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Why Every Theory of Luck is Wrong

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There are three theories of luck in the literature, each of which tends to appeal to philosophers pursuing different concerns. These are the probability, modal, and control views. I will argue that all three theories are irreparably defective; not only are there counterexamples to each of the three theories of luck, but there are three previously undiscussed *classes* of counterexamples against them. These are the problems of lucky necessities, skillful luck, and diachronic luck. I conclude that a serious reevaluation of the role of luck in philosophy is called for.

The proper understanding of luck has far-reaching implications for many philosophical projects, including issues surrounding epistemic luck, moral luck, luck egalitarianism, luck and free will, and serendipitous science. Luck is often taken as an undefined primitive. It is only within the literature of the past 20 years or so has there been any effort to develop theories of luck, but even so these are largely nascent. Before the great machinery of philosophy is fully engaged and begins to churn out ever more refined and detailed theories, I aim to throw a wrench into the works. The reigning theories are so fundamentally flawed, along so many dimensions, that a radical rethinking of luck is called for.

There are three theories of luck in the literature, each of which tends to appeal to philosophers pursuing different concerns. These are the probability, modal, and control views. I will argue that all three theories are irreparably defective; not only are there counterexamples to each of the three theories of luck, but there are three *classes* of counterexamples against them. These are the problems of lucky necessities, skillful luck, and diachronic luck.

Nearly all theories of luck assume that an event is lucky or unlucky for a person only if the event is important to them somehow, or would be important to them if they were apprised of the relevant facts. One isn't lucky to flip a coin and have it come up heads unless the toss matters (see Pritchard, 2005 p. 132, Rescher, 1995 p. 32). There are a variety of approaches to the significance condition. Rescher treats importance as a parameter that helps to establish degrees of luck. Others have suggested that the significance of an event determines good luck or bad, but not luck simpliciter. Pritchard formerly regarded the importance of an event as a threshold requirement for its eligibility to be lucky, but in his most recent work iconoclastically rejects importance altogether (Pritchard, 2014). Ballantyne (2012) offers the most in-depth discussion of the significance requirement. While he is no doubt correct that it is a subtle matter to work out to everyone's satisfaction, my

concern here will be with what is added to the significance condition to have a complete theory of luck. To date, there are three basic answers.

1. Three Theories of Luck

Theory 1: Probability

The consensus view among mathematicians and scientists, according to the probability theory an event is lucky or unlucky only if it is improbable. The idea that luck is to be explained by probability goes back at least to Abraham de Moivre's *The doctrine of chances, or, A method of calculating the probability of events in play* of 1718. De Moivre writes,

> If by saying that a man has had good Luck, nothing more was meant than that he has been generally a Gainer at play, the Expression might be allowed as very proper in a short way of speaking: But if the Word *good Luck* be understood to signify a certain predominant quality, so inherent in a Man, that he must win whenever he Plays, or at least win oftener than lose, it may be denied that there is any such thing in nature. (de Moivre, 1718 p. iv).

The ancients regarded luck as an occult property, one that was granted by the whim of the gods or might be harbored in a rabbit's foot or four-leaf clover. Instead of luck being an inexplicable turn of Fortuna's wheel to be harnessed by magic, de Moivre argues that it is fully explainable by mathematics. To that end his book is an original development of probability theory, including a partial proof of the central limit theorem. Bewersdorff (2005) also describes the early development of probability theory as arising out of gamblers' need to explain bad luck (pp. 8–9). Mazur (2010) argues that the gambler's fallacy of expecting good fortune to follow after a run of bad simply arises from a misunderstanding of Bernoulli's law of large numbers. "Luck," Masur writes, "can be cogently explained by the rules of probability" (p. xvii). Ambegaokar (1996) concurs that probability theory is "why it is possible to reason quantitatively about luck" (p. 10).

The main philosophical defender of the probability theory is Nicholas Rescher. In Rescher (1995) he argues that only improbable events can be lucky or unlucky, and that their degree of luck is a function of the event's improbability and its importance (Δ(E)). He offers this formula (Rescher, 1995 p. 211) to measure the amount of luck (λ) in an event E: $\lambda(E) = \Delta(E)$ x pr(not-E). Thus the occurrence of a mildly improbable event that is very important might be just as lucky as a very improbable event that is only somewhat important. Very important, very unlikely events are the luckiest of all. No luck whatsoever attaches to events that are wholly unimportant or are certain to occur.

Theory 2: Modality

The modal view is common among epistemologists. According to this view, an event is lucky only if it is fragile—had the world been very slightly different it would not have occurred. The most prominent defender of the modality theory is Duncan Pritchard, who writes, "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 p. 128). Epistemologists like the modality approach because then epistemic luck involves "a true belief that could very easily have been false" (Pritchard, 2012 p. 272) and due to epistemic luck, "the fact that you could very easily have been deceived is a ground to deny you knowledge, even if in fact you were not deceived" (Pritchard, 2012 p. 275). These ideas pave the way for requiring a safety condition on knowledge, which states that S knows that *p* only if S's true belief that *p* could not have easily been false. Safety may not be the whole story about knowledge—even Pritchard now thinks it must be supplemented with a virtue account of success from ability—but it is widely considered to be a major player in theories of knowledge.

Modally robust events, on the other hand, are not due to luck. A true belief that is false only in distant possible worlds is (or is at least a worthy candidate for) knowledge. It cannot be a matter of luck that a necessary truth is true, or that an inevitable event occurs. A proposition that remains stably true as one moves further and further away from the actual world is less and less attributable to luck.

It is worth noting that the probability and modal theories do not collapse into each other.[1] Consider someone who wins at Russian Roulette. On the modal account they are quite lucky to win; a tiny change in the world, such as if the barrel had rotated just one more chamber, would have meant losing. Victory in Russian Roulette is modally fragile; it is easy to lose. But on the probability account one is *not* lucky to win. The chance of winning is 5/6—it is very likely that one will win Russian Roulette, and so not a matter of luck at all. The difference between the modal and probability approaches is more obvious if one imagines playing Russian Roulette with a very large cylinder—one that holds a googolplex of bullets, say. If all slots but one are empty, then one is fantastically likely to win at Russian Roulette; on the probability view of luck it is plain that there is less luck involved in the win than in any other activity in which one might engage. Yet if a chamber adjacent to the one chosen contains the bullet, then it would have been just as easy to lose as it was in the six-cylinder example. The same small change in the world would have brought about a loss, and so on the modal account the win was still very lucky.

Theory 3: Control

Philosophers interested in moral luck, luck egalitarianism, the luck problem in free will, and virtue epistemology tend to gravitate towards the control theory of luck: if a fact was lucky or unlucky for a person, then that person had no control over whether it was a fact. Al Mele writes, "Agent's control is the yardstick by which the bearing of luck on their freedom and moral responsibility is measured" (Mele, 2006 p. 7). He elaborates:

> What . . . is luck? Well, if the question is why an agent exercised his agent-causal power at *t* in deciding to A rather than exercising it at *t* in any of the alternative ways he does in other possible worlds with the same past and laws of nature is, in principle

> unanswerable—unanswerable because there is no fact or truth to be reported in a correct answer, not because of any limitations in those to whom the question is asked or in their audience—and his exercising it at *t* in so deciding has an affect on how his life goes, I count that as luck for the agent—good luck or bad, depending on the goodness or badness of the effect the particular exercise of agent-causal power has. (Mele, 2006 p. 70).

Parsing this monstrous run-on, it becomes clear that whether an agent is lucky depends on whether the agent is in control of her action. If an agent performs an action A, but might have performed action B instead, even given the same past and the laws of nature, then there seems to be nothing that determines her performance of A. Performing A instead of B then looks arbitrary and outside of her control. If performing A had good effects, then the agent was lucky that she did A when might have easily done the less optimal B instead. For example, if the agent hit a five-iron to the green, she was lucky that she didn't pick the three-iron that her caddy recommended, which would have caused her to fly the green. But if she might have picked the three-iron, even given the same past and laws of nature, then that undermines the sense in which she is in control of which club she uses. It seems like mere luck which club winds up in her hand.

John Greco too is sympathetic to the control account, writing, "something is a matter of luck in relation to some agent just in case it is not the agent's doing. Put differently, something is a matter of luck just in case it is external to the agent's own thinking, choosing, and acting" (Greco, 2010 p. 130). Events outside the control of an agent are properly attributable to luck, irrespective of how probable or modally robust those events are. Other philosophers opt for hybrid views. Neil Levy (Levy, 2011 p. 36), for example, votes for a disjunctive view: luck can be either the modal kind (which he calls chancy luck) or the control variety (which he calls non-chancy luck). He regards them as independent kinds of luck. Wayne Riggs, on the other hand, defends a conjunctive theory: luck is a combination of both the control and probability approaches (Riggs, 2007 see esp. p. 340). As will be demonstrated in the following section, all three formulations of luck are fatally flawed, and combination views fare no better.

2. Three kinds of counterexamples

First type of counterexample: lucky necessities

According to the modal and probability accounts, one is lucky only if things might have gone badly when they went well, or if one's success was against all odds. One is unlucky if one just missed out on a likely success, or if a small change in the world would have brought victory instead of the actual loss. However, there are many examples, previously unnoticed, of necessities that are nevertheless lucky.[2] Lucky necessities are simultaneously a threat to the modal analysis of luck as well as to the probability account. A truth that is logically or metaphysically necessary is true in all possible worlds and therefore could not have been false in any worlds at all, much less close ones. Such truths could never be lucky on the modal analysis. Even merely physically necessary truths could not have been easily false—the laws

of nature are different from what they are only in remote worlds—and so they too are not the result of luck.

No one denies that the axioms of probability theory entail that tautologies are assigned probability 1. However, there is some dispute about whether *all* necessary truths should be regarded as probability 1. Alston, Pollock, Plantinga, Rosenberg, Curd, and Cover all concur that yes, every necessary truth is maximally probable.[3] Indeed, Rosenberg, Curd, and Cover explicitly state it as an axiom. Fitelson (2010 p. 457), on the other hand, doubts that Bayesians have a good reason to insist that all necessary truths be assigned the same probability as a tautology. Adjudicating this dispute is beyond the present work. Certainly if one accepts what seems to be the dominant view, then it is impossible for a necessary truth to be lucky under the probability theory of luck. Even if one sides with Fitelson, it may still be the case that a necessary truth is probability 1, depending on one's choice of Bayesian priors. The examples that follow are designed so that a supporter of the probability view will be hard pressed indeed to explain how these necessities are less than probabilistically certain.

Example 1: the gravitational constant. If the gravitational constant, G, were a bit weaker, then the universe would have rapidly expanded into a thermodynamically entropic thin soup of lifeless fundamental particles. If it were a bit stronger, then everything would have clumped up into giant black holes and there would be no life. We hit the sweet spot: we are lucky that the gravitational constant made life possible.

What is the probability that the gravitational constant made life possible? Given the prior that there is life under G (who could dispute this assumption without self-contradiction?), the probability that G made life possible is 1. Thus under the probability view, it wasn't luck at all. What about the modal theory? The usual understanding of physical necessity is strict entailment from the laws of nature. Clearly the laws strictly entail themselves. Therefore it is physically necessary that the gravitational constant isn't stronger or weaker than what it is. While there are different constants in other possible worlds, worlds with different laws of nature are quite distant from this one. It follows that on the modal theory too it isn't luck that the gravitational constant made life possible.

Example 2: the unhaunted house. Pete and Ashley take an evening stroll past a deserted manor house that everyone in town believes is haunted. Pete suggests to Ashley that they explore the house. Ashley, who doesn't believe in ghosts, remarks, "We're lucky that creepy old house isn't really haunted. Otherwise I would be afraid to go in."

The traditional conception of ghosts is that they are incorporeal spirits that depart a body upon death. Nevertheless ghosts reputedly have location, are visible, have shapes, move objects, make noises, and even wear ghost clothes. However, since something cannot be both wholly immaterial and yet have physical properties, ghosts are logically impossible. Even philosophers who think that ghosts are conceivable define them in such a way that the sort of Hollywood-style ghost that might haunt a house is not metaphysically possible (e.g. Goff, 2010). On the modal view, it can't be the case that Pete and Ashley are lucky that the house isn't haunted

because it is impossible for the house to be haunted. There are no haunted houses in any worlds.

Example 3: Jack the Ripper.[4] Jack the Ripper is terrorizing the neighborhood. There's a knock on your door, which you promptly and thoughtlessly open. It is your friend Bob (who is not Jack the Ripper). Bob rolls his eyes at your carelessness and says, "You're lucky I'm not Jack the Ripper."

It is metaphysically necessary that things (and people) are self-identical. Given that Bob is not Jack the Ripper, it is metaphysically impossible for him to be Jack the Ripper. Bob cannot be other than what he is.

Example 4: time travel. Given the rate at which we are trashing the planet for future generations, we're lucky that there's no backwards time travel. Otherwise we'd face a lot of angry people coming back in time to hassle us.

Suppose that the various arguments against backwards time travel, such as the Information and Grandfather paradoxes, are sound and backwards time travel is a metaphysical impossibility. One might of course dispute this assumption, but whether we're lucky that there is no backwards time travel surely does not depend on one's antecedent temporal metaphysics. If it is objectively true that backwards time travel is metaphysically impossible, then in no worlds does it occur. Nevertheless, we are lucky not to face disgruntled time travelers.

The preceding examples were cases of luck with physical and metaphysical necessities. Here are three examples of lucky logical necessities. These may be the most telling examples. While they are obviously counterexamples to the modal view and to the common interpretation of probability theory in which necessary truths are maximally probable, they are also straightforwardly counterexamples to those like Fitelson who hold that only logical truths are probability 1.

Example 5: the logical bandit. The logical bandit points a gun at you and tells you that unless you correctly answer a logic puzzle, he's going to steal your wallet. He gives you this poser:

> Suppose you go to a diner where the cook is famous for pancakes. Actually, he is famous for burning 50% of the pancake-sides he cooks, and cooking the other 50% perfectly. The statistics: One third of his pancakes are golden on both sides; one third are black on both sides; and the remaining third are golden on one side and black on the other. You order a pancake. When it comes, the side you can see is golden. What is the chance that the other side is golden?

You are horrible at this sort of thing, and are completely flummoxed by the gun, the puzzle, and the whole situation. You make a wild guess and say "it's 2/3." The logical bandit, who could tell you were just guessing, smiles ruefully and replies, "you're lucky the correct answer is indeed 2/3," and vanishes into the night.[5]

Mathematical facts are of course necessarily true, and so it is a matter of logical necessity that the right answer to the pancake puzzle is 2/3.

Example 6: Fermat. The Pythagorean Theorem is $A^2 + B^2 = C^2$. In 1637 Pierre de Fermat wondered if this formula would work for powers other than 2. He decided that the answer was no, and that $A^N + B^N = C^N$ has no solutions for N in the positive integers greater than 2. He famously wrote in the margins of

his copy of Diophantus's *Arithmetica* that he had discovered a marvelous proof of this theorem, which the margins were too small to contain. Generations of mathematicians attempted to prove or falsify Fermat's last theorem, without success, until Andrew Wiles succeeded in 1995. Since it took 358 years for anyone to prove the theorem, and then only by using branches of mathematics that didn't exist in Fermat's day, no one believes that Fermat himself had really discovered a sound proof. Instead his unknown "proof" is assumed to be partial or flawed, as were all the other attempts for over three centuries. Fermat was lucky that his last theorem was true, despite his flawed proof, because it secured his mathematical immortality. Needless to say, Fermat's last theorem is necessarily true.

Example 7: logic grad student. 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 Gödel'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.

Here are the propositions offered above as claims of luck:

(1) We are lucky that the gravitational constant made life possible.
(2) Pete and Ashley are lucky that creepy old house isn't really haunted. Otherwise Ashley would be afraid to go in.
(3) You're lucky that Bob isn't Jack the Ripper.
(4) We're lucky that there's no backwards time travel. Otherwise we'd face a lot of angry people coming back in time to hassle us.
(5) You're lucky the correct answer to the pancake puzzle is 2/3.
(6) Fermat was lucky that his last theorem was true, despite his flawed proof, because it secured his mathematical immortality.
(7) Katerina was unlucky that her dissertation thesis was not a provable result.

Defenders of the modal or probability theories may attempt to dismiss all those attributions of luck as *façons de parler*. That is, they may deny that any of the above are literally true—there is luck involved in those scenarios, but it is to be located elsewhere. For example, one might argue that you're not lucky that your friend Bob isn't Jack the Ripper, but you *are* lucky that it was not Jack the Ripper at your door instead of Bob. Or Katerina is not unlucky that mathematics isn't complete, consistent, and finitely axiomatizable, but she *is* unlucky to have picked an impossible hypothesis to try to prove in her dissertation. You're not lucky that the correct answer to the pancake puzzle is 2/3, but you *are* lucky to have guessed that it is 2/3. The genuine luck present in these scenarios is compatible with either the modal or probability accounts of luck.

Paraphrasing may seem like the right device to pull out of the philosophers' toolbox, but it is a tool that seldom works as well as the advertising promises. Philosophers have contended that statements ostensibly about ethical truths were to be

replaced with expressions that conveyed emotional states but had no truth-value. Others argued that sentences employing mental state terms could be exchanged *salva significatione* and *salva veritate* with sentences about observable behavior. Still others have argued that statements ostensibly about physical objects were to be replaced with statements that referred only to sense data or logical constructions out of sense data. Needless to say, these revisionist programs are no longer popular.[6] That's not to say that surface grammar is never misleading. "I would like to apologize for my rude behavior" superficially states an intention to apologize, when of course it actually constitutes an apology.

A systematic attempt to show that every lucky necessity can be replaced with a statement that relocates the luck to somewhere contingent is a substantial undertaking that requires much more than a promissory note. On the face of it, many of the cases will require distinct diagnoses about where the luck really comes in. Perhaps some of them can be handled by the same diagnosis, but it certainly looks like this move will require considerably fine parsing of the elements of the lucky situation/event/person/what have you. It's very hard to anticipate that, once this is done, any one of the views under discussion will have an account of luck that is at all plausible, and not merely a Rube Goldberg contraption built by ad hoc gerrymandering. One wonders what the right paraphrase for "we are lucky that the gravitational constant made life possible" or "Fermat was lucky that his last theorem was true, despite his flawed proof, because it secured his mathematical immortality" would be. Fermat was lucky in many ways: that he thought of his last theorem, that he was the first to think of it, that he wrote it down. But there is a powerful intuitive sense that he was also lucky it was actually true.

What about the control theory of luck? According to the control view, something was lucky or unlucky for a person only if that person had no control over it. Clearly no one has any control over whether a necessity is true, and so the control account correctly rules that all of the cases above were in fact cases of luck. However, there are also necessities that are *not* lucky yet appear under the control view to be a matter of luck.[7] For example, while we may be lucky that the gravitational constant is such that it made life possible, it is not luck that tomorrow the force of gravity will be the same. While the fact that the physical constants are, well, constant may be of significance and importance to us, their stability is not just a turn of Fortuna's wheel. It is commonly held to be a matter of metaphysical necessity that the laws of nature do not change and are immutable (cf. Lange, 2008). Likewise it is clearly important that deduction continues to work, a necessary truth that is of course outside of anyone's control but is surely not a matter of luck. So it seems that the control theory fails immediately.

Such a swift dismissal of the control view may be too hasty, though. Defenders of the view are largely interested in luck accruing to human actions, not impersonal facts, and more sophisticated defenders (like Levy, as we shall see shortly) require that the putatively lucky event be variable in a way that would exclude necessary truths. However, the control view does not fare so well with the next sort of problem, which is a counterexample to all three theories of luck.

Second type of counterexample: Skillful luck

Bernard Williams wrote that, "when I first introduced the expression *moral luck*, I expected to suggest an oxymoron" (Williams, 1994 p. 251). *Skillful luck* suggests a similar oxymoron; skill is typically assumed to be the very opposite of luck. Mauboussin, for example, attempts to show the interplay between luck and skill, and to "place activities properly on the continuum between skill and luck" (Mauboussin, 2012, p. 24). Similarly, Preston Greene writes, "the influence of luck is incompatible with genuine achievements" (Greene, 2013). Applied to epistemology, Greco writes, "when *S* has knowledge, *S* gets things right as the result of her own abilities as opposed to getting things right as a result of blind chance or dumb luck" (Greco, 2010, p. 97). Knowledge is a skillful achievement for virtue epistemologists, one in which luck has no role to play. Indeed, eradicating all traces of luck from knowledge has greatly occupied epistemologists since Gettier. Expressing a common view, Riggs writes, "the immunity-from-luck requirement [for knowledge] is virtually the only thing in the theory of knowledge about which we can claim consensus" (Riggs, 2007 p. 330). Nevertheless, there are straightforward cases of skillful luck, and these serve as counterexamples to all three theories under review. The problem of lucky necessities showed that the probability and modal theories cast their nets too narrowly, failing to accommodate legitimate cases of luck. The problem of skillful luck shows that they cast their nets both too narrowly and too widely. There are cases of skillful achievement that all three theories declare to be no more than luck, and cases of luck that all three theories rule are due to skill and not luck.

Example 1: Ty Cobb. Ty Cobb is one of the best hitters in the history of baseball, and one of the first four players to be elected to the Baseball Hall of Fame. Cobb still holds the major league record for the best career batting average, batting .366. Yet on all three accounts Cobb was just lucky to hit the ball.

Consider the probability account. Cobb, despite being the best hitter in history, failed to get a hit nearly 2/3rds of the time. Every time he was at the plate it was improbable for him to get a hit; thus according to the probability theory, it is always luck when he succeeded. Even more, no one in baseball history ever batted over .500 for a season or even in a streak. Thus every hit in the history of the game is attributable to luck. While no one denies that professionals are more skilled than amateurs, the probability account of luck cannot properly explain the difference. Everyone is lucky to get on base; the most the probability theory could do is lamely maintain that some are just luckier than others. Yet intuitively when Cobb hits a typical single to right, it is because he is an expert player, not because he was lucky. It is skill that separates the amateurs from the professionals, not bad luck. One might argue that luck plays a role some specific circumstance, but not for every last hit, as the probability account implies.

Similarly, on the modal account any hit is luck. Hitters usually fail to get on base because so many factors could go easily awry. For any particular hit, had the world been slightly different, had the pitcher threw the ball with a different speed or spin, had the outfielder been in better position, the sun been more glaring, the crowd more distracting, or his indigestion been worse, then Cobb would have

missed. Hitting in baseball is modally fragile, even for the very best players; it is just too easy to fail.[8]

With skillful luck, the control account fares no better. Here's how Lackey (2008 p. 256) summarizes the control theory:

> An event is lucky for a given agent, S, if and only [if] the occurrence of such an event is beyond—or at least significantly beyond—S's control.[9]

Whether Cobb gets a hit in any particular at-bat is significantly beyond his control. Not only is hitting not a basic action that might be within his direct control, but Cobb cannot control which pitches he received, what distractions might affect his concentration, or the play of the opposing fielders. No batter can plausibly be said to have control over whether he hits the ball. That Cobb is merely lucky to get a hit is not an idiosyncratic result of Lackey's particular way of defining the control view. Here's Levy's (2011, p. 36) presentation of the control theory, what he calls "non-chancy luck."

> An event or state of affairs occurring in the actual world . . . is non-chancy lucky for an agent if (i) that event or state of affairs is significant for that agent; (ii) the agent lacks direct control over that event or state of affairs; (iii) events or states of affairs of that kind vary across the relevant reference group, and (iv) in a large enough proportion of cases that event or state of affairs fails to occur or be instantiated in the reference group in the way in which it occurred or was instantiated in the actual case.

Getting a hit is a significant event in a baseball game. Cobb's control was at best very limited; there is no sense in which had direct control over hitting the ball. Events or states of affairs of that kind (hitting successfully) vary across the relevant reference group (professional baseball players). Finally, in a large enough proportion of cases that event or state of affairs fails to occur or be instantiated in the reference group in the way in which it occurred or was instantiated in the actual case. That is to say, hitters miss a lot. Again, any time Cobb hits, and mutatis mutandis any time any baseball player gets a hit, it is just plain luck. Notice that Riggs's conjunctive view that *event E is lucky for S = E is improbable + S lacked control over E* also falls foul of the problem of skillful luck. Any hit from Cobb was improbable and he lacked suitable control over hitting, yet not all of his hits were merely due to luck, as the Riggs formula would have it. If the success of the best hitter in baseball history turns out to be simply luck, then something is deeply amiss with the account of luck that led to such a conclusion. Unfortunately, all of them do.

Example 2: Lucas Rosol. In the Ty Cobb case, the three theories of luck fail because they rule a case of skillful achievement to be merely a matter of luck. In the present example, we get the opposite result: an instance of luck that, according to the theories on offer, is not luck at all.

In the second round of the 2012 Wimbledon tournament, Rafael Nadal played Lukas Rosol. Nadal was ranked #2 in the world, and was the second seed in Wimbledon. Rosol was ranked #100 in the world, and everyone expected Nadal to thrash him. Even Rosol himself only hoped "just to play three good sets [and] don't

lose 6–0, 6–1, 6–1."[10] Instead Rosol soundly beat Nadal in what was the greatest upset at Wimbledon in the last quarter century (6–7 (9), 6–4, 6–4, 2–6, 6–4). Was Nadal unlucky to lose, or, conversely, was Rosol lucky to win? Intuitively, Rosol was incredibly lucky to beat the far superior Nadal. However, it is not easy to derive this result from the theories of luck that we have been considering.

Let's first examine the probability theory. If one only considers the prior probability of a Rosol victory, then yes, he was lucky to win, since the chance of him winning was so low. However, if we instead take into account the additional evidence that Rosol was playing the all-time best match of his career, the posterior probability of Rosol's victory conditional on that evidence means it was not luck at all. It was *not* probable that Nadal would win, given that he delivers an average (for him) performance and Rosol plays his maximum best.

So which counts for the probability theory of luck? Prior probability or posterior probability? Suppose Luciano goes to Las Vegas to play blackjack. The prior probability is that he will lose, since the odds always favor the house. Before any cards are dealt, Luciano concludes that "if I win it will be luck." He sits down to play and is dealt two face cards. Given the new evidence of his cards, it is suddenly extremely likely that he will win the hand. Luciano's victory isn't guaranteed—the house could still hit 21—but if he loses now it will be bad luck. Luciano now reasonably believes, "if I win, it will not be luck," which suggests that it is posterior probability that counts for determining luck.

To sum up, I am assuming that Rosol was lucky to beat Nadal and Luciano was lucky to beat the house at blackjack. However, the probability account has a difficult time accommodating those assumptions. It gives the right result if we take only the prior probability of those events into account, but the wrong result if we instead look at the posterior probability. One might rejoin that our intuitions about luck are malleable depending on what information is presented and how; viewed from one perspective Rosol was lucky, but viewed from another perspective it wasn't luck at all. But such a result is hardly amenable to the probability theory, which promised to deliver a mathematically precise verdict on any ostensible case of luck.

Does the modal theory fare any better? The modal theory rules that Rosol was lucky to win and Nadal unlucky to lose just in case Rosol's victory was modally fragile: in a wide class of the nearest possible worlds where the relevant initial conditions are the same as in the actual world, Nadal wins instead. It is difficult to determine whether this condition is met. Certainly a "relevant initial condition" is that Nadal was delivering an average performance and Rosol was playing his all-time best tennis. Given those stipulations, Rosol's victory may be fairly robust. Could Nadal, playing his typical game, beat Rosol when he is at his peak? Not easily, for sure. That suggests that the worlds in which Nadal does win under those conditions are fairly distant, and that Rosol's victory was not luck. If we were to ignore the facts about performance levels in the actual match, and just ask, "would Rosol be lucky to beat Nadal at Wimbledon?" the answer seems to be yes, as Nadal would beat Rosol in most circumstances; Rosol wins only in fairly distant worlds. As with the probability theory, the modal theory also does not give a clear-cut

answer as to whether Rosol's victory was luck. The result is malleable depending upon what assumptions one makes in evaluating the case. If we assume their actual level of play as a "relevant initial condition," then the modal theory gives the wrong answer. If we do not make that assumption then the modal theory gives the right answer. Not a very satisfying result. As Richard Feldman once put it, "the problem with counterfactual analyses is that they never work."[11]

Let us now consider the control account of luck, according to which Nadal would be unlucky to lose if his loss was outside his control. What is it to be in control? For one, Nadal was able to repeatedly and effectively choose the depth, height, direction, speed, and spin of the ball.[12] In addition, he was able to direct points, implement strategic shot selection, and pursue tactical advantages. Out of the 276 points of the match, Nadal committed only 16 unforced errors.[13] In other words, Nadal played like the world-class tennis champion he is, not like a weekend hacker spraying his shots with limited command of the ball. Nor was his loss due to a series of fluke accidents of the sort philosophers love to imagine. By any sensible measure, Nadal's performance on the court was subject to his control.

Was Nadal's loss a matter of luck? Recall Lackey's summary of the control theory: an event is lucky for a given agent, S, if and only [if] the occurrence of such an event is beyond—or at least significantly beyond—S's control. Nadal's loss was *not* beyond, or significantly beyond, his control. By comparison, if I (a hobbyist tennis player) were to play Nadal, my inevitable and rapid loss would most certainly be beyond my control. There is nothing I could do to beat Nadal. Nadal's victory would hardly be a matter of luck. However, his loss to Rosol is intuitively a matter of bad luck, even though that loss was not reasonably beyond his control. Thus the control theory gets it wrong. Now, one might argue that if Nadal were truly in control of the match, then he would have won; genuine control entails success. Yet, as Sosa (2011, p. 53) notes, maximal control of this sort is an unreasonable standard. It is to make the demand for control so strict that it only applies to agent-causal basic actions. Few (if any) actions can satisfy that demand, which would make nearly all successes lucky ones.

Was Rosol lucky to win? He was not in control of Nadal's return shot selection, speed, spin, or strategy, although he *was* able to dictate most of the points in the match and able to keep Nadal on the defensive. So one could reasonably hold that under the control account of luck, Rosol's victory was not a matter of luck—he simply delivered a superior performance and more control than Nadal. Thus under the control account, Rosol was not lucky to win and Nadal was not unlucky to lose. But that is clearly wrong. Obviously Rosol's outstanding performance was within the range of his skill as a tennis player, but he was deviating far above his mean performance level. He was lucky to be "playing in the trees" the day of his match against Nadal. The best match of his life might have shown up at any time over the course of his career. Rosol is lucky it happened the day he played Nadal at Wimbledon.

One might object that Rosol has no control over the level of his performance, no control over when he has an outstanding day on the court, and this lack of control means his success was indeed due to luck. However, such an objection

seems to make the demands for control once against unreasonably, even impossibly, high. Rosol and Nadal always try their best in major tournaments. As top athletes with superb mastery of the game and no unusual interference (no one was sick, injured, etc.), they are in control of their performance. No one has control of when their performance at a task deviates substantially from their mean performance; otherwise everyone would give their best possible performance every time. A golfer who *could* hit an eagle on a par 5 *will* hit an eagle every time. Then the eagle becomes the mean performance. Put another way: it is impossible to always play above average. Being in control cannot require doing the mathematically impossible.

To sum up the problem of skillful luck, in the Ty Cobb case, the data is that Cobb is *not* lucky to get a base hit. Yet the probability, modal, and control theories all rule that every hit in baseball is due to luck. In the Lucas Rosol case, the preanalytic data is that Rosol *was* lucky to beat Nadal at the 2012 Wimbledon tournament. The probability and modal accounts give ambiguous results, depending on what assumptions one makes in the evaluation. The control account yields the wrong result, that Rosol was not lucky. There is one more type of counterexample to the existing theories of luck to consider.

Third type of counterexample: Diachronic luck

Naïve attributions of luck are contextually determined, a fact that none of the three theories of luck on offer are able to accommodate. More precisely, luck is sensitive to temporal context. Diachronically, an event is judged to be lucky as a part of series or streak that takes place over time, but synchronically the same event is is not regarded as lucky when it is considered atemporally, independently of its relations to other events. At first blush this may seem like more of a problem for ordinary language: how can the same event be both lucky and not lucky for the same person? Perhaps a philosophical account of luck should properly avoid such a result. While perhaps initially surprising, I think that a philosophical theory of luck is successful only if it can incorporate this contextual element. Compare: under epistemic contextualism, it is possible for S to both know that P and not know that P. S knows that P in low standards contexts but does not know that P in high standards (e.g. skeptical) contexts, even given the same evidence base. This result is a feature, not a bug. Likewise one can be lucky diachronically but not synchronically, and conversely. Call this the problem of diachronic luck. Let us consider some examples of diachronic luck and then examine how the theories of luck on offer falter when confronted with it.

Example 1: slot machine. Suppose you are playing an old-fashioned mechanical slot machine (new ones are digital, computer-controlled, and randomized). Pull the lever, and three reels spin around independently of each other, each with the same probability to land on a lemon, cherry, apple, lime, grape, watermelon, etc. A common setup is to have 16 different images per reel. The reels do not stop all at once; the one on the furthest left stops first, then the middle reel, then the one on the right. You pull the lever. The first reel lands on a cherry. That's not luck; you don't care. It is irrelevant what the first symbol is. Then the second reel also stops on a cherry. You're still not feeling too lucky, because there's no payout for two

cherries. But now you are certainly crossing your fingers for the third reel, hoping for a visit from Lady Luck. When it stops, it too lands on a cherry. Jackpot! You were very lucky that the 3rd reel came up cherry.

Told in that manner, it is perfectly sensible that the first cherry was not a matter of luck at all, the second cherry also not luck (or maybe a tiny bit lucky), but the third cherry was tremendously lucky. Viewed as an element of a diachronic series, the final cherry was lucky, since it secured the jackpot. However, the spins of the reels are independent trials and are not causally connected to each other. Furthermore, each wheel had to land on the same symbol in order to win; it was no more necessary that the 3rd reel land on cherry than it was for the first two. Given that the 3rd reel was cherry, the first two had to be as well. Viewed synchronically, no one wheel seems any luckier than any other. They all had to cooperate together to yield a payout.

Consider how our three theories of luck fare. The probability that the final symbol would be a cherry was no lower than the chance the first symbol was. The chance that all three would hit on the same fruit was low (.02%), so the probability theory gives the correct result that beating a slot machine is lucky. But whether it is lucky to get a streak of cherries is not the issue: *was getting a cherry on the 3rd reel luckier than getting one on the 1st or 2nd reel*? On the probability theory the answer is no. The chance was the same for each reel. The modal view gives the same result. All it takes is a small change in the world (the reel stops a few clicks later or a few before what it did in the actual world) and reel 3 would have not hit on a cherry. Yet the exact same thing is true of reels 1 and 2. The success of reel 3 in producing a cherry is no more modally fragile than the other two reels; therefore a cherry on reel 3 is no luckier than the other two. The control theory lines up with the others. A player has no control over where any of the reels stop spinning. One has no less control over the 3rd reel than over any of the others. Therefore under the control theory the relative luck assigned to each of the reels is exactly the same. It doesn't matter for our purposes here whether it was lucky or not lucky that a reel hit on cherry. The salient issue is whether it was luckier that the third reel did so.

Synchronically, all the theories get it right: landing on a cherry on reel three isn't any luckier than getting one on either of the other two reels. Yet none of the theories are able to accommodate the diachronic judgment that during play the successful spin of the third reel seems vastly luckier than the other two. Hitting a cherry on the third reel seems both luckier than a cherry on the first two reels (viewed diachronically) and also not luckier at all (viewed synchronically). While the extant theories of luck can accommodate synchronic luck, they cannot explain diachronic luck.

One might argue that hitting cherry on the third reel was more significant than it was for the first two reels. So even if the probability of, modal fragility of, or control over cherry on the third reel was no different from the first two, its importance was, and therefore it really was luckier for the third reel to come up cherry than it was for the first two reels. However, this rejoinder is mistaken, and in fact highlights the problem of synchronic vs. diachronic luck. Considered synchronically, in isolation of its position in a temporal series, it is no more important that a cherry come up

on one reel over any other. It was equally essential for the same fruit to appear on each reel to hit the jackpot. It was just as important, or unimportant, for the first or second reels to come up cherry as it was for the third. Another way to see this is that it doesn't matter at all what fruit shows up on a reel—any reel—when the reel is considered alone, apart from anything that happened before or after. Some fruit or other is going to appear. If it is a cherry, so be it. However, what happens on the third reel does seem to matter more when it is considered diachronically, as an element of a series. Given that there were cherries on the first two reels, it is now of considerable significance that a cherry come up on the third. The fundamental phenomenon is the differing attributions of luck depending on the diachronic or synchronic perspectives.

One might wonder whether things work out differently in cases of skillful performance. It will be argued below that the reasoning is the same for cases involving agency, and not wholly impersonal chance.

Example 2: Joe DiMaggio. DiMaggio's 1941 streak of safely hitting in 56 consecutive baseball games is widely considered the most outstanding record in the history of sport (cf. Gould, 1991, p. 467) What role did luck play? Arbesman and Strogatz (2008) conducted a Monte Carlo simulation on the history of baseball, using a comprehensive baseball statistics database (from 1871 to 2004). They constructed a variety of different mathematical models of alternate possible histories of baseball, taking into account for each player the number of games played, number of at-bats, times walked, being hit by a pitch, sacrifice hits, and so on. Their five models varied the minimum number of plate appearances and a few other variables, and they ran 10,000 computer simulations for each model. These simulations amounted to complete alternative histories of baseball. One of the results was that there was only between a 20% and 50% chance that anyone would have safely hit in 56 or more consecutive games. DiMaggio, who in the actual world did have a 56 game hitting streak, was barely in the top 50 of the most probable players to hold that record. In fact, they write that, "while no single player is especially likely to hold the record, it is likely that an extreme streak would have occurred" (p. 11). The probability of someone or other having a long hitting streak is high, but the probability of DiMaggio in particular having the record is low.

So, given the Arbesman and Strogatz analysis, DiMaggio was hugely lucky to have the streak, and the probability, modal, and control accounts all line up in agreement. In fact, the longer the streak went on, the luckier he was to keep it up. Was DiMaggio unlucky on July 17, 1941, the date that his streak ended? In that game, Indians third baseman Ken Keltner made two terrific backhanded stops to prevent DiMaggio from hitting successfully in what would have been the 57th game of the streak. The day after the streak ended, DiMaggio began another hitting streak that lasted 17 games. Surely it was terrible luck that Keltner made such good plays and prevented DiMaggio from getting a hit in game 57. If he had, then instead of being 56 games long, DiMaggio's hitting streak would have been a stunning 74 games in a row (NB: safely hitting 73 of 74 games in a row is also still a record). Viewed diachronically, as an element of a series, DiMaggio had bad luck against

the Indians in game 57. Had he managed to get even one hit that game, then he would have the untouchable mega streak of hitting in 74 games in a row.

Considered synchronically, however, it was not bad luck at all that DiMaggio failed to hit. As was argued earlier, on all three theories of luck it is simply luck when a baseball player gets a hit—it is always improbable, modally frail, and not really within their control. Even during his streak DiMaggio missed most of the time (batting .409). The fact that he failed to hit in game 57 was a wholly ordinary, routine part of baseball. If it were any other game, no one would think DiMaggio was unlucky; it is only because of its location between his two streaks that it seems that way.

I've presented the DiMaggio case as one in which he was diachronically unlucky (which the theories of luck under consideration cannot accommodate) but synchronically his performance was not a matter of bad luck at all (both intuitively and according to the three theories of luck). Here is one final case to make the point, this time of a streak in which a player is diachronically lucky but viewed synchronically his performance is not due to luck.

Example 3: Micheal Williams. Micheal Williams, a point guard for the NBA Timberwolves, holds the NBA record for a free throw streak: over a period of nine months in 1993 he sunk 97 free throws before missing.[14] Since his career free throw percentage was .868, on the probability account no individual free throw was lucky—Williams was very likely to sink it. On the modal account it is difficult to judge how distant the closest possible world is in which Williams misses any particular free throw. Unlike baseball, where each pitch is different and more generally the playing conditions vary, free throws have replicable conditions. Players shoot from the same spot, and no one else interferes with or controls the ball prior to their shot. So it may be that the world would have to be considerably different for Williams to miss a free throw that he made in the actual world. On the control account Williams has significant control over the basketball—he is a pro ballplayer and is shooting without interference or unusual distractions. So it seems that all three theories of luck are in agreement: Williams is not lucky when he hits any particular free throw. Nor is he unlucky; successfully sinking a free throw just isn't a matter of luck at all. His success seems properly assignable to skill, not luck.

Nevertheless, Williams was lucky to hit the 79th shot in a row, the one that broke Calvin Murphy's old record, since that was the shot that cemented his place in the record books. As NBA hall of famer Rick Berry writes, "all great free-throw shooters must possess technique, confidence, routine and a little luck."[15] Calvin Murphy agreed, complaining at the time that, "what really bugs me is Micheal Williams breaking my consecutive streak and now he's shooting 83 percent. That tells me he was lucky."[16] Williams was lucky to make the record-breaking shot, despite the fact that he was in control of the ball, very likely to make it, and apart from the streak it was more-or-less an indistinguishable shot from any other free throw. As in the slot machine case, viewed synchronically no particular free throw was lucky, but when seen as a part of diachronic series, the third cherry or the record-breaking shot is lucky indeed.

In sum, I have argued that all existing theories of luck are effectively dead on arrival. They fall to whole classes of counterexamples: lucky necessities, skillful luck, and diachronic luck. I do not expect every reader to be convinced by every specific example. Experience has shown that a "shotgun" approach is preferable to resting content with one or two counterexamples and expecting that the intuitions of all readers conform. Instead I hope that all readers acknowledge the force of at least some of the cases presented and, given the general schema of the three types of counterexamples, see that other cases can be readily devised by industrious philosophers.

Where does this leave theories of luck, or philosophical projects predicated on them? Theorizing about luck is currently a confusion. At the very least, philosophers of luck need to broaden the expanse of examples they consider and notice how our intuitive judgments about these cases vary across multiple dimensions. I have no doubt that devotees of luck will revise their views in an attempt to overcome the counterexamples in the present paper, although I do doubt that philosophy will be well-served by what will eventually amount to Gettierology for luck.

A heretofore unexplored possibility worth considering is that there is no such thing as luck, and that worrying about luck in epistemology, ethics, political philosophy and other areas has been a red herring. As I argue elsewhere, experimental work shows that luck attributions are profoundly subject to cognitive biases, particularly framing and recency effects.[17] Those results coupled with the arguments of this essay amount to a one-two punch against luck: (1) every theory of luck irreparably fails on its own terms, and (2) given that we systematically exhibit bias—we are predictably irrational—in assignments of luck, (3) it may be more reasonable to subscribe to an error theory that explains luck attributions as a form of cognitive illusion. Certainly such a position requires much more defense than can be provided here. Still, it is worth putting on the table, and is an idea I intend to pursue in future work.[18]

Notes

[1] Pritchard (2014) provides independent reasons to separate the probability and modal accounts.

[2] Levy (2011 p. 26) argues that a necessarily true belief can still be epistemically lucky, and that such a belief undermines a safety constraint on knowledge. But Levy does not see the broader implications for theories of luck, nor does he develop any of the examples I provide. In *The Passions of the Soul* §145, Descartes presciently remarks that "we must set [necessity] against Fortune in order to expose the latter as a chimera which arises solely from an error of our intellect." His concerns are too tangential to the ones of this paper for further analysis here, though.

[3] Alston 2006 pp. 97–98; Pollock 2006 p. 94; Plantinga 2000 p. 107; Rosenberg 2011 p. 187; and Curd and Cover 1998 p. 628.

[4] Thanks to John Hawthorne for this example.

[5] Proof that the correct answer is 2/3: Your pancake could only be golden/golden or golden/black. Of the three golden sides you could be seeing, two of them have golden on the other side. Another way of putting it is that before you get any pancake, the chances that you'll select one with matching sides are two out of three. So then if you get a pancake and see a black side, the chances that the other side is also black is two of three. If you get a pancake and see a golden side, the chances that the other side matches is also two of three.

[6] There are always those with an enthusiasm for retro projects, though. Cf. Chalmers (2012).

[7] These are closely related to "sunrise cases." It is outside of anyone's control that the sun rose this morning, but that fact does not seem to be a matter of luck. Cf. (Pritchard 2005, p. 127; Riggs 2007, p. 337; Lackey 2008, p. 257).

[8] Mauboussin (2012) argues for the same thing. See pp. 137–138 *et passim*.

[9] Surely Lackey does not intend the biconditional in her summary. More properly she states a necessary condition for luck; a significance clause should be added for a complete statement of the control theory.

[10] http://www.wimbledon.com/en_GB/news/articles/2012--06--28/20120628134091749321 4.html

[11] Personal communication.

[12] The five controls of the ball, according to the United States Tennis Association.

[13] http://espn.go.com/tennis/wimbledon12/story/_/id/8106990/wimbledon-2012-rafael-nadal-upset-second-round-lukas-rosol

[14] http://www.basketball-reference.com/players/w/willimi02.html, http://www.nba.com/history/records/regular_freethrows.html

[15] http://www.nba.com/2009/news/features/01/14/barry.011409/index.html

[16] http://community.seattletimes.nwsource.com/archive/?date=19940410&slug=1904894

[17] Hales and Johnson 2014.

[18] This work began life under a grant from the Spanish Government (Ministerio de Economía y Competividad), Research Projects FFI2008–01205. Puntos de Vista. Una Investigación Filosófica and FFI2011–24549. Puntos de vista y estructuras temporales. I am grateful to Marga Vásquez and the workshops she has organized at Universidad de la Laguna. I have further benefited from a workshop on luck at the University of Edinburgh, especially criticisms from Duncan Pritchard, Allan Hazlett, Nathan Ballantyne, and Wayne Riggs. My colleague Gary Hardcastle was an excellent sounding board for many of the ideas in this paper. Thanks also to an anonymous reviewer at *Noûs* for helpful comments.

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