



Philosophical Review

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Source: *The Philosophical Review*, Vol. 100, No. 2 (Apr., 1991), pp. 229-247

Published by: [Duke University Press](#) on behalf of [Philosophical Review](#)

Stable URL: <http://www.jstor.org/stable/2185301>

Accessed: 18/01/2011 15:46

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Clever Bookies and Coherent Beliefs*

David Christensen

Since the 1930s, “Dutch Book” arguments have been used to support the view that one’s degrees of belief should conform to the probability calculus. These arguments show that if an agent’s degrees of belief violate the probability calculus, then a clever bookie, knowing nothing beyond what the agent’s degrees of belief are, can offer the agent a set of bets with the following two properties: (1) each of the bets in the set will be fair, given the agent’s degrees of belief; and (2) the set of bets taken together guarantees that the agent will end up losing money overall. Such a set of bets is called a “Dutch Book.” Clearly, there is something unattractive about a belief state which leaves one open to this sort of exploitation.¹

Closely related arguments have also been given in support of further conditions on rational degrees of belief, conditions which go well beyond probabilistic consistency. Some of these arguments support popular “Conditionalization” principles, which describe the way an agent’s degrees of belief should change when she is confronted with new evidence. (The probability calculus itself provides no guidance in such matters, so Conditionalization principles fill an important gap in probabilistic accounts of rationality.)² Sim-

*I would like to thank Hilary Kornblith, Arthur Kuflik, Derk Pereboom, Alan Wertheimer, and the editors of *The Philosophical Review* for helpful comments on earlier drafts of this paper. I would also like to thank the University of Vermont for research support.

¹Classic sources for the general argument are F. P. Ramsey, “Truth and Probability,” and B. de Finetti, “Foresight: its Logical Laws, its Subjective Sources,” both reprinted in H. E. Kyburg, Jr. and H. E. Smokler, eds., *Studies in Subjective Probability* (Huntington, N.Y.: Robert E. Krieger, 1980). (Ramsey’s piece was written in 1926, but not published until 1931; de Finetti’s was first published in French in 1937.) A more accessible presentation of Dutch Book arguments can be found in B. Skyrms, *Choice and Chance* (Encino, Calif.: Dickenson, 1975).

²The original argument of this type, supporting the classical form of Conditionalization, is credited to David Lewis, and appears in P. Teller,

ilar considerations have been taken to show that a rational agent should *predict* that she will change her beliefs by Conditionalization.³ And most recently, some authors have argued in this same way for a further principle (named “Reflection” by Bas van Fraassen) which, roughly, would require an agent to have a certain kind of confidence in her own future degrees of belief.⁴

All of these additional requirements on rationality are supported as being necessary to avoid what I, following van Fraassen, will call “Dutch Strategies.” Dutch Strategies, as opposed to Dutch Books, involve series of bets made over time, rather than sets of simultaneously offered bets; but the end result is the same: the unhappy agent who violates the favored requirement suffers a certain loss in betting with a bookie who knows nothing more than the agent’s probabilities.⁵

I would like to begin by looking carefully at the last of these additional proposed constraints on rational belief. The principle of Reflection is admitted by its defenders to be somewhat implausible. Nevertheless, they claim that it must be seen as “a new requirement of rationality” (van Fraassen, *op. cit.*, p. 244) or an “[aspect] of a rational ideal,” violations of which are committed only by the “intellectually imperfect” (Sobel, *op. cit.*, pp. 56, 68). I will argue that this proposed requirement is more than just initially implausible; it is wrong. In some cases, violations of Reflection are not only rationally permissible, but mandatory; to respect Reflection in such cases would itself constitute a grave intellectual imperfection. To put it bluntly, there are cases in which satisfying the principle of Reflection would be downright stupid.

“Conditionalization and Observation,” *Synthese* 26 (1973), pp. 218–258. Brad Armendt, in “Is there a Dutch Book Argument for Probability Kinematics?” *Philosophy of Science* 47 (1980), pp. 583–588, presents similar arguments in support of a generalized Conditionalization principle of the type advocated in Richard Jeffrey’s *The Logic of Decision* (New York, N.Y.: McGraw-Hill, 1965).

³See P. Horwich, *Probability and Evidence* (Cambridge, England: Cambridge University Press, 1982), p. 31.

⁴See B. van Fraassen, “Belief and the Will,” *The Journal of Philosophy* 81 (1984), pp. 235–256; and J. H. Sobel, “Self-doubts and Dutch Strategies,” *Australasian Journal of Philosophy* 65 (1987), pp. 56–81.

⁵This is slightly inaccurate in the case of the Dutch Strategy arguments for Conditionalization, in which the bookie is also assumed to know the agent’s rule for changing beliefs; but this point will not affect the present discussion.

The interest of this observation, however, does not lie simply in demonstrating the incorrectness of taking a certain (admittedly implausible) principle to be a component of rationality. It lies mainly in the questions this raises about the legitimacy of the very plausible-seeming arguments advanced in favor of Reflection. Could it be rational to have beliefs that leave one vulnerable to Dutch Strategies? If so, must we abandon the Dutch Strategy arguments for Conditionalization? What about the apparently similar Dutch Book arguments for probabilistic consistency?

Answering these questions requires a careful look at the philosophical force of arguments which would derive requirements on rationality from guaranteed betting losses. I will argue that the correct understanding of the force of these arguments has two important features: first, it explains the power of the classic Dutch Book arguments, and does so in a way that shows some of the criticisms leveled at them in the literature to be misguided. Second, it explains how a certain apparently trivial dissimilarity between the traditional Dutch Book arguments and the newer Dutch Strategy arguments is actually quite important; in fact, it undermines the force of the latter arguments entirely.

Inasmuch as this analysis allows us to reject Reflection without sacrificing the traditional Dutch Book arguments, it should be a welcome result. However, the analysis also raises troubling questions about the justification of Conditionalization principles. These principles provide attractive solutions to a difficult problem with probabilistic accounts of rationality. But the present analysis suggests that some of the more persuasive justifications for these principles must be abandoned.

I. REFLECTION AND THE DUTCH STRATEGY

Let us begin by giving a precise statement of the principle of Reflection. Van Fraassen puts it in English as follows:

To satisfy the principle, the agent's present subjective probability for proposition A, on the supposition that his subjective probability for this proposition will equal r at some later time, must equal this same number r (*op. cit.*, p. 244).

In other words, if I am asked how likely it is to rain tomorrow afternoon on the supposition that tomorrow morning I'll think

rain 50% likely, my answer should be “50%.” We may put the principle in symbolic form as follows, where P_0 is the agent’s present probability function, and P_1 her probability function at some future time:

$$\text{Reflection: } P_0(A/P_1(A) = r) = r.$$

What, in more down-to-earth terms, does this principle express? It is a bit difficult to capture the force of the principle precisely in common-sense terms. It seems to involve a certain self-confidence, or perhaps a commitment to a certain sort of consistency over time in one’s judgments. Adherence to the principle essentially requires that we endorse in advance our own future probability assessments, whatever those might turn out to be. We thus must regard our own future selves quite differently (epistemologically speaking) from the way we view other people. For example, we may easily hold that the probability of rain tomorrow, given that our overly pessimistic neighbor will hold it 50% probable, is only 25%. But if we are to be Reflective, we cannot see our own future selves as “overly pessimistic” in the same way.

Before thinking harder about the implications or plausibility of Reflection, let us look at the Dutch Strategy argument for showing it to be rationally required. I will not here present the abstract general formula for generating Dutch Strategies from violations of Reflection. It will be more useful, I think, to concentrate on a concrete example, which will show how an arbitrary violation of Reflection leaves an agent vulnerable to a guaranteed betting loss. (Readers who wish to see the general proof, which shows that any agent who is Irreflective—who violates Reflection—is vulnerable to a Dutch Strategy, are referred to van Fraassen, *op. cit.*, or Sobel, *op. cit.*) Suppose that our agent, whom we may take to be always probabilistically consistent, thinks that she herself will be unduly pessimistic tomorrow morning. In particular, she thinks that the probability of rain tomorrow afternoon, on the supposition that tomorrow morning she will take the probability of rain to be 50%, is only 25%. Thus her probability function includes:

$$(1) P_0(R/P_1(R) = .50) = .25,$$

a clear violation of Reflection. We must also assume that the agent

assigns some non-zero probability to the proposition that tomorrow morning she will think rain 50% likely (if she did not, the conditional probability in (1) would not be defined). The exact value doesn't matter; suppose she assigns this proposition a probability of 20%:

$$(2) P_0(P_1(R) = .50) = .20.$$

The Dutch bookie then offers the agent two bets, each of which is fair by her own lights. The first bet will be won by the agent if tomorrow morning she does assign 50% probability to rain. The agent, by (2), thinks her chances of winning this bet are 20%; thus she considers it fair to put up \$2 to the bookie's \$8.

The second bet is a bit more complex. It is *conditional* on the agent's winning the first bet (that is, conditional on her assigning rain a 50% probability tomorrow morning). If this condition is not fulfilled, neither the agent nor the bookie wins anything. If the condition is fulfilled, then the agent wins the bet if it does not rain tomorrow afternoon, and the bookie wins if it does. By (1), the agent takes the probability of rain, given that the condition is fulfilled, to be 25%. Thus her probability that she will win the bet, given that the condition is fulfilled, is 75%. She thus considers it fair for her to put up \$30 to the bookie's \$10.

The bookie now waits until the next morning, when it is discovered whether the agent does, in fact, assign a 50% probability to afternoon rain. If she does not, the second bet is null and void, with neither bookie nor agent profiting from it. The bookie has, however, won the first bet, and ends up richer by the \$2 put up by the agent.

Suppose, however, that the next morning the agent does assign a 50% probability to afternoon rain. In this case, the agent has won the first bet, earning \$8. And the second bet will not be null and void, but will be won or lost depending on whether it rains in the afternoon. At this point, the bookie offers the agent a third bet. This third bet will be won by the agent if it rains in the afternoon, and by the bookie if it doesn't. Given the agent's current assignment of 50% to the probability of rain, she considers even stakes as fair, and is willing to put up \$20 to the bookie's \$20.

The bookie can now relax, confident of certain profit come the afternoon. To see this, suppose first that it rains. In that case, he

has won the second bet, and will collect the \$30 the agent put up. The agent, of course, wins \$20 back on the third bet, and has also won \$8 on the first. Still, the bookie ends up with a \$2 profit. On the other hand, suppose that the rain doesn't come. In that case, the bookie has lost the second bet, forfeiting the \$10 he put up there, along with the \$8 he lost on the first bet. However, he has won \$20 on the third bet, ending up once again with a \$2 profit overall.

The strategy employed by the bookie here guarantees that the agent will lose \$2, no matter what happens to her beliefs on Tuesday morning or to the weather on Tuesday afternoon. Yet each of the bets he offers her is, by the agent's own probability function, perfectly fair. And the bookie does not need to know anything other than the fact that the agent's (perfectly consistent) initial probability function contains (1) in order to guarantee his winning the agent's money. This would seem to lend substantial credence to the claim, embodied in the principle of Reflection, that the agent's initial probability function is, by virtue of containing (1), defective.⁶

II. THE IRRATIONALITY OF REFLECTION

Having seen the *prima facie* plausibility of the Dutch Strategy arguments, I would now like to look closely at something that has been discussed surprisingly little by defenders of Reflection: the kind of circumstance in which one would have good reason for doubting one's future credences. Consider, for example, the following possibility: there is an unusual psychedelic drug, call it LSQ, with the property that those under its influence, while fairly normal in most respects, believe very strongly that they can fly. Suppose that our agent is quite sure that she has just swallowed a hefty dose of LSQ, and someone asks her, "What do you think the probability is that you'll be able to fly in one hour, given that you'll then take the probability that you can fly to be .99?"

I take it as obvious that the answer mandated by Reflection (".99, of course!") is ridiculous. Although we know from vast expe-

⁶This version of the Dutch Strategy relies on conditional bets, but an equivalent result can be obtained involving only non-conditional bets (see van Fraassen, *op. cit.*, for examples).

rience that LSQ gives its users the belief that they can fly, we also know that it actually confers no such ability; indeed, we may suppose that this very fact has led to a series of unfortunate incidents. The sane answer to the above question is clearly one that gives a very low probability to the agent's ability to fly one hour from now, even on the supposition that she will at that time give it a very high probability. In other words, the only rational answer is one that constitutes an extreme violation of Reflection.

The necessity for violating Reflection is apparent not only in the answers a rational agent would give to questions about her conditional probabilities. It is also apparent in the practical measures a rational agent would take in situations like the one described. Clearly, one would be a fool to take LSQ while on an unsupervised hike up a cliff. A minimally rational LSQ user must take precautions: she must partake of the drug while locked in a basement, or tied to a chair, or accompanied by strong attendants. Failure to take such precautions should earn one no intellectual badge of honor; it is sheer idiocy. And the reason these precautions are rationally required is precisely that the agent *should think* that there is a very high likelihood of her having a certain very strong, but false, belief. The obvious rationality of taking the precautions flows directly from the obvious rationality of an extreme violation of Reflection.

I have argued that an agent in the type of situation described above must be highly Irreflective to be rational. It might be thought, however, that the case I described was defective; after all, isn't the agent clearly irrational anyway, in virtue of taking such an irrationality-inducing drug? I do not think that this is a serious worry. First of all, it is not obvious that any action which results in decreased rationality is itself irrational—perhaps LSQ is also a powerful stimulant of the pleasure centers in the brain, and is perfectly safe if one takes the types of precautions described above. Second, nothing in the example entails that LSQ produces a net decrease in rationality—perhaps it vastly improves much of the user's thinking. Finally, nothing in the example requires that the agent had any choice at all about taking LSQ. We may suppose that she has just been informed, as she put down her empty Kool-Aid glass, that her drink was surreptitiously laced with the drug, and that she is quite upset about this. Thus I think that there is no

reason to suppose that the agent in our example is irrational at the time she is Irreflective.

Perhaps it will be insisted that the agent, even if not obviously irrational at the beginning of my story, is certainly irrational at the end of it, when the LSQ takes effect. Now I am not sure how that would cut any philosophical ice, since the violation of Reflection I am defending occurs at the beginning of the story. But it is also no essential part of the story that the agent is ever affected by the drug. Indeed, we may imagine that the usually reliable person who told her the Kool-Aid had been spiked was wrong. Thus no violation of the agent's rationality, at any time, need be assumed in order to make violation of Reflection required by minimal common sense.

We need not indulge in pharmaceutical fiction to find examples where Irreflection is required for rationality. More realistic examples can be gleaned from reflection on patterns of human psychology. I take it as generally acknowledged that the ratio of people who believe themselves to be the Messiah, to people who are the Messiah, is rather high. Keeping this in mind (along with, perhaps, an awareness of the somewhat ignoble nature of so many of my thoughts and deeds), I think it is only reasonable for me to put the probability of my actually being the Messiah, even on the condition that I come to strongly believe myself to be the Messiah, as very low. In having this conditional degree of belief, I violate Reflection severely. Yet I suspect that almost anyone who thought about these matters a bit would come to share my emphatically Irreflective stance. And far from being evidence of widespread irrationality, this seems to me to be evidence of intellectual health. In fact, those who fail to reach the Irreflective conclusion are likely to be found subsequently in mental institutions, or on busy street corners with signs around their necks.

This example relies simply on the relative abundance of Messiah complexes and scarcity of Messiahs. Other common-sense examples of rationally required Irreflection involve propositions such that my coming to have a high degree of belief in them would in itself tell *against* their truth.⁷ An extreme example in this cate-

⁷This class of examples was suggested to me by Hilary Kornblith.

gory involves the proposition that I have no degrees of belief greater than .90. What credence should I accord this proposition, on the supposition that I come to believe it to degree .95? Reflection says “.95”; elementary probability theory says “0.” This seems to be a case where Reflection cannot be “a new requirement of rationality, in addition to the usual laws of probability calculation”—it is inconsistent with those very laws.⁸

I conclude from all of these cases that taking Reflection to be a requirement of rationality is more than initially unintuitive. In countless cases, to respect Reflection is to abandon rationality and embrace the absurd. From this point of view, arguments in support of Reflection take on a new dimension of interest: as *reductions ad absurdum*. If Irreflective states are sometimes rational, what are we to make of the fact that they leave us vulnerable to Dutch Strategies? Resolving this tension between the convincing argument and its unacceptable conclusion will occupy the rest of the paper.

III. DUTCH BOOKS AND RATIONALITY

Let us begin by looking a bit more closely at just what is irrational about someone whose credences render her vulnerable to a Dutch Book. As noted by some critics of Dutch Book arguments, mere potential vulnerability to a Dutch Book produces no monetary loss at all (or even substantial likelihood of monetary loss). There is, after all, no Evil Super-bookie constantly monitoring everyone's credences, with an eye to making Dutch Book against anyone who falls short of probabilistic perfection. Even if there were, many people would decline to bet at “fair odds,” due to suspiciousness, or risk aversion, or religious scruples. In short, it is pretty clear that Dutch Book vulnerability is not, *per se*, a practical liability at all!⁹

⁸The violation of the probability axioms depends on assuming that one has some non-zero (though perhaps incredibly small) credence that one will come to believe the proposition in question to degree .95. But this seems only right; surely such belief states are possible.

⁹Ellery Eells, in *Rational Decision and Causality* (Cambridge, England: Cambridge University Press, 1982), presents these criticisms along with

Furthermore, even if there *were* a substantial likelihood that violators of the probability calculus would meet with substantial misfortune, this in itself would provide no support for probabilistic theories of rationality. Suppose, for example, that those who violated the probability calculus were regularly detected and tortured by the Bayesian Thought Police. In such circumstances, it might well be argued that violating the probability calculus was imprudent, or even “irrational” in a practical sense. But I don’t think that this would do anything toward showing that probabilistic consistency was a component of rationality in the epistemic sense relevant here. After all, the Thought Police might just as easily have decided to torture those who obeyed the law of non-contradiction!

If the Dutch Book arguments have any philosophical force, then, it cannot be to point out some dire practical consequence that follows from violating the probability axioms. But if that is so, what sort of problem could Dutch Book vulnerability be? It seems to me that the answer is twofold. First, Dutch Book vulnerability, in itself, does not *constitute* a problem of any sort; rather, potential vulnerability to this particular kind of monetary loss serves as a vivid *symptom* of a real problem. Second, this problem is not a practical one, involving agents’ financial prospects, but rather an *epistemic* one. What is exploited by the Dutch bookie can be thought of as a certain kind of internal incoherence or inconsistency on the agent’s part, parallel to standard deductive inconsistency.¹⁰

On this interpretation, consistency in one’s degrees of belief is a cognitive desideratum, in and of itself. Now one would not expect a consistent set of beliefs to sanction a set of bets that would lose no

references to other criticisms (and defenses) of the classic Dutch Book arguments.

¹⁰This is certainly how Ramsey and de Finetti, the discoverers of the Dutch Book arguments, thought of beliefs which violated the axioms of probability. And although some recent sympathetic presentations of Dutch Book arguments clearly misconstrue their force as practical (or pass so quickly from Dutch Book vulnerability to irrationality that they at least appear to see the vulnerability as constituting, rather than indicating, the problem), some recent presentations of the arguments do indicate that a species of inconsistency is revealed by susceptibility to Dutch Books (see, for example, Skyrms, *op. cit.*, or his “Higher Order Degrees of Belief,” in D. H. Mellor, ed., *Prospects for Pragmatism: Essays in Honor of F. P. Ramsey* (Cambridge, England: Cambridge University Press, 1980)).

matter what the world turned out to be like. Yet the Dutch Book arguments show that if a set of beliefs violates the axioms of the probability calculus, then it does sanction such a set of bets. Thus the Dutch Book arguments support our taking the probability axioms as criteria of consistency. This interpretation explains the importance of a key assumption in the arguments: that the bookie knows nothing beyond the agent's credences. The Dutch bookie is not simply profiting from some lack of fit between the agent's beliefs and the world. He is exploiting something internal to the agent's belief system.

Seen in this light, Dutch book vulnerability is philosophically significant because it reveals a certain inconsistency in some systems of beliefs, an inconsistency which in itself constitutes an epistemic defect. This is important to keep in mind when assessing the force of the Dutch Strategy arguments. Their force will be parallel to that of the classic Dutch Book arguments only if the potential for monetary loss they involve is also an indicator of epistemically objectionable inconsistency.¹¹

IV. INCONSISTENT BELIEF SETS AND IRRATIONALITY

Before looking more closely at the Dutch Strategies employed by van Fraassen and Sobel, I would like to examine a couple of different situations in which a clever bookie can assure himself of a profit merely by knowing agents' probability distributions and offering fair bets. These examples will, I think, shed considerable light on the connection between betting losses and rationality. In doing so, they will support the above interpretation of the classic Dutch Book arguments and provide instructive points of comparison with the newer Dutch Strategies.

The Double Agent Dutch Book: Suppose that I am shopping with my wife. My credence in rain today is 25%. My wife, who is somewhat more pessimistic than I, sets the probability of rain at 50%. I am approached by a bookie, who offers to bet me \$1 to my \$3 that it will rain (that is, he will win if it rains). Given my credence, I

¹¹I am, of course, using "inconsistency" loosely here, leaving open the question of what particular kind of inconsistency may be involved in the beliefs of those who are susceptible to Dutch Strategies.

regard this bet as fair, accept it, and go back to weighing out wax beans. The bookie then approaches my wife, offering her a bet at \$2 to \$2, which he will win if it doesn't rain. Given her credence, she regards this bet as fair, and accepts it. The bookie has now assured himself of a \$1 profit: if it rains, he gets my \$3 and pays my wife \$2; if it doesn't, he pays me \$1 and gets \$2 from my wife.

This story is simply a Double Agent analogue to the classic Dutch Book argument. The analogy may perhaps be improved by noting that my wife and I hold all our assets in common, so that not only has the bookie made a sure profit, but we have sustained a sure loss. If the force of this example were parallel to that of the classic Dutch Book, it would provide powerful support for the claim that my beliefs should not only be probabilistically consistent among themselves, but also with those of my wife. Nevertheless, I think it is clear that despite all this, nothing in the story impugns my rationality, or that of my wife, in the slightest.

The reason the Double Agent Dutch Book does not show anyone to be irrational, I think, is this: although my beliefs are in a clear sense inconsistent with my wife's, that is a perfectly reasonable state of affairs. Consistency in degrees of belief, like deductive consistency, is a rational ideal for individuals, not couples—even couples with joint checking accounts. If the force of Dutch Book considerations were practical—if the reason for obeying the probability calculus were to avoid actual monetary loss—then perhaps the Double Agent Dutch Book could be used to support a demand for probabilistic consistency between individuals (or at least between spouses who share their assets). But as we've seen, the real force of the classical Dutch Book arguments lies in their supporting certain axioms as criteria of coherence or consistency among beliefs. In doing this, Dutch Book arguments simply do not bear on the prior question of whether any particular set of beliefs *should* be coherent. In the present case, since we don't antecedently take interpersonal consistency to be a rational ideal, susceptibility to the Double Agent version of the Dutch Book is not an indicator of irrationality.

The Prescient Dutch Bookie: This time, let us imagine a bookie whose abilities exceed even those of the bookie imagined in the classic Dutch Book arguments. We'll assume that the bookie can determine not only the agent's current probability distribution, but

also what her probability distribution will be one hour from now. Now suppose that the agent changes her degree of belief in any proposition, to any degree whatsoever. The bookie, foreseeing this change, can easily assure himself of a profit by offering appropriate odds in bets, now and one hour from now, on this proposition and its negation.

Now the possibility of this sort of betting loss might, I suppose, be taken to support a very strong diachronic condition on rational credences, a condition which would preclude any change at all in degree of belief (we might call the condition “Calcification”). But I think it is clear that any such argument would be absurd. The prescient Dutch bookie example just doesn’t seem to provide any reason for taking Calcification to be a rational requirement.

Why, though, is the possibility of a prescient Dutch bookie so untroubling? One explanation that might be suggested lies in the fact that the assumption of psychic prescience is extremely unrealistic. But this seems quite beside the point. Even the classical assumptions about the bookie’s knowledge are highly unrealistic. This, as we have seen, is not relevant, since the force of the Dutch Book argument is not to point out some practical danger in being inconsistent.

Is there something else about the assumption of prescience that undercuts the force of the example? I do not see what it would be. As in the classic Dutch Book, we are not giving the bookie knowledge of anything beyond the agent’s credences. As in the classic Dutch Book, the bookie’s certain profit reveals a certain kind of inconsistency in the set of beliefs the bookie takes advantage of. The difference, I would suggest, is only that in the prescient Dutch bookie example, the beliefs in question are not held by the agent concurrently. We do not think that the beliefs an agent holds at different times should cohere in the way an agent’s simultaneous beliefs should. For this reason, the incoherence revealed by the vulnerability to the prescient Dutch bookie simply does not concern us.

Let us summarize the lesson of the above examples. The monetary loss inflicted by a Dutch bookie is a powerful indicator of some inconsistency among a certain set of beliefs—the set of beliefs involved in the bets the bookie must be able to make to ensure his profit. However, this type of inconsistency should not neces-

sarily be of any concern. As the examples show, the inconsistency should not concern us at all unless the set of beliefs in question *should* be consistent. Moreover (and this is a crucial point), the question of whether the beliefs in a certain set should fit with one another has nothing to do with anyone's financial prospects. Vulnerability to the Dutch bookie, while it reveals an inconsistency in a certain set of beliefs, simply does not speak to this prior question at all.

V. DUTCH STRATEGIES AND RATIONALITY

Keeping all this in mind, let us turn now to a more careful examination of Dutch Strategies, with an eye toward seeing what sort of problems in an agent's belief set they might reveal. The first thing we should notice is that Reflection is a constraint on the beliefs of a single agent—in fact, it is a constraint on a single agent's beliefs at one time. This might be seen as showing that the Dutch Strategies in question *do* trade on the type of inconsistency we want to avoid, rather than on the harmless type of inconsistency exploited in the two examples considered above.

On closer inspection, however, things are not so simple. Remember that a Dutch Strategy, unlike a Dutch Book, relies not only on a set of bets made at the initial time, but also on the bookie's option to make further bets, at a subsequent time. These subsequent bets will, of course, be fair according to the agent's *subsequent set of credences*. Thus the set of beliefs that give rise to Dutch Strategy vulnerability includes beliefs the agent has at two separate times. In this respect, the Dutch Strategy argument for Reflection resembles our prescient Dutch bookie argument for Calcification more than it does the classic Dutch Book argument for synchronic probabilistic coherence.

This suggests, of course, that vulnerability to the Dutch Strategy does not indicate irrationality after all. For without *independent* reason to think that the agent's future beliefs should mesh in some particular way with her present ones, we have no reason to think she should avoid the incoherence exploited by the imaginary bookie. What is suggested, in other words, is that without an independent argument for diachronic consistency of beliefs, the Dutch

Strategy does not give us any reason at all to respect the principle of Reflection!

Furthermore, this analysis suggests that in rejecting the Dutch Strategy argument for Reflection, we need not reject the superficially similar Dutch Book argument for probabilistic consistency. Indeed, it is precisely appreciating the true force of the classic Dutch Book that enables us to appreciate the Dutch Strategy's impotence. Considering the intuitive power of the classic Dutch Book argument, and the manifest absurdity of Reflection, this is exactly the result we would have hoped for.

Before resting content with this analysis, however, I would like to examine one potential source of concern about it. I have claimed that the Dutch Strategy urged in defense of Reflection depends on future beliefs in a way that undercuts its claims on our rationality. But it might be objected that I have not accounted for an important observation: that while the bookie in the Dutch Strategy argument must be able to bet on the agent's subsequent beliefs, *it does not matter what these beliefs turn out to be*. Given that the agent is Irreflective at the initial time, *any* subsequent beliefs she comes to have will provide grist for the bookie's mill. In this respect, the role played by the agent's future beliefs in the Dutch Strategy argument for Reflection is quite unlike the role played by the agent's future beliefs in the unpersuasive argument for Calcification. Mightn't this indicate that the Dutch Strategy is, after all, best seen as exploiting a synchronic inconsistency?

It seems to me that no such conclusion is warranted. What is shown by the observation is not that an Irreflective agent's beliefs are synchronically incoherent, but rather that such an agent's beliefs are *diachronically incoherent with any set of her subsequent beliefs*.¹²

¹²This distinction is not the product of some subtle sophistry. It has a clear parallel, for example, in the distinction between my own beliefs not being simultaneously satisfiable, and my beliefs not being satisfiable simultaneously with any beliefs my wife might have. Suppose that I have only the following two beliefs:

- (1) It will rain;
- (2) My wife believes it won't rain.

My beliefs are simultaneously satisfiable. However, they are not satisfiable simultaneously with those of my wife—no matter what her beliefs are. If my wife does not have the belief I attribute to her, then my belief about

But since diachronic inconsistency is not in itself irrational or undesirable—as evidenced by the absurdity of Calcification—it is hard to see any reason for thinking that a belief state which *guaranteed* diachronic inconsistency was something we should be concerned to avoid.

In order to make this point a bit more concrete, I would like to consider one additional example, a variant of the Double Agent Dutch Book example above. This example will parallel the Dutch Strategy under discussion quite closely, in that the bookie will be able to devise his winning Strategy merely on the basis of knowing a single person's beliefs at a single time. Also, the Strategy he devises will ultimately depend on his being able to make bets on another set of beliefs. This time, though, he must be able to bet on the beliefs of a second agent, rather than the beliefs of the first agent at a subsequent time.

The Double Agent Dutch Strategy: Suppose that I go shopping again with my wife, whom I consider to be unduly pessimistic. In particular, I take the probability of rain, on the supposition that *she* puts the probability of rain at 50%, to be only 25%. (I also put some non-zero probability—say, 20%—on the proposition that she does take the probability of rain to be 50%.) The bookie now approaches me, and offers me the following two bets: The first will be won by me just in case my wife's probability for rain is in fact 50%. As I consider my chances of winning to be 20%, I am willing to put up \$2 to the bookie's \$8. The second bet is conditional on my winning the first one—no one collects unless my wife's probability for rain is 50%. If the condition is fulfilled, I win if it does not rain, and the bookie wins if it does. Given my beliefs I consider my chances of winning (given that the condition is fulfilled) to be 75%; I am thus willing to put up \$30 to the bookie's \$10.

Having made these two bets, the bookie smiles. Whatever the weather holds in store, and *whatever my wife's beliefs turn out to be*, he will be able to profit. He will first determine if my wife's probability for rain is, in fact, 50%. If it is not, he wins the first bet with me, the second bet is called off, and he goes home \$2 richer. If my

her is false. On the other hand, if she does have the belief I attribute to her, then one of us has a false belief about the weather.

wife's probability for rain is 50%, he must do a bit more work. First he will pay me \$8 on the first bet. Then he will offer a third bet, this one to my wife. She will win if it rains; he will win if it doesn't. Given her 50% probability for rain, she will regard it as fair to put up \$20 to the bookie's \$20.

The bookie is now assured a net profit in any weather. If it rains, he has won \$30 from me, and owes my wife \$20; taking into account the \$8 he paid me earlier, he's up by \$2. If it does not rain, he must pay me \$10 on top of the earlier \$8; however, the \$20 my wife must pay him still nets him a \$2 profit. In sum, no matter what my wife's beliefs were, and no matter how the weather turned out, our checking account balance was destined to shrink by \$2.

This example is obviously modelled closely on the Dutch Strategy described in Section I; in fact, it is structurally identical. The only difference is that I have replaced the subsequent beliefs of the original agent by concurrent beliefs of a second agent. In each case, the bookie must be able to bet on this second set of beliefs to ensure his profit. In each case, however, it does not matter what the beliefs in the second set turn out to be. The original beliefs of the original agent guarantee that whatever the beliefs in the second set are, they will be inconsistent with the original set of beliefs, in a way that will allow the bookie to make his profit.

One might try to use this Double Agent Dutch Strategy to argue for a "new requirement of rationality," formulated as follows (where P_a is the agent's probability function and P_s is the probability function of the agent's spouse):

$$\text{Solidarity: } P_a(A/P_s(A) = r) = r.$$

It might be claimed that this principle expresses an aspect of a marital ideal; that it reflects the proper commitment to "stand by your (wo)man." But while this is pretty dubious as moral advice, it is nothing short of wacky as a constraint on rationality. The Dutch Strategy argument for Solidarity is a non-starter.

The reason that the argument is so unpersuasive is not simply that the conclusion is absurd. Rather, it is unpersuasive for the same reason the first Double Agent Dutch Book argument was unpersuasive: interpersonal consistency is not a requirement of ratio-

nality; and the inconsistency exploited by the bookie here is interpersonal. It is interpersonal, even though the Strategy will work whenever a single agent violates Solidarity—which is, after all, a requirement on the individual agent's beliefs alone! Although the Strategy works no matter what the spouse's beliefs turn out to be, this does not nullify the fact that the bookie's profit ultimately depends on the lack of fit between the spouse's beliefs and the agent's. And this fact renders the Strategy incapable of supporting Solidarity as a requirement of rationality.

The moral we should draw from this example is, I think, obvious. The Dutch Strategy argument for Reflection depends on subsequent beliefs in precisely the same way as our argument for Solidarity depends on another person's beliefs. We can thus rest content with the analysis given above, even though Reflection is a synchronic requirement, and even though the bookie can make a profit from the Irreflective agent no matter what the agent's subsequent beliefs turn out to be. Without some independent reason for thinking that an agent's present beliefs must cohere with her future beliefs, her potential vulnerability to the Dutch Strategy provides no support at all for the principle of Reflection.

VI. CONCLUSION: BETTING LOSSES AND REQUIREMENTS ON RATIONALITY

We can now see why Dutch Strategies do not, after all, support Reflection in the same way that the classic Dutch Book argument supports the requirement of probabilistic consistency. How does this bear on the Dutch Strategy arguments intended to justify Conditionalization principles governing change of belief? Conditionalization principles are, of course, explicitly diachronic constraints on an agent's beliefs. Thus it is not surprising that the arguments which show these principles necessary to avoid guaranteed betting losses turn out to depend on the bookie's ability to make bets on the agent's beliefs at two different times. But this is, of course, the very feature that undermined the Dutch Strategy arguments for Reflection. It turns out, then, that the guaranteed betting losses potentially suffered by those who violate Conditionalization have no philosophical significance at all.

In sum, then: Reflection, as a constraint on rational belief, is absurd. Defenders of probabilistic theories of rationality should not, however, worry that the classic betting-loss-based arguments for requiring probabilistic consistency are thereby subject to *reductio ad absurdum*. For despite the striking similarities between the guaranteed betting losses involved in Dutch Books and those involved in Dutch Strategies, we can see that only the former bear on questions of rationality.

That is good news; but perhaps not all the news is good. For once we see clearly the relations between guaranteed betting losses and rationality, it becomes apparent that one attractive avenue for justifying Conditionalization principles is in fact a dead end. Those who would make some form of Conditionalization a requirement of rationality, then, must seek its justification by some alternative route.

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