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Lucky Math: Anti-luck Epistemology and Necessary Truth

Draft!

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Abstract

How to accommodate the possibility of lucky true beliefs in necessary (or armchair) truths within contemporary modal epistemology? According to safety accounts luck consists in the modal proximity of a false belief, but a belief in a true mathematical proposition could not easily be false because a proposition believed could never be false. According to Miščević modal stability of a true belief under small changes in the world is not enough, stability under small changes in the cognizer should also (and primarily) be considered. I argue for a more traditional modal reliabilism based on the critical question: how easy is it for a belief to be false, given the way it was formed? A belief (a priori or a posteriori) is then agent-lucky when based on a specific method which might easily lead to a false belief in the target proposition. Miščević suggests a unifying approach in terms of virtue epistemology. It seems to me that this approach, if successful, will undermine the project that he started with: formulate an anti-luck condition in the frame of a modal theory of luck.

Keywords: modal epistemology, safety, necessary truth, reliabilism, virtue epistemology

1.

In our latitudes many of us learned how to do philosophy in an analytical manner from Nenad Miščević. His implicit basic methodological advice was deceivingly simple: when investigating a certain philosophical problem you first do the "geography" of the field, map the main positions, develop a taxonomy, explore (inter)relations. And then – situate yourself, take a stand, argue for your option. A very simple advice, but difficult to follow. First of all, one usually lacks Nenad's encyclopedic knowledge. Moreover, taking a firm stand is not always easy. Sometimes the problem addressed is complex, philosophy can really be difficult. This, I think, is true of the topic of my paper: the intersection of modal epistemology and epistemology of modals (necessary, *apriori* truths).

2.

A belief, even if true, cannot count as knowledge if it is just a matter of *luck* that the person so arrived at the truth. According to Pritchard (2007: 279–280) *lucky* events in general should be explained in the *modal* way: An event is lucky only if it obtains in the actual world but does

not obtain in a wide class of near-by possible worlds in which the relevant initial conditions for that event are the same as in the actual world. Suppose you win in a fair lottery with astronomically long odds. There is a wide class of near-by possible worlds in which the relevant initial conditions for that event are the same as in the actual world, but you lose – due to a very small departure from the actuality, one ball (or whatever) turns differently. We start with a modal theory of luck, then delineate the sense in which knowledge is incompatible with luck and finally we formulate an anti-luck condition on knowledge in those terms (Pritchard 2007: 280):

> S's true belief is *lucky* only if there is a wide class of near-by possible worlds in which S continues to believe the target proposition, and the relevant initial conditions for the formation of that belief are the same as in the actual world, and yet the belief is false.

Consider the standard case of *aposteriori* epistemic luck adopted from Zagzebski (1996: 285–6).

> *Mary*
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> Mary has very good eyesight, but it is not perfect. She can reliably identify her husband sitting in his usual chair in the living room and she has made such an identification in many times. She enters the house, looks into the living room and forms the belief "My husband is sitting in the living room." But she misidentified the man in the chair. It is not her husband, but his brother, whom she had no reason to believe was even in the country. However, her husband was seated along the opposite wall of the living room, unseen by her.

Mary forms a true belief by looking at the man in the chair. Her belief is justified (very good eyesight, etc.), but she does not *know*. Her belief is only luckily true, there is a wide class of near-by possible worlds in which she *mistakenly* continues to believe that her husband is in the living room (worlds without her husband in the room). Knowledge is incompatible with luck, so if S *knows* that *p,* then S's true belief that *p* could not have easily been false (Pritchard 2005: 156):

> For all agents, if an agent knows a *contingent* proposition *p*, then, in most near-by possible worlds in which she forms her belief about *p* in the same way as she forms her belief in the actual world, that agent only believes that *p* when *p* is true.

This formulation of *safety* as anti-luck condition is not final but it will do for our purposes. True beliefs which could easily be false are lucky true beliefs and so unsafe. According to modal epistemology luck consists in the modal proximity of a false belief (if *p* had been false, you would still have believed it). This characterization immediately excludes the possibility of lucky beliefs in *necessary* truths: a belief in a true mathematical proposition could not easily be false because a proposition believed could *never* be false. Safety is incapable of eliminating epistemic luck in this case, for if *p* is necessarily true then S's true belief that *p* is automatically safe.

Can we be lucky with respect to necessary or *apriori* truths? I will limit myself to simple mathematical truths in accordance with the bulk of the (scarce) literature on this topic.[1] Let me start with several cases of *simple* luck.

Felicity

Felicity is learning how to solve fractions for two-figured numbers. She establishes the following result: 16/64 = 1/4. The method used is the following: cross out the last digit of the numerator and the first digit of the denominator (1~~6~~/~~6~~4). She forms some additional true beliefs based on this "heuristics": 19/95 = 1/5 and 26/65 = 2/5. Her beliefs are true, but she does not really know that, say 26/65 = 2/5 (the method obviously fails in many other cases).

Next take the famous Euler's identity: $e^{\pi i} + 1 = 0$. Imagine the following scenario:

Mystica

Mystica has learned about complex numbers in high school, she is also familiar with natural logarithms. In her dreams, later described by her as a moment of mystical revelation, she is struck by the mystical unity of five constants (e, i, π, 1, 0) and three operations revealed to her in the form of: $e^{\pi i} + 1 = 0$. Her belief is true, but we would not say that she *knows* the Euler's identity.

Pritchard sometimes uses the example of a lucky guess – an agent forms a true belief in a mathematical proposition – that 2+2 = 4, by flipping a coin. More often he gives the example of a broken calculator (2012: 256):

Mathema

Mathema uses a calculator to find out the product of 12 × 13. As a result, he forms a true belief that 12 × 13 = 156. Unbeknownst to Mathema, however, his calculator is in fact broken and generating "answers" randomly.

Mathema's belief is luckily true, so he does not know the target proposition. These cases are the *apriori* counterparts to standard *aposteriori* cases of true beliefs based on hunches, superstition, horoscope, wishful thinking … . They are cases of *simple* luck, unjustified true beliefs. Are there any cases of *justified* true beliefs in necessary propositions which still fail to count as knowledge? Miščević introduces Jane, a good mathematician, who normally has reason to trust her capacities. But she makes two very subtle mistakes in calculation or proof that cancel each other out resulting in the correct solution (Miščević 2007: 56):

Jane

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[1] Levy (2011: 26) describes the case of Jack who is lucky with respect to his metaphysically necessary true belief that Water = H_2O; Miščević also mentions some other cases in a footnote (Miščević 2007, fn. 25, 70-71).

Jane arrives at correct result R, which is further corroborated in application. In fact, it takes a genius to detect two subtle mistakes that have cancelled each other. Then, Jane is a priori justified in believing the result R. She thus has a true justified belief, which is, by most people's lights, not a piece of knowledge.

Jane is Gettier lucky in her *apriori* true belief (justified, but fails to know). Mary, Felicity, Mystica, Mathema and Jane are all cases of *veritic* luck: it is a matter of luck that the agent's belief is true relative to her justification. They can be ordered from lucky guesses (simple luck) to Gettier-like double-luck scenarios (Mary, Jane). Can a unified modal theory of luck cover all of the cases and their combinations, *apriori* and *aposteriori*, simple luck and Gettier-lucky beliefs?

3.

Modal theory of luck is a *minimal* change theory: an actual event is lucky only if it obtains in the actual world but does not obtain in a wide class of near-by possible worlds which are *minimally* different from the actual world. In the case of epistemic luck we are interested in the event of *having a true belief*. According to Miščević this event decomposes into two components: (1) the contribution of the world – the relevant facts of the matter; (2) the contribution of the agent. Furthermore there are *three* ways to explain the modal closeness of cognitive failure, of not having a true belief: (a) in a near-by world you have a false belief (*p* is not the case but you still believe it); (b) in a near-by world you do not have any beliefs whether *p*; (c) in a near-by world *p* is the case, but you believe that not-*p*.

Recall Mary and her luckily true belief that her husband is sitting in the living room. Modal fragility of Mary's actually true belief is explained by factors (1a) above: (1) the world might be slightly different (her husband is not in the living room), but (a) she would still believe that her husband is in the room. This explanation is "world-centered" according to Miščević (minimal changes in the world result in her having a false belief). Not so with Jane: the mathematical facts could not be different, so Miščević proposes (2b) or (2c) as explanandum of her lucky true belief (2007: 61):

> … had the cognizer's ways of thinking (or even her capacities) been slightly different, she would not have managed to arrive at the same true belief as in the actual world. She might have ended up with believing the negation of the target proposition, or with agnosticism about it.

If Jane had not made a second mistake that killed the first one she would have ended up with the wrong result. The locus of luck is the agent – "the unstable human mind with its limited capacities" and not the external environment. Instead of the safety principle, requiring the stability of a true belief under small changes in the environment (minimal differences in the world), we get the principle of agent *stability* (Miščević 2007: 61):

> For all agents, A, if an agent knows an armchair proposition *p*, then, in most near-by possible worlds in which she forms her belief about *p* in a slightly different way or with slightly changed cognitive apparatus as in the actual world, that agent will also come to believe that *p*.

There is, however, an immediate problem with this proposal. Remember our goal: a unified modal theory of luck covering all the cases and their combinations, *apriori* and *aposteriori*, simple luck and Gettier-luck. Yet the proposed solution does not cover the cases of *simple* luck at all! Felicity is quite stubborn, she uses a *robust* (albeit stupid) method of solving fractions for two-figured numbers. There is no instability in her cognitive functioning: when she believes truly she could not easily end up with the negation of the target proposition, or with agnosticism about it. The same is true of Mathema (he firmly believes the results of the broken computer) and Mystica (she is full of trust for her prophetic dreams and very stable in believing them). It is easy to spot the problem: they all use bad ways for forming their beliefs. And equally easy to find a remedy: do not use a *way* of forming your beliefs that could easily lead to false beliefs. Here is the famous grandmother case (Nozick 1981: 179):

> A grandmother sees her grandson is well when he comes to visit; but if he were sick or dead, others would tell her he was well to spare her upset. Yet this does not mean she doesn't know he is well (or at least ambulatory) when she sees him.

If her grandson were sick she would still believe (falsely) he is well, yet she knows that he is well. In terms of safety – suppose that her grandson might (for whatever reason) easily be sick. The grandmother might then easily believe falsely that her grandson is well. Still, the fact that she would in a near-by possible world use another, *deficient* way of arriving at her mistaken belief (misleading testimony), does not show she didn't know that her grandson was well when she actually used the *reliable* way (sight).

Once we focus on ways of forming beliefs it becomes clear that faulty methods must be the best explanation for *lucky* true beliefs in cases of Felicity, Mystica and Mathema. All of them use unreliable procedures, in near-by worlds they deliver false results. If Felicity used her method on 27/75 she would get the wrong result, if Mystica dreamt that e x π^i + 1 = 0 she would be wrong, if Mathema wanted to find out the product of 14 x 13 the broken calculator would give the wrong result. But note: "[the faulty] method by which [the belief is] reached could just as easily have led to a false belief in a *different* proposition" (Williamson 2000: 182). And to quote Sainsbury (1995: 595):

> A lucky guess is not a proposition which might easily not have been true, but a way of reaching a belief which might easily not have delivered a true one.

With respect to contingent propositions your faulty way of reaching a belief that *p* might easily deliver a false belief that *p*, but with respect to *apriori* true propositions your faulty way of reaching a belief that *p* might easily deliver a false belief in a *different* proposition, *q*.

Let me introduce some standard scientific terminology (inspired by Luper 2012): a *false positive* is a test result that indicates a given condition has been fulfilled, when it actually has

not been fulfilled. The main epistemological condition is truth, so a false positive is a case when your way of forming a belief indicates that a certain proposition is true while it is false. A *false negative* is a test result that indicates a given condition has not been fulfilled, when it actually was successful. In epistemology a false negative is a case when your way of forming a belief indicates that a certain proposition is not true while it really is true. We can know things even though the methods on which we rely might yield false negatives. It suffices that our methods would not give us false positives.

Take an example from mathematics: (i) a number is divisible by 3 if the sum of the digits is divisible by 3; (ii) a number is divisible by 9 if the sum of the digits is divisible by 9. Suppose that Al mixed up something. He uses the second method for establishing that a number n is divisible by 3, but if the sum of the digits is not divisible by 9, then, he thinks, the number might or might not be divisible by 3. Using this method he establishes (and believes) that 7227 is divisible by 3. Does he *know* that? Given his method he would be agnostic with respect to 7224. Still, he knows that 7227 is divisible by 3, his method will never yield a false positive (though it will miss some instances). Even more: suppose that Al uses the second method for establishing that number n is divisible by 3, but if the sum of the digits is *not* divisible by 9, then, he thinks, the number is *not* divisible by 3. Using this method he establishes that 7227 is divisible by 3. Does he know that? Given his method he would believe that 7224 is *not* divisible by 3. Still, he *knows* that 7227 is divisible by 3, his method will never yield a false positive (but it might give a false negative).

Once we agree that safety must include the ways that epistemic agents use in forming their beliefs we get a uniform treatment of *aposteriori* luck and simple *apriori* luck. It is always the modal proximity of a false belief that matters (*false positive*), not the proximity of not having a true belief (*false negative*). We are interested in truth value of the belief that is formed in near-by possible worlds on the same basis as in the actual world, even when the resulting belief is not of the *same* proposition. We could codify a qualified safety condition along the lines suggested by Williamson (2009: 23):

> S's true belief p is safe only if the basis B which resulted in S's belief p is such that B could not easily result in a false belief that p *or* its epistemic counterparts.

The counterpart p^* is close to p in a way analogous to that in which a world w^* may be close to a world w. Counterparts should be relativized to the agent: $27/75 = 2/5$ is for Felicity a counterpart to $26/65 = 2/5$, $e \times \pi^i + 1 = 0$ is for Mystica a counterpart to $e^{\pi i} + 1 = 0$, and $14 \times 13 = 156$ is for Mathema a counterpart to $12 \times 13 = 156$. Luck undermines knowledge just when the conditions that gave rise to the belief could have easily yielded a falsehood. Any false belief formed in near-by possible worlds in the same way as in the actual world is relevant to the safety of the target belief, not just false beliefs in the very *same* proposition as in the actual world.

How about Jane? Does she use a problematic method that luckily produces a true belief? After all her way of forming beliefs includes mistakes and a basis which includes mistakes could easily lead to a false belief in a *different* proposition. Consider, as an example, the history of Fermat's Last Theorem:

The theorem is simple to state: The equation x-squared + y-squared = z-squared is true when the exponent is 2, or squared, but for no higher whole number. Fermat wrote a note in the margin of his *Arithmetica* by Diophantus (1630): "I have a truly marvellous demonstration of this proposition which this margin is too narrow to contain." Mathematicians have been trying to supply the missing proof for more than three and a half centuries. Finally Andrew Wiles on June 23th, 1993 proved a partial version of the Taniyama-Shimura-Weil Conjecture on elliptic curves, which had a very special corollary, namely Fermat's Last Theorem. Wiles checked and double-checked the proof before releasing it to the referees. The manuscript was split into *seven* chapters, and each chapter was sent to a pair of expert examiners. Gradually it emerged that there was a fundamental flaw in one stage of the argument. Stewart and Tall (2002: 210) report Andre Weil's comment on Wiles' proof in the March 1994 issue of *Scientific American:*

> I believe he has had some good ideas in trying to construct the proof, but the proof is not there. To some extent, proving Fermat's Theorem is like climbing Everest. If a man wants to climb Everest and falls short of it by 100 yards, he has not climbed Everest.

Many years earlier Wiles had considered using an alternative approach, but it floundered and so he had abandoned it. Now he realized that what was causing the more recent method to fail was exactly what would make the abandoned approach succeed. On October 6th, 1994 he sent the amended proof to three mathematicians primed for the job, and all three reviewers found the new ideas satisfactory. By the following year there was general agreement that the proof was acceptable. The proof was finally published in May 1995 (with 127 pages in total!).

Did Wiles *know* in 1993? The theorem is true and he used a good (even *genial*) approach, there was just a "technical hitch" in the execution. Still, according to the experts cited above, strictly speaking, it was not a proof when it was announced.

How much error does a justification in a mathematical proposition still tolerate? Proof based on mistakes is not accepted as a basis for forming mathematical beliefs. Given these high-grade standards Jane forms her belief in a deficient way, so she does not know. She is like Felicity: what explains their failures to know are unsafe *ways* of forming their beliefs. Mistakes in the application of an algorithm count as an unreliable way of forming a belief. In a near-by world Jane forms a false belief (in a *different* proposition) on such a shaky basis, so we get the unified approach in the spirit of anti-luck epistemology (avoid the modal proximity of a false belief).

The bar has now been set up very high. If near proof is not a proof, then a proposition based on such a proof is not justified. Even Jane's actually true belief is then not justified. The case of Jane is not the case of Gettier-luck after all, it is just a sophisticated case of simple *apriori* luck. Let me call this "basis relativized small change theory of luck" (BSCT for short). The price for a unified modal theory of luck that BSCT has to pay seems to be an elimination of *apriori* true Gettier-lucky beliefs.

This solution squares with the consensus that *apriori* Gettier-lucky beliefs are at least possible. Let us explore another option, the one suggested by Miščević, I will call it "agent relativized small change theory" (ASCT for short). Jane is lucky (two mistakes cancel each other out), but she does not use any strange or problematic methods. Jane is like Mary, who misidentifies her husband in the living room, and not like Felicity. Mary's belief is true and formed by her truth-conducive vision, it is just a matter of luck that her reliable procedure has resulted in true belief. In the same manner Jane's cognitive success is not just a lucky guess, she uses a good procedure, it is just a matter of luck that the procedure has resulted in true belief.

Let me explore Sosa's analogy of an archer shooting at a target (Sosa 2007: 22). An *accurate* shot is successful in hitting the bull's eye. An *adroit* shot manifests the archer's competence. And an apt shot is accurate because it is adroit. The accuracy of an apt shot is creditable to the skill of the archer. In the same way we can ask whether a belief is accurate (true); whether a belief is adroit (epistemically competent) and finally, whether a belief is apt (true because competent). Apt beliefs are creditable to the skill of the believer and this dimension is absent in Gettier cases. Suppose that an archer's competently shot arrow is first blown off course by a gust of wind. A second gust of wind then blows the arrow back onto its original course and the arrow hits the bull's eye. In this case the accuracy of the shot is not attributable to the archer's skill, but rather to luck.

Jane is a skillful mathematician, but the *accuracy* of her belief is not attributable to her skill. Mistakes which cancel each other are produced by the "winds of her mind," so to speak. Mary's belief is true and formed by a reliable process (sight), but it is veritically lucky – small changes in the *external* environment could easily lead to her having a false belief. Jane's belief is true and also formed by a reliable process (she follows the good algorithm, etc.) but it is a matter of luck that her procedure resulted in a true belief. Small changes in her "internal environment" (her attention, ability to avoid distractions, capacity to memorize, etc.) could easily lead to her having a false belief. According to ASCT the procedure she follows is reliable but the agent is not (due to "instability of her cognitive functioning").

Did we not say earlier that a near proof is no proof at all? Well, the verdict is not final. Remember how the case of Wiles was described (Stewart and Tall 2002: 210): "the *reviewers* found the new ideas satisfactory; by the following year there was general *agreement* that the proof was acceptable." This would suggest less stringent criteria and dependency on social criteria:

> In the real world of mathematics, a mathematical paper does two things. It testifies that the author has convinced himself and his friends that certain »results« are true, and it presents a part of the evidence on which this conviction is based. Complete proof simply means proof in sufficient detail to convince the intended audience - a group of professionals with training and mode of thought comparable to that of the author (Davis, J. P., Hersh, R., 1987: 61).

Given these low-grade standards it is possible to describe both Wiles and Jane as having justified true beliefs after all. Her lack of knowledge would then really be explained by the modal proximity of the case where *p* is true but she fails to believe it or disbelieves it.

We now have two general approaches, BSCT and ASCT – how to decide? Each has its merits and each has its problems. BSCT promises a unified modal theory of luck based on the critical question: how easy is it for a belief to be false, given the way it was formed? In case of necessary truths the target proposition need not be the same as the one actually believed. The main problem for BSCT is its elimination of Gettier-lucky *apriori* true beliefs. ASCT is motivated by the existence of Gettier-lucky *apriori* true beliefs from the very beginning. But the "winds of mind" solution is inappropriate in the cases of simply lucky *apriori* truths. Moreover, ASCT goes against the spirit of anti-luck epistemology: it is the modal proximity of false positives that explains luck not the proximity of undetected truths or false negatives.

4.

Let me sketch the most plausible directions of development for each theory and then "take my stand."

We saw that however the actual belief was produced, this is something we have to hold fixed when we go from the actual world to nearby worlds and assess whether the belief continues to be true. I spoke about methods, ways of forming a belief, basis for the belief … . Now we have to be more precise. Mary and (supposedly) Jane are justified because they both use generally reliable (truth-conducive) processes of forming their beliefs – process that produce mostly true beliefs: standard perceptual processes, remembering, good reasoning – correct algorithms, efficient heuristics, etc. Horoscopes, wishful thinking and the procedures used by Felicity, Mystica and Mathema are unreliable. Reliable processes are grounds for justification, unreliable processes explain cases of *simple* luck (their results could easily be false). But when Nozick introduced methods of belief formation he did not have in mind such *general* belief-forming processes (1981: 184-85):

> A person can use a method (in my sense) without proceeding methodologically, and without knowledge or awareness of what method he is using. Usually, a method will have a final upshot in experience on which the belief is based, such as visual experience, and then (a) no method without this upshot is the same method, and (b) any method experientially the same, the same "from the inside", will count as the same method.

He was criticized for giving concessions to internalism and thus undermining his generally externalist epistemology. Still, Becker (2008) has argued persuasively that modal condition should be relativized to the actual method the agent uses in forming the specific (token) belief in question. When we distinguish the particular methods by which one forms a belief in a specific instance from the general processes from which one forms beliefs we see there are

two sources of luck according to Becker: *world* luck and *process* luck. True beliefs based on unreliable processes are cases of *process* luck. But Mary's general belief-forming process (sight) is reliable, so there must be a different explanation for her luckily true particular belief – peculiar features of the actual world, this is the case of *world* luck (Becker 2008: 357).

I think that these distinctions can be used by BSCT in order to explain our intuition that Jane's belief is lucky, though justified. She uses a reliable process of belief formation (good algorithm), it's just that her *particular* belief based on the specific method she actually uses is luckily true. Quirky features of the agent result in her having a reliably formed but still luckily true belief, so let's call this a *agent* luck.

We now have *three* types of luck: process luck, world luck and agent luck. Anti-luck conditions are usually sufficient to eliminate all cases of luck, but not always. Jane's belief is safe, based on a reliable process which does not constitute knowledge because she is *agent* lucky. Her belief is based on a specific method (mistakes in the execution) which could easily lead to a false belief (in a different proposition). Once we acknowledge these distinctions we recognize that it is not just beliefs *apriori* that can be safe but still *agent* lucky. The phenomenon is more general. Take the cases of memory in which I could easily be mistaken that *p*, but in fact I am not, and my true belief rests on evidence:

> *Fish*
>
> I believe we had fish for dinner on Saturday two weeks ago. This is true, we had flatfish. My grounds for holding this belief are memory and induction. We almost always have salmon on Saturdays and my memory is usually very reliable. But I completely forgot that my mother-in-law gave as two nice pieces of flatfish on Saturday morning, so we skipped salmon.

It is compelling to say that my belief is justified, yet still luckily true. But this is not the case of world luck, it is not that the world could easily be different (no fish on Saturday). The source of luck are "winds of my mind," mistakes in my memory which cancel each other out. And the explanation is the one offered by BSCT: my belief is agent-lucky because it is based on a *specific* method (holes in my memory) which might easily lead to a false belief in the target proposition. The target proposition is not the same as the one actually believed but its epistemic counterpart (say, when did I actually call the maintenance service, last Friday or last Thursday?).

This is a promising way of developing BSCT though it is admittedly complex – there are now three types of luck (process, world, agent) and two components in the way of forming a belief (general process and specific method). So, let us explore the options for ASCT. The most natural development is in direction of *virtue* epistemology as suggested by Miščević (2007). Recall Mary – according to Zagzebski she forms a belief using her epistemic virtues (intellectual virtues, but we can include cognitive abilities and faculties) and her belief is true, but she does not have the truth *because* of her virtues (Zagzebski 1996: 297). Jane is like Mary: she has conscientiously attempted to reach the truth using sound mathematical methods and she does reach the truth. But she does not get to the truth *through* her conscientious

epistemic activity. She does not deserve *credit* for her success because one of the principal causes of her success is a lucky event (two mistakes cancelling each other out) and not her competence. Her success is not a manifestation of her ability.

I have lumped several approaches in virtue epistemology together, since it is not clear how to augment the safety account with a virtue-theoretic conditions. With the resources of virtue epistemology, why still safety with all of its baggage (methods, ways of forming beliefs)? Why not virtues all the way down? There are proposals for a virtue-oriented theory of luck on the market: one's belief is epistemically lucky when one fails to deserve *credit* for reaching the truth (Greco 2003). Or, whether an agent is lucky depends on whether the agent is in *control* of her action so one knows that *p* when one comes to have a true belief that *p* in a way that is sufficiently under one's control (Riggs 2009). It seems that the approach of virtue epistemology will undermine the project that Miščević started with: formulate an anti-luck condition in the frame of a *modal* minimal change theory of luck.

5.

Miščević draws our attention to the phenomenon of *agent* luck, an unexplored area in contemporary epistemology, an amazing achievement by-itself, given more than fifty years of "Gettierology." Yet the evidential base for his approach is very thin. The case of lucky Jane belongs to a subclass (Gettier-lucky true beliefs) of a subclass (a priori lucky true beliefs) of a class (lucky true beliefs) and the proposed solution does not generalize. A uniform theory covering all cases of lucky knowledge might not be obtainable, there is a danger that we might end up agreeing with a defender of *situationism*: "I'm into situation epistemology. The situation changes, I change my epistemology."

Difficult choices and no neat solutions, but there is no reason for despair. I suggested a more traditional theory in the spirit of modal *reliabilism*. To compare, consider the following suggestion for a more general account in the direction of *virtue* epistemology (Miščević 2007: 65):

> The modal definitions of luck in terms of surrounding worlds is world-centered, whereas the skeptical problem of the external world is mind-centered: it is the manipulability of our minds by the Demon and the poverty-underdetermination of the phenomenology that produce skeptical worries. So both external world luck and armchair luck have a common root and a definition of epistemic luck is needed that captures this common root having to do with qualities of "virtues" of the agent.

When the agent does her epistemic best, when her beliefs are the product of her conscientious efforts and her best cognitive abilities, what more should be required from her to be *virtuous*? More checking and checking, developing better cognitive equipment (perhaps with the help of AI?)? Highly unrealistic demands, we are just not god-like – this is our epistemic human predicament. What more is needed? The world has to conspire in a beneficent way, or, better,

to combine Levin (2004: 407) with the insights from Miščević (2007): attaining the *teloi* of cognition is to some extent contingent on the world and the contingencies of our mind, and never wholly within the agent's control.

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