

Towards a Hybrid Account of Luck

ABSTRACT The concept of luck has been used both in epistemology and in ethics to clarify knowledge and free will respectively. In this paper, I investigate what is perhaps the most prominent account of luck in the literature: the Modal Account of Luck (MAL). MAL states that the degree of luck to which an event is subject depends on how easily that event could have failed to occur. I raise an objection to MAL based on an ambiguity in this claim. The objection motivates a new, hybrid account of luck that combines modal and probabilistic conditions. I briefly present such an account, discuss how it relates to a similar account recently proposed by Carter and Peterson (2017), and consider some objections.

Keywords: Luck, degrees, modal account, Pritchard, probability, Rescher

Luck is a slippery notion. Yet the concept of luck plays an important role in both in our daily lives and in philosophical theory.¹ Neil Levy, for example, argues that certain forms of luck are incompatible with free will. In epistemology, Duncan Pritchard argues that certain forms of luck are incompatible with knowledge. One of the most prominent accounts in the literature is the Modal Account of Luck (MAL), versions of which are endorsed by both Levy and Pritchard.²

MAL is motivated by the claim that lucky events are events that could have easily failed to occur. In this paper, I argue that this claim is ambiguous. Whereas proponents of MAL have usually understood this claim as concerning the modal *distance* between the actual world and the nearest world where the event is concerned, it can be interpreted probabilistically as well. I present cases indicating that luck depends *both* on modal distance and on probability. I suggest a new, hybrid account of luck that accommodates these observations, compare this account to a similar account proposed by Carter and Peterson (2017), and consider some objections.

1. A Modal Account of Luck

The core motivation for MAL is the idea that lucky events are events that occur in the actual world, but could have easily failed to occur.³ Paradigm cases of luck, such as winning the lottery or finding a treasure by randomly digging a hole, confirm this: these events tend to be such that even if they occur in the actual world, they could have easily failed to occur. This intuition is captured by leading proponents of MAL in the following way:

¹ For some example in ethics, see (Levy, 2011; Williams & Nagel, 1976). For some examples in epistemology, see (de Grefte, 2017a; Goldberg, 2015; Pritchard, 2005)

² That is not to say it is uncontested, of course. See for example (Goldberg, 2015; Hiller & Neta, 2006; Lackey, 2008)

³ This claim is not uncontroversial. In Section 6 I defend it against an objection put forward recently by Broncano-Berrocal (2015).

(L1) If an event is lucky, then it is an event that occurs in the actual world but which does not occur in a wide class of the nearest possible worlds where the relevant initial conditions for that event are the same as in the actual world. (Pritchard 2005: 128)

(L1) is meant to capture the idea that lucky events could have easily failed to occur. How? Pritchard uses a standard possible world framework.⁴ Possible worlds can be ordered in terms of how similar they are to the actual world. Thus, the more similar a world is to ours, the closer it is, modally speaking.⁵ The idea is then to interpret easy possibilities in terms of close possible worlds. On this view, lucky events are events that fail to occur in worlds similar to our own.⁶

It should be noted that proponents of MAL sometimes include other conditions on luck besides (L1).⁷ In this paper, I will restrict my attention to (L1). Everything I say will be compatible with the addition of other conditions on luck besides those discussed in this paper.

For our purposes, it is of substantial importance that luck is a gradual notion: events can be lucky to a greater or lesser extent. Pritchard accommodates this fact about luck in the following way:

[D]egree of luck involved varies in line with the modal closeness of the world in which the target event doesn't obtain (but where the initial conditions for that event are kept fixed. (Pritchard, 2014, p. 600)

This is plausible for some differences in degree of luck. I am more lucky to survive when the sniper's shot misses me by an inch, than when it misses me by a foot. And indeed, it seems the nearest world where I get hit is more similar to the actual world in the first case than in the second, because less needs to chance to the actual world for me to get shot if the actual world is a world where the sniper misses me by an inch than if the actual world is such that the sniper's shot misses me by a foot. Proponents of MAL thus interpret the difference in degree of luck as a difference in the relevant modal distance between the two cases.

Importantly, what this will mean is that we can no longer say that only *nearby* possibilities are relevant for whether an event is a case of luck or not. The degree to which events are subject to luck can vary between 1 (where the event fails to occur in the nearest possible worlds where the relevant initial conditions are the same as in the actual world), and 0, where the event does not fail to obtain in *any* such possible worlds). An event may be subject to a minute degree of luck

⁴ Pritchard draws primarily on Lewis' seminal work (Lewis, 1973, 1986).

⁵ Similarity is another notion that is less than clear. What makes two worlds similar to each other? Lewis and Pritchard both take this notion to be primitive. I'll follow their usage and rely on our intuitive understanding of degrees of similarity.

⁶ That is not quite accurate: only the nearby worlds where the 'relevant initial conditions' for the event are the same as in the actual world are relevant for luck. I will leave this complication aside in this paper, since it does not impact its main point.

⁷ Cf. (Coffman, 2007b; Levy, 2011; Pritchard, 2005)

because it fails to obtain in a world quite removed from the actual one. This means that in general far-out worlds will be relevant for the degree of luck to which an event is subject.⁸

We should be careful not to take this observation to count against the modal account of luck. Degree of luck is still a function of the modal distance between the actual world and the nearest world where the event fails to obtain.⁹ In particular, the closer the worlds in which the event fails to obtain, the higher the degree of luck. Clearly lucky events such as winning the lottery fail to obtain in very close possible worlds, and will consequently will properly be judged as highly lucky on this nuanced account, leaving the intuitive motivation for the view intact.

On this view, events that do not fail occur in any possible world (i.e. events that occur in all possible worlds) are lucky to the degree 0, or not lucky at all. This means that necessities, on our account, will not be subject to any amount of luck. Initially, this may seem plausible. It is not a matter of luck that the union of my set of two beers with your set of two beers forms a set that has four beers as its members, or that we did not find any square circles yesterday. Interestingly, however, it has been argued that some necessities *are* cases of luck. Stephen Hales provides the following case:

Katerina, a logic graduate student in 1930, decides that for her dissertation topic she will prove that mathematics is complete, consistent, and finitely axiomatizable. Her advisor tells her that she will be lucky if this is in fact a provable result, and unlucky if it is not. Sadly for Katerina, she picked her dissertation topic a year before Godel's incompleteness proofs. While it is necessarily true that mathematics is not complete, consistent, and finitely axiomatizable, Katerina was nevertheless unlucky that her dissertation thesis turned out to be unprovable. (Hales, 2016, p. 496)

It is important in such cases to be maximally clear about the event in question. In this case, the event in question is the event of Katarina's dissertation thesis turning out to be unprovable. If Hales is right, this event is both a case of (bad) luck and necessary. Whether the event is necessary and thus presents a counterexample to our claim depends, however, on whether we read the phrase "Katarina's dissertation thesis" *de dicto* or *de re*. Read *de dicto*, it seems at least possible that Katarina could have chosen a different, *provable*, thesis topic. On this reading, it is not a matter of necessity that Katerina's dissertation turned out to be unprovable. Reading the case this way will thus allow us to conclude that it was to some degree a matter of bad luck that Katarina ended up choosing an unprovable thesis topic. To my mind, this is the most intuitive interpretation of the case, which would explain why we have the intuition that luck is involved.

Read *de re* however, the event is necessary. It is impossible for Katarina, or anyone else, to prove that mathematics is complete. But now that we are explicitly considering the event in question to be the event of Katarina trying to prove that mathematics is complete and failing to do so, I submit our intuitions are much weaker that it was a matter of luck that she failed. She may have

⁸ The fact that far-out worlds may be relevant for luck has also been noted by Church (2013) and Carter and Peterson (2017). We will discuss the latter of these in more detail below.

⁹ Although, as we will see below, not *exclusively* a function of the modal distance between the actual world and the nearest world where the relevant event fails to obtain.

been unlucky to select an impossible task, but it was not a matter of luck that she failed to complete the task of proving that mathematics is complete successfully. Neither on a *de dicto* reading, nor on a *de re* reading does Hales' case show that there are lucky necessities. We can explain away our intuition that luck is involved *somewhere* in the case by noting events in the vicinity of the case (Katarina selecting the topic of proving completeness) that is subject to some degree of bad luck. For now, our claim that there are no lucky necessities still stands.¹⁰

Let us take stock. In this section I presented the modal account of luck and argued that the degree of luck to which an event is subject varies with the modal distance of the nearest possible world where that event fails to obtain. As I will argue in Section 3 however, there are cases that indicate that modal distance is not the only factor influencing degree of luck. To pave the way for this claim, I will in the next section present an alternative interpretation of the bedrock motivation for the modal account of luck, the claim that lucky events could have easily failed to occur.

2. An ambiguity

We saw in the previous section that for Pritchard, lucky events are events that could have easily failed to occur in the sense that these events fail to occur in worlds similar to the actual world. Here I want to suggest a plausible alternative interpretation of the claim that lucky events could have easily failed to obtain.

On this alternative interpretation, events that could have easily failed to obtain are events that have high probability of not obtaining, or, what amounts to the same thing, a low probability of obtaining.

Such a probabilistic interpretation of luck can be supported to a large extent by the same cases that support Pritchard's modal interpretation. For just as winning the lottery and finding a treasure are events that fail to occur in worlds much like our own, these are also events that tend to have a low probability of occurring.

A probabilistic interpretation of easy possibilities is not just plausible when luck is concerned. When we say things like 'It is not easily possible to beat the house in roulette', or 'It is easily possible that our soccer team advances to the next round', these statements seem to track our probabilistic judgements. In the above cases, we think it is not very probable to beat the house in

¹⁰ To be fair, Hales discusses other putative cases of lucky necessities as well. While unfortunately I do not have the space to go over all of them here, I should like to say two things. First, mere physical necessities will not suffice as a counterexample to our claim, since there are possible worlds that have quite different physical laws than our own. Second, insofar as metaphysical and logical necessities are concerned, we can in all of Hales' cases explain away our intuition that luck is involved by identifying a contingent event in the vicinity that does satisfy our conditions for luck.

roulette, but we think it is highly probable that our favourite soccer team advances to the next round.¹¹

That luck seems to be inversely related to probability has been noted by various authors, including, most recently, by Nicholas Rescher (Rescher, 2001, 2014). On Rescher's account, (good) luck (λ^+) is a product of the significance of an event (Δ) and the probability that the event did *not* occur ($1 - p$):

$$\lambda^+ = \Delta \cdot (1 - p) \text{ (Rescher, 2014, p. 624)}$$

For Rescher, the degree of luck to which an event is subject is inversely related to the probability of the event occurring. The higher this probability (holding fixed the significance of the event), the less the degree of luck.

It may be thought that, actually, the modal and probabilistic interpretations of the concept of an 'easy possibility' come down to the same thing. But this is not the interpretation of MAL that its proponents have in mind. When discussing his modal interpretation of luck, Pritchard makes it clear that his modal criterion for luck should not be understood in a probabilistic way:

One advantage of understanding luck in terms of a similarity ordering of possible worlds is that it explains why agents would be willing to take part in lotteries given the low odds of success. This is because the very attraction of a fair lottery lies in the fact that the possible world in which one wins is very like the actual world, even though it is in fact unlikely that such a possible world should be the actual world. This point highlights the sense in which the similarity ordering of possible worlds is not tantamount to an ordering in terms of probability. (Pritchard, 2005, p. 128)

The idea is that for Pritchard, what matters for luck is not the *number* of possible worlds where the relevant event fails to obtain, but rather the similarity of the nearest world where it fails to obtain to the actual world. In the lottery case, just a one different number would have to be selected for one to win instead of lose. Thus, Pritchard classifies the event of losing as lucky even if it has a very high probability of occurring.

The lottery case shows that high probability events can nevertheless occur in modally close worlds. To say that a lucky event fails to occur in modally close worlds is thus not the same as saying it is a low probability event. The ambiguity in the claim that lucky events could have easily failed to occur is thus substantial. We can take it either to mean that these events fail to occur in nearby possible worlds, or that they have a low probability of occurring. Pritchard opts for the former interpretation, Rescher for the latter. In the next section, however, I argue that the dichotomy is a false one: the degree to which an event is subject to luck depends *both* on modal distance *and* on probability.

¹¹ Of course, this does not mean that our probabilistic judgements have to be correct. I claim that our judgments of what is easily possible correlate with our *judgements* of probability, not with any actual probabilities involved.

3. *Two factors of influence*

So far, we have seen that there are two possible ways to interpret the claim that lucky events could have easily failed to obtain. Pritchard presents a modal interpretation, and Rescher a probabilistic one. I will now present two pairs of cases that lend support for the claim that both Pritchard and Rescher are partially correct.

The first pair of cases is the following:

C1: Jill buys a lot for a wheel of fortune. The wheel spins, and as it slows down, Jill's number approaches. In fact, as the wheel nearly stops, the flapper touches one of the pins between which Jill's number is. It bends, it bends... but it fails to go over the pin. Jill has lost.

C2: Joe buys a lot for the same round of the same wheel of fortune. The wheel spins, and as it slows down, Jill's number approaches. In fact, as the wheel nearly stops, the flapper touches one of the pins between which Jill's number is. It bends, it bends... but it fails to go over the pin. Like Jill, Joe has lost. But Joe had lost interest some time before, because his number was located at the opposite side of the board.

Just before spinning, Jill and Joe had the same probabilities for winning and losing on the wheel of fortune. As it turned out, both lost. This event was equally probable for Jill as it was for Joe. But it was not equally easily possible, since less needs to change to the actual world to get to the nearest world where Jill wins, than to get to the nearest world where Joe wins. Just a minute difference in force applied to the wheel in Jill's case, a little more difference in force in Joe's.

Now, the crucial question is whether there is a difference in luck between Jill and Joe. I believe there is a strong intuitive pull to say that there is more bad luck involved in Jill's case than in Joe's. Even though the probabilities for winning are the same between them, it seems natural to say that Jill could more easily have won than Joe. If this is true, then ease of possibility, and therefore luck too, will sometimes depend on the relevant modal distance involved, *rather* than the probabilities.

In fact, the judgement that Jill is more (un)lucky to have lost than Joe coheres well with empirical work done by psychologist Karl Teigen (1996, 2005). These studies indicate that not just probabilities, but also modal distance influences people's ascriptions of luck. For example, Teigen found that certain judgements of luck do not depend on probability but rather on counterfactual closeness of alternatives: subjects were found to judge events as dissimilar in the amount of luck that was involved, even while explicitly admitting that the probability for the events was the same (Teigen, 2005). Teigen's examples included judgements of luck concerning roulette wheel outcomes. If the outcome was physically close to the number on which subjects had placed bets, the subjects judged the event to be a case of (bad) luck. The further the outcome was physically removed from this number, the less willing subjects were to regard the event as a case of luck, even if they agreed that the probabilities of the relevant events were the same,

indicating that our judgements of luck here are responsive to modal distance rather than to probability.¹²

Thus, we cannot explain the difference in luck between Jill and Joe in terms of the relevant probabilities, but instead need to appeal to modal distance. On the basis of this one might conclude that luck depends *only* on the modal distance between the actual world and the nearest world where the relevant event fails to obtain. And this is indeed the conclusion Pritchard seems to draw. Certain other cases, however, indicate that probability is another factor influencing degree of luck. Consider the following two cases:

C3: Jaimy wins the lottery. Her ticket is randomly selected out of the 10.000 tickets that have been sold for this lottery.

C4: Jerome wins the lottery. His ticket is randomly selected out of the 100 tickets that have been sold for this lottery.

Let us assume that in both of the above cases, the procedure for selecting the lottery results is the same, say by numbering each ticket and then using a random number generator to select a number out of the relevant range. Further, let us assume that in both cases, the nearest worlds where these events fail to obtain are worlds where the number generator picks out just one different digit. Under these assumptions, the modal distance between the nearest world where Jaimy loses and *her* actual world is equal to the modal distance between the world where Jeremy loses and *his* actual world. These worlds are similar to the respective actual worlds to exactly the same degree. If modal distance were the only determinant of luck, the events should thus be equally lucky.

But this clashes with our intuitions. I take it that most of us would agree that Jaimy is more lucky to win than Jerome, other things being equal.

While this difference in degree of luck cannot be explained in terms of a difference in modal distance between these cases, we *can* explain the difference in terms of probability. For in the above cases, the probability that Jaimy will win the lottery is clearly lower than the probability that Jerome will win.¹³ Thus, if Rescher is right and luck is inversely related to probability, Jaimy should be more lucky than Jerome to win, which seems to be the correct verdict.

The upshot of this, I take it, is that *both* modal distance *and* probability influence the degree of luck to which an event is subject. If we want to account for all relevant differences in degree of luck, we need an account of luck that acknowledges the influence of both of these factors. Such an account would include both a modal condition as well as a probability condition. In the next section, I provide a tentative proposal for such a hybrid account of luck.

¹² I make the same point in my dissertation, as do Pritchard and Smith in an earlier paper (de Grefte, 2017b, p. 89; Pritchard & Smith, 2004, p. 11)

¹³ It should be noted that it is somewhat problematic to speak of ‘the’ probability of an event. This problem, known as the ‘reference class problem’, will be set aside here. On most plausible interpretations of the relevant reference classes it will be the case that the probability that Jaimy will win is lower than the probability that Jerome will win. See also our discussion in section 6.

4. A Hybrid Account

So far, we have seen that the degree of luck to which an event is subject may depend both on the modal distance between the actual world and the nearest world where the event fails to occur, as well as on the probability of the event occurring. In this section I provide a hybrid account of luck that does justice to this fact.

The account I want to propose is a combination of the views by Rescher and Pritchard. To this end, I will first assume that the degree of similarity between two worlds can be represented on a scale ranging from 0 to 1.¹⁴ When the similarity between two worlds is 0, they are maximally dissimilar. When their similarity is 1, they are identical. Given such a scale, we can provide the following definition of degree of luck (λ) as the product of similarity between the nearest world where the event fails to occur and the actual world (S) and the probability of the event failing to occur ($1-(p)$):

$$\text{HAL: } \lambda = S \cdot (1-p)^{15}$$

What can be said in favour of weighing these factors in this way? To start, this definition captures some important features of luck. First, the higher the probability of an event, other things being equal, the lower the degree of luck to which it is subject. Second, the greater the modal distance between the nearest world where an event fails to occur and the actual world (lower S), the lower the degree of luck to which it is subject. Third, if an event occurs necessarily, it is not a matter of luck at all. The definition thus captures the features of luck that we emphasized so far.

More particularly, this definition weighs the influence of world similarity and probability *equally* by giving them the same value ranges and taking degree of luck to be determined by their product. Both S and $(1-p)$ range from 0 to 1 and they are multiplied. That means that the effect of a value of 0,8 for S and 0,2 for $(1-p)$ would be the same as the effect of the value set of 0,2 for S and 0,8 for $(1-p)$. This ensures the influence of world similarity is the same as the influence of the probability of the event in question. Since there is no reason, at least not so far as I can see, for supposing the one factor should weigh more heavily than the other, this seems the right thing to do.

¹⁴ How to measure this degree of similarity? That is a difficult question, and there is considerable controversy regarding its answer. In this paper, I will assume it *has* an answer, but I will remain uncommitted as regards the specific form the answer may take, or whether it will be a *precise* answer (see also below). In any case, it seems we have a relatively firm intuitive grasp on the notion of similarity, at least firm enough to make the points I want to make in this paper.

¹⁵ Note that this measure of luck does not feature a factor for the significance of the event, contrary to Rescher's account (where this significance was denoted by the symbol Δ). This is in line with my earlier comment, that my present focus is on the influence of modal and probabilistic considerations on degree of luck. The account is compatible in principle with additional relevant factors.

Given these relative weights, either a probability of nearly one and a similarity of nearly 0 would mean the degree of luck, at least insofar as it is determined by these factors, is nearly 0, no matter what the value of the other variable. Thus, if an event has probability close to 1, given its relevant initial conditions, then the event will be judged virtually non-lucky, even if it fails to occur in a world that is highly similar to the actual world. This may seem problematic if we want to give the intuitively right verdict about lottery cases, where one forms the belief that one will lose on the basis of the long odds involved. As was said above, we should want to accommodate the widespread intuition that what prevents knowledge in lottery cases is that the relevant beliefs, if true, would be true only by luck. This intuition remains even if we make the lottery size extremely large, in which case the probability of one forming a true belief is almost negligible. In this case, it seems our account would give the wrong verdict, since the low probability of forming a false belief would render the degree of luck to which the event of forming a true belief is negligible as well.

I think there are two distinct plausible ways of responding to this worry. The first is to say that even if the degree of luck in such cases is very small, especially if one increases the lottery to near-infinite size, that may still be sufficient to prevent knowledge. Perhaps knowledge is incompatible with any degree of luck.¹⁶ A second response is to maintain that there are certain *threshold* values of *S* that automatically render the event lucky enough to prevent knowledge. Lottery beliefs would fit this criterion, because in such cases, the nearest world where the belief is false is *very much* like the actual world, even if the probability for the event to fail to occur is extremely low. Within our framework, there are thus multiple ways to accommodate the knowledge-preventing luck in lottery cases.

Our hybrid account of luck would be able to accommodate the differences in luck between our pairs of cases. Jill is more lucky than Joe, because *S* for her is higher than for Joe, which, given the same probabilities, will result in a higher degree of luck. We can explain the difference between Jaimy and Jerome by appealing to the fact that for Jaimy (*p*) is much lower than for Jerome. Both our pairs of cases can be straightforwardly accommodated by our hybrid account.

Admittedly, our account is vague in certain respects. In particular, it features the vague notion of world similarity. What this means is that the exact degree of luck to which an event is subject may sometimes be indeterminable, on our account.¹⁷ Not all vague notions are unfit for clarification, however. For example, we may clarify the notion of ‘giants’ by stating that giants are tall, even if ‘tall’ is a vague notion. It seems at least plausible that luck is a vague notion too. Our account is able to clarify why and in what respect this is so.

¹⁶ At first sight, this seems to have sceptical consequences. Perhaps all, or very many of our beliefs are subject to *some* degree of luck. If this is enough to prevent knowledge, we will have far less knowledge than we suppose we do. Perhaps this is the right way to go, and I am somewhat sympathetic to biting this bullet. In any case, I think it is somewhat dangerous to use this kind of argument, especially if one wants one’s definition of luck to be useful in epistemology. For if we want our notion of luck to be useful in clarifying our notion of knowledge, then it had better be the case that we can provide an independent motivation for our analysis of luck, a motivation that does not draw upon our intuitions regarding knowledge.

¹⁷ It should be noted that this feature is shared by all extant modal accounts of luck.

I have provided a pair of cases that poses problems for traditional analyses of luck. Are there any analogous cases that pose problems for our account? That is hard to say without committing to any specific set of jointly *sufficient* conditions for luck. As I have stressed, my aim in this paper is not to provide a full-fledged account of luck, but rather argue for two separately necessary conditions on luck. If one finds a difference of degree of luck that cannot be explained by referring to a difference in the satisfaction of those two conditions, then that is reason to suppose these conditions are not sufficient, but again, I do not claim they are. To support my claim, I only need to provide plausible cases where a difference in degree of luck *is* attributable to a difference in the satisfaction of either of the two conditions. I have provided two pairs of such cases, and I am confident more can easily be found.

Thus, while an account of luck in terms of modal distance, or probabilities alone would be problematic, an account of luck that accommodates the influence of both these factors seems much more promising. In this section, I have proposed a specific formulation of such an account. In the next section, I will compare our account to a similar account proposed by Carter and Peterson (2017), and argue that our account improves upon it.

5. Carter and Peterson's account of luck

It should be noted that that what I have said about luck shares a close affinity with the account of luck developed in Carter and Peterson's paper *The Modal Account of Luck Revisited* (2017). I take this to provide additional support for the general kind of view outlined here, the view that luck does not just depend on modal distance. In this section I will compare the present account to Carter and Peterson's account of luck, and argue that our account improves upon it by making the notion of luck more precise.

First of all, let us briefly review the account of luck developed by Carter and Peterson. Carter and Peterson provide the following definition of degree of luck, to which they refer with the term *modal weighted likelihood* of an event E ($ml(E)$):

$$ml(E) = \int_{x=0}^{\infty} w(x) \cdot (1 - d(E, x))$$

First, $w(x)$ is a value between 0 and 1 that denotes the weight assigned to events that occur at distance x from the actual world. This weight is inversely related to the distance x ; the smaller x is, the higher $w(x)$ will be. As Carter and Peterson note: “[i]t is plausible to assume that $w(x)$ approaches 0 as x approaches ∞ and that $w(x)$ approaches 1 as x approaches 0” (2017, p. 2181). This has the consequence that just like for our account, *ceteris paribus*, the greater the modal distance between the nearest world where an event fails to occur and the actual world (higher x), the lower the degree of luck to which it is subject. And that is not surprising, since as we already noted modal distance is standardly interpreted as the inverse of world similarity.

Second, $d(E, x)$ denotes the density of E worlds at distance x from the actual world. In the words of Carter and Peterson, “[f]or each distance x from the actual world, $d(E, x)$ assigns a value $[0, 1]$ that represents the density of E-worlds at distance x from the actual world, such that $d(E, x) = 0$ if

and only if E occurs in no world at distance x , and $d(E, x) = 1$ if and only if E occurs in all worlds at distance x . Although not explicitly noted by Carter and Peterson, probability functions form a subset of the set of possible integrations of such density functions.

This final point is important, because what it means is that the definition of luck proposed in the present paper is a particular *interpretation* of Carter and Peterson's proposed formula. While the truth of our account entails the truth of Carter and Peterson's account, the converse is not true. Carter and Peterson's account is thus less committed than the one proposed here: Carter and Peterson allow for more kinds of density functions to be possibly relevant for luck than does the present one. An advantage of the present account is then that it is more informative than the account provided by Carter and Peterson, something which I take, in general, to be a good thing. Furthermore, by opting for probabilities, our account is explicitly connected to Rescher's probabilistic account, a connection that lays only implicit in Carter and Peterson's account.

The question is of course whether there is any evidence for the more specific interpretation. I think there is, and it is provided in section 3. We are trying to figure out what determines the degree of luck to which an event is subject. As our examples in section 3 clearly illustrate, our judgements of luck are partly guided by what we take to be the probabilities involved. This, together with the fact that we prefer more informative definitions to less informative ones, provides a reason to prefer our more specific definition in terms of probability over Carter and Peterson's more general one in terms of a general density function. Of course, the accounts are compatible, and so there is no 'real' completion here. As I see it, the present paper continues the work of Carter and Peterson, provides extra evidence for the claim that luck partially depends on factors other than modal distance, and argues for a stronger version of their definition of luck.

6. Objections

Our account stresses the relevance of both probability and world similarity for luck. There are several worries, however, that either have already been raised in the literature or that may yet be raised against such accounts of luck. In this section, I will consider what I take to be the most important of these.

First, one may object to HAL on the grounds that it will have to judge all events in a causally determined world as non-lucky. For causally determined events have probability 1, given their causes, and, what essentially amounts to the same thing, if the event is causally determined, there is no possibility, neither near nor far, given the cause, that the event would fail to obtain. But as many authors note, it is highly plausible that some causally determined events could nevertheless be substantially lucky (Coffman, 2007a; Pritchard, 2005, pp. 126–127).

Proponents of a pure modal account of luck like Pritchard solve this problem by restricting the set of 'relevant initial conditions for the event', such that even in deterministic worlds, it need not be the case that the event is determined relative to this restricted set of initial conditions:

if one includes in the initial conditions for the event the demand that the balls fall into the lottery machine in a certain way, then one will no longer generate the desired result that the event is lucky in light of (L1) because the specification of the initial conditions

will *determine* the event in question across all the relevant nearby worlds. What we have in mind by this clause is thus some conception of the initial conditions which does not understand them in such a way that, individually or collectively, they determine the event in question. (Pritchard, 2005, p. 131)

Interestingly, this shows is that even on the standard modal account, the degree of luck to which an event is subject is not *just* a function of how close the nearest possible worlds where the event fails to obtain to the actual world, but *also* of the relevant initial conditions for that event. If we take these conditions to be the total state of the world just before the event occurred, then, under the assumption that causal determinism is true, there will not be *any* possible worlds where the event fails to obtain, neither near nor far. If we relax the conditions such that they do not include all causes for the event, however, then the event may still fail to occur in some possible worlds, and the event will then correspondingly be subject to some degree of luck.

In a sense, we are free to choose any set of initial conditions we like. Pritchard believes that we can usually let our intuitions guide us as to what is the appropriate set of initial conditions in specific cases. I agree but I think we can be more specific by saying there are at least two general constraints on what we should take, in a given case, to be included in the set of relevant initial conditions. The first constraint is provided by our interests. Thus, when we consider a lottery win, we are usually not interested in whether it was a matter of luck that the relevant subject won the lottery given that she bought 'the winning ticket' read *de dicto* (on this description, losing is simply impossible by definition and so her winning will not be a case of luck at all). Much more often we will be interested in whether she was lucky to win given only that she randomly bought a lottery ticket (given this description, there *are* nearby possible worlds where these conditions are met and she loses, so her win *will* on this conception be subject to substantial degrees of luck).

Another constraint on the initial conditions for an event relevant for determining degree of luck is given by the information available to luck-assessors. If we take the lottery case again, it does not seem to be particularly lucky that subject S won the lottery, *given* that she bought ticket #1 and *also given* that ticket #1 was drawn. Given these facts, it is not a matter of luck that she won (she could not have easily lost under these conditions). However, we often do not possess information about which ticket will win beforehand, and so our normal judgment that lottery wins are lucky may reflect the fact that we only take into account the information available to the subject at the time of buying the ticket. Given *these* facts only, S might have easily lost the lottery (for all she knew, another ticket than ticket #1 might have easily been drawn).

Some may object that this makes our account of luck unsuitable for an anti-luck epistemology, because it would entail a problematic form of pragmatic encroachment into anti-luck theories of knowledge. If the degree of luck to which an event is subject is to some extent determined by our interests and available information, then so will knowledge similarly come to depend on these factors, if knowledge is incompatible with certain degrees of luck, as many epistemologists maintain.

At least two can be said in response to this worry. First, we are presently concerned with the analysis of *luck*, not of knowledge. In this sense, if our account of luck turns out to be unsuitable in the analysis of knowledge, so much the worse for anti-luck epistemology. Second, it is not clear that pragmatic encroachment for luck in general necessarily transfers to pragmatic encroachment for knowledge. It is generally thought that there are two kinds of luck particularly problematic for knowledge, called *reflective luck* and *veritic luck*. Very briefly, a belief is veritically lucky if it is produced by a belief-forming method that could have easily produced a false belief instead, and reflectively lucky if this is so from the reflective perspective of the agent. What this means is that the kinds of luck relevant for the analysis of knowledge have relatively well-defined sets of relevant initial conditions, consisting of the actual belief-forming method in the case of veritic luck, and the method the subject *believed* she used in the case of reflective luck. This seems to indicate that while luck in general will be subject to pragmatic encroachment, the kinds of luck relevant for knowledge will require uniform sets of relevant initial conditions (always just the belief-forming methods and/or believed belief-forming methods) and thus not be subject to pragmatic encroachment. When knowledge is concerned, our interests and the information required to establish the relevant degrees of luck might be uniform, even if this is not so for luck in general.

It seems thus that there are ways for modal accounts of luck to make sense of the idea that even in causally deterministic worlds there can be genuine cases of luck. Crucially, the fact that our account incorporates an additional probability condition does not change this. In fact, it is well-known that probabilities are defined only in relation to a particular reference class. Thus, the probability that a particular agent might develop lung cancer at the age of 50 will depend on whether we describe her as belonging to the class of doctors, of smokers, of smoking doctors, etc. Importantly, our agent might belong to all these classes at once, and there does not seem to be a principled way of choosing one reference class rather than another. What reference class we use to determine probability will depend on both our interests and the information that we have available at the time of analysis. This general feature of probability will allow for lucky events even in causally deterministic worlds, since we may choose the reference class such that it will include events caused differently. Even in causally deterministic worlds, it may be true that the probability that *a random doctor* develops lung-cancer at the age of 50 is less than 1.

One may think that this feature of probability theory makes a notion of luck that incorporates it unfit in an analysis of knowledge for similar reasons as provided against our modal condition above. But such worries can be similarly dispelled. First, we are analysing the notion of luck in this paper, not the notion of knowledge. Second, it seems plausible that the probabilities relevant for knowledge (the probability that the method used yields true belief and the probability that the method the subject *believes* was used yields true belief) are much better defined than the probabilities relevant for luck in general.

These observations about the relevance of the set of initial conditions for degree of luck also provide a way to respond to a second, related worry that there can be highly probable or modally robust cases of luck (Broncano-Berrocal, 2015). Since usually, the probability and modal

conditions are part of competing accounts of luck, Brocano-Berrocal argues against these conditions separately.

Against the probabilistic condition on luck, Broncano-Berrocal provides the following counterexample (abbreviated for ease of exposition).

LAZY LUKE Lazy Luke is a unemployed computer technician from the future. He does not want to work at all, but is required to apply for jobs by governmental regulations. By using his supercomputer, he is able to apply for billions of jobs at once. Since he does not want to work at all, he uploads in every case the worst possible CV. However, some unusual interference scrambles his CV in his application to the company MicroCorp in such a way that it is now a very good CV, and consequently, MicroCorp decides to hire Luke straightaway.

Broncano-Berrocal argues that Lazy Luke was unlucky to get a job, even though the event was highly likely due to the fact that he sent out billions of applications, and the probability of a disjunction increases with the number of disjuncts. Even if the probability that Luke will land the job for any particular application is very low, the probability that he will land one of the billion jobs that he applied for will be substantial.¹⁸

I will grant that the probability that Luke will land one of the billion jobs that he applied for is substantial. I will not grant, however, that it is a matter of luck that this occurred. Brocano-Berrocal does not provide extensive motivation for his claim to the contrary, but I suspect his intuitions are driven by the unusual interference and how it happened to scramble Luke's CV in just the right way. What this shows, however, is not that it is a matter of luck that Luke managed to acquire a job at all, but rather that he was unlucky to acquire the *particular* job that he did in this *particular* way. But if this is what is lucky about the case, it does not present a counterexample to our claims. For this particular event has a low probability.

I think that what goes wrong is Broncano-Berrocal's inference from the luckiness of this particular event to the luckiness of the more general event that Luke got a job at all: "Yet it is by luck that Luke gets a job at MicroCorp and, therefore, it is by luck that he gets at least one job" (Broncano-Berrocal, 2015, pp. 9–10). Here we see again the relevance of the reference class: the reference class for the former event includes only situations where Luke applies to MicroCorp, whereas the reference class for the latter event includes all situations where Luke applies to any company at all. This is how it is possible that the probability of the former event is much lower than the probability of the latter. Properly understood, the case fails to show that low probability is not necessary for luck.

Broncano-Berrocal uses a different case to argue against the necessity of a modal condition on luck. The case is simply one where unbeknownst to you, the lottery wherein you participate is

¹⁸ One may wonder whether the disjunction rule for probability applies in this case however, since landing one job will influence the probability of landing another (after all, once Luke has a job he will stop looking for another). This means the events are not independent, and that consequently the disjunction rule does not apply. Since I want to focus on a different issue, I will set this worry aside.

rigged in your favour. If you win such a lottery, Broncano-Berrocal maintains, it is still a matter of luck that you won, even if you could not have easily failed to win, and thus even if the modal condition on luck is not satisfied.

What can be said against this putative counterexample? Our intuition seems to be driven by the fact that the subject does not *know* that the lottery is rigged in her favour. After all, if we change the case such that the subject knows that the lottery is rigged, our intuition that it is a case of luck disappears. What I take this to mean, however, is that that we evaluate the case from the perspective of the agent. Rather than providing a counterexample to a modal condition on luck, it actually supports such a condition. For from the perspective of Broncano-Berrocal's subject, losing *will* be easily possible, because her relevant set of initial conditions does not include the fact that her lottery is rigged, since it is stipulated that she does not know this. Thus, from the perspective of the relevant subject, the modal condition will be satisfied, and our account of luck explains why, *from this perspective*, we should think the case a case of luck. And this is perfectly compatible with the claim that from an objective, outsider's perspective, the event could not have easily failed to occur, and is thus not objectively a case of luck. I therefore submit that properly understood, this case fails to provide a counterexample to our claim that only modally fragile events can be cases of luck.

A third objection states that our account is *ad hoc*. The main reason for endorsing our hybrid account of luck is that it is able to accommodate certain cases. Preferably, we would like an explanation as to why it is the case that both probability and modal distance are relevant for luck, a reason based on principled grounds rather than on the desire to save as much of our intuitions as possible.

One such explanation can be provided by going back to the claim made at the beginning of this paper that lucky events are events that could have easily failed to occur. As we have argued, this claim is ambiguous. It can either mean that the event in question has a low probability, or that it occurs in a world much like our own. We can explain the relevance of both factors for luck by noting this ambiguity.

Furthermore, there seems to be reason for supposing that the phenomenon of luck is complex rather than simple. As mentioned before, many different accounts of luck exist in the literature, and various factors relevant for degree of luck have been identified. This provides some evidence for the claim that the nature of luck is complex rather than simple. In light of this, an ecumenical approach may be preferable over a somewhat dogmatic focus on only some of the aspects of luck. That is at least the spirit of the approach in this paper.

7.. Conclusions

In this essay, I argued that degree of luck depends both on modal distance *and* on probability. I argued that this requires a hybrid account of luck, an account with both modal and probabilistic features. I presented such an account, compared it to a similar proposal in the literature, and briefly considered four possible objections.

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