과학철학 23권 3호 (2020) pp. 29-59

# An ‘Intrapersonal Permissivist’ Worry about Epistemic Utility-Based Arguments for Bayesianism†

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Leitgeb and Pettigrew (2010a, 2010b) have offered epistemic utility-based arguments for Bayesianism. However, in this paper, my purpose is to show that, on the assumption that epistemic rationality is solely grounded on accuracy, the following two conditional claims are true: (i) If Intrapersonal Permissivism is true, Leitgeb and Pettigrew’s arguments for Bayesianism are unsound; (2) more generally, if Intrapersonal Permissivism is true, any epistemic utility-based arguments that rely on Propriety would be unsuccessful. As is well known, Propriety is one of the minimum requirements in Epistemic Utility Theory. Thus, my results show that many of the results of Epistemic Utility Theory rely crucially on a particular view of permissive rationality.

【Key words】Intrapersonal Permissivism, Epistemic Utility, Propriety

† This work has supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (No. 2018S1A5A8028184).
I am especially grateful to Ilho Park for all his help on this project. Many thanks to an anonymous referee.

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# 1. Introduction

Let $\boldsymbol{W}$ be a set of mutually exclusive and jointly exhaustive worlds that are epistemically possible for an agent at a time. In a typical Bayesian fashion, let us assume that an agent's doxastic state at time $t$ can be represented by some credence function $c_t$ from the power set of $\boldsymbol{W}$ (or propositions) to the non-negative real numbers $\boldsymbol{R}^+$.[1)]

Probabilism and Conditionalization constitute the core of Bayesianism. Probabilism says that a doxastic state should be probabilistically coherent. That is, a doxastic state should be represented by a probability function. Conditionalization says that an agent should update her doxastic state by conditionalizing on total evidence that she newly learns with certainty. That is, if a rational agent whose credence function is $c_t$ learns $E$ with certainty at $t$+1 and nothing else between $t$ and $t$+1, then her post-learning credence function would be $c_{t+1}(\cdot) = c_t(\cdot \mid E)$. From now on, let us call any theory that endorses both Probabilism and Conditionalization *Bayesianism*.

An epistemic utility is a type of epistemic desirability determined by epistemic values such as *accuracy*, *informativeness*, *simplicity*, and *verisimilitude*. According to Epistemic Utility Theory (EUT for short), any legitimate epistemic principle is justified by epistemic utility considerations. Then, can Bayesianism be justified by appealing to epistemic utility? A variety of such arguments have been offered,[2)]

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1) I use the set-theoretic notation and syntactic notation interchangeably throughout, depending on which seems more stylistically convenient. And, for simplicity, I will omit a time subscript when unnecessary.

2) For instance, Joyce (1998, 2009) and Pettigrew (2016) attempt to justify Probabilism; Greaves and Wallace (2006), Easwaran (2013), and Pettigrew (2016) attempt to justify Conditionalization.

but the focus of this paper will be arguments by Hannes Leitgeb and Richard Pettigrew (2010a, 2010b) for the claim that Bayesianism maximizes expected epistemic utility. If their arguments are successful, we might have (at least partly) good *epistemic* reason for Bayesianism. In this paper, however, I will show that their arguments are not free from the evidential permissivist worry that will be explained below. Finally, I will consider more generally whether there could be any other epistemic utility-based arguments that are free from the evidential permissivist worry.

I will proceed as follows. Section 2 introduces the framework for EUT and, with the framework in hand, explains what Leitgeb and Pettigrew (2010a) call a *local inaccuracy measure* and a *global inaccuracy measure*. Section 3 provides Leitgeb and Pettigrew (2010b)'s argument for Bayesianism. Section 4 discusses the evidential permissivist worry about Leitgeb and Pettigrew's argument: After clearly defining two types of Permissivism (what I call *Interpersonal Permissivism* and *Intrapersonal Permissivism*), I will show that, on the assumption of Accuracy-First Rationality, which says that epistemic rationality is solely grounded on accuracy, if Intrapersonal Permissivism (described in section 4) is true, the key premise of Leitgeb and Pettigrew's argument is not well justified. Section 5 discusses more generally whether there could be any other epistemic utility-based arguments that are free from the evidential permissivist's worry. In this regard, I will consider whether Intrapersonal Permissivism is compatible with Propriety (described in section 5), which constitutes the minimum requirements in EUT. I will show that, on the assumption of Accuracy-First Rationality, if Intrapersonal Permissivism is true, any accuracy-first arguments that rely on Propriety would be unsuccessful. Thus, an intrapersonal permissivist would not accept much of what EUT has to offer, including the justification of Bayesianism, because many results of EUT rely on Propriety.

## 2. Set-Up and Notations

Let $\boldsymbol{C_W}$ be a set of credence functions from the power set of $\boldsymbol{W}$ (or propositions) to the non-negative real numbers $\boldsymbol{R}^+$. Let $\boldsymbol{C_W}$ cover all (possible) credal states over the power set of $\boldsymbol{W}$. Thus, $\boldsymbol{C_W}$ represents all possible doxastic states over the power set of $\boldsymbol{W}$ to an agent.

In EUT, it is assumed that an epistemic utility can be represented by some epistemic utility function. There are various epistemic utility functions because there are various ways of measuring epistemic utility. As already pointed out, an epistemic utility is determined by epistemic values that many think include *accuracy*, *informativeness*, *simplicity*, and *verisimilitude*. There are, of course, various ways to weigh epistemic values against each other. For instance, there could be some epistemic utility functions that give accuracy much more weight than they give to other epistemic values, or some other epistemic utility functions that might treat verisimilitude similarly.

Leitgeb and Pettigrew assume Accuracy-First Epistemic Utility; that is, they assume that epistemic utility is measured only by accuracy. On the assumption of Accuracy-First Epistemic Utility, they propose two kinds of epistemic utility function—what they call a *local inaccuracy measure* and a *global inaccuracy measure*. A local inaccuracy measure is a function $I$ from a proposition $A \subseteq \boldsymbol{W}$, a possible world $w \in \boldsymbol{W}$, and a nonnegative real number $x \in \boldsymbol{R}^+$ to a nonnegative real number $r \in \boldsymbol{R}^+$: $I(A, w, x)$ refers to some nonnegative real number that represents how *inaccurate* it is to have credence $x$ in a proposition $A$ when $w$ in fact obtains. On the other hand, a global inaccuracy measure is a function $G$ from a credence function $c \in \boldsymbol{C}_W$ and a possible state of the world $w \in \boldsymbol{W}$ to a nonnegative real number $r \in \boldsymbol{R}^+$: $G(c, w)$ refers to some real number that represents how *inaccurate* it is to adopt $c$ when $w$ in fact obtains.

## 3. Leitgeb and Pettigrew’s Argument for Bayesianism

Leitgeb and Pettigrew’s argument for Bayesianism consists of two sub-arguments: one for Probabilism and the other for Conditionalization. We can first lay out their sub-argument for Probabilism as follows:

***(i) Sub-Argument for Probabilism***

(P1) Accuracy (Synchronic expected local): An agent ought to have a credence in every proposition $A \subseteq \boldsymbol{W}$ with the minimal expected local inaccuracy with respect to her *current* credence function, relative to a legitimate local inaccuracy measure and over the set of worlds that are currently epistemically possible for her (i.e., $\boldsymbol{W}$).

(P2) Local and Global Inaccuracy Measures: The only legitimate local and global inaccuracy measures are quadratic inaccuracy measures.

(C) Probabilism

Here the *quadratic inaccuracy measures* are *Brier scores* in the literature on scoring rules.[3] What are the Brier scores? If a local

3) See Brier (1950).

inaccuracy measure is the Brier score, the inaccuracy of having credence $x$ in a proposition $A \subseteq \boldsymbol{W}$ at $w_i \in \boldsymbol{W}$ is as follows:

$$I(A, w_i, x) = \lambda(|t_A(w_i) - x|)^2$$

where $\lambda \in \boldsymbol{R}^+$ ( $\lambda > 0$) and $t_A(w_i)$ is the characteristic function that represents the truth value of $A$ at $w_i$ in a way that $t_A(w_i) = 1$ if $w_i \in A$; $t_A(w_i) = 0$ otherwise.

Similarly, if a global inaccuracy measure is the Brier score, the inaccuracy of having a credence function $c \in \boldsymbol{C_W}$ at $w_i \in \boldsymbol{W}$ is as follows:

$$G(c, w_i) = \lambda\left(\sqrt{\sum_{w_j \in \boldsymbol{W}} (t_{\{w_j\}}(w_i) - c(\{w_j\}))^2}\right)^2$$

where $\lambda \in \boldsymbol{R}^+$ ( $\lambda > 0$) and $\sqrt{\sum_{w_j \in \boldsymbol{W}} (t_{\{w_j\}}(w_i) - c(\{w_j\}))^2}$ is the Euclidean distance between the vector representation of $c$ and the vector representation of $w_i$.

The sub-argument for Probabilism is deductively valid.4) That is, having the quadratic inaccuracy measures in hand, Leitgeb and Pettigrew prove that at any time t, an agent's credence function at t ought to be probabilistically coherent in order to minimize the expected inaccuracy with respect to her current credence function at t.5)

We can also lay out Leitgeb and Pettigrew's sub-argument for Conditionalization as follows:

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4) See Leitgeb and Pettigrew (2010b: 263-265) for the proof.

5) Note that the inaccuracy of a credence function at a possible world is the negative of its accuracy, and vice versa. Thus, minimizing inaccuracy is just maximizing accuracy, and vice versa.

***(ii) Sub-Argument for Conditionalization***

(P1') Accuracy (Diachronic expected local): For any $E \subseteq W$, if an agent learns $E$ with certainty between t and t+1 and nothing else, at t+1, an agent ought to have a credence in every proposition $A \subseteq W$ with the minimal expected local inaccuracy with respect to her *current* credence function at t, relative to a legitimate local inaccuracy measure and over the set of worlds that are epistemically possible for her at t+1 (i.e., $E$).

(P2) Local and Global Inaccuracy Measures

(P3) Probabilism

(C') Conditionalization

The sub-argument for Conditionalization is also valid.[6] That is, having the quadratic inaccuracy measures in hand, Leitgeb and Pettigrew prove that an agent ought to update her doxastic state by conditionalizing on a total evidence that she newly learns with certainty in order to minimize the expected inaccuracy.

However, one might plausibly claim that the expected inaccuracy-minimizing intuitions that Leitgeb and Pettigrew offer for Bayesianism are *synchronic* ones. Why? According to Leitgeb and Pettigrew, an agent should minimize expected inaccuracy with respect to her credence function at *a particular time*. Thus, in contrast to synchronic principles, like P1, no strong *diachronic* principle, like P1', seems to follow from the expected inaccuracy-minimizing intuitions. To see this point, it is important to realize that, in their sub-argument for Conditionalization, Leitgeb and Pettigrew consider the expected accuracy of credence in $A$ at t+1 with respect to a (current) credence function at t. Thus, one might plausibly claim that all Leitgeb and Pettigrew have shown us is that, at t (i.e., *before* an

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[6] See Leitgeb and Pettigrew (2010b: 249-250 and 265) for the proof.

agent undergoes the learning experience), the agent should think that she will *update* by conditionalizing on a total evidence that she now knows she will newly learn with certainty between t and t+1. Leitgeb and Pettigrew have not shown us that, however, once the agent has actually received the total evidence at t+1 (i.e., *after* the agent undergoes the learning experience), she should *actually* update by Conditionalization. Moreover, Leitgeb and Pettigrew do not provide any independent argument for why the rational agent at t+1 should care about how she thought at t. Without such a bridge argument, we cannot clearly see why the agent is irrational when she disregards how she planned to update.

One might still think that the expected inaccuracy-minimizing considerations can justify the *synchronic* version of Conditionalization. That is, having the quadratic inaccuracy measures in hand, Leitgeb and Pettigrew may at least convince us that, given that an agent knows that she will learn total evidence with certainty, the agent ought to currently think that she will update her doxastic state by conditionalizing on the total evidence in order to minimize the expected inaccuracy. Following Easwaran (2013, 132), let us call the *synchronic* version of Conditionalization *Plan Conditionalization*. We can also lay out a Leitgeb and Pettigrew style of sub-argument for Plan Conditionalization as follows:

***(iii) Sub-Argument for Plan Conditionalization***

(P1’’) Accuracy (Synchronic Plan expected local): Let an updating plan be a function from a proposition $E \subseteq \boldsymbol{W}$ to a credence function $c_E \in \boldsymbol{C_W}$. For any $E \subseteq \boldsymbol{W}$, at t, if an agent knows that she will learn $E$ with certainty between t and t+1 and nothing else, then the agent ought to have an updating plan on $E$ such that, for every proposition $A \subseteq \boldsymbol{W}$, $c_E(A)$ minimizes the expected local inaccuracy with respect to her *current* credence function at t, relative to a legitimate local inaccuracy measure and over the set of worlds that are epistemically possible for her at t+1 (i.e., $E$).

(P2) Local and Global Inaccuracy Measures

(P3) Probabilism

(C'') Plan Conditionalization: For any $E \subseteq W$, at t, if an agent knows that she will learn $E$ with certainty between t and t+1 and nothing else, the agent ought to plan to update her credence in every proposition $A \subseteq W$ by Conditionalization.[7)]

The sub-argument for Plan Conditionalization is also valid.[8)] That is, having the quadratic inaccuracy measures in hand, we can prove that an agent ought to *plan* to update her doxastic state by Conditionalization in order to minimize the expected inaccuracy. From now on, let us call any theory that endorses both Probabilism and Plan Conditionalization *Weak Bayesianism*.

As pointed out above, one might plausibly claim that Leitgeb and Pettigrew's argument for Bayesianism fails to convince us because no strong *diachronic* principle, like P1', follows from the expected inaccuracy-minimizing intuitions that they appeal to. What about Weak Bayesianism? That is, does Leitgeb and Pettigrew's argument, which consists of (i) and (iii), successfully justify Weak Bayesianism? Unfortunately, it does not because, as I will explain below in detail, on the assumption of a plausible view on permissive epistemic rationality (described in Section 4.1), it is unsound: (P2) is false.

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7) Pettigrew (2016: 187) suggests a different version of Plan Conditionalization. In this paper, I restrict my discussion on the version of Plan Conditionalization which relies on P2 to justify it.

8) See Easwaran (2013) for the proof.

### 3.1. Leitgeb and Pettigrew's Argument for Local and Global Inaccuracy Measures

Leitgeb and Pettigrew provide three separate arguments, each of which shows that Local and Global Inaccuracy Measures follow from the five premises that, according to them, any *legitimate* local and global inaccuracy measures should satisfy. Let us restrict our attention to their first argument, which appeals to what Leitgeb and Pettigrew call *Agreement on Inaccuracy* (described below). Nothing will hinge on this restriction. My objection to the argument will apply to Leitgeb and Pettigrew's other two arguments for Local and Global Inaccuracy Measures as well, because the problem with each is the same.[9] Here are its first four premises (pp. 219-221):

L&P$_1$: (Local Normality and Dominance) For any $A \subseteq \boldsymbol{W}$, $x \in \boldsymbol{R}^+$, and $w_i \in \boldsymbol{W}$, the inaccuracy of credence $x$ in proposition $A$ at $w$ ought to depend only on the distance between $x$ and the truth value of $A$ at $w_i$; local inaccuracy increases as this distance increases.

L&P$_2$: (Global Normality and Dominance) For any $c \in \boldsymbol{C_W}$ and $w_i \in \boldsymbol{W}$, the inaccuracy of credence function $c$ at $w_i$ ought to depend only on the Euclidean distance between

9) I will show that an intrapersonal permissivist has good epistemic reason to reject Agreement on Inaccuracy. A similar intrapersonal permissivistic objection can be applied to the other two arguments that appeal to what Leitgeb and Pettigrew call *Separability of Global Inaccuracy* and *Agreement on Directed Urgency*, respectively, since the problem lies in an implicit assumption on permissive rationality shared by all three arguments. So the objections against the other two arguments that appeal to what Leitgeb and Pettigrew call *Separability of Global Inaccuracy* and *Agreement on Directed Urgency*, respectively, are exactly analogous and can be easily reconstructed from the objection against *Agreement on Inaccuracy*.

the vector representation of $c$ and the vector representation of $w_i$; global inaccuracy increases as this distance increases.

L&$P_3$: (Local and Global Comparability) Any function on the real numbers that gives rise to a legitimate local inaccuracy measure also gives rise to a legitimate global inaccuracy measure and vice versa.

L&$P_4$: (Minimum Inaccuracy) Any function that gives rise to a legitimate local inaccuracy measure and a legitimate global inaccuracy measure takes the value of zero when the distance between truth value and credence or between world and credence function is zero.

As Pettigrew (2016: 36) points out, L&$P_1$, L&$P_2$, and L&$P_4$ are “about what local and global inaccuracy supervene upon,” and L&$P_3$ is about “how the local and global measures of inaccuracy should interact.” To illustrate each premise, let us consider the following simple example. Suppose that you have a coin that has been tossed. Suppose further that you have not observed the result of the toss yet, and so you are not sure whether ($H$) it lands heads or ($T$) it lands tails. Let ***W’*** be the following set of mutually exclusive and jointly exhaustive possible states of the world in question:

***W’*** = $\{w_1, w_2\}$, where
$w_1$: the coin lands heads
$w_2$: the coin lands tails

You have a doxastic state over the power set of ***W’***. Let $c'$ be your credence function that represents your doxastic state over the power set of ***W’*** as follows: $c'(\{w_1\}) = x_1 \in \boldsymbol{R}^+$; $c'(\{w_2\}) = x_2 \in \boldsymbol{R}^+$. Thus, $c'(H) = x_1$ and $c'(T) = x_2$ as well, since $H = \{w_1\}$ and $T = \{w_2\}$.

Then, L&$P_1$ implies that $I(H, w_1, x_1) = f(|t_H(w_1) - x_1|)$, where $f$ is a strictly increasing function from $\boldsymbol{R}^{+}$ to $\boldsymbol{R}^{+}$.

L&P$_2$ implies that $G(c', w_1)$ = $g(\sqrt{(t_{\{w_1\}}(w_1)-x_1)^2+(t_{\{w_2\}}(w_1)-x_2)^2})$, where $g$ is a strictly increasing function from $\boldsymbol{R}^{+}$ to $\boldsymbol{R}^{+}$.

L&P$_3$ implies that if $I(H, w_1, x_1) = f(|t_H(w_1) - x_1|)$ is a legitimate local inaccuracy measure, then $G(c', w_1)$ = $f(\sqrt{(t_{\{w_1\}}(w_1)-x_1)^2+(t_{\{w_2\}}(w_1)-x_2)^2})$ is also a legitimate global inaccuracy measure; if $G(c', w_1)$ = $g(\sqrt{(t_{\{w_1\}}(w_1)-x_1)^2+(t_{\{w_2\}}(w_1)-x_2)^2})$ is a legitimate global inaccuracy measure, then $I(H, w_1, x_1) = g(|t_H(w_1) - x_1|)$ is also a legitimate local inaccuracy measure.

L&P$_4$ implies that if $I(H, w_1, x_1) = f(|t_H(w_1) - x_1|)$ is a legitimate local inaccuracy measure, then $f(0) = 0$; if $G(c', w_1)$ = $g(\sqrt{(t_{\{w_1\}}(w_1)-x_1)^2+(t_{\{w_2\}}(w_1)-x_2)^2})$ is a legitimate global inaccuracy measure, then $g(0) = 0$.

As Leitgeb and Pettigrew point out, even though L&P$_1$, L&P$_2$, L&P$_3$, and L&P$_4$ constrain what they call *the class of legitimate inaccuracy measures*, these four premises open the possibility that two inaccuracy measures (i.e., a local inaccuracy measure and a global inaccuracy measure) lead us to *conflicting* epistemic evaluations. That is, for some strictly increasing function $f$, some credence function $c \in \boldsymbol{C_W}$, and some possible world $w_i \in \boldsymbol{W}$, even if both the global inaccuracy measure $G$ and its counterpart local inaccuracy measure $I$ are defined by $f$, $G$ and $I$ yield different values for the inaccuracy of $c$ at $w_i$ in a way that $G(c, w_i) \neq \sum_j I(\{w_j\}, w_i, c(\{w_j\}))$, where $w_j \in \boldsymbol{W}$. Thus, it is possible that $f(\sqrt{(t_{\{w_1\}}(w_1)-x_1)^2+(t_{\{w_2\}}(w_1)-x_2)^2}) \neq f(|t_{\{w_1\}}(w_1)-x_1|) + f(|t_{\{w_2\}}(w_1)-x_2|)$. For instance, when = 0.7, = 0.4, and $f(x) = x^3$, $f$

$(\sqrt{(t_{\{w_1\}}(w_1)-x_1)^2+(t_{\{w_2\}}(w_1)-x_2)^2}) = 0.125 \neq f(|t_{\{w_1\}}(w_1)-x_1|) + f(|t_{\{w_2\}}(w_1)-x_2|) = 0.091$.

Given *no* principled way of relating the global and local way of determining the inaccuracy of a credence function at a possible world, the global inaccuracy measure and its counterpart local inaccuracy measure can yield *conflicting* outcomes about the inaccuracy of some credal state.

In order to exclude such a possibility, Leitgeb and Pettigrew suggest the following condition as the fifth premise for their argument:

> $L\&P_5$: (Agreement on Inaccuracy) For any $c \in \boldsymbol{C_W}$ and $w_i \in \boldsymbol{W}$, if $G$ and $I$ are generated by the same strictly increasing function $f$, $G(c, w_i) = \sum_j I(\{w_j\}, w_i, c(\{w_j\}))$, where $w_j \in \boldsymbol{W}$.

$L\&P_5$ says that if the global inaccuracy measure and its counterpart local inaccuracy measure are generated by the same strictly increasing function $f$, then the global inaccuracy of $c$ at $w_i$ should be equal to the sum of the local inaccuracies of $c(\{w_j\})$ at $w_i$, where $w_j \in \boldsymbol{W}$.

Local and Global Inaccuracy Measures deductively follow from the five premises $L\&P_1$ - $L\&P_5$.[10)] Thus, on the assumption of Accuracy-First Epistemic Utility, if each of the five premises is independently justified as a condition that any legitimate inaccuracy measure must satisfy, the quadratic inaccuracy measures (i.e., the Brier scores) would be justified. And, as already pointed out, given Local and Global Inaccuracy Measures, Probabilism deductively follows from Accuracy (Synchronic expected local), Conditionalization deductively follows from Accuracy (Diachronic expected local) and

10) See Leitgeb and Pettigrew (2010a) for the proof.

Probabilism, and Plan Conditionalization deductively follows from Accuracy (Synchronic Plan expected local) and Probabilism.

Do Leitgeb and Pettigrew (2010a) succeed in justifying Local and Global Inaccuracy Measures? No, as I will explain below in detail, $L\&P_5$ crucially depends on a particular view on permissive epistemic rationality.

## 4. An Intrapersonal Permissivist's Worry

There are some issues whether $L\&P_2$ is well justified or not.[11] However, let's set aside those issues for now. My objection to Leitgeb and Pettigrew's arguments does not rely on whether $L\&P_2$ is well justified or not. We can show that, even if $L\&P_2$ is taken for granted, Leitgeb and Pettigrew's arguments fail to provide *at least* some *permissivists* with a good epistemic reason for Local and Global Inaccuracy Measures. Why? $L\&P_5$ assumes a strong connection between the global inaccuracy measure and its counterpart local inaccuracy measure, and, given a particular version of Permissivism, we have a good epistemic reason to reject it. To illustrate this, let me first briefly explain what *Permissivism* and *Impermissivism* are.

### 4.1. Permissivism and Impermissivism

Some philosophers endorse the following epistemic principle:

> Evidential Impermissivism: for any total evidence *E*, there is a unique doxastic state, which a possible agent with that total evidence *E* should take.[12]

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[11] See Leitgeb and Pettigrew (2010a: 203-5) for the illustration.

They call this ‘Evidential Impermissivism’ (‘Impermissivism’ for short), because it implies that *no* total evidence could be *permissive* for rational doxastic states.

However, other philosophers endorse the following epistemic principle:

> Evidential Permissivism: for some total evidence *E*, there are multiple doxastic states, any one of which a possible agent with that total evidence *E* can rationally take.[13]

They call this ‘Evidential Permissivism’ (‘Permissivism’ for short), because it implies that some total evidence could be *permissive* for rational doxastic states. It is noteworthy that there are two kinds of Permissivism: Intrapersonal Permissivism and Interpersonal Permissivism.[14] According to Intrapersonal Permissivism, some total evidence is permissive with respect to *the range of rational doxastic states* open to a particular agent with that total evidence, whereas, according to Interpersonal Permissivism, no total evidence is permissive in such a way. To put it another way, as Jackson (forthcoming: 2) points out, according to Intrapersonal Permissivism, “there are evidential situations in which a single agent can rationally adopt more than one doxastic attitude toward a proposition”; according to Interpersonal Permissivism, “there are evidential situations in which two (or more) agents can rationally adopt more than one doxastic attitude toward a proposition.” To illustrate, suppose that two rational agents, called Adam and Bill, share the

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12) For instance, see Feldman (2007); White (2005, 2014); Christensen (2007); Schultheis (2018).

13) For instance, see Kelly(2014); Schoenfield (2014, 2019); Meacham (2014); Jackson (forthcoming)

14) This distinction is from Kelly (2014).

total evidence. Intrapersonal Permissivism is illustrated by the case where Adam and Bill each have multiple permissible doxastic states. Interpersonal Permissivism is illustrated by the case where Adam and Bill have different doxastic states that are *uniquely* permissible for Adam and Bill, respectively. Last, in contrast to Permissivism, Impermissivism is illustrated by the case where there is a unique credal state that Adam and Bill should take.

### 4.2. An Intrapersonal Permissvist's Objection against Agreement on Inaccuracy

Let us now return to our main question: Do Leitgeb and Pettigrew convince us to endorse $L\&P_5$ (Agreement on Inaccuracy)? No, on the assumption of Intrapersonal Permissivism, we have good epistemic reason to reject $L\&P_5$. In this paper, I will not evaluate the merits of Intrapersonal Permissivism per se.[15] My purpose here is to show that the following conditional claim is true: If Intrapersonal Permissivism is true, Leitgeb and Pettigrew's $L\&P_5$ is false.

To illustrate, suppose that Intrapersonal Permissivism holds in the following way: There is some total evidence $E_1$ that is permissive with respect to the range of two different rational doxastic states, $D_1$ and $D_2$, that are open to a particular agent with that total evidence $E_1$. Suppose further that, according to the global inaccuracy measure $G$, the inaccuracy of $D_1$ at $w_1 \in E_1$ is a minimum. However, according to its counterpart local inaccuracy measure $I$, the inaccuracy of $D_2$ at the same possible world $w_1$ is a minimum. For instance, when $D_1 = (0.8, 0.8)$, $D_2 = (0.4, 0.6)$, and $f(x) = x^3$, according to the

15) See Jackson (forthcoming) and Li (2019) for the merits of Intrapersonal Permissivism. They focus on all-or-nothing beliefs but, I think, most of what they say can be applied to credences as well.

global inaccuracy measure $G$, the inaccuracy of $D_1$ at $w_1$ is 0.5607 and the inaccuracy of $D_2$ at $w_1$ is 0.610; according to the local inaccuracy measure $I$, however, the inaccuracy of $D_1$ at $w_1$ is 0.52 and the inaccuracy of $D_2$ at $w_1$ is 0.432, where $w_1 \in E_1$.[16] Figure 1 illustrates the set of credence functions that, according to the global inaccuracy measure, are less accurate than (0.8, 0.8) but, according to the local inaccuracy measure, are more accurate than (0.8, 0.8).

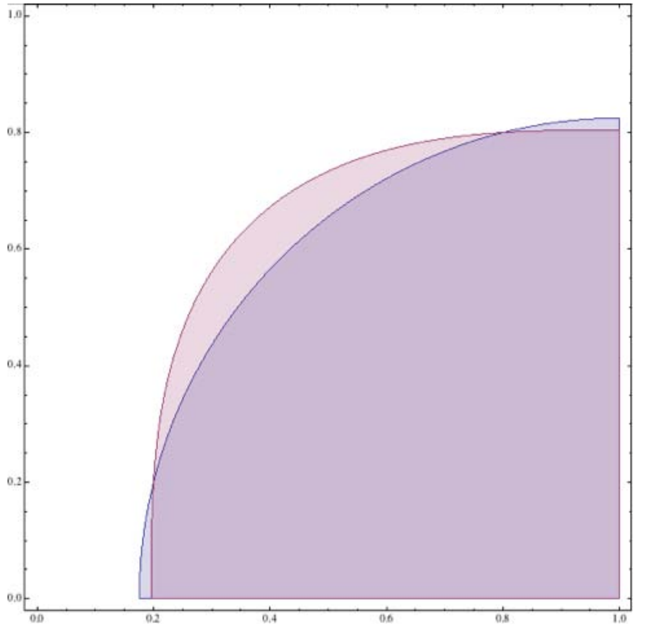


**Figure 1** The two arcs represent the credence functions that are exactly accurate as (0.8, 0.8) at $w_1$ according to the global inaccuracy measure and local inaccuracy measure. Thus, the points that lie between them represent exactly the credence functions that, according to the global (local) inaccuracy

16) It should be noted that the defenders of L&$P_5$ cannot accuse us here of adopting the incoherent doxastic state $D_1$ = (0.8, 0.8), because Probabilism is justified by appealing to L&$P_5$.

measure, are more accurate than (0.8, 0.8) at $w_1$ and, according to the local (global) inaccuracy measure, are less accurate than (0.8, 0.8) at $w_1$.

In such a case, even if the global inaccuracy measure and its counterpart local inaccuracy measure yield *conflicting* outcomes about the inaccuracy of $D_1$ (and $D_2$), we have good epistemic reason to regard both the global inaccuracy measure and its counterpart local inaccuracy measure as *legitimate* inaccuracy measures. Why? Because, by assumption, both $D_1$ and $D_2$ are epistemically rational.

Of course, it is assumed here that there is a strong connection between epistemic rationality and (in)accuracy. That is, the following is assumed:

> Accuracy-First Rationality: epistemic rationality is solely grounded on (in)accuracy.

Accuracy-First Rationality is at least controversial.[17] However, Leitgeb and Pettigrew endorse a strong connection between epistemic rationality and (in)accuracy. Thus, given some possible evidential situations where Intrapersonal Permissivism holds, we have good epistemic reason to reject L&P$_5$.

Leitgeb and Pettigrew (2010a: 222-3) argue that if the global inaccuracy measure and its counterpart local inaccuracy measure yield conflicting outcomes about the inaccuracy, we would face “an unacceptable epistemic dilemma.” So they claim that, in order to avoid it, we should accept L&P$_5$ (Agreement on Inaccuracy). However, in an epistemic situation where Intrapersonal Permissivism and Accuracy-First Rationality hold, as pointed out above, it is

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[17] For instance, see Easwaran and Fitelson (2012), Levinstein (2015), and Christensen (2016).

rationally permissible that the two inaccuracy measures yield different outcomes.

One might claim that there is a natural reply to my objection, which is worth at least briefly addressing now. It is noteworthy that Leitgeb and Pettigrew assert the following two norms:

> Accuracy (Expected local): An agent ought to minimize the expected local inaccuracy of her credences in all propositions $A \subseteq \boldsymbol{W}$ relative to a legitimate measure of local inaccuracy.
>
> Accuracy (Expected global): An agent ought to minimize the expected global inaccuracy of her credence function relative to a legitimate measure of global inaccuracy.[18)]

Given both of these norms, every rational agent would have to minimize expected inaccuracy with respect to both. Thus, given the two norms, the intrapersonal permissive case, where it is possible for a *rational* agent to minimize local (or global) but not global (or local) expected inaccuracy, would be impossible.

However, why should we accept both of these two norms as rational constraints? Leitgeb and Pettigrew do not provide any epistemic reason for the claim that all rational agents must minimize both local and global expected inaccuracy. Thus, an intrapersonal permissivist could say that, without such an epistemic reason, the reply begs the question. Moreover, Leitgeb and Pettigrew themselves concede that, in certain cases, it does not seem that both norms are satisfiable.[19)]

I have argued that if Intrapersonal Permissivism is true, L&$P_5$ is false. Because Local and Global Inaccuracy Measures deductively follow from L&$P_1$ - L&$P_5$, Leitgeb and Pettigrew's argument for

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18) Leitgeb and Pettigrew (2010a: 206-207).

19) See Leitgeb and Pettigrew (2010a: 221-229).

Local and Global Inaccuracy Measures fails to give us a good reason to accept it. And, without Local and Global Inaccuracy Measures in hand, of course, (Weak) Bayesianism is not successfully justified in the accuracy-based way to which Leitgeb and Pettigrew appeal.

## 5. Propriety and Intrapersonal Permissivism

I have shown that if Intrapersonal Permissivism is true, Leitgeb and Pettigrew's argument for Local and Global Inaccuracy Measures (i.e., the Brier score) is unsound. However, is the Brier score necessary to justify (Weak) Bayesianism? One might claim that (Weak) Bayesianism would be successfully justified in the accuracy-based way, if Local and Global Inaccuracy Measures were replaced by the following more general claim (P2'):

(P2') Propriety: All legitimate inaccuracy measures are *proper* scoring rules.

What are *proper* scoring rules? Let $\boldsymbol{P}_{\boldsymbol{W}}$ be a set of all probability functions from the power set of $\boldsymbol{W}$ (or propositions) to the non-negative real numbers $\boldsymbol{R}^+$. To say that an inaccuracy measure $M$ is (strictly) *proper* is to say that for any $p \in \boldsymbol{P}_{\boldsymbol{W}} \subset \boldsymbol{C}_{\boldsymbol{W}}$ and any $c \in \boldsymbol{C}_{\boldsymbol{W}}$, $EM_p(p) = \sum_{w \in \boldsymbol{W}} p(w) \cdot M(p, w) \leq EM_p(c) = \sum_{w \in \boldsymbol{W}} p(w) \cdot M(c, w)$, with equality if and only if $p = c$. That is, for any $p \in \boldsymbol{P}_{\boldsymbol{W}}$, if an agent's current doxastic state is represented by $p$ whose inaccuracy is measured by a *proper* inaccuracy measure, then the agent would expect $p$ to be the least inaccurate one from the perspective of $p$ itself.

As is well known, the Brier score is *proper*. However, there are several *proper* ways of measuring inaccuracy. For instance, the logarithmic score and the spherical score are also *proper*.[20] And the argument for (Weak) Bayesianism might still work if these scoring rules rather than the Brier were used. Indeed, many epistemic utility theorists explicitly or implicitly assume Propriety to justify epistemic principles such as Probabilism and (Plan) Conditionalization.[21]

However, why should we accept Propriety? Some philosophers have offered plausible objections to Propriety.[22] More importantly, is Intrapersonal Permissivism compatible with Propriety? If not, intrapersonal permissivists would reject Propriety. In this section, I will focus on the latter question.

To see how Intrapersonal Permissivism relates to Propriety, let $Acc^A{}_p$ be the set of doxastic states that are the most accurate by the light of an agent, A, whose *current* doxastic state is $p \in \boldsymbol{P}_W$ ($A_p$ for short); let $Per^A{}_{p,\ E}$ be the set of doxastic states that are epistemically permissible to $A_p$ whose total evidence is $E \subseteq W$.

According to Propriety, each probabilistically coherent agent expects her doxastic state to be the most accurate one, relative to her own current doxastic state. That is, according to Propriety, for any $A_p$, $Acc^A{}_p = \{p\}$. Intrapersonal Permissivism says that some total evidence $E$ is epistemically permissive with respect to *the range of rational doxastic states* open to a particular agent with that total evidence $E$. Thus, according to Intrapersonal Permissivism, if $A_p$'s total evidence is intrapersonally permissive, there is a range of multiple doxastic states that are epistemically permissible to $A_p$. That

20) See Joyce (2009) for various proper scoring rules.

21) See Easwaran (2013); Greaves and Wallace (2006); Joyce (2009); Myrvold (2012).

22) For instance, see Blackwell and Drucker (2019) and Pettigrew (2017: 40-46).

is, Intrapersonal Permissivism implies that there is total evidence $E$ such that $|Per^{A}_{p,\ E}| > 1$.

And, as pointed out in Section 4.2, Accuracy-First Rationality says that epistemic rationality is grounded solely on (in)accuracy. Let's call those who endorse Accuracy-First Rationality *accuracy-firsters*. Most accuracy-firsters are likely to endorse the following:

> Accuracy-Permissive Rationality$_1$: for any $E \subseteq W$ and for any $p \in \boldsymbol{P}_W$, if A's current doxastic state is $p$ and her total evidence is $E$, $Per^{A}_{p,\ E} = Acc^{A}_{p}$.

Accuracy-Permissive Rationality$_1$ is about how accuracy relates to permissive epistemic rationality. According to Accuracy-Permissive Rationality$_1$, for a probabilistically coherent agent $A_p$ with the total evidence $E$, the set of epistemically permissible doxastic states to $A_p$ is the set of doxastic states that are the most accurate by the light of $A_p$.

It is obvious that Propriety, Intrapersonal Permissivism, and Accuracy-Permissive Rationality$_1$ jointly yield a contradiction, because, given Propriety and Accuracy-Permissive Rationality$_1$, for any $A_p$, whatever $A_p$'s total evidence is, $|Per^{A}_{p,\ E}| = 1$. That is, given Propriety and Accuracy-Permissive Rationality$_1$, whatever $A_p$'s total evidence is, the epistemically permissible doxastic state for $A_p$ to adopt is unique. Thus, on the assumption of Accuracy-Permissive Rationality$_1$, Intrapersonal Permissivism is *incompatible* with Propriety. Given Accuracy-Permissive Rationality$_1$, of course, intrapersonal permissivists would reject Propriety. Thus, on the assumption of Accuracy-Permissive Rationality$_1$, intrapersonal permissivists could not justify (Weak) Bayesianism by using proper scoring rules.

In order to circumvent the contradiction, however, intrapersonal permissivists do not have to reject Propriety, but could instead weaken Accuracy-Permissive $\text{Rationality}_1$ as follows:

> Accuracy-Permissive $\text{Rationality}_2$: for any $E \subseteq W$ and for any $p \in \boldsymbol{P}_W$, if A's current doxastic state is $p$ and her total evidence is $E$, $Per^A_{p,\ E} = \bigcup_{x \in \{p\} \cup DA_p} Acc^A_x$, where $DA_p$ is the set of doxastic states that $A_p$'s *epistemic doppelgängers* adopt.

Accuracy-Permissive $\text{Rationality}_2$ says that, for any $A_p$ with $E$, a doxastic state is epistemically permissible to $A_p$ so long as it is the most accurate by the light of $A_p$ or one of $A_p$'s epistemic doppelgängers. But what are $A_p$'s epistemic doppelgängers? They share a set of cognitive properties that $A_p$ has, but adopt different credence functions. That is, $A_p$'s epistemic doppelgängers adopt different doxastic states, but they are as epistemically rational (or epistemically irrational) as $A_p$ is, share total evidence with $A_p$ at every time, and adopt the same system of epistemic evaluation that $A_p$ adopts.

It is obvious that, in contrast to Accuracy-Permissive $\text{Rationality}_1$, on the assumption of Accuracy-Permissive $\text{Rationality}_2$, Intrapersonal Permissivism is *compatible* with Propriety unless, for any $A_p$, whatever $A_p$'s total evidence is, $DA_p$ is a null set.[23] That is, for some $A_p$ with total evidence $E$, if $|DA_p| \geq 1$, then $|Per^A_{p,\ E}| \geq 2$, even though, for each $x \in DA_p$, $|Acc^A_x| = 1$ by Propriety.

However, Accuracy-Permissive $\text{Rationality}_2$ has an implausible implication: Given Accuracy-Permissive $\text{Rationality}_2$, for any agent $A_p$, which doxastic states are epistemically permissible to $A_p$ is constrained by her current doxastic state, $p$, and her *epistemic*

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[23] It is obvious that, for any $A_p$, whatever $A_p$'s total evidence is, if $DA_p$ is a null set, Accuracy-Permissive $\text{Rationality}_2$ is equivalent to Accuracy-Permissive $\text{Rationality}_1$.

*doppelgängers'* doxastic states rather than by her total evidence. To illustrate, suppose that there is an agent $A_p$ such that, whatever her total evidence is, the union of $\{p\}$ and $D_{A_p}$ is unchanged. That is, $A_p$ and her epistemic doppelgängers are extremely epistemically conservative: for any $E \subseteq W$, even if $A_p$ and her epistemic doppelgängers newly learn $E$, they do not change their doxastic states. In such a case, Accuracy-Permissive Rationality$_2$ implies that, whatever $A_p$'s total evidence is, the set of permissible doxastic states for $A_p$ to adopt is unchanged. This is hard to accept, because (total) evidence does not constrain the permissible doxastic states for $A_p$ to adopt at all.

In order to avoid the problem (or similar ones), I think, (total) evidence properly needs to constrain $A_p$ and $A_p$'s epistemic doppelgängers in the first place. However, what does it mean that (total) evidence properly constrains $A_p$ and $A_p$'s epistemic doppelgängers? It means, I think, that (total) evidence screens off any *epistemically irrational* epistemic agents. Thus, if we are to be careful, we should make it explicit that, if there are $A_p$ and $A_p$'s epistemic doppelgängers, they should be *epistemically rational*. We can do so by replacing "epistemic doppelgängers" with "rational epistemic doppelgängers" in Accuracy-Permissive Rationality$_2$. When we make this substitution, we arrive at:

> Accuracy-Permissive Rationality$_3$: for any $E \subseteq W$ and for any $p \in \boldsymbol{P}_W$, if A's current doxastic state is $p$ and her total evidence is $E$, $Per^A_{p,\ E} = \bigcup_{x \in \{p\} \cup RDA_p} Acc^A_x$, where $RDA_p$ is the set of doxastic states that $A_p$'s *rational epistemic doppelgängers* adopt.

Since we assume that, for any $A_p$, $A_p$'s epistemic doppelgängers are as epistemically rational (or irrational) as $A_p$ is, Accuracy-Permissive

Rationality$_3$ implies that $A_p$ is also epistemically rational.

It is obvious that, on the assumption of Accuracy-Permissive Rationality$_3$ (like Accuracy-Permissive Rationality$_2$), Intrapersonal Permissivism is also *compatible* with Propriety unless $RDA_p$ is a null set. Moreover, Accuracy-Permissive Rationality$_3$ is (unlike Accuracy-Permissive Rationality$_2$) free from the above problem (or similar ones). Thus, one may accept Accuracy-Permissive Rationality$_3$ and claim that, on the assumption of Intrapersonal Permissivism, (Weak) Bayesianism can be justified by using proper scoring rules.

However, do $A_p$'s *rational* epistemic doppelgängers exist? Moreover, on the assumption of Accuracy-First Rationality and Propriety, if accuracy-firsters endorse the compatibility of Propriety with Intrapersonal Permissivism by appealing to Accuracy-Permissive Rationality$_3$, they would be committed to a circular reasoning. To see this, note that, according to Accuracy-First Rationality, epistemic rationality is grounded solely on accuracy, which, according to Propriety, should be measured by proper scoring rules. And, as Accuracy-Permissive Rationality$_3$ clearly shows, the compatibility of Propriety with Intrapersonal Permissivism relies on the existence of epistemically *rational* agents ($A_p$ and $A_p$'s epistemic doppelgängers). But what does it mean that $A_p$ and $A_p$'s epistemic doppelgängers are epistemically rational? In order for accuracy-firsters to answer this question, they have to appeal to Accuracy-First Rationality again.

There could be other ways on which Intrapersonal Permissivism is *compatible* with Propriety. However, I think, in order for accuracy-firsters to avoid the above problem, those other versions also have to appeal to rational agents. Thus, given Accuracy-First Rationality and Propriety, those other versions would also be subject to the circular reasoning in a similar way.[24]

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24) Note that Accuracy-Permissive Rationality$_1$ has an implausible implication

To sum up, then, on the assumption of Accuracy-Permissive $\text{Rationality}_1$, Intrapersonal Permissivism is *incompatible* with Propriety. Thus, given Accuracy-Permissive $\text{Rationality}_1$, an intrapersonal permissivist would reject Propriety. In contrast, on the assumption of Accuracy-Permissive $\text{Rationality}_2$ or Accuracy-Permissive $\text{Rationality}_3$, Intrapersonal Permissivism is *compatible* with Propriety. But Accuracy-Permissive $\text{Rationality}_2$ has the implausible implication that evidence does not constrain the permissible doxastic states at all and, on the assumption of Accuracy-First Rationality, Propriety, and Accuracy-Permissive $\text{Rationality}_3$, the compatibility of Intrapersonal Permissivism with Propriety leads us to the circular reasoning. Therefore, if Intrapersonal Permissivism is true, any accuracy-first arguments for (Weak) Bayesianism that depend on Propriety would be unsuccessful.

## 6. Conclusion

In this paper, I have not intended to provide an argument for Intrapersonal Permissivism. My purpose here is to show that, on the

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in a similar way: Given Accuracy-Permissive $\text{Rationality}_1$, for any $A_p$, which doxastic state is epistemically permissible to $A_p$ is constrained by $p$ rather than by $A_p$'s total evidence. Thus, in order to avoid the above problem, if we replace '$A_p$' with 'epistemically rational $A_p$' in Accuracy-Permissive $\text{Rationality}_1$, we would be committed to a circular reasoning in a similar way. However, as already pointed out, an intrapersonal permissivist who wishes to justify (weak) Bayesianism by appealing to Propriety has more strong reason not to endorse Accuracy-Permissive $\text{Rationality}_1$: On the assumption of Accuracy-Permissive $\text{Rationality}_1$ (whether $A_p$ is epistemically rational or not), Intrapersonal Permissivism is *incompatible* with Propriety.

assumption of Accuracy-First Rationality, the following two conditional claims are true:

(i) If Intrapersonal Permissivism is true, Leitgeb and Pettigrew’s argument for (Weak) Bayesianism would be unsuccessful;
(ii) More generally, if Intrapersonal Permissivism is true, any accuracy-first arguments that rely on Propriety would be unsuccessful.

As is well known, Propriety is one of the minimum requirements in EUT, and Accuracy-First Rationality is generally assumed in EUT. Thus, my results show that many of the results of EUT rely crucially on a particular view of permissive rationality.

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| 논문 투고일 | 2020. 10. 23 |
| 심사 완료일 | 2020. 11. 17 |
| 게재 확정일 | 2020. 11. 17 |

# 범위 허용주의와 인식적 효용에 기반한 베이즈주의 옹호 논증

정재민

라이트겝과 페티그루는 인식적 효용에 기반한 베이즈주의 옹호 논증을 제시했다. 이 논문은 다음 두 주장이 참이라는 것을 보이고자 한다: (i) 만약 범위 허용주의가 참이라면, 라이트겝과 페티그루의 논증은 건전하지 않다; (ii) 보다 일반적으로, 만약 범위 허용주의가 참이라면, 적절성 조건에 의존하는 어떠한 인식적 효용에 기반한 베이즈주의 옹호 논증도 성공적일 수 없다.

**핵심어:** 범위 허용주의, 인식적 효용, 적절성 조건