Uncertainty and Climate Change

The truth is, we don't know EXACTLY what to expect when it comes to climate change. Predictive models range from *bad-but-nothing-we-can't-handle* to *totally-catastrophic*. In short, there is UNCERTAINTY. How does uncertainty affect our moral duties?

1. How Not to Deal With Uncertainty: Here's what NOT to do.

(1) **Do Nothing (Active):** Continuing to perform some potentially harmful action until you are certain that it IS harmful.

For example, you might hear someone claim, "No, we should not ban assault weapons. We don't know for sure that banning them would fix anything. Let's keep selling them until we have all the facts."

Historically, this has largely been the policy of the U.S. regarding climate change as well: "No, let's keep emitting greenhouse gases. Climate science is incomplete. We're not going to take an economic hit to our nation until we have all the facts."

Reply: Perhaps this makes sense if there is no reason to suspect that the action you're performing isn't harmful. But, it isn't a reasonable stance if there's good reason to suspect that an action IS causing harm! For instance, imagine that the FDA puts out a statement that there is a 10% chance that a certain baby food is causing cancer. "No, I'm going to keep feeding it to my baby until all the facts are in and we're CERTAIN it's fatal!" would be a really irrational stance. In this case, "better safe than sorry" seems like the best advice.

(2) **Do Nothing (Non-Active):** Refraining from performing some potentially harmful action until you are certain that performing it is beneficial and not harmful.

For example, someone might say, "We don't know all of the long terms of the COVID vaccine yet, because it hasn't been tested long-term. I'm not going to take it until we are CERTAIN that it's safe."

In this case, it seems that it is rational to take the risk. Our best evidence indicates that the vaccine is very safe, and the risks of NOT doing anything are quite high. So, doing nothing is a bad way to respond to uncertainty.

A general note about (1) and (2): Note that both of these suggestions entail that we mustn't change our behavior until we are CERTAIN about the future. But, we will NEVER

be CERTAIN about ANYTHING – let alone, the future of Earth's climate. [*I'm not even certain that I have hands! For all I know, perhaps I'm a tentacle monster experiencing a very real [computer simulation](#) of human life. Whoa... Dude...*]

Furthermore, we NEVER make decisions based on complete certainty. When you eat food, you can't be 100% CERTAIN that it's not poison. When you step confidently onto the ground, you can't be 100% CERTAIN that it will support your weight (maybe it's cleverly disguised quicksand!). But, this does not mean that it is irrational to eat, or walk around. Absolute certainty is nearly always unobtainable.

(3) **Act Based on the Assumption that What is Most <u>Likely</u> to Occur WILL Occur:** This advice seems to be getting *closer* to good advice in the face of uncertainty. But, Broome points out, sometimes it is rational to take steps to plan for outcomes that are NOT likely to occur.

For example, it is unlikely that your house will burn down. So, by this advice, you have no reason to take steps to purchase home insurance, or buy a fire extinguisher. Rather, you should make your plans under the assumption that there will NOT ever be a house fire – since a house fire is very unlikely. Similarly, you seem to have no reason to wear a seatbelt, since you *probably* won't be getting into a car crash. (This seems like an ill-advised way to react to uncertainty.)

<u>2. How To Deal With Uncertainty:</u> Broome suggests the following:

Expected Value Theory: Under conditions of uncertainty, we ought to do whatever maximizes (or at least increases) expected value.

The expected value of a decision can be calculated using the following formula. (Here is the formula for a decision with only two possible outcomes.)

Expected Value Formula =
(probability of outcome 1 occurring) x (what you stand to gain or lose if outcome 1 occurs) + (probability of outcome 2 occurring) x (what you stand to gain/lose if outcome 2 occurs) + ...

To illustrate, let's play a game. I'll flip a fair coin.

- **Heads:** I'll give you $1
- **Tails:** You'll give me $5

Would you like to play? Would it be a good idea to play? Is it a good bet?

Intuitively, this is NOT a good bet, and I'm sure you can see that intuitively – even if you cannot articulate precisely why. Expected value formula will help us see *exactly* why it's a bad bet. Let's calculate the expected value of playing this game:

E.V. (of playing the game) = (0.5)($1) + (0.5)(- $5) = $0.50 – $2.50 = – $2.00

The expected value of playing this game is – $2.00. (The expected value of not playing this game is zero, since you neither gain nor lose anything by refraining from playing.) What this means is that, if you were able to play this game multiple times, you should expect, on average, to lose $2 per game. For example, if you play ten times, you should expect to win 5 times (winning $5 total) and also lose 5 times (losing $25) – ultimately losing $20 total, for an average of a $2 loss per game.

When the expected value of some action is negative, it is a **bad bet**. You shouldn't do it.

Earlier, Broome said it was rational to buy a fire extinguisher. Let's see why: First, the probability of a house fire is about 1 in 3,000. Imagine that your house and all of your belongings are worth $300,000. The expected value of NOT buying a fire extinguisher is:

E.V. (no fire extinguisher) = (1/3,000)(–$300,000) + (2,999/3,000)($0) = – $100

Fire extinguishers cost about $50. Assume that, if you owned a fire extinguisher, you would be able to stop any and all house fires before they caused any real damage. Would the purchase be worth it? Yes! As we've just shown, the expected value of NOT buying one is twice as bad. (*Though of course, if your home and belongings have no value, then buying a fire extinguisher may actually be a BAD bet, by this formula.*)

3. Moral Value, Not Monetary Value: Now, expected value theory as we've just presented it MAY seem to get things totally wrong in some cases. Consider this case:

> **Gambling Your Retirement** You are just about ready to retire. Your total assets (home, retirement plan, savings, etc.) equal $1 million. I offer you a bet: We'll flip a fair coin. If it lands heads, I'll give you $3 million dollars. If it lands tails, you'll give me your entire life's savings and everything you own. Should you bet?

Expected value theory says yes!

E.V. (gamble) = (0.5)($3 million) + (0.5)(-$1 million) = $1.5M - $0.5M = +$1 million

That's a really good bet!

In fact, according to E.V., you should even be willing to pay me $999,000 just to play! ...Wait, can that be right? Most people would probably say that it would be irrational to play – and even MORE irrational to PAY to play – despite the fact that playing has a very high, positive expected value. Uh-oh!

Maximize Expected MORAL Value: Where did the E.V. formula go wrong? Answer: The only thing of value included was MONEY! But, you'd lose a lot more than money if you lost everything you owned at retirement age. For instance there would be:

- Psychological and emotional hardship from such a great loss
- The inconvenience of being homeless and possession-less for a while (or forever)
- The inconvenience of starting over (finding a new place to live, new things, etc.)

Losing the bet not only affects your wallet, but more importantly your **well-being**. Once we consider all of these additional NON-monetary costs, it becomes clear that the expected value of not gambling your retirement away is very much in the negative.

For this reason, Broome suggests that, when determining what we ought to do in the face of uncertainty, we ought to do whatever maximizes (or increases) **expected well-being**. (*Not to mention, there might be OTHER things of significant moral value besides happiness/well-being. For instance, beauty, life, justice, freedom, and so on. If those things are intrinsically valuable, then these should get included in our E.V. calculations too!*)

4. Conclusion: So, where does this leave us? Well, note that, on the expected value formula, we seem to have very strong moral reasons to take measures to prevent even those outcomes that are *very improbable* – provided that the potential losses are also *very large*. For example, if a particular action has only a 1 in 1,000 chance of killing a billion people, we still have VERY strong reasons to refrain from doing it. (In this case, the expected value of performing the action is *one million deaths!!*)

Similarly, Broome claims that, *even if you believed that the probability that climate catastrophe will occur is quite small*, you would STILL have very strong moral reasons to take measures to prevent it – since climate catastrophe would entail a TREMENDOUS loss of moral value.

A house fire, though improbable, would be catastrophic for your life. For these reasons, we ought to buy the fire extinguisher. Similarly, the worst-case-scenario with respect to climate change, though perhaps improbable, would be catastrophic for humanity. For these reasons, DESPITE the presence of uncertainty, we ought to act to prevent it.

In short: **Let's "buy the fire extinguisher", so to speak, by taking measures now to avoid the worst outcomes of climate change!**

(But note: The sacrifices we'll need to make are MUCH larger than spending $50 on a fire extinguisher. For instance, a 2023 IPCC report states that, by 2030, [we need to cut global emissions in HALF](), and from there, developed nations need to reach ZERO carbon emissions by 2040, and undeveloped nations by 2050, in order to avoid exceeding a 1.5° C rise in average global temperature, and avoid the worst, most catastrophic effects of climate change! Reaching that goal would require a TREMENDOUS sacrifice!)

Afterthoughts: If the above reasoning is correct, what does this entail regarding our moral reasons to put money and resources into things like:

- pandemic response teams
- rogue asteroid detection and prevention programs
- colonization of Mars (as a failsafe to avoid human extinction)

(What do you think?)