporary epistemology (*e.g.*, in some empirical, truth/knowledge-conducive sense [1]).

- Our notions of coherence will supervene on *logical* (and *formal probabilistic*) properties of judgment sets.

(ii) *Synchronic* coherence has to do with the coherence of a set of judgments held by an agent *S* at a single time *t*.

- So, we'll *not* be discussing any *diachronic* [40] requirements.

(iii) *Epistemic* coherence involves *distinctively* epistemic values (*e.g.*, accuracy [19], evidential support [7], knowledge [Meno]).

- This is to be distinguished from *pragmatic* coherence (*e.g.*, immunity from dutch books [38], and the like [17]).

(iv) *Coherence* has to do with how a set of judgments “hangs together”. CRs are *wide-scope* [3], global requirements.

(v) *Requirements* are *evaluative*; they give *necessary* conditions for (ideal) epistemic rationality of a doxastic state [40].
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Here is a — perhaps the — “paradigm” CR [36, 39, 32, 23].

**The Consistency Requirement for Belief.** Agents should have sets of beliefs that are *logically consistent*.

The Consistency Requirement is implied by The Alethic Ideal (*i.e.*, if $S$ is Alethically Ideal, then $S$’s beliefs are consistent).

*Alethic Ideal* (for belief). $S$ should (*alethically, ideally*) believe (disbelieve) that $p$ just in case $p$ is true (false).

We’ve already seen (Gibbard’s Coin) that The Alethic Ideal can come into *conflict* with The Evidential Ideal.

*The Evidential Ideal* (for belief). $S$ should (*evidentially, ideally*) believe (disbelieve) $p$ if $S$’s total evidence supports (counter-supports) $p$. Otherwise, $S$ should *suspend* on $p$.

More subtle cases reveal that The Consistency Requirement can also conflict with The Evidential Ideal [6, 25, 13, 24].

We’ll refer to the claim that there exist *some* such cases as the *datum*. Foley’s [13] explanation of the *datum* is helpful.
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“...if the avoidance of recognizable inconsistency were an absolute prerequisite of rational belief, we could not rationally believe each member of a set of propositions and also rationally believe of this set that at least one of its members is false. But this in turn pressures us to be unduly cautious. It pressures us to believe only those propositions that are certain or at least close to certain for us, since otherwise we are likely to have reasons to believe that at least one of these propositions is false. At first glance, the requirement that we avoid recognizable inconsistency seems little enough to ask in the name of rationality. It asks only that we avoid certain error. It turns out, however, that this is far too much to ask.”

We will offer an explication of Foley’s (Old) Lockeanism. The idea: *Epistemic rationality requires minimization of expected inaccuracy*. Later, we will examine a New (Knowledge Centered) Lockeanism, based on a refinement of this idea.
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• We assume that our agent has a credence function $b(\cdot)$, which is *probabilistic*. This allows us to use $b(\cdot)$ to define notions of (subjective) *expected* (epistemic) utility.

• We assume that our agent takes exactly one of three qualitative attitudes ($B, D, S$) toward each member of a finite agenda $\mathcal{A}$ of (classical, possible worlds) propositions.

• We do *not* assume that these qualitative judgments can be *reduced* to $b(\cdot)$. But, we will use $b(\cdot)$ to derive a *rational coherence constraint* for qualitative judgment sets $B$ (on $\mathcal{A}$).

• This derivation requires both the agent’s credence function $b(\cdot)$ and their *epistemic utility function* $[18, 29, 31] u(\cdot)$.

• Following Easwaran [11] & Dorst [9], we assume our agent cares only about whether their judgments are *accurate*.

• Specifically, our agent attaches some *positive* utility ($r$) with making an *accurate* judgment, and some *negative* utility ($-w$) with making an *inaccurate* judgment (where $w > r > 0$).
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Specifically, our agent attaches some *positive* utility ($r$) with making an *accurate* judgment, and some *negative* utility ($-\mathcal{W}$) with making an *inaccurate* judgment (where $\mathcal{W} > r > 0$).
We assume that our agent has a credence function $b(\cdot)$, which is *probabilistic*. This allows us to use $b(\cdot)$ to define notions of (subjective) *expected* (epistemic) utility.

We assume that our agent takes exactly one of three qualitative attitudes ($B, D, S$) toward each member of a finite agenda $A$ of (classical, possible worlds) propositions.

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• Thus, we have the following piecewise definition of $u(\cdot, w)$.

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\begin{align*}
    u(B(p), w) &\overset{\text{def}}{=} \begin{cases} 
        -w & \text{if } p \text{ is false at } w \\
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• With this *accuracy-centered* epistemic utility function in hand, we can derive a naïve EUT coherence requirement.
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With this \textit{accuracy-centered} epistemic utility function in hand, we can derive a naïve EUT coherence requirement.
To do so, we’ll also need a decision-theoretic principle.

As we saw, applications of EUT to grounding probabilism as a (synchronic) requirement for \( b(\cdot) \) typically appeal to a non-dominance (in epistemic utility) principle [20, 37, 35].

But, some authors apply an expected epistemic utility maximization (or expected inaccuracy minimization) principle to derive rational requirements [28, 16, 12, 33].

Coherence. An agent’s belief set \( B \) over an agenda \( \mathcal{A} \) should, from the point of view of their own credence function \( b(\cdot) \), maximize expected epistemic utility (or minimize expected inaccuracy). That is, \( B \) should maximize

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EEU(B, b) \equiv \sum_{p \in \mathcal{A}} \sum_{w \in W} b(w) \cdot u(B(p), w)
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The consequences of Coherence are rather simple and intuitive. It is straightforward to prove the following result.

**Theorem** ([11, 9]). An agent with credence function $b(\cdot)$ and qualitative judgment set $\mathcal{B}$ over agenda $\mathcal{A}$ satisfies Coherence if and only if for all $p \in \mathcal{A}$

- $B(p) \in \mathcal{B}$ iff $b(p) > \frac{w}{r+w}$,
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In other words, Coherence entails Lockean representability, where the Lockean thresholds are determined by the way the agent (relatively) values accuracy vs. inaccuracy.

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As Dorst [9] puts it: **Lockeans maximize expected accuracy.**
In the *Meno* (97e–98a), Socrates says:

*For true opinions, as long as they remain, are a fine thing and all they do is good, but they are not willing to remain long, and they escape from a man’s mind, so that they are not worth much until one ties them down... That is why knowledge is prized higher than correct opinion, and knowledge differs from correct opinion in being tied down...*

- Our epistemic utility function (for belief) only assigned positive value to *correctness*. What about *knowledge*?
- Nothing in our (teleological) framework for epistemic utility theory rules out attaching (additional) value to *knowledge*, *over and above* the value we place on correctness/accuracy.
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Here’s the most general class of models we’ve come up with:

<table>
<thead>
<tr>
<th>world ($w$)</th>
<th>$b(w)$</th>
<th>$u(B(p), w)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$K(p)$</td>
<td>$a$</td>
<td>$\chi$</td>
</tr>
<tr>
<td>$p &amp; \neg K(p)$</td>
<td>$b$</td>
<td>$\gamma$</td>
</tr>
<tr>
<td>$\neg p &amp; \neg K(\neg p)$</td>
<td>$c$</td>
<td>$\zeta$</td>
</tr>
<tr>
<td>$K(\neg p)$</td>
<td>$1 - (a + b + c)$</td>
<td>$\upsilon$</td>
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When we represent things at this level of generality, we realize there are (at least) two key choice points here.

1. Are knowledge and truth both positively valuable (or is knowledge the only state that has positive value)? That is: should we have both $x > 0$ and $\gamma > 0$, or just $x > 0$?

2. Should truth be more valuable than falsehood, even within the state of ignorance? That is, should we have $\gamma > \zeta$?

These choices — especially (1) — will impact the kinds of “Lockean Theses” that fall out of the models (via MEEU).
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1. Are knowledge and truth both positively valuable (or is knowledge the only state that has positive value)? That is: should we have both \(x > 0\) and \(\gamma > 0\), or just \(x > 0\)?

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**K-Coherence.** $B(p)$ is rationally permissible just in case $b(K(p))$ is “sufficiently high,” where “sufficiently high” may be rather complicated (and it may depend on the other credences the agent assigns), but it will always have to be greater than $\frac{1}{2}$, provided only that the penalties for non-knowledge are greater than the reward for knowledge.

Models which answer (1) in the *affirmative*, are far more complex, and can be compatible with $b(K(p))$ being arbitrarily low. We don’t have a full characterization of those models, but we have some special cases worked out.

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**Theorem** ([10]). For all $n \geq 2$ and any probability function $\text{Pr}(\cdot)$, the $\text{Pr}(\cdot)$-Lockean-representability of $\mathcal{B}_n$ (with threshold $t$) entails deductive consistency of $\mathcal{B}_n$ iff $t \geq \frac{n-1}{n}$.

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Thus, according to such models, the standard lottery beliefs can be irrational, and not because agents are (or ought to be) certain/near certain (or “stable”) in their beliefs.

Thus, Lottery beliefs can be irrational, because (a) only knowledge has positive epistemic utility, and (b) maximizing expected EU will force such agents to believe only claims which they are (sufficiently) confident that they know.

I, for one, am not confident that I know (any) lottery propositions. So, as applied to me, they prohibit me from believing that (e.g.) my lottery ticket will lose.

Similar applications can be formulated for Moorean beliefs, beliefs based “solely on statistical evidence”, etc.
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- Like the **Alethic Ideal**, (AMU) is *not a requirement of rationality*; and, like **Consistency**, (PMU) isn’t a rational requirement either (this was the lesson of *Miners* [34, 26]).

- As Foley (*op. cit.*) explains, **Consistency** is *too demanding*. But, **Coherence** is *not* — it does *not* “pressure us to believe only those propositions that are (close to) certain for us”.
I’ve been presenting epistemic requirements as if they applied to “doxastic acts” of believing, disbelieving or suspending judgment (or assigning some credence).

Strictly speaking, I should present both epistemic and prudential requirements as constraints on preferences.

For instance, the key evaluative claim about Miners is (strictly speaking) that the (partial) preference ranking

$$C > A \sim B$$

is not irrational — because it is aligned with the agent’s expected utility ranking (where $C \overset{\text{def}}{=} \text{blocking neither shaft}$).

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  - There does *not* exist an alternative belief set $B'$ such that:
    1. $(\forall w)[u(B', w) \leq u(B, w)]$, and
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  It turns out [10, 11] that *Coherence* $\Rightarrow$ (WADA) $\Rightarrow$ (SADA).

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The Closure of Rational Belief Principle (CRBP).
If S rationally believes $p$ at $t$ and S knows (at $t$) that $p$ entails $q$, then it would be rational for S to believe $q$ at $t$.

The No Known Contradictions Principle (NKCP).
If S knows (at $t$) that $\bot$ is a logical contradiction, then it would not be rational for S to believe $\bot$ (at $t$).

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- (SPC) If $p \not\equiv q$, then any B s.t. $\{B(p), D(q)\} \subseteq B$ is incoherent.
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If $B(p)$ and $p$ are correlated under $b(\cdot)$, then the verdicts delivered by Coherence can be partition-sensitive, i.e., they can depend on the way in which the underlying set of doxastic possibilities is partitioned or carved up [21].

More importantly, if $B(p)$ and $p$ are correlated under $b(\cdot)$, then EUT can yield unintuitive (and/or odd) verdicts (even assuming a “natural” partition of states). See [4, 15, 5, 27].

For instance, Carr [5] considers cases in which $B(p)$ and $p$ are positively correlated (e.g., believing you will do a handstand makes it much more likely that you will).

Examples involving negative correlation between $B(p)$ and $p$ have been discussed by various authors (e.g., [15]). The most extreme (and difficult) examples along these lines are the self-referential examples due to Michael Caie [4].
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Caie’s original example involved (only) *credences* [4]. It was designed to undermine Joycean (accuracy-dominance) arguments for *probabilism* as a requirement for $b(\cdot)$.

There are analogous examples for full belief. Consider:

$(P)$ S does not believe that $P$. [$\neg B('P')$.]

One can argue (Caie-style) that the only non-dominated (opinionated) belief sets on $\{P, \neg P\}$ are $\{B(P), B(\neg P)\}$ and $\{D(P), D(\neg P)\}$, which are both *ruled-out* by Coherence.

<table>
<thead>
<tr>
<th>$P$</th>
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<th>$B(P)$</th>
<th>$B(\neg P)$</th>
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<tbody>
<tr>
<td>$w_1$</td>
<td>F</td>
<td>T</td>
<td>$\times$</td>
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<td>$w_2$</td>
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If this Caie-style reasoning is correct, then it shows that some of our assumptions must go. But, which one(s)?
• Caie’s original example involved (only) *credences* [4]. It was designed to undermine Joycean (accuracy-dominance) arguments for *probabilism* as a requirement for \( b(\cdot) \).

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<tr>
<td>( w_1 )</td>
<td>F</td>
<td>T</td>
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<tr>
<td>$w_1$</td>
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<tr>
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- Majority rule aggregations of the judgments of a group of consistent agents need not be consistent.

Q: does majority rule preserve our notion(s) of coherence, e.g., is (WADA) preserved by MR? A: yes (on simple, atomic + truth-functional agendas), but not on all possible agendas.

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