

## Chapter 2

# DOOMSDAY!

The Doomsday argument concerns a question sure to arouse interest—the survival of the human race. It is rivaled only by the Simulation argument in attempting to address profound questions of human nature and destiny through elementary probability calculations. Proponents of the argument maintain that we are randomly selected from among all who ever live. This randomness makes it unlikely that we are among the earliest humans. A calculation demonstrates that if we are not among the earliest humans, then the human race has less time left than is usually allotted to it. Among all people who have ever lived, our current birth-order rank is something like 60 billion. If humanity is to continue as long as we usually suppose with the population sizes of the modern world,<sup>1</sup> then we shall have a quite low rank among all who ever live. This should be considered unlikely; it is more probable that we have an average rank among all who ever live, in which case doomsday will be much sooner than we generally suppose. Your birth rank (one plus the number of humans born before you) which can be estimated, corresponds to the number on the lottery ticket drawn (see 1.1). This rank is used to infer whether you are part of a big lottery (prolonged existence of the human race) or a small lottery (early doom). This suggests that the entire human lottery is not large relative to our rank, i.e., doomsday is likely to be relatively soon.

The ease with which the Doomsday argument extracts from a quite modest investment of current fact, substantial information about the remote future has provoked suspicion in most quarters; however, critiques that have not been snidely dismissive have tended to be as mystifying as the Doomsday argument itself. The Doomsday argument is a worthy paradox in that it is much easier to see the conclusion is unwarranted than to locate the fallacy. Bostrom (2002, p. 109) reports having heard more than one hundred attempted refutations of the Doomsday argument. The Babel of conflicting objections indirectly lends credence to the argument—more than a hundred attacks and still standing.

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<sup>1</sup> It is the number of future individuals, not the amount of time to Doomsday, that allegedly regulates the sampling probabilities. Although we've had a fairly long history with low populations, the Doomsday argument indicates that assuming large populations, we have a short future.

Proponents of the Doomsday argument base their reasoning on Bayes' Theorem, an uncontroversial proposition of probability theory (see 9.1). Use of Bayes' theorem should not be confused with Bayesianism, a controversial viewpoint on the nature of probability associated with subjectivism and the claim that correct statistical inference depends crucially on assessment of prior distributions. The most avid frequentist has no quarrel with Bayes' Theorem proper. Leslie blurs this distinction in a manner that allows him to portray the Doomsday argument as an application of a controversial doctrine (Bayesianism) to a straightforward fact of our existence (birth rank) with the suggestion that the argument, although a little dubious, may, along with Bayesianism, turn out to be fundamentally sound. However, Bayes' Theorem is rigorously demonstrable (Feller 1968, p. 124); if the premises of the theorem are fulfilled, the conclusion follows with the force of logic. As with other rigorous results, the sticking point in applications is not whether the theorem is correct, but the extent to which the premises are fulfilled. The Doomsday argument should be seen as a straightforward application of an uncontroversial theorem (Bayes') to data produced from a highly questionable assumption (HR examined below). For this paradox and the next two, the fallacy is most easily traced in two stages: *randomness in reference class* and *retrocausality*.

## 2.1 Randomness in Reference Class

Bayes' Theorem permits the derivation of a conditional dependence from the converse dependence, in the presence of the right kind of background information. If our birth rank can tell us via Bayes' Theorem something about the likelihood of Doomsday, then it has to be because Doomsday can tell us something about our birth rank; there is no way around this. Doomsdayers make this connection by means of an assumption: the **Human Randomness Assumption** (HR): *We can validly consider our birth rank as generated by random or equiprobable sampling from the collection of all persons who ever live.* (I may have been the first to articulate this assumption (Eckhardt 1997, p. 248). Under HR the probability one has a given birth rank is inversely proportional to how many ranks exist. Chancing to have a birth rank as low as we do then makes it likely there are relatively few ranks available overall. Without HR the proposed application of Bayes' Theorem is trivial and fruitless, with HR the reasoning runs smoothly to its alarming conclusion. For a true lottery with an unknown quantity of tickets consecutively numbered, starting with 1, the random drawing of a ticket does indeed give us information about the probable size of the ticket pool. The issue in the Doomsday argument is whether such random lotteries constitute appropriate models, that is, whether HR is true.<sup>2</sup>

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<sup>2</sup> In light of this Leslie's copious urn and lottery examples can all be seen to be question begging; each one assumes equiprobability of sampling, precisely what must be established to validate

If we are random<sup>3</sup> humans, are we also random primates? random vertebrates? random readers of English? Leslie proposes that a single human be taken as a random sample from the class of all humans *and* from the class of all mammals (Leslie 1993, p. 491). One cannot be random in more than one among such diverse classes. Suppose *x* were a random human *and* a random mammal. *x* is human, and hence a most unusual mammal; conversely a random mammal should not be a human except by the most freakish chance. How would you go about selecting *x*? Choose from among humans and it is not a random mammal, choose a random mammal and it is almost surely not a human; keep choosing random mammals until you get a human and you have spoiled the randomness of your mammal selection. The instruction to select an *x* that is random in both these classes is incoherent. Since different randomness reference classes yield different statistics and different conclusions for Doomsday reasoning, on what grounds choose humans as the unique class for the argument? Doomsdayers appear at times to take this choice for granted, at other times to suggest alternatives that contradict it, such as that the reference class should be all intelligent individuals including extra-terrestrials or simulated people.

Examine how the allegedly random user of the Doomsday argument is selected. Self-selection is undertaken only after the Doomsday argument, or its central concept that we are randomly selected humans, is invented. HR amounts to the claim that we can select ourselves as random, on the basis of the invention of the Doomsday argument. Inventions are chancy but not purely random, e.g., they are closely related to the technological and cultural conditions of the time and are not equally likely to appear at one time as another. Since there is no reason to believe this invention occurs randomly, there is no reason to believe that self-selection dependent on the invention yields a random human.

## 2.2 Retrocausality

Even if the considerable problems of reference class were resolved, there looms a more serious obstacle. The HR assumption stipulates a quantitative relationship between the probability of having your birth rank and the number of people who

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(Footnote 2 continued)

Doomsday reasoning. (In response to my objection to the assumption of random human sampling in the Doomsday argument, Leslie produced additional urn and lottery analogies presupposing random sampling (Leslie 1993)). Leslie seems to believe these matters can be settled through sheer weight of accumulated analogies. Although of possible pedagogic or heuristic value, such analogical reasoning can at best support only the preliminary stages of investigation, whereafter it becomes incumbent to find nonanalogical evidence or otherwise to investigate the validity of the analogies.

<sup>3</sup> I use **random** only to refer to an equiprobable sampling on a finite set, i.e., probability  $1/N$  is assigned to each of  $N$  objects.

come *after* you. For the argument to be valid, the crucial sampling probability has to be based not only on how many were born before you but also how many are to be born after you. How it is possible in the selection of a random rank to give the appropriate weight to unborn members of the population? In presuming that unborn populations have somehow been factored into the current selection procedure the Doomsday reasoners tacitly presuppose retro-causal effects that is, the effects comes before the cause. Suppose some crucial event prevents a catastrophe in the year A.D. 2050 and doom is thereby delayed a thousand years. By Doomsday reasoning, the probability of having your birth rank is therefore lower than it would have been were humans to become extinct in 2050. The Doomsday argument tacitly requires that future events influence current ones. You have a *random* birth rank whose expected value consequently depends on the total number who ever live which itself depends on the number who come after you. Consider a standard lottery with numbered tickets to which higher numbers are subsequently added; this addition raises the average value of a number drawn. Similarly, for HR to hold, all humans, even unborn ones, must be accorded their appropriate weight in the selection of a random birth rank. The Doomsday argument hinges on correlation<sup>4</sup> between your allegedly random birth rank and the size of future populations because a protracted future tends to boost random birth ranks, and a short future tends to depress them. Only if future populations exert this kind of influence on current births can knowledge of the relative lowness of your birth rank be so informative about the distant future. Such retrocausal influence is not inconceivable; however, the need for it further compromises the already tattered plausibility of the Doomsday argument.

## References

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<sup>4</sup> By **correlation** we mean simply “lack of independence”. The term “dependence” may seem more apt, but dependence is often asymmetric whereas independence and correlation are symmetric. In this framework **positive correlation** between events X and Y means that  $P(XY) > P(X)P(Y)$  and negative correlation that  $P(XY) < P(X)P(Y)$ . (This kind of correlation is sometimes called stochastic or probabilistic correlation.)



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