CONDITIONALIZATION AND ESSENTIALLY INDEXICAL CREDENCE[*]

1. Introduction

Those with a broadly Bayesian perspective have often claimed that an ideally rational

agent ought, upon becoming newly certain of the truth of a proposition *e* (and nothing

stronger), to alter her credence in each other proposition *h* by conditionalization—adopting, as

her new credence for *h*, her prior credence for *h* conditional on *e*. While this "principle of

conditionalization" is a normative principle regarding how our opinions ought to be revised

upon the receipt of new knowledge, it is closely linked with a natural account of when such

knowledge counts as evidence for another proposition. For according to a standard account of

incremental confirmation, *e* confirms *h* when $P(h/e) > P(h)$, and one way of demonstrating that

this inequality obtains is to demonstrate that a rational agent would have a higher degree of

belief in *h* after conditionalizing on *e*.[1]

Frameworks for probabilistic epistemology have also traditionally attributed to agents

credence functions defined over propositions. More specifically, they have appealed to

---

[1] I suppress reference to background knowledge.

credence functions defined over propositions as traditionally conceived—as objects of belief or

partial belief which do not change their truth value from one time to another or from one

person to another and which are, at least in principle, cognitively accessible to all rational

agents at all times. However, it has become increasingly clear that an adequate account of our

opinions must allow that we have essentially indexical opinions which cannot be captured in

the traditional framework of propositions. Moreover, essentially temporally indexical credence

appears to raise significant new questions about the principle of conditionalization and the

related account of evidence.

Consider a clock-watcher who sits merely watching the time pass on a clock which she is

certain is perfectly accurate. She first believes that it is 1:00 PM, and then that it is 1:01 PM, and

so on. She is, it appears, certain of one proposition and then certain of an incompatible

proposition. As some have noted, such changes of credence cannot be brought about by

conditionalization.[2] However, the existence of a change of confidence not produced by

conditionalization is not itself problematic, as Bayesians have always held that one's confidence

can change other than by conditionalization—this is exactly what occurs when one makes an

observation. The difficulty, rather, is the apparent replacement of one certainty with an

incompatible certainty because if one allows that the clock-watcher has adopted full credence in

a proposition in which she previously had a zero credence, a straightforward application of the

---

[2]   See Frank Arntzenius, "Some Problems for Conditionalization and Reflection," this JOURNAL,

C (2003): 356-370, p. 367; Christopher Hitchcock, "Beauty and the Bets," *Synthese* CXXXIX

(2004): 405-420, p. 416.

principle of conditionalization would yield the absurd result that all her posterior credences should be undefined.[3]

My goal in this paper is to move some distance toward an adequate Bayesian treatment of such essentially indexical credence. Because they have so frequently been addressed together, I shall discuss both essentially temporally indexical credence (credence *de praesenti* or *de nunc*) and essentially personally indexical credence (credence *de se*). My focus, however, will be primarily on credence *de praesenti*. In particular, I will argue that the principle of conditionalization is not, as has been claimed, falsified by cases like that of the clock-watcher. Rather, I shall argue that essentially temporally indexical credence falls entirely outside the scope of the principle of conditionalization because it is impossible for the relevant object of

---

[3]   Michael Titelbaum, "The Relevance of Self-Locating Belief," *Philosophical Review* CXVII (2008): 555-605, p. 566. M. J. Schervish, T. Seidenfeld, and J. B. Kadane, suggest ("Stopping to Reflect," this JOURNAL CI (2004): 315-322) that the principle of conditionalization is best thought of as a conditional the antecedent of which requires that the information the agent has at the latter time includes all the information she had at the earlier one and which is vacuously satisfied whenever this is not the case. A difficulty with this view is that it appears to imply that, inasmuch as we always gain and lose temporally indexical information, the principle is vacuously satisfied by any change of credence.

new temporally indexical certainty to be in the domain of an agent's credence function at any prior time.[4]

In addition to saving the principle of conditionalization from counterexample, this result pays substantial dividends in connection with the Sleeping Beauty problem, for many philosophers who have addressed this problem have claimed that one can conditionalize on temporally indexical knowledge when one is, unlike the clock-watcher, initially uncertain of the time. Given the connection between conditionalization and evidential relevance just noted, this possibility would appear to justify the conclusion that essentially temporally indexical knowledge can be evidentially relevant. However, if I am right about the impossibility of conditionalizing on temporally indexical credence, not only do we have a clear diagnosis of the error in the arguments for two standard positions on Sleeping Beauty, but such a route to demonstrating evidential relevance is foreclosed.

2. *Sleeping Beauty and Essentially Temporally Indexical Knowledge*

Sleeping Beauty is informed on Sunday that she will be put into a dreamless sleep for the next two days. She will be awakened on Monday morning, shortly thereafter told that it is

---

[4]   The notion of an "object" of credence is not ideally suited to the present discussion as it applies most clearly to the second relatum in a dyadic cognitive relation between a person and a proposition while (a) a state of credence is not clearly a dyadic relation between a person and a proposition, and (b) some of the views of indexical binary belief discussed in this paper explicitly reject the dyadic propositionalist picture.

Monday and then, if the toss of a fair coin lands heads, returned to sleep until Wednesday. If the toss of the coin lands tails, she will have her memory of Monday morning erased prior to being awakened again on Tuesday morning in a state subjectively indiscernible from her Monday awakening.[5] When she awakens on Monday, what should her credence be that the coin lands heads?

'Thirders" hold that Beauty's credence that the coin lands heads should be 1/3.[6] "Halfers" maintain that it should remain 1/2.[7] Let P be Beauty's credence function immediately after

---

[5]   We must also suppose that Beauty knows on Sunday exactly what every experimental awakening will be like.

[6]   Thirders include Adam Elga, "Self-Locating Belief and the Sleeping Beauty Problem," *Analysis* LX (2000): 143-147; Cian Dorr, "Sleeping Beauty: In Defense of Elga," *Analysis* LXII (2002): 427-439; Bradley Monton, "Sleeping Beauty and the Forgetful Bayesian," *Analysis* LXII (2002): 47-53; Arntzenius, "Some Problems for Conditionalization and Reflection"; Terry Horgan, "Sleeping Beauty Awakened: New Odds at the Dawn of the New Day," *Analysis* LXIV (2004): 10-21; Ruth Weintraub. "Sleeping Beauty: A Simple Solution," *Analysis* LXIV (2004); 8-10; Hitchcock, "Beauty and the Bets"; Dennis Dieks, "Reasoning about the Future: Doom and Beauty," *Synthese* CLVI (2007): 427-439; Robert Stalnaker, *Our Knowledge of the Inner World* (New York: Oxford, 2008); Titelbaum, "The Relevance of Self-Locating Belief"; Jacob Ross, "Sleeping Beauty, Countable Additivity and Rational Dilemmas," *Philosophical Review* (forthcoming); and Luc Bovens, "Judy Benjamin is a Sleeping Beauty," *Analysis* (forthcoming).

awakening on Monday and let P^+ be her credence function immediately after she is told by the experimenters that it is Monday. Let HEADS be the proposition that the coin lands heads, MONDAY the proposition that it is now Monday, and TUESDAY the proposition that it is now Tuesday. Then the following initially plausible claims are inconsistent, given the probability calculus:

(1) $P(\text{HEADS}) = 1/2$

(2) $P^+(\text{HEADS}) = 1/2$

(3) $P^+(\text{HEADS}) = P(\text{HEADS/MONDAY})$

(4) $P(\text{HEADS/not-MONDAY}) = 0$

(5) $0 < P(\text{MONDAY}) < 1$[8]

---

[7] Halfers include David Lewis, "Sleeping Beauty: Reply to Elga," *Analysis* LXI (2001): 151-176; Nick Bostrom, "Sleeping Beauty and Self-Location: A Hybrid Model," *Synthese* CLVII (2007): 59-78; Joseph Hapern, "Sleeping Beauty Reconsidered: Conditioning and Reflection in Asynchronous Systems," *Oxford Studies in Epistemology* I (2007): 111-142; Christopher Meacham, "Sleeping Beauty and the Dynamics of *De Se* Beliefs," *Philosophical Studies* CXXXVIII (2008): 245-269; Peter Lewis, "Credence and Self-Location," *Synthese* CLXXV (2010): 369-382; Peter Hawley, "Inertia, Optimism and Beauty" *Nôus* (forthcoming); and Darren Bradley, "Self-Location is No Problem for Conditionalization," *Synthese* (forthcoming).

[8] Dorr, "Sleeping Beauty: In Defense of Elga," provides the following proof:

In light of the indiscriminability of her Monday and (possible) Tuesday awakenings and the stipulation that Beauty knows with certainty the experimental set-up, (4) and (5) are agreed by (almost) all to be unassailable. Elga and Lewis both accept (3), endorsing the view that Beauty ought to change her degree of belief in HEADS (a non-indexical proposition) upon learning MONDAY (a temporally indexical proposition). Elga accepts (2) and so must deny (1). However, Beauty was certain in advance that she would be awakened during the experiment with no recollection of a previous experimental awakening and hence intuitively seems to gain no new evidence upon awakening on Monday morning. [9] Lewis accepts (1) and so must deny

---

P(HEADS) = P(HEADS/MONDAY) * P(MONDAY) + P(HEADS/not-MONDAY) * P(not-MONDAY), by (5).

P(HEADS) = P(HEADS/MONDAY) * P(MONDAY), by (4).

P(HEADS) = P+(HEADS) * P(MONDAY), by (3).

1/2 = 1/2 * P(MONDAY), by (1) and (2).

P(MONDAY) = 1, contradicting (5).

[9]   Roger White, "The Generalized Sleeping Beauty Problem: A Challenge for Thirders," *Analysis* LXVI (2006): 114-119, argues that both Elga's argument for 1/3 and the Dorr-Arntzenius argument for 1/3 (discussed later in this paper) generalize in an unacceptable way. However, White explicitly admits that he has not diagnosed "the exact error" in either argument and provides no suggestion as to how the halfer could avoid following Lewis in

(2). However, Beauty, having been told that it is Monday, is then certain that the fair coin toss lies in the future and hence intuitively seems to have strong reason to regard heads and tails as equiprobable.[10]

Both of these counterintuitive results could be avoided if (3) is rejected. If (3) is false, then Elga's and Lewis' arguments give us no reason to reject the view, that of the so-called "double-halfer," that Beauty's credence in HEADS ought to remain 1/2 throughout her Monday awakening.[11] However, it may seem that (3) is supported by the principle of conditionalization.

---

claiming that (2) is false. I hope to have done both in this paper while also supporting the plausible verdict on White's generalization of the problem.

[10] Lewis and Elga also accept, on the basis of a "restricted principle of indifference,"

(6) P(MONDAY/TAILS) = P(TUESDAY/TAILS).

Hence, Lewis must claim that $P^+(HEADS) = 2/3$ and Elga must claim that $P(HEADS) = 1/3$.

[11] Bostrom, Halpern, Meacham, P. Lewis and Hawley also defend this "double-halfer" position, but on grounds distinct from those in the present paper. Halpern rejects (3) invoking the distinction, familiar from so-called "Thomason cases," between the P(H/E) and P(H/I learn that E), but he does not explain exactly how this distinction justifies rejecting (3). Meacham rejects (3) by arguing that an alternative updating rule, "compartmentalized conditionalization," provides more palatable results in other cases and so should be preferred to standard conditionalization. Bostrom claims that P(HEADS/MONDAY) = 2/3,

Indeed, Elga and Lewis both claim that (3) is true because Beauty should, upon learning from the experimenters that it is Monday, conditionalize on MONDAY in order to arrive at P+.[12] I'll argue that (3) cannot be so supported because it is entirely impossible to conditionalize on a temporally indexical certainty. Hence, we can accept the universal applicability of the principle of conditionalization while rejecting (3).

P+(HEADS/I now know MONDAY) = 1/2, and because P(I now know MONDAY) = 0, P(HEADS/I now know MONDAY) is undefined. However, he doesn't explain why he takes this to be consistent with a standard conditionalization principle. Hawley rejects (5) and P. Lewis rejects the proof of the inconsistency of (1) – (5) in Fn. 8, claiming that P(HEADS) ≠ P(HEADS & MONDAY).

[12] So, among others, do Dorr, Arntzenius, Dieks, Titelbaum, Bradley and Hawley. Titelbaum, in "The Relevance of Self-Locating Belief," provides an admirably clear and detailed modeling framework for *de se* and *de praesenti* credence and utilizes it to defend 1/3. However, he explicitly avoids thorough examination of the nature of indexical credence, couching his framework in terms of sentences. Titelbaum claims that, in circumstances in which the temporally indexical *sentence* representing an agent's *de praesenti* credence has (and is known to have) the same truth value at t_1 and t_2 (though it is not known what the truth value is at t_1), one can conditionalize on the new *de praesenti* certainty at t_2 (p. 583). If my arguments in the remainder of this paper are correct, Titelbaum errs in neglecting the fact that the sentence in question necessarily represents, at each distinct time, a different item in which credence is invested.

Even though they endorse Elga's original argument, Dorr and Arntzenius each provide an additional argument for 1/3. Their arguments, however, also require conditionalization on temporally indexical knowledge. In the original case, when Beauty awakens on Monday, she is certain that she is in one of the following three situations: HEADS & MONDAY, TAILS & MONDAY, and TAILS & TUESDAY. The Dorr and Arntzenius arguments each involve appeal to a variant case in which HEADS & TUESDAY is a possibility with some positive epistemic probability upon Beauty's Monday awakening. Dorr's variant case is one in which Beauty is certain that she will be awakened on both Monday and Tuesday and the coin flip determines whether she will be administered a drug that entirely erases her memories of Monday (tails) or one that merely delays their onset for one minute upon her Tuesday awakening (heads). Arntzenius' case is exactly like the original case except that Beauty is such that if she is not awakened on a given morning, she dreams that she is awakened. This dream is indistinguishable from genuine awakening except that if she "pinches herself" while dreaming, she feels nothing and does not wake up and if she pinches herself while awake, it hurts. [13]

Arntzenius and Dorr make the following claims about their respective variant cases: (I) Upon awakening on Monday, Beauty ought to have equal credence of 1/4 in HEADS & MONDAY, HEADS & TUESDAY, TAILS & MONDAY, and TAILS & TUESDAY. (II) After

---

[13] Somewhat similar arguments for 1/3, also invoking conditionalizing on temporally indexical knowledge, appear in Bovens, "Judy Benjamin is a Sleeping Beauty," and in Bovens and José Luis Ferreira, "Monty Hall Drives a Wedge Between Judy Benjamin and the Sleeping Beauty: A Reply to Bovens," *Analysis* (forthcoming).

failing to have the experience which she would certainly have if HEADS & TUESDAY were true (the flood of memories or the painless "pinch"), she ought to have 0 credence in that claim and 1/3 credence in the remaining three possibilities. (III) As Beauty has the same total (relevant) evidence at some suitable point in the original and variant cases, P(HEADS) = 1/3 in the original case [i.e. ~(1)]. Dorr and Arntzenius defend (II) with the claim that Beauty's failure to have the relevant experience *now* (or ~(HEADS & TUESDAY) which that failure entails) should be conditionalized upon.[14] If, as I shall argue, it is impossible to conditionalize upon such temporally indexical certainty, then Dorr's and Arntzenius' arguments for 1/3 also fail.[15]

3. *Conditionalization and Credence De Praesenti*

Thus far, I have referred to the objects over which Beauty's credence function is defined as "propositions." However, important features of Beauty's epistemic predicament during the course of the experiment can only be characterized indexically and, on some views of

---

[14] Arntzenius, "Some Problems for Conditionalization and Reflection," p. 364; Dorr, "Sleeping Beauty: In Defense of Elga," p. 294.

[15] As will become clearer below, I do not deny that Beauty has, in the variant cases, learned something that is inconsistent with one of the four claims about her (then) current situation. I do deny that she has ruled out an antecedently grasped possibility. Notice that if my claims about conditionalization and temporally indexical credence are correct, they also create difficulties for Arntzenius' treatment of the case of The Prisoner in "Some Problems for Conditionalization and Reflection" (pp. 357-363).

propositions, essentially indexical belief cannot be thought of as a dyadic relation relating a

person to a proposition (and, presumably, essentially indexical credence cannot be thought of as

a triadic relation relating a person to a proposition and a number from zero to one). Beauty, by

construction, knows in advance all of the non-indexical truths (and all of the merely *de se*

indexical truths) about her predicament from Sunday through Monday evening. She knows, for

example, that she will sleep Sunday night, will awaken on Monday morning without any

recollection of a previous awakening, will be told that it is Monday, will be returned to sleep,

etc. Her ignorance regarding her situation when she awakens on Monday can *only* be properly

characterized in temporally indexical terms, as ignorance of whether it is *now* Monday or *now*

Tuesday.

A great deal of ink has been spilt on the question of precisely how to understand

indexical thought. According to the extremely influential *argument from cognitive significance*,[16]

indexical statements cannot be translated into standard *de dicto* statements free of indexicals.

Two famous illustrations of this form of argument are provided by John Perry:

---

[16]   See John Perry, "The Essential Indexical," *Nôus* XIII (1979): 3-21, and H. N. Castañeda,

"On the Logic of Attributions of Self-Knowledge to Others," this JOURNAL LV (1968): 439-

456.

THE SHOPPER

I once followed a trail of sugar on a supermarket floor, pushing my cart down

the aisle on one side of a tall counter and back the aisle on the other, seeking the

shopper with the torn sack to tell him he was making a mess. With each trip

around the counter, the trail became thicker. But I seemed unable to catch up.

Finally it dawned on me. I was the shopper I was trying to catch. I believed at

the outset that the shopper with a torn sack was making a mess. And I was right.

But I didn't believe that I was making a mess. That seems to be something I came

to believe. (p. 3)

THE MEETING

[A] professor, who desires to attend the department meeting at noon, sits

motionless in his office at that time. Suddenly, he begins to move. What

explains his action? A change in belief. He believed all along that the

department meeting starts at noon; he came to believe . . . that the meeting starts

now. (p. 4).

Perry argues that there is no acceptable *de dicto* translation of the shopper's new belief free of the

personal indexical 'I' and no acceptable *de dicto* translation of the professor's new belief free of

the temporal indexical 'now.' In particular, Perry claims that no account free of the relevant

indexicals has the appropriate rationalizing explanatory force. These sorts of cases are the

standard justification of the claim (which I assume in what follows) that at least some knowledge is "essentially indexical."

According to a standard formulation of the principle of conditionalization, when one learns e (and nothing stronger) at t_2, $P_{t2}(h)$ should be equal to one's previous degree of belief in h conditional on e, i.e. $P_{t1}(h/e)$. The principle of conditionalization, then, requires that the proposition newly certain at t_2 *had some value in one's prior credence distribution* at t_1. Hence, if there is some reason why even an ideally rational agent must lack *any* prior credence (even zero) for some proposition of which she becomes certain, then it will be impossible to conditionalize on that proposition. In the next section, I shall show that on the most straightforward account of temporally indexical knowledge, it cannot be conditionalized on for precisely this reason. I'll then turn, in subsequent sections, to the two main alternative accounts of indexical belief and, by extension, degrees of belief. It will turn out that each of these alternative accounts of indexical credence requires compensatory alterations to the synchronic and diachronic constraints on rational credence and that each suitably modified principle of conditionalization also precludes conditionalizing on temporally indexical credence. Given that the major frameworks for understanding indexical opinions preclude such conditionalization, we have strong reasons for thinking it impossible.

4. *Propositions of Limited Temporal Accessibility*

The most straightforward way of dealing with the phenomena of essential personal and temporal indexicality, and the only one that clearly preserves the traditional view that belief is a

dyadic relation between a person at a time and a proposition,[17] is simply to accept that there are *propositions of limited accessibility*—propositions which only a particular person can grasp or which can only be grasped at particular times.[18] Though Perry rejects the view, he provides a nice summary of its central tenets,

> One may take all that has been said so far as an argument for the existence of a
>
> special class of propositions, propositions of limited accessibility. . . . [A]t noon
>
> on the day of the meeting, we could all express the proposition the tardy
>
> professor expressed by those words at that time. But once that time has past, the

---

[17] Some who reject propositions of limited accessibility hold that *belief* is a dyadic relation between a person and a proposition but claim that it holds only when a different triadic relation with an additional relatum holds. Rational belief doesn't, on this picture, behave in traditional ways but rather behaves in ways governed by the underlying triadic relation. See Section 5 for further discussion.

[18] For acceptance of propositions of limited accessibility see Roderick Chisholm, *Person and Object* (La Salle, IL: Open Court, 1976); Christopher Peacocke, "Demonstrative Thought and Psychological Explanation," *Synthese* XLIX (1981): 187-217; John Pollock, *Language and Thought* (Princeton, NJ: Princeton, 1982); Graeme Forbes, "Indexicals and Intensionality: A Fregean Perspective," *Philosophical Review* XCVI (1987): 3-31; Peter Markie, "Multiple Propositions and 'De Se' Attitudes," *Philosophy and Phenomenological Research* XLVII (1988): 573-600.

proposition becomes inaccessible. We can still identify it, as the proposition which was expressed by those words at that time. But we cannot express it with those words any longer, for with each passing moment they express a different proposition. And we can find no other words to express it. (pp. 15-16)

There are a variety of accounts of such propositions of limited accessibility. Chisholm's account takes them to involve *haecceities*—individual non-qualitative or non-repeatable properties of particulars. In the personal case, it is claimed that each person has the property of being herself, S^*, such that nothing else has or could have had that property. To believe of oneself as oneself that one is wise is to believe S^* and wisdom to be co-exemplified or to believe a singular proposition predicating wisdom of S^*.[19] The temporal case would be treated analogously in postulating an individual property, T^*, had by each time such that no other time could have had that property. To believe of a time as the then present time that it is the time when the meeting starts is to believe the property of being a time when the meeting starts to be co-exemplified with T^* or a singular proposition predicating that property with respect to that temporal *haecceity*.

This way with essentially indexical belief preserves the of the traditional view of propositions as abstract necessary objects which are true or false objectively or absolutely, and it

---

[19]   Ernest Sosa provides (but does not endorse) such a characterization in "Consciousness of the Self and of the Present," in James Tomberlin (ed.), *Agent, Language, and the Structure of the World* (Indianapolis: Hackett, 1983): pp. 131-145, p. 132.

preserves the traditional dyadic account of the psychological attitudes as relating a person and a proposition. However, in order to account for cases like THE MEETING and THE SHOPPER it must hold that such propositions cannot be grasped by other persons or at other times, presumably because each person can grasp only their own essence and only the essence of the present moment may be grasped.

An alternative account is provided by neo-Fregeans such as Peacocke and Forbes, who take Fregean thoughts to be the content of propositional attitudes and the bearers of truth-values.[20] They postulate, in light of the phenomena of essential indexicality, token modes of presentation obtained by indexing with a person or time a certain type of way of thinking of a person or a time. Peacocke, for example, holds that there is a particular temporal type of mode of presentation "under tokens of which *at any given time one can think only of that time and no other*" (p. 190, emphasis added), though it is one which may form thoughts "to which many people can have attitudes." Similarly, the Peacocke-Forbes account appeals to modes of presentation of the self which only that person can take direct attitudes toward, token modes of presentation "under which any person can think only of himself, and under which no one else can think of him" (p. 190).[21]

---

[20] Saul Kripke, "Frege's Theory of Sense and Reference: Some Exegetical Notes," *Theoria* LXXIV (2008): 181-218, offers another Fregean account clearly committed to propositions of limited temporal accessibility.

[21] Perhaps this neo-Fregean story makes the propositions or thoughts employing indexical modes of presentation contingent. However, as Peacocke notes (p. 197), Frege's general

The various proponents of propositions of limited accessibility do not hold that no other person can think about a person's personally indexical thoughts or that persons at times cannot think about temporally indexical thoughts entertained at other times. The Peacocke-Forbes version distinguishes between *employing* a mode of presentation and *referring to* a mode of presentation. As Peacocke notes, "From the fact that only John can think thoughts containing [his token mode of presentation] it does not follow that we cannot know which thoughts he thinks, or that we cannot think about the constituent modes of presentation of his thoughts" (p. 191). Pollock, another proponent of propositions of limited accessibility, draws a similar distinction between *entertaining* a proposition and *thinking about* the proposition. Even Perry, who rejects propositions of limited accessibility, allows in the passage quoted above that our inability to *express* such a proposition does not imply an inability to *refer to* the proposition.

Any version of the theory of propositions of limited accessibility clearly implies that it is impossible to conditionalize on a new certainty regarding what is now true. The theory holds that the temporally indexical proposition grasped at t when one considers 'It is *now* Monday' cannot be grasped at a distinct moment in time, t'. Recall that (3) is alleged by the philosophers discussed above to be justified by the *diachronic* claim that Beauty's credence in HEADS on Monday afternoon ought to be equal to her earlier credence in HEADS conditional on the proposition newly certain for her—that it is *now* Monday. However, on the doctrine of

---

opposition to such a view was derived from his requirement that the individuation of senses be answerable to facts about cognitive significance, which facts Peacocke's account endeavors to respect.

propositions of limited accessibility, the proposition newly certain at *t* could not even have been grasped at an earlier time and so Beauty could have no credence invested in it at the earlier time. On this view, while one can learn that a temporally indexical proposition is true, one cannot have had previous uncertainty regarding that very proposition.[22] So, while Beauty learns something when she is told that it is Monday, she cannot update by conditionalization on this new knowledge.[23]

5. Essentially Synchronic Proposition-Guise Pairs

Although those with a generally Fregean outlook appear forced by the phenomena of essential indexicality to endorse propositions of limited accessibility, many philosophers now endorse the view that all propositions (or at least the propositions relevant to the present discussion) are purely "Russellian" in that the constituents of a proposition are the very objects

---

[22] Notice that a precisely parallel point will hold for a temporally indexical proposition previously grasped as one cannot now grasp the proposition. See Fn. 15.

[23] There is a tendency in the literature to formulate the relevant hypotheses regarding Beauty's temporal location in terms of days (e.g. "It is Monday") rather than moments. This obscures the fact that when Beauty considers whether it is Monday, she is really considering whether it is *now* Monday, i.e. whether the present moment occurs on Monday. When she is informed that it is Monday, she is actually learning that the (then) present moment occurs on Monday, a proposition which was, on the present view, previously inaccessible to her.

(individuals, properties and relations) the proposition is about.[24] Such views generally hold, for

example, that the proposition that 'Hesperus = Hesperus' and the proposition that 'Hesperus =

Phosphorus' are in fact the same proposition. They also typically entail that Beauty's Monday

morning utterance of 'I'm awake now' and her Sunday utterance of 'I am awake on Monday' or

'I'll be awake on Monday' express the same proposition.

As this account of propositions and their identity conditions is, if belief is fundamentally

a dyadic relation to propositions, *prima facie* inadequate as a response to the intuitions about

cognitive significance which motivated Frege's theory—that, for example, a fully rational

thinker need not take the same attitude toward 'Hesperus = Hesperus' and 'Hesperus =

Phosphorus'—many theorists hold that belief is either (a) a triadic relation between a person, a

Russellian proposition, and a *way of believing* the proposition or a *propositional guise*, or (b) a

dyadic relation which is analyzed in terms of a triadic relation (belief*) with the aforementioned

three relata and which behaves in ways governed by the third relatum.[25] In what follows, I'll

---

[24] Despite their differences, most direct reference and hidden-indexical theorists would

endorse the views discussed in this section. See, in addition to Perry, Nathan Salmon,

Frege's Puzzle (Cambridge, MA: Bradford Press, 1986); Salmon, "Illogical Belief," *Philosophical

Perspectives* III (1989): 243-285; David Braun, "Understanding Belief Reports," *Philosophical

Review* CVII (1998): 555-595; Mark Richard, "Direct Reference and Ascriptions of Belief,"

Journal of Philosophical Logic XII (1983): 425-452.

[25] Salmon and Braun hold that it is the existential generalization of such a triadic relation. So,

for *S* to believe *p* is for there to be some guise under which S believes *p*. A particular

assume the former view simply to avoid needless qualification and repeated reference to the

underlying belief* relation posited by the latter view. Different "triadic propositionalists"

provide different accounts of ways of believing or guises, some incorporating something very

much like Fregean modes of presentation, others sentences in the language of thought, and still

others modes of access to a proposition or kinds of acquaintance with the constituents of the

proposition. The differences between these accounts do not matter for present purposes.

On triadic propositionalism, one believes a proposition only when one believes the

proposition in some particular way. Therefore, while a rational agent can have contradictory

attitudes toward the same proposition at the same time, Fregean concerns about cognitive

significance are accommodated by requiring that the proposition be believed and denied in

different ways or under different guises. Furthermore, cases like THE MEETING and THE

SHOPPER are accommodated by maintaining that only a given person can believe propositions

about herself in the personally indexical way and only at a particular time can one believe

propositions about that time in the temporally indexical way.[26] Someone other than John might

believe that John is making a mess and John might realize that he himself is making a mess.

Even if the same proposition is believed, say the Russellian proposition <John, making a mess>,

it is believed, as Perry says, "in different ways." Similarly, even if the professor believes all

---

credence or degree of belief would have to be treated as a quadratic relation or a suitable

existential generalization of such a relation.

[26] See Perry, "The Essential Indexical" and Richard, "Direct Reference and Ascriptions of

Belief."

along the Russellian proposition <Noon, meeting begins>, he believes it in different ways at different times.

Whatever else one thinks of this apparatus, its adoption obviously requires a reformulation of standard synchronic constraints on rational credence. For example, while the triadic theorist will deny that a rational agent who has degree of belief of 3/4 in a proposition p must have degree of belief of 1/4 in ~p, she will hold that something like such a principle is true, when guises are appropriately incorporated. In this case, the amended principle would be that any rational agent who has a degree of belief of 3/4 in p under guise w must have degree of belief of 1/4 in ~p under the negation of that guise. More generally, each of the constraints on rational belief or rational credence invoked by the dyadic propositionalist theorist of belief will be rejected by such triadic propositionalists about belief in favor of an analogous constraint governing belief or degrees belief under guises.

By now, however, it will be clear that *diachronic* principles of rational credence must also incorporate appeal to guises or ways of believing. In particular, any acceptable principle of conditionalization must hold the guises of propositions diachronically constant. That is, it must hold that when one becomes certain of e under guise g_e, one ought to adopt, as one's new credence for h under guise g_h, one's previous degree of belief in h under guise g_h conditional on e under guise g_e. For non-temporally-indexical belief no new problem is produced by introducing diachronic constraints on guises. However, if temporally indexical guise-proposition pairs are *limited in their temporal availability*, our earlier difficulty simply reappears in this more complex framework. Indeed, as noted above, the doctrine at hand accounts for the phenomenon of essentially temporally indexical credence by holding that a temporally

indexical "*now*-guise" necessarily relates one to a proposition about the current time. This is how it accounts for the professor's psychological change when he comes to believe that the meeting starts now. So, when it comes to knowledge *de praesenti*, the temporally indexical guise under which one believes a proposition at a given time must be distinct from the guise under which one believes that very proposition at any other time.

Beauty, on this account, believes the same propositions from Sunday through Monday evening but believes those propositions under different guises. Hence, as one must update relative to a guise, updating on the current temporally indexical guise of a given proposition will be impossible because the current temporally indexical guise cannot have been the previous guise of that proposition. While this account avoids positing propositions of limited temporal accessibility, it trades them for proposition-guise pairs of limited temporal accessibility and, given a suitable corresponding revision of the principles of diachronic and synchronic credence, yields again the conclusion that one cannot conditionalize on temporally indexical knowledge.

6. *Essentially Synchronic Objects of Attribution: The Inadequacy of Centered Worlds*

Roderick Chisholm and David Lewis famously took cases like THE MEETING and THE SHOPPER to support the radical thesis that belief and the other propositional attitudes are not really propositional at all. They are not, that is, relations between a person and a proposition, whether or not such a relation has (or is analyzed in terms of a relation having) an additional relatum. Rather, Chisholm and Lewis claim, belief in general is a relation between a person and

a property or, in cases of belief *de praesenti*, either a person, a property and a time, or a temporal part of a person and a property.[27]

Chisholm's account of *de se* belief holds that to believe of oneself as oneself that one is wise is to *self-attribute* wisdom. Ernest Sosa suggests that "a parallel solution for our consciousness of the present would replace present-tense propositions with *present-attribution* of corresponding properties of times."[28] On this view, when *S* believes of the present time as the present time that it is on Monday, *S* is said to engage in *present-attribution* of the property of being on Monday. As Sosa rightly notes, one would have to allow combined joint "self-cum-present-attribution" of properties in order to capture present-tense first-person belief.

Lewis' view of *de se* belief is much like Chisholm's in that he treats essentially indexical *de se* belief as the self-attribution of properties. However, Lewis claims that temporally indexical belief should be treated as a special case of belief *de se*, belief in which the believer is

---

27   Roderick Chisholm, *The First Person* (Minneapolis, MN: University of Minnesota Press, 1981); David Lewis, "Attitudes *De Dicto* and *De Se*," *Philosophical Review* LXXXVIII (1979): 513-543.

28   Sosa, "Consciousness of the Self and of the Present," p. 134. Note that "self-attribution" (by a person or a temporal part) and "present-attribution" are taken as theoretical primitives by these theorists. See Stephen Boër and William Lycan, "Who Me?," *Philosophical Review* LXXXIX (1980): 427-466, p. 445, for an expression of skepticism regarding the intelligibility of such primitives.

not a normal continuant but "a more-or-less momentary time-slice thereof" (p. 527). Imagining

an insomniac who wonders all through a given night what time it is, Lewis suggests:

> To understand how he wonders, we must recognize that it is time-slices of him
>
> that do the wondering. A slice of the insomniac may locate the whole of the
>
> insomniac well enough in logical space and space and time. Yet that slice may
>
> fail to locate itself in space, in time, and in the population of slices of the well-
>
> located continuant insomniac. The slice at 3:49 A.M. may self-ascribe the
>
> property of being one slice of an insomniac who lies awake all night on such-
>
> and-such date at such-and-such place at such-and-such a kind of world, and yet
>
> may fail to self-ascribe the property of being at 3:49. That is how this slice may
>
> be ignorant, and wonder what time it is, without failing in any relevant way to
>
> locate the continuant to which it belongs. It is the slice, not the continuant, that
>
> fails to self-ascribe a property.[29]

Lewis' account requires endorsing the doctrine of temporal parts with respect to

persons. However, one could endorse the doctrine of temporal parts while also appealing to

---

[29] "Attitudes *De Dicto* and *De Se*," p. 527. See also *On the Plurality of Worlds* (New York:

Oxford, 1986), p. 29, where Lewis suggests that by "treating the subjects of belief as

momentary, we can subsume belief about what time it is as a special case of egocentric

belief."

propositions of limited temporal accessibility or proposition-guise pairs of limited temporal accessibility. When it comes to conditionalizing on temporally indexical knowledge, those proposals would have the difficulties I've already outlined. So, what is essential to treating Lewis' proposal as a genuinely distinct one is careful attention to the combination of the doctrine temporal parts with the view that belief *de praesenti* is self-attribution of properties *by a temporal part*.

Of course, given these alternative accounts of belief and credence as non-propositional, we require a different set of constraints on rational belief and credence. Whereas many standard synchronic constraints on rational belief and degrees of belief are derived from the logical relations between the propositional content of such opinions, the required alternative set of constraints must be based on the necessary relations between self-attributed or present-attributed properties. However, while propositions are true or false, properties are not. Hence, such an account must, in order to mimic the truth-functional logical relations determined by propositions, appeal to the necessary relations between properties taken as jointly possessed by or co-instantiated in a fixed object. For example, rather than holding that a rational agent must not believe both *p* and *~p* at *t*, it must require that a rational agent not attribute both a property and its negation to the same object at *t*. Rather than holding that a rational agent's credence in *p*

at t and $\sim p$ at t must sum to 1, it must hold that a rational agent's partial attributions of F to o at t and of $\sim F$ to o at t must (suitably normalized) sum to 1.[30]

Furthermore, just as any plausible version of the standard diachronic principle of conditionalization requires grasp of the same proposition by the same person at two points in time, any similarly plausible modified diachronic principle of conditionalization suitable for use by the property theorist would require both a constant attributed property *and a constant object of attribution*. It is easy to overlook this last requirement as identity of the object of attribution is automatically guaranteed for all *de se* beliefs had by a given continuant person at any time and for all *de praesenti* beliefs at a given time. Hence, specification of the object of attribution can almost always be neglected without loss. However, the required identity of the object of attribution cannot obtain in the special case of *de praesenti* beliefs at different times.

Given the Chisholm-inspired account of temporally indexical belief outlined above, it is impossible to conditionalize on a new temporally indexical certainty as the moment to which one fully present-attributes a given property is, of necessity, a different moment from that to which one previously less-than-fully present-attributed the property. Given Lewis' account of temporally indexical belief, conditionalization will be impossible because such credence is self-attribution by a temporal part—a part which cannot exist at multiple times. To hold the object of attribution constant, Lewis must require that if a temporal part S_2 fully self-attributes E at t_2,

---

[30] While it seems to me that degrees of belief or confidence cannot be captured properly by the intuitive notion of attribution or ascription because that notion seems not to allow for degrees, I set that problem aside here.

then S_2 ought to self-attribute H to the degree S_2 self-attributed H conditional on E at t_1.

However, S_2, being a mere temporal part, didn't exist at t_1 and so the principle would have the

difficulties already noted. Chisholm and Lewis, then, avoid propositions of limited temporal

accessibility and essentially synchronic proposition-guise pairs, but trade them for *objects of

attribution* (times or believers) of momentary duration.[31]

It is well worth pausing at this juncture to dwell briefly upon the fact that much of the

contemporary debate about credence *de se* and *de praesenti* attributes to agents credence

functions defined over Lewis' "centered worlds." Such worlds are treated formally as ordered

triples of possible worlds, persons and times, or as ordered pairs of worlds and temporal parts

---

[31] Space considerations preclude a detailed examination of the thesis that credence *de se* and *de

praesenti* are just a special sort of credence *de re* of oneself and of the present time (see Boër &

Lycan, "Who Me?"). Notice, however, that austere accounts of *de re* belief (such as that in

Stephen Schiffer, "The Basis of Reference," *Erkenntnis* XIII (1978): 171-206) hold that only

beliefs of oneself and of the present moment are genuinely *de re* and so will still yield my

conclusions. Furthermore, a typical feature of more latitudinarian accounts of *de re* belief is

a failure to support standard deductive and probabilistic constraints, rendering them

inappropriate for Bayesian treatment. Latitudinarian accounts of *de re* belief which are so

constrained by the addition of something like modes of presentation (such as that in Barbara

Davidson, "Belief *De Re* and *De Se*," *Australasian Journal of Philosophy* LXIII (1985): 389-406)

clearly encounter exactly the problems with conditionalizing on temporal indexicals that

I've been discussing.

of persons. However, we can now see that to explicate an agent's credences merely by appeal to such possible worlds with "designated centers" is to represent only the properties attributed and to neglect the issues of *who* is doing the attributing of properties and *to what or to whom* they are attributing the properties. As just noted, this neglect is entirely inconsequential for modeling all the opinions of an agent at a time and every non-temporally-indexical opinion of an agent at multiple times. Perhaps this is why it is easy to make the common mistake of supposing that a continuant person's credence function could be fully captured by a probability distribution over the same set of centered worlds at two distinct points in time. While the set of centered worlds is not limited in its temporal accessibility, to take a person's temporally indexical opinions to be adequately captured by a probability distribution over such a set at two distinct times is to ignore the crucial fact that temporally indexical credence requires either present-attribution to the present time or self-attribution by a temporal part. Hence, an adequate representation of an agent's credence function (or at least that part featuring *de praesenti* opinion) at a time requires either that the time at which the agent has the credence or the temporal part of the agent with the credence be an additional element in each *n*-tuple over which credence is distributed. Once this is done, however, it is again clear that the function cannot have a constant domain over time.

Here is Lewis apparently making the mistake against which I have just warned:

[I]t is interesting to ask what happens to decision theory if we take all attitudes as *de se*. Answer: very little. We replace the space of worlds by the space of centered worlds, or by the space of inhabitants of worlds. All else is just as

before. Whatever the points of the space of probabilities may be, we have

probability distributions over the space and assignments of utility values to the

points. For any rational agent at any time there is a pair of a probability

distribution and a utility assignment. The probabilities change under the impact

of his perception.[32]

If we restrict ourselves to attitudes *de se* of continuants, Lewis is correct. When it comes

to credence *de praesenti*, however, all else is not as before. This is not because, as some have

suggested in connection with cases like the clock-watcher, conditionalizing on newly acquired

de praesenti certainties can yield unpalatable results. Rather, it is because the space of centered

worlds is simply inadequate as a representation of a continuant's *de praesenti* opinions.

7. *Credence De Se and the Doppelganger Case*

The literature on Sleeping Beauty contains other cases, structurally similar in various

respects to the original case, but in which the uncertainty at issue is (continuant) *de se*

uncertainty rather than *de praesenti* uncertainty.[33] In one such variant, "the Doppelganger Case,"

---

[32]   "Attitudes *De Dicto* and *De Se*," p. 534.

[33]   Adam Elga, "Defeating Dr. Evil with Self-Locating Belief," *Philosophy and Phenomenological*
       Research LXIX (2004): 383-396; Arntzenius, "Some Problems for Conditionalization and
       Reflection"; Brian Kierland and Bradley Monton, "Minimizing Inaccuracy for Self-Locating

the experimenters awaken Beauty on Monday morning if a fair coin falls heads and, if the coin falls tails, rather than awakening her on an additional occasion, they duplicate her and awaken both Beauty and her doppelganger (separately) on Monday morning. Such cases are often treated as mere variations on the original case and thought to require the same arguments and verdicts. We are now in a position to see that this is a mistake.

Consider how such a case would have to be structured for an argument analogous to Elga's to apply. The case would have to be one in which the experimenters tell Beauty, soon after awakening, that she is Beauty. Let BEAUTY be the "proposition" that one is oneself Sleeping Beauty. Let P and P+ be Beauty's credence function upon awakening and upon being informed that she is Beauty. The set of claims analogous to the original inconsistent set would then be:

(1D) $P(\text{HEADS}) = 1/2$

(2D) $P^+(\text{HEADS}) = 1/2$

(3D) $P^+(\text{HEADS}) = P(\text{HEADS}/\text{BEAUTY})$

(4D) $P(\text{HEADS}/\text{not-BEAUTY}) = 0$

(5D) $0 < P(\text{BEAUTY}) < 1$

Beliefs," *Philosophy and Phenomenological Research* LXX (2005): 384-395; Titelbaum, "The Relevance of Self-Locating Belief."

Taken as epistemic probability claims, it seems to me that (4D) and (5D) are as overwhelmingly plausible as their analogs in the original Sleeping Beauty case. However, my argument against the possibility of conditionalizing on MONDAY rests on the fact that MONDAY is a temporally indexical claim whereas BEAUTY is not a temporally indexical claim, but a personally indexical one. Nothing in my argument implies that there is any difficulty in conditionalizing on (mere) knowledge *de se*. The essential difficulty with conditionalizing on credence *de praesenti*—the radically synchronic nature of such credence—simply does not afflict credence *de se*.³⁴ Hence, there appears no barrier to conditionalizing on BEAUTY and my argument against (3) does not apply to (3D). Friends of conditionalization must, it seems, choose between (1D) and (2D).

While this is sufficient to demonstrate that the original case and the Doppelganger case should be treated differently, notice also that (2D) lacks some of the intuitive grounds adduced in favor of (2). Beauty is, in the Doppelganger case, certain on Monday that the coin toss lies in the past rather than, as in the original case, the future. Furthermore, if one thinks (2D) plausible because in the Doppelganger case Beauty has the same total (relevant) evidence on Sunday and on Monday afternoon (having been told she is Beauty), this supports the denial of (1D) only by appeal to a fact which does not obtain in the original case as it amounts to treating the Doppelganger case as a novel case of forgetting. While I would resist the claim that Beauty has forgotten when she awakens on Monday morning in original case, on the grounds that

---

³⁴ Though some *de se* knowledge cannot be conditionalized on for a quite different reason, as is shown in my "Cartesian Knowledge and Confirmation," this JOURNAL CIV (2007): 269-289.

forgetting requires going from full (or high) credence in a proposition to some lower credence in the very same proposition, these grounds do not apply to the Doppelganger case.[35] So long as we are considering *merely de se* and not *de se cum de praesenti* knowledge, it is natural to suppose that Beauty has, upon awakening in the Doppelganger case, forgotten who she is. After all, she knows who she is, and then she does not. Hence, there is nothing surprising about the view that her credence upon awakening ought to be different from her Sunday credence and this supports the denial of (1D).

So, upon examination, the Doppelganger case is, while in some sense "structurally identical" to the original Sleeping Beauty case, different in significant ways. I have provided an independent argument, based on the nature of credence *de praesenti*, against the claim that (3) follows from the principle of conditionalization, but (mere) credence *de se* is not essentially synchronic and so no similar argument can be produced against (3D). Furthermore, (2D) is only plausible, if at all, on grounds quite different from those that support (2) and such grounds also support the denial of (1D). Hence, the differences are significant enough that we ought not be tempted to endorse the same verdicts about the original Sleeping Beauty case and the Doppelganger case.

---

[35]   See Monton, "Sleeping Beauty and the Forgetful Bayesian," for an attempt to defend the thirder on the grounds that Beauty forgets her temporal location from Sunday to Monday morning. See Kai Draper, "Sleeping Beauty's Evidence," *American Philosophical Quarterly* XLIV (2007): 61-70, for a version of the objection I offer above.

8. The Irrelevance of Temporally Indexical Knowledge

I have made a case that temporally indexical knowledge simply cannot be conditionalized upon. Any plausible normative constraint on the temporal evolution of a person's credence function must hold that the credence function is that of the same person at two distinct times. On the doctrine of propositions of limited temporal accessibility, we may suppose that we have the same person at two distinct points in time, but conditionalization on such propositions is precluded by the fact that we cannot take the domain of the function to be constant. On the triadic propositionalist model invoking temporally indexical guises, we may suppose we have the same person and the same propositions at two distinct points in time, but the domain of the (more complex) function involves a distinct element (temporally indexical guises) which necessarily relate a person to different propositions at different times and so we again lack a diachronically constant domain. The same is true on the present-attribution and self-attribution by temporal parts models. On the present-attribution model, we have constant properties and constant persons, but lack constant objects of attribution (i.e. times) over time. On the model featuring self-attribution by temporal parts of persons, we have, waiving objections to a temporal parts metaphysic of continuant persons, constant persons and properties, but lack constant objects of attribution (i.e. temporal parts) over time.

As noted at the beginning of this paper, many have thought that temporally indexical credence falsifies the principle of conditionalization because they have assumed that rational changes in one's temporally indexical views can produce, as Arntzenius claims, a "shifting" of one's credence function over a constant space of possibilities. That is, they have assumed that in cases like the clock-watcher, an agent's new credence function assigns 1 to an item the agent's

previous credence function assigned 0 and assigns 0 to an item the agent's previous credence

function assigned 1.[36] It should now be clear that there simply is no such thing as shifting in

this sense, as the set of possibilities over which temporally indexical credence is distributed

cannot remain constant over time. Hence, temporally indexical credence doesn't falsify the

principle of conditionalization by implying the absurd result that all agents ought to have

entirely undefined credences. That absurdity follows only if we assume that all objects of

credence are equally accessible to all rational agents at all times. Instead, in cases of newly

acquired temporally indexical knowledge, the new item in which credence is invested was not

even in the domain of one's previous credence function.[37] So, the principle faces no threat from

temporally indexical knowledge as one can have no prior probability whatsoever (not even

---

[36] I conjecture that many philosophers have been misled by adopting the centered worlds

framework without attending to its property-attributionist interpretation and motivation.

See, for example, Arntzenius, "Some Problems for Conditionalization and Reflection," p. 367;

Hitchcock, "Beauty and the Bets," p. 411; Meacham, "Sleeping Beauty and the Dynamics of

De Se Beliefs," p. 246.

[37] This account is further supported by the fact that standard diachronic Dutch Book

arguments for conditionalization fail when it comes to *de praesenti* opinion as it is impossible

to gain the relevant sort of diachronic access to the same proposition, proposition-guise pair

or object of property-attribution required for betting at two distinct times.

zero) for that item with a present probability of one.[38] Furthermore, insofar as we link

evidential relevance to the possibility of conditionalizing, it also appears clear that temporally

indexical knowledge is, in itself, evidentially irrelevant.

In closing, let us return briefly to Sleeping Beauty. Thirders claim, plausibly, that

P^+(HEADS) = 1/2. However, P^+ cannot be the product of conditionalization and so the Elga and

Arntzenius-Dorr arguments provide no reason to hold, contrary to Lewis, that P(HEADS) ≠ 1/2.

Lewis claims, plausibly, that P(HEADS) = 1/2. Again, however, without the claim that Beauty

should conditionalize to arrive at P^+, there is no reason to hold that, contrary to the thirders,

P^+(HEADS) ≠ 1/2. Without the link provided by (3) we are free to hold that P(HEADS) =

P^+(HEADS) = 1/2. We are, in other words, free to endorse the intuitively plausible (1) *and* the

intuitively plausible (2) and thereby to accept 1/2 without embarrassment.[39]

---

[38] It also follows that van Fraassen's Reflection principle (see Bas van Fraassen, "Belief and the

Problem of Ulysses and the Sirens," *Philosophical Studies* LXXVII (1995): 7-37) is, contrary to

Arntzenius (p. 370) and Elga (p. 146), unthreatened by temporally indexical credence.

[39] A complete defense of the double-halfer requires addressing the other arguments for the

thirder position such as Horgan's "Synchronic Updating" argument ("Sleeping Beauty

Awakened: New Odds at the Dawn of the New Day"), Hitchcock's diachronic Dutch book

argument ("Beauty and the Bets"), and Pollock and colleagues' direct inference argument

(The Oscar Seminar, "An Objectivist Argument for Thirdism," *Analysis* LXVIII (2008): 149-

155). I argue against Horgan in my "Horgan on Sleeping Beauty," *Synthese* CLX (2008): 97-

101. He replies in "Synchronic Bayesian Updating and the Sleeping Beauty Problem: Reply

Joel Pust

University of Delaware

---

to Pust," *Synthese* CLX (2008): 155-159. Kai Draper and I argue, in "Sleeping Beauty and

Diachronic Dutch Books," *Synthese* CLXIV (2008): 281-287, that Hitchcock's argument

succeeds only if strict causal decision theory is correct. (We were, however, mistaken in

claiming (p. 286, fn. 5) that there is a different diachronic Dutch book argument against the

position of the double-halfer which even an evidential decision theorist must accept). A

brief initial response to the argument of Pollock and his colleagues appears in my "Sleeping

Beauty and Direct Inference," *Analysis* (forthcoming).