

# *Pascal's Hell*\*

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ABSTRACT: Expected utility maximization with unbounded utilities implies that tiny probabilities of huge positive or negative payoffs can dominate over all expected-utility calculations. In other words, it leads to *fanaticism*. Fanaticism is counterintuitive, as illustrated by cases such as Pascal's Mugging and the St. Petersburg paradox. However, these cases do not illustrate the most counterintuitive implications of fanaticism. This paper shows, in the form of a dialogue, how a world filled with fanatical agents can be almost certain to be devoid of value—and by their own choice. The case presented here does not involve infinities, and it avoids the criticisms that have been raised against earlier cases.

*Satan*: I'm here to give you an offer, as I've heard that you might be interested in a small probability of a huge payoff.

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*Pascal:* Anything that maximizes expected utility!

*Satan:* Excellent. (Satan smiles cunningly). And your utility function is unbounded, am I right?<sup>1</sup>

*Pascal:* Bounded utilities are implausible. For example, if utilities were bounded, then the evaluation of prospects would depend on what happens in remote locations and times that are causally disconnected from the here-and-now, like some faraway planets.<sup>2</sup> That's, frankly, *weird*. But it gets weirder. Bounded utilities also imply that sometimes one would choose a small probability of a mediocre (but positive) payoff rather than a high probability of a great payoff.<sup>3</sup> If anything is a clear sign of insanity, that is.

*Satan:* That is indeed weird. My frenemy, God, also dislikes bounded utilities because people with bounded utilities make bad missionaries. For example, they would rather save some (very large) number of lives with probability one than save *any* number of lives with a probability almost one.<sup>4</sup>

*Pascal:* So many souls lost due to extreme risk-aversion. Besides extreme risk-aversion, bounded utilities also lead to extremely risk-seeking and unethical behavior.<sup>5</sup> (Satan scoffs to indicate that he does not care about a theory recommending unethical behavior.)

*Satan:* It's my favorite implication of bounded utilities! Suppose the world is full

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<sup>1</sup>The utility function does not necessarily have to be unbounded for this case to work—it is enough that the upper bound is very high and the lower bound very low.

<sup>2</sup>See Beckstead and Thomas (2023, §3.2).

<sup>3</sup>See Beckstead and Thomas (2023, §3.4).

<sup>4</sup>Kosonen (2022, p. 33).

<sup>5</sup>Beckstead and Thomas (2020, §3.4).

of misery. (A smile flickers across Satan's face.) Then I can offer someone with bounded utilities even odds between a billion years of torture for all sentient creatures on their planet and someone getting a lollipop—and they will take it!<sup>6</sup> They will take it! (Satan laughs hysterically.) They say that the possibility of additional suffering does not contribute much disvalue near the lower bound of utilities, so the value of someone getting a lollipop can outweigh the disvalue of all those poor unfortunate souls suffering for a billion years. (Satan wipes a tear from his eye.)

*Pascal:* Clearly, bounded utilities are unacceptable from an ethical point of view.

*Satan:* Of course they are, of course they are. Let's change the topic, my friend. I believe you have already met my minion, the Mugger.<sup>7</sup> And you refused his offer. May I ask the reasons for your refusal? I thought my minion gave you a fair offer. A thousand quadrillion happy days in the Seventh Dimension and everything—in exchange for a mere \$100.

*Pascal:* I had a few reasons for my refusal. First, the larger the payoff the Mugger promised to deliver, the lower the probability I assigned to him sticking with his promise.<sup>8</sup> And my probabilities went down faster than the Mugger's offer's utilities went up. (Satan shakes his head disapprovingly.) Secondly, there exist symmetrical

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<sup>6</sup>Beckstead and Thomas (2020, §3.4) and Kosonen (2022, p. 34–35).

<sup>7</sup>In Bostrom's (2009) Pascal's Mugging, a mugger claims to be an Operator from the Seventh Dimension and promises to give Pascal a thousand quadrillion happy days in the Seventh Dimension if Pascal pays the mugger ten livres—money that the mugger will use for helping many orphans in the Seventh Dimension. This case is based on discussions by various people, such as Yudkowsky (2007).

<sup>8</sup>This objection is from Baumann (2009, p. 447). See Hanson (2007) for a related objection.

possibilities that cancel out the expected utility of the Mugger's offer.<sup>9</sup> For example, I might meet another mugger who promises me an amazing payoff if I do *not* pay the original mugger.

*Satan:* I admit: I did send other muggers with such offers as well. So, you're not wrong. On the first point, let's agree to disagree. But there's one thing I don't understand: I heard you also refused to pay a large sum to play the St. Petersburg game.<sup>10</sup> Why?

*Pascal:* I'm suspicious of infinities and unsure how to handle them. Also, I have a credence zero in ever facing a St. Petersburg lottery.<sup>11</sup>

*Satan:* I can't argue with that. But confess to me, Pascal: Do you discount small probabilities down to zero?<sup>12</sup> (Satan looks at Pascal with contempt.)

*Pascal:* Over my dead body! That view faces a myriad of problems. For example, it violates dominance principles<sup>13</sup> and is vulnerable to money pumps: Probability discounters would pay for something they could keep for free.<sup>14</sup>

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<sup>9</sup>This objection is from Hiller and Hasan (2025, p. 14).

<sup>10</sup>The St. Petersburg game gives a  $1/2$  probability of \$2, a  $1/4$  probability of \$4, a  $1/8$  probability of \$8, and so on. Therefore, it has infinite expected monetary value:

$$2 \cdot \frac{1}{2} + 4 \cdot \frac{1}{4} + 8 \cdot \frac{1}{8} + \dots = 1 + 1 + 1 + \dots = \infty.$$

<sup>11</sup>See Kosonen (2022, pp. 51–52) for criticism of this idea.

<sup>12</sup>See Monton (2019) and Smith (2014) for defenses of discounting small probabilities. Also see Hájek (2014), Isaacs (2016), Lundgren and Stefánsson (2020), Kosonen (2022, pp. 137–239), Beckstead and Thomas (2023) and Cibinel (2023) for criticism of discounting small probabilities.

<sup>13</sup>See Isaacs (2016), Smith (2016), Monton (2019, pp. 20–21), Lundgren and Stefánsson (2020, pp. 912–914), Kosonen (2022, Ch 4) and Beckstead and Thomas (2023, §2.3).

<sup>14</sup>Kosonen (2024). Note that fanaticism is also vulnerable to money pumps given St. Petersburg style lotteries. See Russell and Isaacs (2021).

*Satan:* I need to find those people and exploit them.

*Pascal:* They have it coming. But I'm not finished yet. Discounting small probabilities is also vulnerable to Each-We dilemmas and ex ante Pareto violations.<sup>15</sup> And, on this view, even a tiny decrease in the probability of a payoff cannot be outweighed by any (finite) increase in the size of the payoff.<sup>16</sup>

*Satan:* Funny people, those probability discounters. They claim to ignore tiny probabilities but they surely seem to care a great deal about tiny *changes* in probabilities.

*Pascal:* I feel like I forgot something. (Pascal gazes up at the night sky.) Oh, and similarly to bounded utilities, this view implies that the evaluation of prospects can depend on what happens in distant, causally disconnected locations and times—like on some planet up there.<sup>17</sup> But of course I should ignore what happens on causally disconnected planets. For these reasons, I must discount discounting small probabilities.

*Satan:* Don't you worry about what happens on other planets. (Satan coughs and Pascal gets slightly worried.) Leaving probability discounting aside, some try to avoid tiny-probability problems by appealing to knowledge. Do you conditionalize on knowledge before maximizing expected utility?<sup>18</sup>

*Pascal:* I would never! What even is this thing called 'knowledge'?

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<sup>15</sup>Kosonen (2022, Ch 3 and Ch 6). A theory faces Each-We dilemmas if “there might be cases where, if each does better in this theory's terms, we do worse, and vice versa.” See Parfit (1984, p. 91). Ex ante Pareto, in turn, states that what is ex ante better for everyone is better overall.

<sup>16</sup>See Beckstead and Thomas (2023, p. 13).

<sup>17</sup>See Beckstead and Thomas (2023, §3.2).

<sup>18</sup>See Hong (2024).

*Satan:* Who *knows*.

*Pascal:* Please stop.

*Satan:* ...

*Pascal:* Anyway, conditionalizing on knowledge before maximizing expected utility also leads to money pumps.<sup>19</sup>

*Satan:* More money for me!

*Pascal:* Not from me. I have a high credence in credences being sufficient—we do not need the concept of knowledge.

*Satan:* Makes sense, I guess. But do you *know* knowledge isn't—you *know*—a thing?

*Pascal:* Please stop or I don't *know* what I'll do.

*Satan:* I apologize. I have one last question before I give my offer. Do you, Pascal of the Earth, accept *fanaticism*? It's the brave idea that, for any probability  $p$  and any (finitely) good outcome, there is some great enough outcome such that probability  $p$  of the great outcome (and otherwise nothing) is better than certainty of the good outcome.<sup>20</sup> In other words, whatever (finite) prospect you've already got, there's always a better prospect that gives only a tiny chance of something amazing (and otherwise nothing).

*Pascal:* Yes, I'm a fan of fanaticism and unbounded expected utility maximization. Although it boggles me why the view is called fanaticism. Anyway, most of

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<sup>19</sup>See Kosonen (2022, pp. 48–51).

<sup>20</sup>Wilkinson (2022, p. 449). See Beckstead (2013, Ch 6), Goodsell (2021), Russell and Isaacs (2021), Wilkinson (2022), Russell (2023), Kosonen (2022, pp. 11–38) and Beckstead and Thomas (2023) for discussions of issues related to fanaticism. Various plausible principles imply fanaticism. See Wilkinson (2022). Yet, many of these or related principles—such as Stochastic Dominance and Separability—are, in fact, mutually inconsistent. See Russell (2023).

the problems of unbounded expected utility maximization are due to the St. Petersburg game, but as I have a credence zero in ever facing one, the theory looks appealing.

*Satan:* Aren't you worried about infinities?

*Pascal:* Infinities present something of a problem for unbounded expected utility maximization. I admit, I will be *infinity-obsessed*: Any non-zero probability, however small, of an infinite payoff is better than any certain finite payoff.<sup>21</sup> But this is a minor problem compared to the problems other theories face. I'm ready to choose unbounded expected utility maximization: give me utility or give me death!

*Satan:* You are a brave young man, Pascal. (Pascal blushes.) I have a new offer for you, and it does not involve infinities.<sup>22</sup> Also, your concerns about the Mugger's offer don't apply here either.

*Pascal:* I'm excited!

*Satan:* The offer is this: I'll flip a coin, and if it lands on heads, I'll help humanity settle on new planets in faraway galaxies and live in bliss until the heat death of the Universe in  $10^{106}$  years. (This is the fate of the Universe in which Satan and Pascal live.) Until then, it will be like Heaven.

*Pascal:* So far so good. What's the catch? You're—you know—Satan after all.

*Satan:* If the coin lands on tails, then everyone on Earth will suffer excruciating

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<sup>21</sup>Beckstead and Thomas (2023, p. 17).

<sup>22</sup>Pascal's Mugging is similar to Pascal's Wager, except that the former does not involve infinite utilities. Pascal (1958) famously argued that one should believe in God because of the possibility of gaining an infinitely good payoff in Heaven: "Let us weigh the gain and the loss in wagering that God is. Let us estimate these two chances. If you gain, you gain all; if you lose, you lose nothing. Wager, then, without hesitation that He is."

pain until life on Earth is no longer possible—one billion years of Hell. (Satan's eyes shimmer with excitement.) But before you answer, here's one caveat: No settling on other planets without my help.

*Pascal:* Your offer sounds great. An even coin flip between  $10^{106}$  years of bliss for many Earth-like planets versus a billion years of torture for just one planet.

*Satan:* Oh, pardon me, I forgot to say that my coin is somewhat biased. The probability of heads is one in a googolplex. I admit your chances aren't great. But *if* the coin lands on heads, I'll create a thousand googolplex happy Earth-like planets that survive until the heat death of the Universe.

*Pascal:* The devil is in the details, as they say. Nevertheless, the offer is still amazing. The expected utility of taking the gamble is clearly greater than the expected utility of rejecting it. Actually, its expected utility might even be greater than the expected utility of the offer I initially thought you were making. So, I'm positively surprised.

*Satan:* Oops, I made a mistake: I read the wrong page. The instruction manual (*Creating Hell*) says that the probability of heads happening on Earth is one in Graham's number. But it's in my power to create any finite number of happy Earth-like planets, so I believe I can still give you a good offer. If the coin lands on heads, I'll create a million Graham's number of happy Earth-like planets.

*Pascal:* Now your offer is even better! Although I dread the almost certain torture of everyone on Earth for the next billion years, the expected utility of your offer is far greater than the expected utility of not taking it. So, rationality compels me to accept it. (Satan looks at Pascal in disbelief.)

*Satan:* Sometimes rationality is crazy. But don't get me wrong: crazy in a good way.

Pascal and Satan then shake hands to agree on the deal, and Satan flips the coin. Unsurprisingly, it lands on tails.

*Satan:* Everyone on Earth will now suffer excruciating pain for the next billion years.

*Pascal:* Oh well. I did what was rational in expectation—the rest was Nature's choice. Thank you for your offer.

*Satan:* I never imagined persuading people to enter Hell would be this easy...

\* \* \*

So Satan traveled from one planet to another, and the inhabitants of those planets—also expected utility maximizers with unbounded utilities—always accepted his offer. According to Satan's instruction manual, the probability of the coin ever landing on heads was merely one in a googolplex, so the Universe was almost certain to be void of joy and laughter. Yet they all lived happily ever after (in expectation).

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