# Are all truths maximally risky?

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**Abstract**

According to the modal account, risk is a function of modal closeness. A puzzling consequence of this account is that all truths are maximally risky. I defend this puzzling claim against several objections found in the literature, by drawing connections between axiom T for safety and risk and between counterfactual reasoning and risk. I conclude by briefly explaining why we find the conclusion puzzling and by advocating for a pluralist notion of risk where modal risk is a legitimate notion alongside the probabilistic one.
Keyworlds: risk, modality, epistemology, safety, counterfactuals

## 1 Modal risk

Recently, a modal account of risk has emerged (Williamson 2009, Pritchard 2015, 2016). The modal account views risk as a function of modal closeness rather than probability. While often modal closeness and probability go hand in hand, sometimes they diverge: my belief that my lottery ticket is a loser is risky despite being extremely probable. In the modal account this is explained by the fact that there is a close possible world where my belief is false. Risk, in this sense, is the mirror-image of safety (Sosa 1999). Safety is a kind of local necessity: $\phi$ is safe if it is persistent across all close worlds. Thus, risk is a kind of local possibility: $\phi$ is risky if it happens in a close world.

**Definition 1 (Modal Risk)** *An undesirable $\phi$ is risky iff there is a close world where $\phi$ is true.*

This is an absolute rather than a comparative definition of risk. No specific comparative notion is forced upon us by the modal definition, but it is natural to think that, the closer a world where $\phi$ is, the riskier is $\phi$, all else equal (Pritchard 2015, 447). We obtain the following definition of comparative modal risk:

**Definition 2 (CMR)** *$\phi$ is riskier than $\psi$ iff the closest $\phi$-worlds are closer to the actual world than any $\psi$-world.*[1]

The modal account promises to have important applications to epistemological puzzles like the lottery and preface paradox (Williamson 2009, Pritchard 2015)

[1] I am setting aside the undesirability component, which I will discuss later in section 3.

and legal puzzles where statistical evidence is not sufficient for a guilty verdict (Cohen 1977, Blome-Tillmann 2015, Smith 2016, 2018, Littlejohn 2020, Pritchard 2020). I am not here to defend the modal account, however. Rather, I am interested in a specific and puzzling consequence of CMR and weak centering:

**TMAX** All truths are maximally risky.

Weak centering is the self-evident claim that the actual world is among the closest worlds. The point of this article is to argue for TMAX and defend it against several objections put forth by Ebert et al. (2020), Hirvelä (2024), Hirvelä and Paterson (2024) and Smith (2023).

I don't wish to endorse the view that CMR is the only acceptable comparative notion of modal risk. It might very well be that, on some equally acceptable notion of comparative risk, TMAX doesn't make sense. I don't think that someone endorsing a modal account of risk should abandon the probabilistic account. As I claim in the conclusion, it is more reasonable to say that risk is a pluralist notion and both the modal and the probabilistic notion co-exist. The claim I'd like to defend is that, when we focus on the modal notion of risk, CMR and TMAX are correct and, if and when they are not correct, it is not because of the aforementioned objections.

## 2 Objections to TMAX

I will now build the case against TMAX. First of all, on the modal account one cannot settle the risk of $\phi$ without taking a stance on whether $\phi$ is true.

> Suppose one is about to drill into a wall in a West Australian house built in the 1970s, and is wondering about the risk that the wall contains asbestos. On the modal account, if the wall really does contain asbestos, then the risk is maximally high. [...]. If, on the other hand, the wall does not contain asbestos, then, according to the modal account, the risk will be lower. (Ebert et al. 2020, 441)

Call "risk-priority" the view that an assessment of the risk of $\phi$ can be independent of an assessment of $\phi$. The asbestos case shows that modal risk violates risk-priority because of TMAX. Puzzling consequences follows: $\phi$ cannot be low risk unless it is false, for if it was true, then its risk would be maximal. "There's a low risk that there is asbestos in the wall, but there might be" sounds perfectly fine but "There's is no asbestos in the wall, but there might be" doesn't, yet this latter claim is a consequence of the former, following TMAX (Smith 2023, 156).

On the modal account, any true proposition cannot be less risky than any false proposition. Suppose a fair die lands on a 6. Intuitively, the risk that the result would have been "1 or 2 or 3 or 4 or 5" is higher than the risk that it would be 6. Yet the modal account predicts the opposite. (Hirvelä and Paterson 2024, 8). Similarly, suppose Yen has bought 999.999/100.000 lottery tickets and Triss has bought only one ticket. Intuitively, the risk that Yen loses the lottery is small while the risk that Triss loses the lottery is high. Yet if Triss wins the lottery, "the risk that Yen would lose the lottery was higher than the risk that Triss would lose the lottery" (Hirvelä 2024, 343).

Another issue is that any two true propositions end up having the same risk. Betting on 1 with a six-sided die is not as risky as betting on 1 with a twelve-sided die, yet if both dice land on 1 the risk is the same, according to TMAX. Similarly, the risks of betting on 1 and betting on "1 or 2 or 3 or 4 or 5 or 6" are the same, if the dice lands on 1 (Hirvelä and Paterson 2024, 9).

We can distinguish between three kinds of objections to TMAX:

1. TMAX defies risk-priority (asbestos case) (Ebert et al. 2020);
2. Different truths differ in risk (die case 2) (Hirvelä 2024, Hirvelä and Paterson 2024);
3. Some false propositions are riskier than some true propositions (die case 1, lottery) (Hirvelä 2024, Hirvelä and Paterson 2024).

## 3 Bad strategies

We have built our case. Before I start unwinding it, let me briefly mention two strategies I will not pursue. First, if we don't ignore the undesirability component, MCR doesn't imply TMAX but only that equally undesirable truths are equally risky, and that any two equally undesirable propositions $\phi$ and $\psi$ are such that $\phi$ is more risky than $\psi$ if $\phi$ is true and $\psi$ is false. Risk-priority still holds for a vast array of propositions: since the risk of $\phi$ is a combination of undesirability and modal closeness, if $\phi$ is desirable or very minimally undesirable, then we can safely conclude that the risk of $\phi$ is low before taking a stance on its truth. Different truths can differ in risk if they differ in undesirability, since any undesirable falsity is riskier than any truth which is not undesirable. However, the crux of the problems remains, and we can reframe each problem using equally undesirable propositions, so I will set aside this strategy.

Secondly, time might be playing a role in our assessment of risk. If Aristotelians are right and future contingents defy bivalence, then risk changes over time as the future settles in a particular way. In a coin toss, before I toss the coin the risk that it lands heads is the same as the risk that it lands tails, since there are two equally close worlds that complete ours where both outcomes occur. After the toss, the objective risk of one of "Heads" and "Tails" is maximal. I won't pursue this strategy further for three reasons: it relies on a specific view on future contingents, the examples can be reframed as happening in the past, and the temporal solution doesn't really answer the objections. Take the first die case: the future contingent strategy will not conclude that "1 or 2 or 3 or 4 or 5" is riskier than 6 even before the throw, at most that they are as risky.

## 4 TMAX vs T

There is a non-comparative notion of risk which is modal, which mirrors safety in epistemology. I am safe from $\phi$ iff $\phi$ is not risky. When I say that my belief is safe, I am making a general claim restricted to worlds that are close-by, not a comparative claim between propositions. It might be that closeness is context dependent, in which case safety is also context-dependent, but that wouldn't make safety gradable, no more than it would make knowledge gradable. Now the following is obvious: if $\phi$, then you are not safe from $\phi$. If I get shot, I was not safe from being shot (Williamson 2009, 11). This is just a consequence of the fact that safety is a local kind of necessity, and necessity satisfies axiom T: if $\phi$ is necessary then $\phi$. Risk is the mirror of safety, so from T and the fact that I am safe from $\phi$ iff $\phi$ is not risky, we can infer that if $\phi$ then $\phi$ was in fact risky: T holds for "risky", as well.

Safety is not an internally defined evidential notion: all of my evidence may point to some conclusion, but I can still be wrong about it and *ipso facto* my belief is not safe. It follows that the mirroring notion of risk must also be externally defined. I would be confused if I were to say: "We are safe from the presence of asbestos but there might be asbestos in the wall": if we are safe then there is no asbestos in the wall.

We can put forth the first point in favour of TMAX against the risk-priority objection: if that objection worked, it would also work against axiom T for risky and, therefore, against axiom T for safety. It overshoots, therefore it should be rejected. If there is asbestos in the wall, then you are not in fact safe from it, which means that "There is asbestos in the wall" is risky. An assessment of the safety of my belief cannot be independent of the assessment of the truth of my belief: I am not in a position to conclude that I am safe from the presence of asbestos in the wall without taking a stance on whether there is asbestos in the wall. Thus, I am also not in a position to conclude that I am not at risk from asbestos in the wall without taking a stance on whether there is asbestos in the wall.

## 5 Counterfactuals and risk

There is a systematic relationship between counterfactuals and risk assessments. When I consider the risk of falling into a stream when attempting to jump across, intuitively I imagine myself attempting the jump, and I judge how likely it is that I make it through. I am asking myself the following counterfactual question: if I did attempt to jump, keeping fixed all relevant variables such as the state of the terrain, the direction of the wind, my physical abilities, how wide the stream is and so forth, would I make it? The similarity semantics for counterfactuals developed by Stalnaker (1968), Lewis (1973) and others systematically links modal risk and counterfactuals: they are both about the closeness relation between possible worlds. Roughly, $\phi \mathrel{\Box\!\!\rightarrow} \psi$ iff $\psi$ is true in all the closest $\phi$-worlds. It follows that, if $\phi \mathrel{\Box\!\!\rightarrow} \psi$ then $\psi$ is high risk on the assumption that $\phi$, since, on the assumption that $\phi$, the closest worlds are such that $\psi$.

Now, suppose I am a very bad jumper: if I jumped across the stream I would fall into the water. Intuitively, then, if I do jump across, the risk that I would fall into the water is high. This has nothing to do with my evidence: I might be delusional and think that I am an excellent jumper while I am not, this doesn't change the risk of jumping but only my awareness of it.[2] Following the example above, I put forth the following rule that links counterfactuals and risk:

$$\phi \mathrel{\Box\!\!\rightarrow} \psi, \phi \therefore \text{ high risk of } \psi \tag{R1}$$

R1 is plausible, yet if one accepts R1 then they must also accept that any truth is high risk, because any $\phi$ counterfactually implies itself. Thus, there must be something wrong with objections 1, 2 and 3, since the examples in those objections relied on the possibility that the risk of some true propositions can be small. Note that argument is not that, since the risk of $\phi$ conditional on $\phi$ is high, the unconditional risk of $\phi$ is high. What I am saying is that, since the risk of $\phi$ given $\phi$ is high and $\phi$ is true, the unconditional risk of $\phi$ is high.

To see what's wrong with the asbestos case, let's change it slightly. Suppose John is considering the risk of nuclear waste being buried in his garden. There is in fact nuclear waste buried in the garden and this amount of radiation would kill in a month any human being living in the house. If someone were to live in that house for more than one month, they would die of radiation poisoning. Unfortunately, John has been living in the house for more than a month. Clearly, then, he is at a high risk of dying from radiation poisoning: R1 intuitively holds. Clearly, then, there is also a high risk of nuclear waste being buried in the garden, for how can there be a low risk of it existing if there is a high risk of John dying from it?

Consider the lottery case above for objection (2): we said that the risk that Yen loses the lottery is small. Yet, if Triss has the winning ticket, since if Triss had the winning ticket Yen would lose the lottery, there must be a high risk of Yen losing the lottery. Suppose Yen mortgaged her house in order to buy the 999.999 tickets and she has no other asset in her name. Since Triss has the winning ticket, and since Yen has lost the lottery, the risk that Yen defaults on the loan and that her house is repossessed is extremely high. Yet, it is very odd to hold at the same time that the risk that she loses her home is extremely high but the risk that she loses the lottery is very low, because her losing the lottery is the only reason why she might lose her home. A similar point can be made about the two die cases.

## 5.1 All truths have the same maximal risk

R1 implies that all truths are high risk, not that they have the same risk. To argue for the latter point is harder but possible. Suppose it is stormy outside;

[2]Hansson (2010) argues that risk arises only if the outcome is not settled yet. I disagree, and I am taking these cases as borderline cases of maximum risk rather than cases of no risk.

if I went out for a walk, I would get drenched. Now, it would be very odd to hold that that the risk that I go out for a walk is lower than the risk of getting drenched, and yet at the same time insist that the only possible reason for me to get drenched is that I go out for a walk. If the risk that I go out for a walk is lower than the risk of getting drenched, there must be some other way for me to get drenched: perhaps by taking a shower, or by trying to fix the kitchen sink. Thus, would I get drenched, I might not have gotten out for a walk. We may generalise to the following principle, where $r(\phi)$ is the risk of $\phi$ and $\Diamond\!\!\rightarrow$ is the might-counterfactual:

$$\phi \;\Box\!\!\rightarrow\; \psi, r(\psi) > r(\phi) \therefore \psi \;\Diamond\!\!\rightarrow\; \neg\phi \tag{R2}$$

Modulo duality, $\phi \;\Box\!\!\rightarrow\; \psi$ is equivalent to $\neg(\phi \;\Diamond\!\!\rightarrow\; \neg\psi)$, therefore R2 is logically equivalent to the principle that two counterfactually equivalent propositions have the same risk. This is also plausible: suppose I receive a suspicious package via mail. Just yesterday I heard on the radio that a terrorist is sending explosive devices through post. Since this terrorist is Ted Kaczynski, had the package been from the terrorist I heard about on the radio, it would be from Ted Kaczynski, and vice-versa. It follows that the risk that it's from Ted Kaczynski cannot be higher than the risk that it's from the terrorist I heard about on the radio: it's the same risk.

Modulo strong centering, R2 implies that all truths have the same risk. For if both $\phi$ and $\psi$ are true, they are counterfactually equivalent, so they have the same risk (for a defence of conjunction conditionalisation, i.e. "$\phi$, $\psi$ therefore $\phi \;\Box\!\!\rightarrow\; \psi$", see Walters and Williams 2013).

To reach TMAX we only need to show that no falsity is riskier than some truth. This is easily done, given the previous conclusion that all truths have the same risk. For then all truths have the same risk as any logical truth, yet no falsity can be riskier than a logical truth. Take the die example above: if "1 or 2 or 3 or 4 or 5" is riskier than 6, then it is riskier than "6 or not 6", which is absurd. Of course, it is more probable that the die lands on some other face than it is that it lands on 6, but here we are not reasoning probabilistically, we are reasoning modally, and sometimes probability and (modal) risk diverge.

## 5.2 Similarity and chance

Recently the similarity account of counterfactuals has been under attack by a new wave of probabilistic analyses (Edgington 2008, Leitgeb 2012, Hájek 2025). Roughly, the probabilistic account argues that the truth of a counterfactual $\phi \;\Box\!\!\rightarrow\; \psi$ is a function of the chance of $\psi$ given $\phi$. A question naturally arises: do my arguments in this section rely on the similarity analysis of counterfactuals? I believe so. If the similarity analysis is flawed, the arguments from R1 and R2 miss the point because they don't talk about modal risk. However, if the probabilistic analysis of counterfactuals is right, counterfactuals still track (a notion of) risk: R1 is plausible if we substitute $\phi \;\Box\!\!\rightarrow\; \psi$ with "the conditional chance of $\psi$ given $\phi$ is high". However, this version of R1 would be about the probabilistic notion of risk, not about the modal notion of risk which is the topic of this paper.

Critics of the similarity analysis of counterfactuals point out that a counterfactual $\phi \boxright \psi$ can be true even if the chance of $\psi$ given $\phi$ is arbitrarily close to 0 (Hájek 2025). This puzzling feature actually mirrors what the modal account of risk predicts about risk: sometimes $\phi$ is highly risky even if its probability is close to 0. Consider the gruesome lottery scenario by Pritchard (2022), in which we are forced to play a lottery where the winner is subjected to some torture. According to the modal account of risk, there is a high risk of winning the lottery regardless of the number of tickets in existence, since the tickets are random, so your ticket could easily be the winning one. This risk is invariant with respect to the number of lottery tickets in existence, unlike the probability, which tends to 0 as the number of tickets increases. Defending these features of the modal account or the similarity analysis of counterfactuals against the probabilistic analysis is beyond the scope of this paper.

## 6 Conclusion

All truths are maximally risky, contrary to the objections above. There are two explanations as to why this strikes us as implausible. We use probabilistic reasoning instead of modal reasoning, or we focus on subjective and evidential risk rather than objective and external risk. The latter point has already been made by Pritchard (2022). He claims that the asbestos case fails to distinguish between "the actual risk in play and what would be an epistemically appropriate assessment of risk relative to a given body of information." Pritchard's distinction is useful: often we use the subjective notion to put blame and praise to people. It would be unfair to blame someone for living in a house only on the basis that there is asbestos in the wall, unless the evidence they possess sufficiently points to the presence of asbestos. This doesn't change the fact that the objective risk of them getting cancer is increased, regardless of their evidence.

I believe that the intuitions behind the die cases and the lottery case are driven by probabilistic reasoning. Probabilistic reasoning is as useful as modal reasoning, they are different heuristics that we often use in tandem, so it is easy to confuse them. If the fact that a die has six faces is enough to conclude that betting on 1 is less risky than betting on "1 or 2", then the same intuition will likely tell us that betting on 1 is as risky as betting on any other number. This cannot be accommodated by any modal notion that overweights the actual world – as I believe any modal account should – even the sophisticated one developed by Hirvelä and Paterson (2024). The actual world will make betting on one number with that die slightly more risky just because that particular die landed on that number. So, the conclusion we should draw from die cases is not that the modal notion is more probabilistic than we thought, but rather that we are confusing different notions of risk: a probabilistic one and a modal one. Risk is a pluralist notion, as advocated by Ebert et al. (2020) and contrary to Hirvelä and Paterson (2024). However, contrary to Ebert et al. (2020), an externally defined, objective modal notion is a legitimate notion of risk.

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