How to Be Rational

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Abstract: The core of this paper is divided into 4 sections. In Sections 2 and 3, I address (2) how to acquire rational belief attitudes, and (3) how to make rational choices. Building on Sections 2 and 3, I then answer two of the most pressing questions of our time: (4) Should you be skeptical of climate change? (5) Should you invest in life-extension medical research?

1. Introduction

> It has always appalled me that really bright scientists almost all work in the most competitive fields, the ones in which they are making the least difference. In other words, if they were hit by a truck, the same discovery would be made by somebody else about 10 minutes later.
> —*Aubrey de Grey*

To make *(instrumentally) rational choices* is to choose courses of action that best serve one's ends full stop. As a good example, one's chances of having a positive impact on the world are significantly greater if one applies one's efforts to the world's biggest, most urgent problems than if one applies one's efforts to comparatively small, non-urgent problems that will not ultimately matter in the long run if the biggest, most urgent problems are left unsolved. Therefore, if one's goal is to make a difference in the world, then it is simply not rational to apply one's efforts to comparatively small, non-urgent problems.

It is true that functioning societies do need people working on comparatively small day-to-day problems. But a shortage of people working on comparatively small day-to-day problems is itself a big urgent problem and so, something that one would need to factor into any rational decision about where to apply one's efforts.

Moreover, it does not require an exceptionally intelligent person to survey the literature on the various problems that we may be facing and to arrive at a correct assessment of what problems are the biggest and most urgent and what problems are comparatively small and non-urgent. Now, to adopt *rational belief attitudes* is to adopt belief attitudes (i.e., to believe, to disbelieve or to withhold belief) that best serve one's epistemic ends, namely those of acquiring true beliefs and avoiding false beliefs. So, provided that one's methodology for acquiring rational belief attitudes is robust, then there is surely a reasonably approachable threshold of analysis and synthesis beyond which more sophisticated analysis and synthesis will not likely

yield a more correct assessment of what problems are the biggest and most urgent and what problems are comparatively small and non-urgent.

We face today an unprecedented number of big urgent problems. With those problems in mind, in this paper, I will supply readers with a robust methodology for acquiring rational belief attitudes and making rational decisions. Readers will then be better equipped to identify and solve the world's most pressing problems.[1]

The core of this paper is divided into 4 sections. In Sections 2 and 3, I will address (2) how to acquire rational belief attitudes, and (3) how to make rational choices. Building on Sections 2 and 3, I will then answer two of the most pressing questions of our time: (4) Should you be skeptical of climate change? (5) Should you invest in life-extension medical research?

2. How to Acquire Rational Belief Attitudes

How should a layperson think (or form belief attitudes) about any given statement? Is it enough to research reliable sources and use logical, unbiased thinking? In this section, I will argue that it is not and that a layperson should instead defer to the majority testimony of experts on that statement, if there are any experts on that statement.

For any statement (or proposition), *p*, there are three possible belief attitudes (or doxastic attitudes, in technical jargon) toward *p*: to believe *p* (which is consistent with having a range of degrees of confidence in *p*), to disbelieve *p* (to believe that *p* is false), and to withhold belief about *p* (to withhold belief about whether *p* is true or false).

Doxastic attitudes may not be directly voluntary, but they can be informed by guiding principles that are sufficiently prima facie plausible or evidenced.[2] Consider the following prima facie plausible principle: Unless there are overriding moral objections, one should form *epistemically rational doxastic attitudes*—that is, doxastic attitudes that best serve one's *epistemic ends*, namely those of acquiring true beliefs and avoiding false beliefs to some respective extent.

Generally, when choosing between different courses of action, with a view to achieving one's ends, false beliefs are undesirable more so than true beliefs are desirable. One error or miscalculation is often enough to undermine such a decision. Nevertheless, true beliefs are still obviously essential to choosing the best courses of action in pursuit of one's goals. Therefore,

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[1] See also Bill Gates and Melinda Gates, "Annual Letters From Bill & Melinda Gates," *Bill & Melinda Gates Foundation*, accessed August 10, 2018, https://www.gatesfoundation.org/Who-We-Are/Resources-and-Media/Annual-Letters-List; William MacAskill, *Doing Good Better: How Effective Altruism Can Help You Make a Difference* (New York: Avery, 2015), http://www.effectivealtruism.org/doing-good-better; Peter Singer, *The Life You Can Save: How to Do Your Part to End World Poverty* (New York: Random House Trade Paperbacks, 2010), https://www.thelifeyoucansave.org/about-us/book; Peter Singer, *The Most Good You Can Do: How Effective Altruism is Changing Ideas about Living Ethically* (Yale University Press, 2015), https://www.thelifeyoucansave.org/blog/id/170/the-most-good-you-can-do; Benjamin J. Todd, *80,000 Hours: Find a fulfilling career that does good* (CreateSpace Independent Publishing Platform, 2016), https://80000hours.org/book/. (See also https://80000hours.org/career-guide/.)

[2] Rico Vitz, "Doxastic Voluntarism," In *The Internet Encyclopedia of Philosophy*, accessed June 3, 2018, https://www.iep.utm.edu/doxa-vol/.

one should aim to maximize one's subjective chances of holding a favorable ratio of true beliefs to false beliefs,[3] rather than the highest absolute number of true beliefs or the lowest absolute number of false beliefs.

It follows that unless there are overriding moral objections, one should acquire *epistemically rational doxastic attitudes*—that is, doxastic attitudes that maximize one's subjective chances of holding a favorable ratio of true beliefs to false beliefs.

Now, avoiding fallacies,[4] mitigating one's cognitive biases,[5] and relying on trustworthy sources of information[6] are the most commonly talked about ways of promoting truth-conducive thinking (or, in other words, acquiring epistemically rational doxastic attitudes). But for any given proposition, unless one is an expert on that proposition, there are ways of thinking about that proposition that are considerably more truth-conducive (or epistemically rational) but rarely if ever discussed outside of specialist academic circles—namely, following the rules of epistemic rationality that govern how laypeople should learn from the testimony of experts.

There are cases of credentialed experts defending fringe claims in reliable sources, such as academic journals, without apparently committing any logical fallacies and without showing any overt signs of bias.[7] This is to be expected in the sciences and in philosophy, where progress often requires that individual scientists and philosophers challenge mainstream or even consensus views.

Laypeople who have learned how to discern logical fallacies, cognitive biases, as well as reputable and disreputable sources of information will be poorly equipped to rationally assess the statements made by those credentialed experts *unless and until* these laypeople are made acutely aware of the rules of epistemic rationality that govern how they should learn from the testimony of experts—that is, how they should adjust their own doxastic attitudes in light of what doxastic attitudes experts hold.

These rules of epistemic rationality can be summarised as follows: For any proposition, *p*, unless and until you become an expert on *p*, you are rationally required to hold whatever doxastic attitude is the *majority* doxastic attitude toward *p* among experts on *p*, unless there are not any experts on *p* or there is no *majority* doxastic attitude toward *p* among experts on *p*, in which cases you are rationally required to *withhold belief* about *p* as long as you are not yourself an expert on *p*.

This can be distilled down to the following rule: For any proposition, *p*, a layperson with respect to *p* is rationally required to believe *p* if and only if *p* is believed by the majority of

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[3] William Alston, "Concepts of epistemic justification," *The Monist* 68, no. 1 (1985): 57–89.
[4] Gary N. Curtis, *The Fallacy Files*, accessed July 21, 2018, http://www.fallacyfiles.org/; Bradley Dowden, "Fallacies," In *The Internet Encyclopedia of Philosophy*, accessed June 4, 2018, https://www.iep.utm.edu/fallacy/.
[5] David Dunning, "We are all confident idiots," *Pacific Standard* 7, no. 6 (November/December 2014): 46–54, https://sites.lsa.umich.edu/sasi/wp-content/uploads/sites/275/2015/11/PS-Nov-Dec-2014-Ignorance.pdf.
[6] "Is My Source Credible?," *Library*, University of Maryland University College, accessed June 4, 2018, https://sites.umuc.edu/library/libhow/credibility.cfm.
[7] See for example Judith Curry, "Reasoning about climate uncertainty," *Climatic Change* 108 (2011): 723–732, https://doi.org/10.1007/s10584-011-0180-z. See also Michael D. Lemonick, "Climate heretic: Judith Curry turns on her colleagues," *Nature*, November 1, 2010, https://doi.org/10.1038/news.2010.577.

experts on *p*.[8] Of course, there is, in principle, nothing stopping a layperson from *becoming* an expert on *p*. In that case, there are several alternative belief-forming methodologies available to him or her in the published literature.[9]

Anyone can be an expert on any given proposition, regardless of their academic or professional credentials, provided that they have studied or researched sufficiently thoroughly and impartially the evidence that bears on that proposition.[10] The key word here is "sufficiently". Given the Dunning–Kruger effect (i.e., "difficulties in recognizing one's own incompetence lead to inflated self-assessments"[11]), those who lack the academic or professional credentials of credentialed experts should exercise caution in self-identifying as experts, and others should also exercise caution in identifying them as experts.

In the case of philosophical propositions, and especially ethical and religious propositions, it is arguable whether there are any genuine experts on those propositions.[12]

3. How to Make Rational Choices

Unless there are overriding moral objections, one should make (instrumentally) *rational choices*—choices that best serve one's ends full stop.[13] *Expected Utility (EU) Theory* is generally accepted as a normative theory of rational choice. EU Theory advises agents to rank their choice options (from least to most choiceworthy) according to their *expected utility (EU)*, where the EU

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[8] There are exceptions to the rule. See Bernd Lahno, "Challenging the majority rule in matters of truth," *Erasmus Journal for Philosophy and Economics* 7, no. 2 (Autumn 2014): 54–72, https://philpapers.org/archive/LAHCTM.pdf. See also David Coady, *What to Believe Now: Applying Epistemology to Contemporary Issues* (Chichester: Wiley-Blackwell, 2012), https://www.wiley.com/en-us/What+to+Believe+Now%3A+Applying+Epistemology+to+Contemporary+Issues-p-9781405199940; Alvin Goldman, "Experts: Which Ones Should You Trust?," *Philosophy and Phenomenological Research* 63, no. 1 (2001): 85–110, http://fas-philosophy.rutgers.edu/goldman/SeminarFall2007/October%2031st/Goldman%20-%20Experts%20Which%20Ones%20Should%20You%20Trust.pdf; and Michael Huemer, "Is Critical Thinking Epistemically Responsible?," *Metaphilosophy* 36, no. 4 (July 2005): 522–31, http://spot.colorado.edu/~huemer/papers/critical.pdf.

[9] Jonathan Matheson, "Disagreement and Epistemic Peers," *Oxford Handbooks Online*, February 2015, http://dx.doi.org/10.1093/oxfordhb/9780199935314.013.13.

[10] Michel Croce, "On What It Takes to Be An Expert," *The Philosophical Quarterly* Forthcoming, https://philpapers.org/archive/CROOWI.pdf.

[11] Justin Kruger and David Dunning, "Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments," *Journal of Personality and Social Psychology* 77, no. 6 (1999): 1121–34, http://dx.doi.org/10.1037/0022-3514.77.6.1121.

[12] See Helen De Cruz, *Religious Disagreement* (Cambridge: Cambridge University Press, 2018), https://www.amazon.com/Religious-Disagreement-Elements-Philosophy-Religion/dp/1108457312; Bryan Frances, "Philosophical Expertise," In *The Routledge Handbook of Applied Epistemology (Routledge Handbooks in Philosophy)*, edited by David Coady and James Chase (Routledge, 2018), http://bryanfrances.weebly.com/uploads/4/6/6/2/46624483/expertise.pdf; Jonathan Matheson, Nathan Nobis, and Scott McElreath, "Moral Experts, Deference & Disagreement," In *Moral Expertise: New Essays from Theoretical and Clinical Perspectives*, edited by Jamie Carlin Watson and Laura K. Guidry-Grimes, 87–106 (Springer, 2018), https://www.academia.edu/35041990/MORAL_EXPERTS_DEFERENCE_and_DISAGREEMENT.

[13] Niko Kolodny and John Brunero, "Instrumental Rationality," In *The Stanford Encyclopedia of Philosophy*, edited by Edward N. Zalta, accessed August 10, 2018, https://plato.stanford.edu/entries/rationality-instrumental/.

of an option is a probability-weighted average of each of its possible utilities.[14] "Nearly all decision theorists agree" that "the principle of maximizing expected value is the appropriate decision rule to apply to decisions under risk."[15] As such, a layperson with respect to decision theory ought to accept EU Theory.

I now wish to briefly introduce an alternative theory of rational choice, namely *Expected Comparative Utility (ECU) Theory*. This theory can be presented as follows, starting with three definitions: (i) Let the *utility* of an option be a cardinal indicator of preference. (ii) For any choice option, *a*, and for any state of the world, *G*, let the *comparative utility (CU)* of *a* be the difference in utility, in *G*, between *a* and whichever alternative to *a* carries the greatest utility in *G* (or one of them in the event that several alternatives are tied). (iii) Let the *expected comparative utility (ECU)* of *a* be the expected value of *a*'s comparative utility—that is, a probability-weighted average of the comparative utilities of *a* across the various states of the world. In my 2018 paper, "Expected Comparative Utility Theory: A New Theory of Rational Choice,"[16] I argue that for any agent, *S*, faced with any decision under *certainty* and for any option, *a*, for *S*, the measure of the choiceworthiness of *a* for *S* is its *comparative utility*, and for any agent, *S*, faced with any decision under *uncertainty* and for any option, *a*, for *S*, the measure of the choiceworthiness of *a* for *S* is its *comparative expected comparative utility (CECU)*—that is, the difference between its expected comparative utility and that of whatever alternative to *a* carries the greatest expected comparative utility. I show that there are cases where the rule of maximizing comparative expected comparative utility delivers different verdicts than the rule of maximizing expected utility.

In what I believe is an exceptionally important paper,[17] Johan Gustafsson has argued that choice options in a decision problem should be construed as sets of acts such that one could jointly intentionally perform, at any time *t*, all the acts in the set, but no additional acts. One of the reasons given by Gustafsson is that if one construes choice options as individual acts, then one runs into the *Problem of act versions*.[18] Consider the following two examples:

> Example 1: Fred is agoraphobic and will experience a lot of anxiety if he starts working out at the gym (–25 utiles), more so than if he does not work out at the gym (0 utiles). Nevertheless, Fred is out of shape, he is single and is in need of companionship, and he has a fair chance of finding a girlfriend if he works out at the

[14] For a defense of EU Theory, see Herbert Gintis, "Rational Choice Explained and Defended," In *The Mystery of Rationality: Mind, Beliefs and the Social Sciences*, edited by Gérald Bronner and Francesco Di Iorio, 95–114 (Springer, 2018), http://www.umass.edu/preferen/gintis/rationalchoice.pdf.
[15] Martin Peterson, *An Introduction to Decision Theory* (Cambridge University Press, 2017), p. 66.
[16] David Robert, "Expected Comparative Utility Theory: A New Theory of Rational Choice," *The Philosophical Forum* 49, no. 1 (2018): 19–37, https://doi.org/10.1111/phil.12178.
[17] Johan E. Gustafsson, "Combinative Consequentialism and the Problem of Act Versions," *Philosophical Studies* 167, no. 3 (February 2014): 585–96, http://johanegustafsson.net/papers/combinative-consequentialism-and-the-problem-of-act-versions.pdf.
[18] See also Lars Bergström, *The Alternatives and Consequences of Actions* (Stockholm: Almqvist & Wiksell, 1966); and Hector-Neri Castaneda, "A Problem for Utilitarianism," *Analysis* 28, no. 4 (1968): 141–42, https://doi.org/10.1093/analys/28.4.141.

> gym and tries to find a girlfriend (100 utiles), more so than if he works out at the gym and does not try to find a girlfriend (–50 utiles), if he does not work out at the gym and tries to find a girlfriend (50 utiles) and if he does not work out at the gym and does not try to find a girlfriend (status quo) (–100 utiles).

Let us suppose that Fred assigns credence 1 to the state of the world as described above. Although the utility of the act 'Fred works out at the gym' is lower than that of the act 'Fred does not work out at the gym', the utility of at least one version of the act 'Fred works out at the gym'—that is, 'Fred works out at the gym and tries to find a girlfriend' (–25 + 100 = 75 utiles)—is greater than the utility of all versions of the act 'Fred does not work out at the gym'—that is, 'Fred does not work out at the gym and tries to find a girlfriend' (0 + 50 = 50 utiles) and 'Fred does not work out at the gym and does not try to find a girlfriend' (0 + –100 = –100 utiles). Thus, intuitively, Fred should start working out at the gym. However, if choice options are construed as individual acts, then EU Theory and ECU Theory both counsel Fred *not* to work out at the gym.

> Example 2: It is raining outside, but Ann will feel invigorated if she takes a brisk walk around the block (10 utiles), more so than if she stays inside (2 utiles). However, Ann has an injured toenail which causes her a great deal of pain when she tries to walk with her rain boots on. She will therefore experience a great deal of pain if she goes out for a walk wearing her rain boots (–30 utiles), more so than if she stays inside wearing her rain boots (–2 utiles). Luckily, Ann has a very comfortable pair of shoes which do not cause her any pain. However, there is a problem: it is raining very hard and her feet will get soaked. Ann will experience considerable discomfort if she goes out for a walk not wearing her rain boots (–15 utiles), more so than if she stays inside not wearing her rain boots (0 utiles).

Let us suppose that Ann assigns credence 1 to the state of the world as described above. Although the utility of the act 'Ann stays inside' is lower than that of the act 'Ann goes out for a walk', the utility of at least one version of the act 'Ann stays inside'—that is, 'Ann stays inside and does not wear her rain boots' (2 + 0 = 2 utiles)—is greater than the utility of all versions of the act 'Ann goes out for a walk'—that is, 'Ann goes out for a walk and wears her rain boots' (10 + –30 = –20 utiles) and 'Ann goes out for a walk and does not wear her rain boots' (10 + –15 = –5 utiles). Thus, intuitively, Ann should stay inside. However, if choice options are construed as individual acts, then EU Theory and ECU Theory both counsel Ann *not* to stay inside, but instead to go out for a walk.

Therefore, to be intuitively plausible, EU Theory and ECU Theory should be minimally cashed out as follows:[19]

> For any agent, *S*, faced with any decision under certainty or uncertainty and for any number of mutually exclusive and jointly exhaustive options, or sets of acts, *a*, *b*, *c*, *d*

[19] Inspired by Gustafsson, 593–594.

and *e*, such that, for each set, *S* could jointly intentionally perform, at any time, *t*, all the acts in the set, but no additional acts,

- *a* is more choiceworthy than *b*, for *S*, at *t*, if and only if the EU (or CU/CECU) of *S* jointly intentionally performing *a* at *t* is greater than the EU (or CU/CECU) of *S* jointly intentionally performing *b* at *t*, and
- *a* is just as choiceworthy as *b*, for *S*, at *t*, if and only if the EU (or CU/CECU) of *S* jointly intentionally performing *a* at *t* is equal to the EU (or CU/CECU) of *S* jointly intentionally performing *b* at *t*.

This implies the following derivative decision rule for individual acts:[20]

For any agent, *S*, faced with any decision under certainty or uncertainty and for any two mutually exclusive acts, φ_1 and φ_2,

- φ_1 is more choiceworthy than φ_2, for *S*, at any time, *t*, if and only if φ_1 is logically entailed by every set of acts such that, for each set, *S* could jointly intentionally perform, at *t*, all the acts in the set, but no additional acts and such that, in accordance with EU Theory (or ECU Theory), the set of acts would be more choiceworthy for *S*, at *t* than each set of acts such that *S* could jointly intentionally perform, at *t*, all the acts in the set, but no additional acts and such that the set of acts logically entails φ_2, and
- φ_1 is just as choiceworthy as φ_2, for *S*, at any time, *t*, if and only if φ_1 is not more choiceworthy than φ_2, and φ_1 is logically entailed by every set of acts such that, for each set, *S* could jointly intentionally perform, at *t*, all the acts in the set, but no additional acts and such that, in accordance with EU Theory (or ECU Theory), the set of acts would not be less choiceworthy for *S*, at *t* than each set of acts such that *S* could jointly intentionally perform, at *t*, all the acts in the set, but no additional acts and such that the set of acts logically entails φ_2.

4. Should You Be Skeptical of Climate Change: Letter to a Climate Skeptic

This is a short letter in response to a Reddit post on climate change skepticism (see below):

> Until recently, I never read much about climate change other than standard newspaper stuff. I think I have heard most of the arguments for it. I've also heard people say stuff like "everyone who actually studies/is an expert on climate change agrees". Well, Judith Curry studies it and doesn't. As I read through this presentation, it seems balanced and well thought out. In fact, searching through "climate sceptic" sites on the web, I find surprisingly sensible-seeming people with

[20] Inspired by Gustafsson, 595.

> logical arguments and data references. This walkthrough is a good example.[21] So can anyone tell me; am I missing something obvious? Why are the arguments for climate scepticism wrong?
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> Any feedback is appreciated.[22]

Dear Skeptic,

I think that you are honest and fair-minded. Your skepticism of consensus climate change science is understandable, but it is misplaced. Since you are *not* an expert on the science of climate change, you are *rationally required* to believe *consensus* climate change science.[23] But you might ask, "Why should I believe that the climate science claims made by proponents of climate change mitigation are consensus climate science?"

Signatory governments to the Paris climate change agreement[24] base their support for climate change mitigation on the *Fifth Assessment Report* (AR5) of the Intergovernmental Panel on Climate Change (IPCC).[25] A key finding of the AR5 is quoted below:

> Projections of changes in the climate system are made using a hierarchy of climate models ranging from simple climate models, to models of intermediate complexity, to comprehensive climate models, and Earth System Models. These models simulate changes based on a set of scenarios of anthropogenic forcings. […]
>
> Relative to the average from year 1850 to 1900, global surface temperature change by the end of the 21st century is projected to *likely* exceed 1.5°C for RCP4.5, RCP6.0 and RCP8.5 (*high confidence*). Warming is *likely* to exceed 2°C for RCP6.0 and RCP8.5 (*high confidence*), *more likely than not* to exceed 2°C for RCP4.5 (*high*

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[21] Judith Curry, "The debate: my presentation," *Climate Etc.*, June 12, 2018, https://web.archive.org/web/20180630062836/https://judithcurry.com/2018/06/12/the-debate-mann-titley-moore-curry/.

[22] u/HCAndersAnd, "What is wrong with these arguments?," *Reddit (r/climatechange)*, June 12, 2018, https://www.reddit.com/r/climatechange/comments/8qnq31/what_is_wrong_with_these_arguments/.

[23] For any proposition, *p*, a layperson with respect to *p* is rationally required to believe *p* if and only if *p* is believed by the majority of experts on *p*. See section 2 ("How to Acquire Rational Belief Attitudes"). See also David Coady and Richard Corry, *The Climate Change Debate: An Epistemic and Ethical Enquiry* (London: Palgrave Macmillan, 2013), https://doi.org/10.1057/9781137326287.

[24] "The Paris Agreement," *United Nations Climate Change*, accessed July 2, 2018, https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement.

[25] Yun Gao, Xiang Gao, and Xiaohua Zhang, "The 2 °C Global Temperature Target and the Evolution of the Long-Term Goal of Addressing Climate Change—From the United Nations Framework Convention on Climate Change to the Paris Agreement," *Engineering* 3, no. 2 (April 2017): 272–78, https://doi.org/10.1016/J.ENG.2017.01.022. Gao, Gao, and Zhang note that,

> In 2008–2014, the IPCC's Fifth Assessment Report (AR5) made a comprehensive assessment of the climate system change, risks, emission budget, and mitigation pathway choice of 2°C global warming on the basis of the research results available. After scientific assessment and a series of political pushes, one of the three goals reached at the 2015 Paris Climate Change Conference was stated as "Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels" [3].

> *confidence*), but *unlikely* to exceed 2°C for RCP2.6 (*medium confidence*). Warming is *unlikely* to exceed 4°C for RCP2.6, RCP4.5 and RCP6.0 (*high confidence*) and is *about as likely as not* to exceed 4°C for RCP8.5 (*medium confidence*). {12.4}[26]

You should believe that the above statement (call it *X*) is consensus climate change science because (i) *X* is clear and unambiguous and (ii) *X* is quoted from the work of the IPCC, and there is a consensus among recognized organizations of experts with expertise in climate science that "the work of the IPCC represents the consensus of the international scientific community on climate change science."[27]

Suppose however that *X* was consensus climate science at the moment of publication of the AR5, but *X* is *no longer* consensus climate science, and you have polling or other unequivocal evidence to support this. It then follows that (i) you should *disbelieve X* if consensus temperature projections have shifted since publication of the AR5 or (ii) you should *withhold belief about X* if there are no longer any consensus temperature projections and no such projections are believed by even the majority of climate scientists.

Suppose instead that *X was not* consensus climate science at the moment of publication of the AR5 (and that *X* is not currently believed by even the majority of climate scientists). This would be the most significant and egregious failure of science communication in history. All the climate scientists who were involved in signing off on *X*'s wording would have experienced a lapse or would have engaged in deception. This would have happened in a report, the AR5's *Summary for Policymakers*, that is designed to guide laypersons in making informed policy decisions on climate change. This is very improbable.

Therefore, unless you have polling or other unequivocal evidence that *X* is no longer consensus climate science, the likelihood that *X is* currently consensus climate science is significantly greater than the likelihood that *X is not* currently consensus climate science. And so, it is rational to believe that *X* is consensus climate science.

In conclusion, if you were a dissenting *expert* on the science of climate change—that is, if you regarded yourself as such or if you were a practicing climate scientist who disagreed with the conclusions of your peers on climate change science—then you would be entitled to *your own view* on those conclusions. But, judging from your question, you are clearly *not* a dissenting

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[26] IPCC, *Summary for Policymakers*, In *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, edited by T.F. Stocker, D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex, and P.M. Midgley. Cambridge: Cambridge University Press, 2013, http://www.climatechange2013.org/images/report/WG1AR5_SPM_FINAL.pdf#page=18.

[27] "The Science of Climate Change," *Science* 292, no. 5520 (May 18, 2001): 1261, https://doi.org/10.1126/science.292.5520.1261. See also "Scientific consensus: Earth's climate is warming," *Global Climate Change: Vital Signs of the Planet*, Earth Science Communications Team at NASA's Jet Propulsion Laboratory, accessed June 30, 2018, https://climate.nasa.gov/scientific-consensus/.

expert. As such, I hope to have convinced you that, *unless and until* you become an expert, you are *rationally required* to believe the statement quoted above from the IPCC's AR5.[28]

5. Should You Invest in Life-Extension Medical Research?

> The right to choose to live or to die is the most fundamental right there is; conversely, the duty to give others that opportunity to the best of our ability is the most fundamental duty there is.
> —*Aubrey de Grey*

Should you invest in healthy life-extension medical research? Aubrey de Grey thinks that you should. De Grey[29] is a biomedical gerontologist and the Chief Science Officer and Co-founder of SENS Research Foundation,[30] a 501(c)(3) public charity that funds biomedical research into "regenerative medicine to repair the damage underlying the diseases of aging."[31] For the past 20 years or so, de Grey has been researching and promoting regenerative medicine solutions to the problem of aging.

In 2007, de Grey published the book *Ending Aging: The Rejuvenation Breakthroughs that Could Reverse Human Aging in Our Lifetime*.[32] *Ending Aging* details how age-related decline and illness could be reversed in the near future if sufficient investments were made in what de Grey calls "SENS" research. SENS (or "Strategies for Engineered Negligible Senescence") refers to a set of regenerative medicine approaches developed by de Grey which directly target age-related tissue damage at the microscopic level. While some gerontologists believe that the maximum lifespan can be extended through metabolic interventions,[33] de Grey thinks that metabolism is too complex to be effectively controlled for the foreseeable future. Just as we can keep vintage cars looking and operating like new by repairing broken parts or replacing them with new ones, de Grey points out that we can keep humans in a youthful state indefinitely by periodically removing or repairing damaged tissues at the cellular and molecular levels.

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[28] I noted three earlier uses of this "Letter to a climate skeptic" format: Mike Kaulbars, "Letter To A Climate 'Skeptic'," *News Junkie Post*, June 14, 2010; David Morrison, "Letter to Climate Skeptics," *Skeptic* 16, no. 2 (2011), 10; and Steph Newman, "An open letter to climate change sceptics," *1 Million Women*, July 1, 2016.
[29] Aubrey de Grey, "CV," *SENS Research Foundation*, accessed July 3, 2018, http://www.sens.org/sites/srf.org/files/AdG-CV.doc.
[30] *SENS Research Foundation*, accessed July 3, 2018, http://www.sens.org/.
[31] "About SENS Research Foundation," *SENS Research Foundation*, accessed July 3, 2018, http://www.sens.org/about.
[32] Aubrey de Grey and Michael Rae, *Ending Aging: The Rejuvenation Breakthroughs That Could Reverse Human Aging in Our Lifetime* (New York: St. Martin's Press, 2007), https://www.amazon.com/Ending-Aging-Rejuvenation-Breakthroughs-Lifetime/dp/0312367074.
[33] Eric Zorn, "A 150-year-old human? Neither side is folding in The Great Longevity Wager," *Chicago Tribune*, July 13, 2018, http://www.chicagotribune.com/news/opinion/zorn/ct-perspec-zorn-longevity-aging-olshansky-austad-20180715-story.html; S. Jay Olshansky, "Is Life Extension Today a Faustian Bargain?," *Frontiers in Medicine* 4, no. 215 (November 29, 2017), 1–3, https://dx.doi.org/10.3389%2Ffmed.2017.00215.

While de Grey's "SENS" proposal to extend healthy human life remains controversial among gerontologists, SENS Research Foundation's 30-member expert Advisory Board has endorsed de Grey's conclusions that,

> Recent biotechnological progress indicates that many aspects of aging may indeed be effectively treatable by regenerative medicine in the foreseeable future. We cannot yet know whether all aspects will be, but extensive scrutiny has failed to identify any definite exceptions. Therefore, at this point there is a significant chance that such therapies would postpone age-related decline by several years, if not more, which constitutes a clear case for allocating significant resources to the attempt to develop those therapies.[34]

On this basis, de Grey has argued that investments in regenerative medicine to extend healthy human life are morally imperative. One of his arguments can be put as follows:

What gives us the right to decide for future generations whether they should or should not live healthily past the age of 120 years? If we refrain from *investing* in healthy life-extension technologies today because of moral concerns, then we are in effect denying future generations (our children and grandchildren) the right to live healthy lives past our current maximum lifespan. What is considered moral today might be considered loathsome tomorrow, either because circumstances have changed or because values have shifted.[35] So if we decide today not to *implement* those technologies because of overriding moral concerns, then we are rationally entitled not to do so, but what we are *not* rationally entitled to do is to prevent future generations from benefiting from those technologies should they deem them morally obligatory. Therefore, we can have a reasoned debate about whether it would be moral to *implement* healthy life-extension technologies today (and de Grey has forcefully argued that it *is* morally obligatory to do so), but what we cannot rationally refrain from doing is *investing* in healthy life-extension technologies today for the benefit of future generations (our children and grandchildren) should they deem those technologies morally necessary.

This suggests a more general principle of ethical and rational choice: Since values and preferences may change over time, a robust decision rule should leave open as many choice opportunities as possible.[36]

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[34] "Research Advisory Board," *SENS Research Foundation*, accessed July 3, 2018, http://www.sens.org/about/leadership/research-advisory-board.

[35] Eric Schwitzgebel, "Will Future Generations Find Us Especially Morally Loathsome?," *The Splintered Mind*, June 30, 2018, https://schwitzsplinters.blogspot.com/2018/06/will-future-generations-find-us.html.

[36] For a helpful introduction to the ethics of ageing, see Christopher Simon Wareham, "What is the ethics of ageing?," *Journal of Medical Ethics* 44 (2018): 128–32, http://dx.doi.org/10.1136/medethics-2017-104374.

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