The Philosophical Quarterly, Vol. 53, No. 210 *January 2003*
ISSN 0031–8094

DISCUSSIONS

THE DOOMSDAY ARGUMENT WITHOUT KNOWLEDGE OF BIRTH RANK

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The Carter–Leslie doomsday argument can be given in a situation where you do not know your birth rank, even approximately. This gives support to the refutation of the doomsday argument based on the self-indication assumption 'Finding that you exist gives you reason to think that there are many observers'.

I. THE DOOMSDAY ARGUMENT

The Carter–Leslie doomsday argument,[1] as standardly presented, relies on the assumption that you have knowledge of your approximate birth rank. I shall demonstrate that the doomsday argument can still be given in a situation where you have no knowledge of your birth rank. As I shall show, this allows one to reply to Bostrom's[2] defence of the doomsday argument against the refutations given by Dieks, Kopf *et al.*, Bartha and Hitchcock, and Olum.[3] (I shall call this refutation 'Dieks' reply' for short.)

The doomsday argument runs as follows. Suppose you have narrowed the possibilities for doom down to two:

[1] Brandon Carter, 'The Anthropic Principle and its Implications for Biological Evolution', *Philosophical Transactions of the Royal Society of London*, 310 (1983), pp. 347–63; John Leslie, 'Risking the World's End', *Bulletin of the Canadian Nuclear Society*, May 1989, pp. 10–15.

[2] Nick Bostrom, 'The Doomsday Argument, Adam and Eve, UN^{++}, and Quantum Joe', *Synthese*, 127 (2001), pp. 359–87, at p. 383. See also his *Anthropic Bias: Observation Selection Effects in Science and Philosophy* (New York: Routledge, 2002), ch. 7.

[3] D. Dieks, 'Doomsday – or: the Dangers of Statistics', *The Philosophical Quarterly*, 42 (1992), pp. 78–84, see also his Letter to the Editor, *Mathematical Intelligencer*, 15 (1993), pp. 4–5; T. Kopf, P. Krtous and D. Page, 'Too Soon for Doom Gloom?', preprint gr-qc9407002 (1994), available at http://xxx.lanl.gov; P. Bartha and C. Hitchcock, 'No One Knows the Date or the Hour: an Unorthodox Application of Rev. Bayes' Theorem', *Philosophy of Science (Proceedings)*, 66 (1999), pp. S339–53; K. Olum, 'The Doomsday Argument and the Number of Possible Observers', *The Philosophical Quarterly*, 52 (2002), pp. 164–84.

H_1. There will have been a total of 200 billion humans
H_2. There will have been a total of 200 trillion humans.

I shall suppose that these hypotheses agree on the number of humans that exist on Earth from 20:41 to 20:42 GMT on April 9, 2002. This supposition is not a standard part of the doomsday argument, but it does not affect the doomsday argument, and it is needed for my argument below. There are two reasons why this supposition is reasonable. First, if the hypotheses disagreed on the number of humans that exist during that time period, then in principle it would be easy to falsify one of them by checking population figures.[4] Secondly, since the hypotheses are meant to represent the possibilities that doom will come soon and that doom will come late, the hypotheses should be understood as agreeing on the number of humans that exist up to now and into the short-term future; they disagree only about how many humans will exist in the long-term future.

After considering the various ways in which human life might end, you might assign the following probabilities:

$$Pr(H_1) = 0{\cdot}05$$
$$Pr(H_2) = 0{\cdot}95.$$

Suppose you also know proposition R: 'I am the 60 billionth human to have been born'. Reasoning with the self-sampling assumption

SSA. Observers should reason as if they were a random sample from the set of all observers in their reference class

you have the following conditional probabilities:

$$Pr(R \mid H_1) = 1/200 \text{ billions}$$
$$Pr(R \mid H_2) = 1/200 \text{ trillions}.$$

Bayes' theorem then gives the result that $Pr(H_1 \mid R) = 0{\cdot}98$. Since you know R, your posterior probability for H_1 is 0·98. Doom is likely to come soon.

Suppose you have no knowledge of your birth rank. How could the doomsday argument still be given? What is needed is a property p such that you know you have p, and the total number of observers expected to have p would be the same regardless of whether H_1 or H_2 is true. (In the previous paragraph, 'having a birth rank of 60 billion' played the role of property p.) We each possess such properties, and thus the doomsday argument does apply. For me, one such property would be the property of being alone in 323 Main Street in Lexington, Kentucky, from 20:41 to 20:42 GMT on April 9, 2002. I shall call this property 'k', and 'K' is the proposition that someone has property k. Before 20:42 I did not know that K is true, but now I do. I can model this learning that K is true by conditionalization, using my prior probability function Pr^*. For any proposition A,

$$Pr(A) = Pr^*(A \mid K).$$

[4] This point is made by Dieks, 'The Probability of Doom', preprint 247 (2001), available at http://philsci-archive.pitt.edu, at p. 3.

It is reasonable for Pr^* to be such that the probability of K does not depend on whether H_1 or H_2 is true:

$$Pr^*(K \mid H_1) = Pr^*(K \mid H_2) = Pr^*(K).$$

If this were not the case, then conditionalization on K would shift my probabilities for H_1 and H_2. The reason why it is reasonable for Pr^* to be such that K does not depend on H_1 or H_2 is that H_1 and H_2 agree on the number of humans existing on Earth from 20:41 to 20:42 GMT on April 9, 2002. It follows that

$$Pr(H_1) = Pr^*(H_1) \text{ and } Pr(H_2) = Pr^*(H_2).$$

Let M be the proposition that I have property k. Using (SSA),

$$Pr(M \mid H_1) = 1/200 \text{ billions}$$
$$Pr(M \mid H_2) = 1/200 \text{ trillions.}$$

Bayes' theorem then gives the result that $Pr(H_1 \mid M) = 0{\cdot}98$. Since I know M, my posterior probability for H_1 is again 0·98. Thus one can get the Bayesian shift in favour of the few-observers hypothesis, regardless of whether one has any knowledge of one's birth rank.

II. DEFENDING DIEKS' REPLY

Dieks' reply to the doomsday argument relies on what Bostrom calls 'the self-indication assumption' (SIA), roughly, 'Finding that you exist gives you reason to think that there are many observers'. The idea behind Dieks' reply is that conditionalizing on your existence shifts the probabilities in favour of H_2, and the doomsday argument shifts the probabilities in favour of H_1, and these two shifts cancel each other out. Bostrom has recently argued against this reply to the doomsday argument by presenting a scenario for which he claims that (SIA) leads to counter-intuitive results. I shall defend (SIA) and Dieks' reply.

Bostrom's scenario is as follows. It is the year 2100, and physicists assign probability 0·5 each to theories T_1 and T_2. T_1 entails that the universe is large, and there are a total of a trillion trillion observers, while T_2 entails that the universe is *very* large, and there are a total of a trillion trillion trillion observers. We do not know our birth ranks, even approximately. Physicists are going to do an experiment to decide between T_1 and T_2, but before they do, a presumptuous philosopher explains that there is no need for the physicists to do the experiment. The presumptuous philosopher says that since he exists, that makes it more likely that there are more observers – T_2 is a trillion times more likely than T_1.

Olum (p. 181) responds to this scenario by granting that the presumptuous philosopher is correct, 'as long as we feel that the likelihoods of the two theories are roughly equal before one considers the effect on the number of observers'. Olum suggests, however, that 'it is possible one should think that a theory involving a very large universe is unlikely in proportion to the size of the universe it proposes' (p. 182). In that case, T_2 would start out with a very low prior probability, and taking (SIA) into account would raise the probability to around 0·5.

The problem with this reply is that it rejects one of the assumptions of Bostrom's scenario, that the physicists, who have not yet taken (SIA) into account, are indifferent between T_1 and T_2. Olum's only response to Bostrom's scenario itself is to bite the bullet. I side with Bostrom in thinking that the position of the presumptuous philosopher is completely unreasonable, but, *pace* Bostrom, this does not show that (SIA) should be rejected.

Bostrom's basic idea is that since we have no knowledge of our birth ranks in his scenario, we can only get the first probability shift via (SIA) in favour of more observers; we cannot get the second doomsday shift in favour of fewer observers. But as I have shown, the doomsday argument can be given even when we have no knowledge of our birth rank. We would have to specify that T_1 and T_2 agree on the number of observers existing in some appropriate space-time region, but this is a legitimate assumption to make. (We can pick the region in such a way that if the theories disagreed, then in principle it would be easy to falsify one of them by checking population figures.) Thus the doomsday argument can be given in Bostrom's scenario, and the combination of (SIA) and the doomsday argument leaves the physicists' probabilities for T_1 and T_2 unchanged. Bostrom's scenario does not show the unreasonableness of (SIA), and Dieks' reply to the doomsday argument is unrefuted.[5]

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[5] I thank Nick Bostrom for helpful discussion.