

the third. If a possible world has some intrinsic property, it is a necessary truth that it has that property. Now consider the proposition that God desires the actual world to have F. This proposition is either necessary or contingent. If it is necessary, the proposition that Possible World Two is the actual world will be necessary and Possible World Two will be the only possible world. If it is contingent, what explains its truth? The fact that God decrees that He desire that the actual world have the property F? And what other candidates are there?

5. The translucent ball and various other features of the following discussion are borrowed from the brilliant exposition of the cosmological argument in Richard Taylor's *Metaphysics*, 4th ed. (Englewood Cliffs, N.J.: Prentice Hall, 1992), pp. 99–108.

6. Quoted in an article in the *Science Times* section of the *New York Times*, 12 March 1991.

7. Daniel Kolak and Raymond Martin, *Wisdom Without Answers: A Guide to the Experience of Philosophy*, 2nd ed. (Belmont, Calif.: Wadsworth Publishing Co., 1991), pp. 79–80.

8. *Ibid.*, p. 77.

9. For some recent scientific speculations about the causal antecedents of the Big Bang, see Denis Overbye, "Before the Big Bang, There Was . . . What?" in the "Science Times" section of the *New York Times*, 22 May 2001. See also Jim Holt, "Nothing Ventured," *Harper's*, November 1994.

## Part Three

# THE INHABITANTS OF THE WORLD

### Introduction to Part Three

The final part of this book is about *us*, the inhabitants of the World. That is, it is about human beings and any other beings there may be that are sufficiently similar to us that it would be reasonable to consider them our fellow inhabitants of the World. (While it may be reasonable to use the word 'inhabitants' in a sense in which apes and beavers and elephants—and perhaps even ants—are "our fellow inhabitants of the World," I shall use the word in the sense suggested by the adjective 'inhabited'—as in the question "Is that island inhabited?") The term traditionally used to describe us and beings "sufficiently similar" to us is 'rational'. Human beings, however irrationally they may behave, and angels and Martians (if there are angels or Martians) are rational in the required sense. Apes and beavers and elephants are not rational in the required sense.<sup>1</sup> Non-human terrestrial animals—especially apes—may, however, be very *intelligent*. For this reason, in Part Three I avoid using the term 'intelligent' to do the work I now assign to the word 'rational'. The use of 'intelligent' to refer to mental capacities not possessed by even the brightest apes is quite common, as may be seen from such familiar phrases as 'the search for intelligent life elsewhere in the universe'. (I have myself used the word 'intelligent' in this strong sense at several points in this book. In Chapter 1, for example, I said that Kant's diagnosis of the failure of human beings to produce a science of metaphysics would apply equally to "intelligent dolphins.") In this phrase, 'intelligent' means just exactly what I will mean by 'rational': anyone who said there was intelligent life elsewhere in the universe would be taken to mean there were somewhere beings that shared with us mental capacities the most "intelligent" apes do not share with us.<sup>2</sup>

And what is rationality? Let us begin to try to answer this question by considering another question, a question asked by the philosopher Ludwig Wittgenstein: "We say that a dog is afraid his master will beat him, but not that he is afraid his master will beat him tomorrow. Why not?" The beginning of the answer to this question is that the idea expressed by the word 'tomorrow' is wholly foreign to the mental world of the dog. If the dog can be said to have ideas at all, the ideas that constitute the content of its thought at any moment are ideas of things it is then aware of or of things that

might well be immediate consequences of the operations of the things it is then aware of (such as an imminent beating). This point is often put by saying that dogs—and all other non-human terrestrial animals—are “incapable of abstract thought.” This idea (applied to a primitive member of our genus) is well expressed in a bit of verse by W. V. Quine:

The unrefined and sluggish mind  
Of *Homo javanensis*  
Could only treat of things concrete  
And present to the senses.

One might, however, wonder whether dogs and other beasts—other non-human terrestrial animals—are not capable of a *little* abstract thought. After all, “being beaten by one’s master” is a sort of abstraction, a universal that has been abstracted from various concrete situations and which could have any number of instances. A dog that fears being beaten by its master would seem to fear that something that has happened before will happen again. And it does not fear the occurrence of an exact duplicate of some earlier event; it fears the occurrence of an event that will be the same as a certain earlier event *in a certain respect*: however the feared event may differ from the earlier event, it will be like the earlier event in being a beating by the dog’s master. As to the matter of “present to the senses,” it suffices to point out that a feared beating that has not yet happened is *not* present to the senses. (It may of course be that it is simply not true that dogs ever fear being beaten, or not in the same sense as that in which human beings fear being beaten. It may be that we use words like these to describe the mental states of dogs simply because we have no others. Perhaps our use of these words is an example of our tendency to anthropomorphism, like ‘The sun is trying to come out’ or ‘The car doesn’t want to start’. But I shall assume our simple, everyday descriptions of the beliefs, hopes, and fears of dogs and other beasts can be literally correct.) Rationality, then, does not consist simply in the capacity for abstract thought. It consists in the capacity for a certain *kind* of abstract thought. A rational being is a being that can do the following:

It can represent to itself complex states of affairs, including non-actual states of affairs, that are quite strikingly remote from its present sense-perceptions. (For example: Jane’s coming to visit a week from next Thursday; someone’s ordering the second-cheapest item on the menu; the government’s preventing a recurrence of bubonic plague by finding a new way to dispose of the refuse that feeds the rats that carry the fleas that are infected with the bacterium that causes the plague.) It can believe that certain states of affairs are actual and that others are non-actual. It can desire that certain states of affairs be actual and others non-actual. It can contemplate states of affairs without raising the question whether they are actual or non-actual. (“I’m trying to imagine what our life will be like if we really go ahead and have a child.”) It can be aware of logical and causal relations between states of affairs. It can sort states of affairs into the categories “probable” and “improbable.” It can assign relative values to states of affairs. (“I’m sorry I embarrassed you. I didn’t *want* to, you know. But I thought that would be preferable to telling an outright lie.”) It can devise plans of action that draw on its beliefs about which states of affairs are actual and non-actual and probable

and improbable and about the logical and causal relations that hold among both actual and non-actual states of affairs in order to attempt to cause states of affairs it values to become actual. It is capable of recognizing other beings as having all these capacities, and it is capable of communicating to those that do facts and orders and questions related to the states of affairs it represents to itself and to its beliefs and desires and values in respect of those states of affairs. A rational being, therefore, is a being capable of making statements and giving orders and asking questions; this implies that, in itself and independently of any such communication, it “has” something to make statements and give orders and ask questions about.

This is rationality. Rationality marks a great divide, a discontinuity between humanity and the beasts. It is wrong to suppose that there is something apes and elephants and beavers have a little of, and we have more of, and that, as a consequence, we are rational and they are not.<sup>3</sup>

It is not that we are “more intelligent” than, say, apes and that that is why we are rational and apes are not—as Alice is able to solve word-analogy problems and spatial-relation problems faster than Alfred because she is more intelligent. (Whatever that means. There. That was a relief. Whenever I write the words ‘more intelligent’ I feel a very strong urge to add the words ‘whatever that means’.) We may indeed be more intelligent than apes; indeed I suppose we are. But if so, that is not why we are rational and apes are not. If there is a connection, it goes the other way: we are more intelligent than apes because we are rational and therefore have more use for intelligence—for intelligence, if it is anything, is the ability to manipulate mental representations of states of affairs in various useful ways, and we have a lot more, and a lot more complex, representations to manipulate than apes do. To suppose we were rational and apes weren’t because we were more intelligent than apes would be like supposing bats could fly and mice couldn’t because bats were more “physically agile” than mice. (Bats probably do have greater physical agility than mice—whatever that means. They need greater physical agility because they can fly and mice can’t.) Human beings who are of subnormal intelligence owing to injuries or genetic defects do not have minds at all like the minds of apes, any more than apes of subnormal intelligence have minds like the minds of elephants or beavers. Rather, they have human minds that are of diminished capacity in respect of dealing with the demands of life in human society. We shall consider four questions about rational beings:

- What rational beings are there, and why do they exist?
- What is the place of rational beings in the World?
- What is the nature of rational beings?
- What are the powers of rational beings?

## Notes

1. Many people shy away from language like this these days because they believe the use of such language implies that human beings have the right to hunt non-human animals for sport or to use them in medical experiments or to do just about anything else it might occur to human beings to inflict on their fellow creatures. And many people are opposed even to eating the

flesh of animals, much less engaging in wanton cruelty toward them. It is therefore natural that they should object to language implying that human beings had the right to use their fellow animals in any way they liked. But the term 'rational being' has no such implication. One might as well say that to distinguish between animate and inanimate objects is to imply that I, being a living being, have the right to smash Michelangelo's *Pietà* with a hammer. If I am considering a course of action that will affect the welfare of dolphins, the fact that I am a rational animal and the fact that dolphins are not rational animals will no doubt be *relevant* to the question of the morality of the proposed course of action. But these two facts by themselves could not settle the question.

2. Science-fiction writers have taken to using the word 'sentient' to express the idea I express by 'rational'. But 'sentient' means 'capable of sensation and feeling': dogs and cats are sentient beings.

3. It is wrong but apparently very natural. I once attended a lecture by a specialist in "artificial intelligence" about the enormous difficulties facing anyone who wants to program a computer to be able to talk (like "Hal 9000" in *2001: A Space Odyssey*). A member of the audience asked afterward, in genuine puzzlement, "But why don't you just make the computer very smart; if it's smart enough, won't it be able to learn to talk?" He was thinking of intelligence and the ability to talk on an "automotive" model: intelligence and the ability to talk are related as are engine-power and the capacity to go fast.

## 8

## WHAT RATIONAL BEINGS ARE THERE?

The only rational beings whose existence is uncontroversial are human beings. The following, if they exist, are rational beings: God, angels, gods, elves and fairies and trolls, rational extra-terrestrial beings, and rational computers or robots. I know of no other candidates, for it is as certain as anything can be that neither chimpanzees nor dolphins nor any other non-human terrestrial creatures are rational.

I suppose no reader of this book seriously wants to discuss the possible existence of creatures of folklore like trolls, and I suppose no one seriously wants to discuss the possible existence of Zeus or Odin. There could be no reason for believing in the existence of angels apart from the revelations claimed by particular religions. We shall later discuss (in connection with the question, Why are there rational beings?) the thesis that the physical universe is the product of rational design; this, together with our discussion in Chapters 6 and 7 of the existence of a necessary being, constitutes as much of a discussion of God as lies within the scope of metaphysics. There are at the present time no rational computers or robots (unless they are the work of extra-terrestrial rational beings), and we shall not raise the question—which belongs more properly to the philosophy of mind than to metaphysics—whether rational computers and robots are intrinsically possible. That leaves us with rational extra-terrestrial beings: Martians or Venerians or Arcturans or whatever.

Is there any good reason to believe such beings exist? A lot of people seem to believe not only that they exist but that the earth has actually been visited by them. Well, a lot of people believe in ghosts and astrology and the Bermuda Triangle. There are certainly no Martians or Venerians or other rational inhabitants of the solar planets. As to the Arcturans, travel "in person" over inter-stidereal distances (picture the earth as a grain of sand circling a basketball-sized sun about thirty meters away; the nearest possible extra-solar planet would be another grain separated from "our grain" by the width of the Atlantic) is a feat so difficult that any species that accomplished it would have a technology that stood to ours as ours stands to that of medieval Europe. One would expect that if extra-terrestrial visitors with literally incredible technological powers wanted us to be aware of them we should be unequivocally aware of them, and no childish hide-and-seek. And if they didn't want us to be aware of them, we

should never have noticed any sign of their presence whatever. There are two kinds of scientists who spend a lot of time looking at the sky: meteorologists (who look at it during the day) and astronomers (who look at it during the night). It is significant that no meteorologist or astronomer has ever reported any manifestation of extra-solar visitors—nor has any scrap of material or any artifact allegedly of extra-solar origin ever reached the hands of a scientist.

Nevertheless, the question whether we have actually been visited by extra-solar rational beings does not really have much to do with the question whether there are such beings. And to the latter question, we can answer only that we don't know. We have no reason to think that there are or that there aren't. We know nothing about how life arose on the earth, much less about other ways in which it might possibly arise, and we therefore know nothing about what proportion of such planets as there may be support life.<sup>1</sup> We know only a few facts that are of any relevance to the question whether there are rational extra-terrestrial beings, and those facts do not encourage us to believe that rational beings are at all common in our part of the cosmos.

First, rationality has arisen on the earth only once. There are between two and thirty million species now living, and there may have been as many as a thousand million species that are now extinct. And yet only one of them is or ever has been rational (unless some extinct species of our genus was also rational; if that were so, it would still be true that rationality has arisen on the earth only once). If we compare rationality with vision or the power of flight, we observe a striking contrast: vision has arisen independently over forty times in the history of terrestrial life,<sup>2</sup> and I, who am no biologist, can point to at least four independent occasions in the history of terrestrial life on which the power of flight arose. And the development of rationality depends on at least one "accident" that is independent of the "internal" processes of biological evolution: if the planetoid or comet that collided with the earth to cause the mass extinctions of sixty-five million years ago had had a slightly different trajectory, we should not be here; it is, in fact, overwhelmingly likely that there would be *no* rational terrestrial species.

Secondly, there is the very good question that was asked by the physicist Enrico Fermi: "Where are they?" It may be difficult to travel in person across the distances that separate the stars, but it is not all that difficult to communicate by radio across those distances. And yet, despite our best efforts, we detect no extra-solar radio signals. Admittedly, a receiver could miss an extra-solar signal if it, the receiver, were not aimed just right, and the enormous task of "checking out" every square arc-second of sky to see whether it is a source of meaningful radio signals has hardly been begun. For all anyone knows, we shall detect a meaningful signal from the stars tomorrow. Nevertheless, thousands of stars have been investigated, including all of them that can be seen with the naked eye, and no signals have been observed. The absence of radio signals is, however, hard to evaluate for many reasons. (To mention just one, there seems to be no very compelling argument for the conclusion that rational beings would be at all likely to have radios. Our ancestors have been rational beings for at least a hundred thousand years and have had radios for only about a thousandth of that span. And only one of the tens of thousands of human cultures has been in a position to invent the radio. Perhaps there are many other rational species in our neck of the galactic woods, but the historical development we call "modern science," on which

the radio depends, exists only because of some unlikely turn of events that has not happened in the histories of all those other species.) Nevertheless, our failure to detect extra-solar radio signals is hardly encouraging to those who would like to believe in a "Star Trek" version of the local spiral arm, laden with technological civilizations like ripe apples on the limb of an apple tree at harvest time.

When the fact of our failure to detect extra-solar radio signals is combined with what we know about our own evolutionary history, it seems most reasonable to believe that there are no rational beings other than ourselves anywhere in what might be called (from an astronomical point of view) the vicinity. But most of the cosmos is not in the astronomical vicinity, and it may well be that there are other rational beings somewhere. And it may well be that there are not. It may well be that we are absolutely alone in the cosmos. (Alone in time as well as in space; it may well be that there have never been any other rational beings. It may well be that there are never going to be any, although that is less likely, since the cosmos is very young: it will be ten thousand times its present age when the last star goes out.)

In my view, to make any pronouncements on this topic in the present state of our knowledge would be most inadvisable. It should, however, be noted that we have a very strong taste for such pronouncements. History shows that human beings have an apparently irresistible urge to people unknown regions with non-human rational beings. Present-day science-fiction enthusiasts who believe, or half-believe, in a galaxy filled with Vulcans and Klingons (or something like them) are responding to the same urge that led ninth-century peasants to fill the hills and woods with elves and trolls and led the seventeenth century to populate the interior of Africa with giants with eyes in their bellies and led my grandfather's generation to cover Mars with canals. For all that, it may be that this deeply seated urge, having led us astray so many times, has finally brought us to the truth. If you let a bet ride long enough you will eventually win. Every hypochondriac is right once.

Let us now turn to the second part of our question: Why are there rational beings? Since, as we have seen, we are the only rational beings we know about, let us treat this question as a question about beings like ourselves: rational animals. We shall ask why there are such things as rational animals.

There are two main types of answer to this question: one type of answer attaches some sort of meaning or purpose to the existence of rational animals, and the other type denies that the existence of rational animals has any meaning or purpose. We saw examples of answers of each type in Chapter 1 when we looked at two possible sets of answers to our three metaphysical questions. Each of these two types may be divided into two sub-types. If there is a meaning or purpose to be found in the existence of beings like us, this meaning may derive from the conscious purposes of some non-human being or beings (in most cases, God) or it may derive from an impersonal "force" that somehow strives toward the goal of producing a more complex, ordered universe. If there is no meaning or purpose to be found in the existence of rational animals, this may be because it is a necessary truth that there are rational animals or it may be because it is a mere matter of chance that there are rational animals.

To my mind, the two interesting possibilities are that the existence of beings like us is due to the purposeful action of a non-human being and that their existence is due to chance. There seems to be no reason whatever to believe in such things as the Di-

alectic of History or, to descend to a somewhat lower intellectual level, a "Force" out of *Star Wars*. Indeed, it is not easy to make out what these things are supposed to be. And the suggestion that the existence of rational animals is a necessary truth is very hard to believe. We saw in Chapter 7 that it was very hard to believe that *all* truths were necessary truths, and, if there are contingent truths, why should the proposition that rational animals exist not be one of them?

In Chapter 7, we quoted a short passage from a textbook the authors of which maintained that the existence of "the universe" was necessary. Even if this were correct, however—and we shall see presently that there are good reasons to doubt whether it is, reasons besides those given in Chapter 7—, it would not follow that the existence of rational animals was necessary unless it was a necessary truth that "the universe" must eventually produce or give birth to or generate rational animals. But if our existence depends on the collision of a planetoid or comet with the earth at just the right moment in evolutionary history, it can hardly be true that the existence of human beings is necessary (unless there is no contingency at all, but *that* is something that can hardly be true). And if rational animals are rare in the universe and the existence of our own type of rational animal is due to an improbable astronomical event, it is hard to see why anyone should think that the existence of rational animals was necessary.

Let us turn to the two interesting possibilities. Let us begin by examining the thesis that the existence of rational animals is due to chance. Here is one version of this thesis, the third answer in our second set of answers to our three metaphysical questions in Chapter 1 (but I have substituted 'rational animals' for 'human beings' in this answer):

Rational animals are complex configurations of matter. Since the World is eternal, the existence of complex configurations of matter is not surprising, for in an infinite period of time, all possible configurations of matter will come to exist. Rational animals are just one of those things that happen from time to time. They serve no purpose, for their existence and their features are as much accidents as the existence and shape of a puddle of spilt milk. Their lives—*our* lives—have no meaning (beyond such purely subjective meaning as we choose to find in them), and they come to an end with physical death, since there is no soul. The only thing to be said about the place of rational animals in the World is that they are—very temporary—parts of it.

This is, as I said, a picture of the World that was at the height of its popularity in the nineteenth century. (But it did not originate in the nineteenth century. It was invented in ancient Greece, and was apparently popular even in the middle ages: an English abbot, writing about the year 1200, complained that "There are many people who do not believe that God exists . . . They consider that the universe has always been as it is now and is ruled by chance rather than by Providence.") It might be held that this argument had the conclusion that the existence of rational animals was necessary, at least given that the existence of a beginningless cosmos of matter in motion was necessary, since the probability that an eternal cosmos would not produce rational configurations of matter at some time or other is literally infinitesimal. Whether we should look at the argument that way is a merely verbal question. In one sense, the argument attributes something very like necessity to the existence of rational animals (and to the existence of just about everything else). In another sense, the argument

implies that the existence of rational animals is a matter of chance: on each occasion on which a species of rational animals came into existence, the coming to exist of that particular species was a matter of chance. But there is no point in taking any pains over this verbal question, since, however the argument is to be described, it has a premise that is held by most experts to be false. Cosmologists today pretty generally agree that the age of the universe is finite. As a consequence, the argument "in an infinite period of time, all possible configurations of matter will come to exist" is no longer one that can be appealed to.

It may be, however, that it is still possible to believe that the existence of rational animals depends upon chance. Although the age of the cosmos is finite, it is, by human standards, enormous. It is possible to speculate that the age of the cosmos is sufficient for it to be reasonably probable (although not necessary) that, in the period of time that has elapsed since the beginning of the cosmos, the random combination and recombination of atoms would produce rational beings like ourselves. The most plausible story would be something like this: first, the random combination and recombination of atoms produces some very simple organism (perhaps something on the order of complexity of the simplest bacterium that exists today); thereafter, Darwinian evolution takes over, and eventually there are rational beings; the present age of the cosmos is great enough that it is unsurprising that this sequence of events has had time to happen in at least the one case we know of.

Is this plausible? Well, let us ask the following question. What proportion of the simplest configurations of matter that are of about the same size and weight as the simplest known bacterium would correspond to a living organism—not necessarily a bacterium, but any sort of living organism, living by any conceivable definition, however liberal? It is impossible to answer this question with anything like a precise number, but there is no doubt that the proportion is very small indeed. It would be something like this: to imagine one of the possible living configurations having been produced by a random mixing of atoms in a universe the age and size of ours would be like imagining a dart thrown at random toward a target as big as the galaxy hitting a bull's-eye smaller than an atom.

That this is so is due to the laws of physics, which dictate that there is only a small number of kinds of particles, that the particles of each kind have very specific properties, and that there is a very specific range of ways in which two particles can interact. It so happens that only a very small proportion of the bacterium-sized configurations of particles that the laws of physics allow have the properties of a living organism—just as only a very small proportion of the ways in which a wristwatch-sized pile of tiny gears and wheels and springs can be arranged in relation to one another will produce a watch or any other functioning mechanism. (The words 'very small proportion' are an understatement, and the statement that they are an understatement is itself an understatement. One might as well say that "only a very small part" of a galaxy-sized target was occupied by a bull's-eye smaller than an atom.)

If this is correct, there would seem to be only one way in which chance could be responsible for the living organisms we see about us today. (If the observable universe were packed with planets, and atoms were constantly being randomly mixed at every point on their surfaces, the probability of this procedure producing a single bacterium-sized living configuration of matter by the time the cosmos was a million mil-

lion times its present age would be essentially zero.) First, chance, or the random mixing of atoms, would have to produce some configuration of matter far simpler than a bacterium, a configuration that was capable of reproducing itself, and then some evolutionary mechanisms—whether the Darwinian mechanisms or some other—that automatically come into play when self-reproducing configurations of matter exist would have eventually to bring it about that the “descendants” of that configuration exhibited the complexity of biological organization we observe today.

There are difficulties with the thesis that this proposal reflects a scenario that has actually occurred on the earth. All known terrestrial organisms depend on a specific sort of interaction between nucleic acids and proteins, and no one can imagine a self-reproducing assemblage of nucleic acids and proteins that is simpler than the simplest bacteria—much less one so simple that there is a significant probability of its having come about by a random mixing of atoms in a few hundred million years on the surface of the newly cooled earth. (But there are interesting speculations about how nucleic-acid/protein life might have evolved out of life that had another sort of chemical basis, and it may well be that the advocates of these speculations are on to something.) Moreover, the only evolutionary mechanisms that have actually been described in a scientifically respectable way—the Darwinian mechanisms—are such that the idea that they are capable of starting with a self-reproducing molecule and eventually producing beavers and dolphins and human beings is pretty much an article of faith. (But the fact that something is held as an article of faith is no reason for thinking it isn't true, and even if the Darwinian mechanisms turn out not to be adequate to explain the observed facts of evolution, it may be that there are other mechanisms, yet to be discovered, that are adequate.)

Our present purposes are speculative and metaphysical rather than scientific. Let us, therefore, waive all these difficulties. Let us imagine that we have an excellent scientific account of the origin of life and the mechanisms by which life evolved to its present degree of complexity. And let us suppose this account makes it plain that, given a cosmos like this one, it is perfectly reasonable to believe rational animals would come into existence by chance sooner or later—and let us suppose this “sooner or later” factor to be of a magnitude that makes the present existence of rational animals (that is, their existence when the cosmos is ten to fifteen thousand million years old and when there has been life on the one planet they are known to have evolved on for just under four thousand million years) a matter of no great surprise to us. Have we an account of how rational animals came about by chance?

In the nineteenth century, it would have been assumed that we had. It was possible to assume this because the cosmos of the nineteenth-century scientific imagination was vague and amorphous. The nineteenth-century scientific imagination saw the universe, basically, as composed of various chunks of matter of arbitrary shapes and sizes moving about in space. This imaginative picture was inconsistent with the actual content of nineteenth-century science. Late nineteenth-century science knew that matter did not come only in solid chunks but could also be in a liquid or gaseous state and that a given quantity of matter could be transformed from one state to another with certain of its important properties remaining constant. It knew that quantities of matter interacted not only by contact but at a distance—across empty space—by heat, light, magnetism, electricity, and gravity. It knew about the odd and beautiful connection between heat

and light and electricity and magnetism. It knew about the resistance of chunks of matter to being put into motion and the odd and unexplained connection between this feature of matter and gravity. It knew a lot about the laws of chemical combination, and it knew that each material had a certain density and certain definite ways of responding to outside forces (bending, flowing, shattering, or whatever). Nevertheless, despite its inconsistency with actual scientific knowledge, the imaginative picture continued to exist and to represent the cosmos as something vague and amorphous. And the vague and amorphous is not something that nags at one for an explanation. If one believes in a vague and amorphous cosmos, one will not be likely to raise the question why the cosmos has the general, overall features it has rather than some others. One will be likely to think of the cosmos as being so uncomplicated that the fact of there being a cosmos of that sort rather than some other requires no explanation. What would the alternatives be, after all? What other kind of cosmos could there be than a cosmos of chunks of matter of arbitrary sizes and shapes moving about in empty space?

Today we have a much more precise and unified picture of the cosmos. Because the picture is precise, we can construct pictures of other ways a cosmos could be simply by making small changes in our actual picture of the cosmos. (We can imagine a cosmos almost like ours but not quite. What would it be to imagine a cosmos almost like a cosmos of matter in motion but not quite?) Because the picture is unified—a vast and superficially unrelated range of phenomena are related at a deep level by the picture—we can ask what the consequences of these small changes would be for a vast range of things. Because the scientific picture is both precise and unified, it is not possible for anyone who has much knowledge of the scientific picture to have, for everyday use, so to speak, an imaginative picture of a vague and amorphous cosmos that ignores a lot of phenomena belonging to the scientific picture that do not fit it very well. Any imaginative picture of a vague and amorphous cosmos will not only have to gloss over some phenomena belonging to the scientific picture that are not well understood; it will also have to have features clearly and demonstrably inconsistent with those of the scientific picture.

Our present picture of the cosmos has two main components: our picture of the nature of the elementary particles that make up the cosmos and the forces by which they interact (supplied by physics) and our picture of the large-scale structure and the history of the cosmos, from the Big Bang to the present (supplied by cosmology). These two components form a very tightly integrated whole. Each of these components involves a lot of numbers. The description of the particles and the forces, for example, involves a number called the fine-structure constant, which relates to the way in which electrically charged particles interact with the electromagnetic field. Other constants have to do with other kinds of interaction, such as gravity and special interactions that take place at very short range between some kinds of elementary particles. The description of the large-scale structure of the cosmos involves numbers like the number of elementary particles that belong to each “family” of particles allowed by theory. Lots of the numbers needed to describe the cosmos cannot be predicted theoretically. They are numbers that, as the physicists say, “have to be put in by hand.” That is, their values have to be established by the laborious process of measurement and experiment. There seems to be no necessity in the values these numbers actually have. Therefore, it looks as if there are perfectly possible cosmosi (the plural of ‘cosmos’) in which these numbers are different, and we can ask what those possible cos-

moi would be like. And, because our present picture of the world is so precise and unified, we can often answer such questions. There is quite a lot that can be said in answer to a question like, What features would the cosmos have if the fine-structure constant had twice its actual value?

The interesting thing about the answers to these questions is that it appears that if the cosmos were much different at all, there would be no life (and therefore no rational animals). Small changes in various of these numbers would result in a cosmos that lasted only a few seconds or in which there were no atoms or in which there were only hydrogen and helium atoms or in which all matter was violently radioactive or in which there were no stars. In no cosmos of these sorts could there be life, and, as a consequence, in no cosmos of these sorts could there be human beings or any other rational animals. (And there are many, many other ways in which small changes in certain of the numbers that describe the features of the cosmos would produce a cosmos inimical to life.)

Suppose we fancifully think for a moment of the cosmos as the product of a machine designed to produce cosmoi. The machine has a largish number of dials on it, perhaps twenty or thirty, and the overall features of the cosmos are the result of the ways the dials were set when the cosmos was produced. If they had been set in other positions, a different type of cosmos would have emerged from the machine. It seems to be the lesson of modern physics and cosmology that *many* statements like the following ones will be true: "The pointer on dial 18 is set at .0089578346198711. If it had not been set at some value between .0089578346198709 and .0089578346198712, there would be no carbon atoms and hence no life"; "The pointer on dial 23 is set at 5.113446 and the pointer on dial 5 is set at 5.113449; if the values of the two readings had been exactly equal, there would have been no matter, but only radiation; if the two readings had differed by more than .000006, all stars would be of a type that would burn out before multicellular organisms could evolve on their planets."<sup>4</sup>

The suggestive metaphor of a cosmos-producing machine with lots of dials on it that must be very precisely set if the machine is to produce a cosmos that could contain life (notice, by the way, that we say 'could contain' and not 'will necessarily produce') has led some writers to say that the cosmos is "fine-tuned" in such a way as to enable it to contain life. Only a vanishingly small proportion of the totality of possible cosmoi are suitable abodes for life, and yet the actual cosmos is one of these very few. (In fact, not only is it a suitable abode for life, but it actually contains life. And not only does it contain life, but it contains rational life. These features make it an even rarer specimen among the totality of possible cosmoi than a mere "life-permitting" cosmos. How *much* rarer is hard to say. We shall be able to speak with confidence on this point only when we have a good scientific account of the origins of life and rationality.) Why is the cosmos one of the few possible cosmoi that permit life? Why does the cosmos appear to have been fine-tuned by someone who had life in mind? Why are the numbers right for life?

One answer to these questions is provided by the so-called teleological argument. Late in the thirteenth century, Saint Thomas Aquinas presented the following argument for the existence of God:

We observe that things that have no knowledge—objects that we find in the natural world, for example—sometimes act for an end. (That this is so is proved by

the fact that they always, or nearly always, behave in the same way, and this way is the way that will lead to the best result. It is evident from this that their behaving in these ways is due not to chance but to design.) But a thing that has no knowledge cannot act for an end unless it is directed by a being that has knowledge and understanding, as an arrow is directed by an archer. There is, therefore, some being having knowledge and understanding who directs all those things in the natural world that act for an end. This being we call God.

This argument has been variously called the teleological argument (from the Greek *telos*, meaning an end or goal), the argument from design ("due not to chance but to design"), and the analogical argument (because it proceeds by drawing an analogy between the apparently goal-directed behavior of things in the natural world—birds flying south for the winter or the leaves of a phototropic plant turning toward the sun—and the behavior of things designed or controlled by human beings: "as an arrow is directed by an archer").<sup>5</sup>

It is commonly held that the teleological argument has been refuted by the Darwinian account of evolution—indeed by the very existence of the Darwinian account, whether or not we know it to be true. And this may very well be so if we take the scope of the argument to be limited to living organisms (that is, to those objects in the natural world whose features the Darwinian theory gives an account of). But what of the cosmos as a whole? If the cosmos is a very special cosmos among all possible cosmoi, and if it has every appearance of being a cosmos that has been designed to be an abode for life, might not the most obvious explanation of this appearance be that the appearance is reality? Might not the most obvious explanation of the fine-tuning of the cosmos be that it has *been* fine-tuned? That its large-scale features (if no others) have been carefully chosen and put into place by a being who "has knowledge and understanding" and who wanted to make an abode for living things? And if a being having knowledge and understanding designed the cosmos to be an abode for living things, and if, as we know it does, the cosmos also contains rational beings like ourselves—rational animals—is it not reasonable to infer further that the existence of those rational beings is a part of the purposes of the Designer (who is, after all, also a rational being and may therefore be presumed to take a special interest in rational beings)?

### Suggestions for Further Reading

For justification of the claims found in the text concerning the origin of terrestrial life and the likelihood of extraterrestrial rational species, see Shapiro, *Origins*, and Mayr, "The Probability of Extraterrestrial Intelligent Life."

Leslie's *Universes* is a brilliant exposition and discussion of physical cosmology and "fine-tuning."

Aquinas's teleological argument can be found in most collections devoted to the philosophy of religion. It is included in Burrill's *The Cosmological Arguments*.

### Notes

1. See Robert Shapiro, *Origins: A Skeptic's Guide to the Creation of Life on Earth* (New York: Simon & Schuster, 1986).

2. This figure is taken from an article by the evolutionary biologist Ernst Mayr, "The Probability of Extraterrestrial Intelligent Life," in *Philosophy of Biology*, ed. by Michael Ruse (New York: Macmillan, 1989), pp. 279-285.

3. The mechanisms might require other factors to be present in the organisms and their environment, provided those additional factors were ones whose existence was "natural" enough to require no particular explanation, or "probable" enough that their existence could reasonably be ascribed to chance. The Darwinian mechanisms, for example, require not only that the configurations of matter be self-reproducing but also that the configurations make use of certain limited resources in order to continue to exist and to reproduce, that the configurations reproduce themselves not perfectly but with (random) variations, and that a significant proportion of the variations be such that a variant configuration will have a tendency to pass some of the variations it exhibits on to its "descendants." Most recent versions of Darwinism treat the existence of "units of heredity"—genes—as essential to the evolutionary process. In the case of organisms that reproduce sexually, some versions of Darwinism require that it occasionally happen that small populations of organisms capable of interbreeding become isolated.

4. I have made these numbers up. They are meant only to give the reader a "feel" for the sensitivity of the existence of life to changes in the actual values of certain numbers, according to modern physics and cosmology. The reader who is interested in some real information on this topic should consult John Leslie's splendid book *Universes* (London and New York: Routledge, 1989).

5. Kant, who invented the labels "ontological argument" and "cosmological argument" called this argument the "physico-theological argument." In this instance, his gift for nomenclature deserted him, and the label (fortunately) never caught on.

## 9 THE PLACE OF RATIONAL BEINGS IN THE WORLD: DESIGN AND PURPOSE

If the existence of rational animals was intended by the Designer of the cosmos, rational animals have a purpose. Their purpose is to be found in the intentions of the Designer, and to discover the purpose of rational animals one need only discover what the Designer's intentions were in bringing them into existence.<sup>1</sup> It is important to realize that if this argument shows that rational animals exist for a purpose, it gives us no clue whatever about what that purpose is. It is plain enough that we may know of something that it has a purpose without having any idea what that purpose is. Many artifacts dug up by archaeologists obviously have a purpose, but what their purpose is is often a subject of interminable debate.

The Shorter Catechism of the Church of Scotland opens with the following question and answer (an "inclusive language" version of the catechism is no doubt forthcoming):

Q. What is Man's chief end?

A. Man's chief end is to glorify God and to enjoy him forever.

This question and answer provide a very clear example of a belief about the end or purpose of humanity; this is an example of what is meant by saying that human beings have a purpose. But the conclusion of the teleological argument in no way suggests that our purpose is anything of this sort. For one thing, it may be that although *some* rational animals have a purpose, human beings do not. But let us simply assume that if any rational animals have a purpose, human beings are among them. Here is a much more important point: the conclusion of the teleological argument does not imply that the Designer has very many of the properties traditionally ascribed to God. There is no reason to suppose—at least the teleological argument supplies none—that the Designer is all-powerful or knows everything or cares about the welfare of created rational beings. And because the Designer whose existence the teleological argument



purports to prove need have few of these properties that have traditionally been ascribed to God, the Designer's purposes might be entirely unlike the purposes that have traditionally been ascribed to God.

It is consistent with the conclusion of the teleological argument that the Designer's purposes be analogous to a scientist's (we are part of a vast experiment) or a dramatist's ("All the world's a stage," in a sense uncomfortably close to the literal). Neither of these purposes would be possible for God: He does not need to conduct experiments, since, being omniscient, He knows how they would turn out without having to conduct them; being loving and good, He would not employ self-aware, flesh-and-blood beings for purely aesthetic purposes—all the more so because He would see all possible dramas laid out simultaneously and in their entirety in the infinite theater of His mind and could therefore have no reason for wanting to watch the actual performance of any play. The teleological argument, therefore, does not claim to prove the existence of a being that is all-powerful or all-knowing or recognizes any moral obligations toward the rational beings whose existence it is responsible for. A moment's reflection will show that it cannot claim to prove the existence of an infinite or necessarily existent or eternal being. (As to eternity, it may be that, for all the teleological argument can claim to show, the Designer has been outlasted by its cosmos, just as the pharaohs have been outlasted by their pyramids.) It is consistent with the conclusion of the teleological argument that the creation of the cosmos have been a cooperative endeavor involving the labors of many beings, like the construction of a ship by human beings. For all the teleological argument can claim to show, it may not only be that the cosmos is the work of many beings but also that these beings have had to learn to build *cosmoi* by trial and error; it may be that there are lying about somewhere outside our ken a lot of "botched and bungled" *cosmoi* representing their earlier and less successful attempts at a working cosmos; it may be that *our* cosmos is an "early draft," which contains unfortunate features like disease and parasitism and natural disasters because its builders had not yet mastered the craft of cosmos-building.

Let all this be granted, however, and it still seems to be true that the teleological argument does show that we should think of rational animals in a way somewhat like the way in which we should think of a cache of mysterious artifacts unearthed by an archaeologist: We may not know what their purpose is, but it is clear they have a purpose; they exist because some designers—known to us only through their productions—made them to fulfill that unknown purpose. (Of course, the above reflections do not show that no one could, or that no one does, know that purpose. There might be any number of ways of finding it out. Perhaps, for example, someone will devise some marvelously clever theory about a purpose we might serve in the eyes of a cosmos-designer, a purpose which, when we consider it carefully, makes so many hitherto mysterious facts "fall into place" that we feel intellectually compelled to believe that this person has guessed the purposes of the Designer. An analogy might be the clever theory that Stonehenge is an astronomical observatory. Or the Designer might be able and willing to communicate with rational animals and might tell certain of them what end their kind serves. But no one *has* devised any compelling theory about the purpose behind our existence, and supposed revelations of the purposes of the Designer are so plentiful and so wildly inconsistent with one another that the metaphysician who does not desire a severely limited audience can make no use of them.)

If we have a purpose, then our existence "has a meaning" in the only sense these words can be given. It must be admitted that it is not at all clear what these words do mean. The term 'meaning' has various senses,<sup>2</sup> but none of them lends any sense to the question, What is the meaning of our existence? other than this sense: Explain why we exist in terms of the purposes we serve. (If Alice surprises a trusted employee who has broken into her office and is going through her files, and if Alice says, "What is the meaning of this?" she is requesting an explanation of a certain state of affairs in terms of the purposes of her employee or those whose agent the employee is.) The question and answer from the Shorter Catechism that were quoted above are a statement—whether true or false—of the meaning of our existence, and any statement of the meaning of our existence must be a statement of the same general sort. At any rate, I can think of no other sort of statement that would count as an answer to the question, What is the meaning of our existence? and if anyone maintains that this statement is not of the right sort to count as an answer to the question, I do not know what that person means by the question.

The conclusion of the teleological argument seems to imply that we serve some purpose and that our existence therefore has a meaning. But does the teleological argument prove its conclusion—that the cosmos is the product of design and not of chance or necessity—or does it at least make that conclusion more reasonable to believe than not? How might those who deny that the cosmos is a product of design reply to the teleological argument?

There are several replies that are of little or no value and one that seems to me to be decisive.

Some philosophers have argued that there is nothing in the fact that the universe is fine-tuned that should be the occasion for any surprise. After all (the objection runs), if a machine has dials, the dials have to be set *some* way, and any particular setting is as unlikely as any other. Since any setting of the dials is as unlikely as any other, there can be nothing more surprising about the actual setting of the dials, whatever it may be, than there would be about any possible setting of the dials if that possible setting were the actual setting. (Here is a parallel argument. If you toss a coin and it comes up "heads" twenty times in a row, you shouldn't be surprised. After all, you wouldn't be surprised if the sequence HHTHTHTTHTHTHTHTHTHT occurred, and that sequence and the sequence HHHHHHHHHHHHHHHHHHHHHH both have exactly the same probability of occurring: 1 in 1,048,576, or about .000000954.) This reasoning is sometimes combined with the point that if "our" numbers hadn't been set into the cosmic dials, the equally improbable setting that did occur would have differed from the actual setting mainly in that there would have been no one there to wonder at its improbability.

This must be one of the most annoyingly obtuse arguments in the history of philosophy. Let us press the "parallel" argument a bit. Suppose you are in a situation in which you must draw a straw from a bundle of 1,048,576 straws of different lengths, and suppose it has been decreed that if you don't draw the shortest straw in the bundle you will be instantly and painlessly killed: you will be killed so fast you won't have time to realize you didn't draw the shortest straw. Reluctantly—but you have no alternative—you draw a straw and are astonished to find yourself alive and holding the shortest straw. What should you conclude?

In the absence of further information, only one conclusion is reasonable. Contrary to appearances, you did *not* draw the straw at random; the whole situation in which you find yourself is some kind of "set-up"; the bundle was somehow rigged to ensure that you would draw the shortest straw. The following argument to the contrary is simply silly. "Look, you had to draw some straw or other. Drawing the shortest was no more unlikely than drawing the 256,057th-shortest: the probability in either case was .00000954. But your drawing the 256,057th-shortest straw isn't an outcome that would suggest a 'set-up' or would suggest the need for any sort of explanation, and, therefore, drawing the shortest shouldn't suggest the need for an explanation either. The only real difference between the two cases is that you wouldn't have been around to remark on the unlikelihood of drawing the 256,057th-shortest straw."

It is one thing, however, to note that an argument is silly and another thing to say why it is silly. But an explanation is not hard to come by. The argument is silly because it violates the following principle:

Suppose there is an  $n$ -membered set of inconsistent and exhaustive possibilities (all about equally probable),  $A_1, A_2, \dots, A_k, \dots, A_n$ . ('Exhaustive' means that one of them has to be realized—together they exhaust the possibilities. If a set of possibilities is exhaustive, at *least* one of its members *must* be realized. If the members of a set of possibilities are inconsistent—if each member of the set is inconsistent with all the others—at *most* one of its members *can* be realized. If a set of possibilities is both exhaustive and inconsistent, therefore, exactly one of its members must be realized.) Suppose further that  $A_k$  is the member of this set that is actually realized. Suppose the number  $n$  is very, very large. (We can understand " $n$  is very, very large" this way: if a number between 1 and  $n$  has been chosen at random, it was very, very *improbable* before the random choice was made that that number would be chosen.) If we can think of a possible explanation of the fact that  $A_k$  was realized that is a good explanation if it is true, and if we can see that, if one of the other possibilities in the set had been realized, no parallel explanation could be constructed for the realization of that other possibility, then the fact that it was  $A_k$ —and not one of the other  $n-1$  possibilities in the set—that was realized cannot be ascribed simply to chance (at least not off-hand, not without further argument).<sup>3</sup>

Some very improbable events have this feature: for all their improbability, one should assume their occurrence was a mere matter of chance. Some very improbable events, but not all of them. This principle is an attempt to state a sufficient condition for its being unreasonable to ascribe a highly improbable event to mere chance.

Let us see what this principle tells us about the straw-drawing case. My drawing the shortest straw out of a bundle of over a million straws in a situation in which my life depends on my drawing just that straw certainly suggests a possible explanation. If an audience were to observe my drawing the shortest straw, they would very justifiably conclude that I had somehow "cheated": they would conclude that I had had some way of knowing which straw was the shortest and that (to save my life) I had deliberately drawn it. (If I know I *didn't* know which straw was the shortest—if I am just as astounded as anyone in the audience at my drawing the shortest straw—, the situation will not suggest that particular explanation of my drawing the shortest straw *to me*, but it will suggest the one I have already mentioned, namely that some unknown

benefactor has rigged the drawing in my favor.) But if I had drawn any of the other straws, the fact that I drew the particular straw I did would not have suggested an explanation that was in any way parallel to this one. If an audience were to observe my drawing the 256,057th-shortest straw (and my consequent immediate demise), this would not suggest *any* explanation to them: no one would suppose—nor would it be reasonable for anyone to suppose—that I knew which straw was the 256,057th-shortest and that I deliberately drew it; nor would anyone suppose that someone had rigged the drawing to ensure my getting the 256,057th-shortest straw; nor would any other possible explanation come to anyone's mind.

We have seen that the setting of the cosmic dials does suggest an explanation: the dials were so set by a rational being who wanted the cosmos to be a suitable abode for other rational beings. Therefore, those critics of the teleological argument who say that one setting of the cosmic dials is no more remarkable than any other possible setting are certainly mistaken. We should note that our principle does *not* say that if one can think of a really good explanation (really good if true) of some antecedently very improbable feature of the world (and if there is no parallel explanation . . . *etc.*), one should automatically assume that explanation is correct; the principle says only that in such cases one may not assume without further argument that that feature of the world requires no explanation.

Let us turn to a second reply to the teleological argument. It is much more interesting than the first but—or so it seems to me—wholly unpersuasive. The teleological argument supposes that there are many ways the cosmos could be besides the way it actually is, ways not only different but radically different from the way the cosmos actually is. But perhaps there are no such ways. There are some physicists who hope to find a physical theory that will be so simple and compelling and arbitrary and beautifully coherent that the mind will be forced to regard it as the only possible physical theory, as the only possible description of the way a cosmos could be set up. In such a theory, even those numbers that appear to us at present to be undeniably contingent (the charge on the electron, for example) will turn out to be necessary. The theory, in short, will require no numbers that have to be "put in by hand," and all the numbers it generates will agree with experiment. (Among philosophers, the authors of the textbook quoted at the end of Chapter 7 would appear to be rather confident that this is how things will turn out.)

If the discovery of such a marvelous theory were to occur, it would all but refute the idea of the actual cosmos's being one among many radically different possible cosmosi, and would therefore all but refute the version of the teleological argument we are considering. At present, however, there seems to be no particular reason to think that this is how things will turn out. (The belief in and search for such a theory is a recurrent tendency in the history of science. Aristotle, Descartes, Kant, and Einstein were involved in earlier manifestations of this tendency. In the past, the search for an "only possible theory of everything" has always been a deceiver, for we now know that no such theory could possibly have been constructed on the basis of the limited knowledge available when the earlier attempts were made. Nevertheless, as we said in connection with the recurrent tendency to people unknown parts of the earth or the cosmos with rational animals, a tendency to belief that has always led us astray in the past might now be on the verge of leading us to the truth.)

I have to record my ignorant layman's conviction that it does not seem to be very plausible to suppose that there will be a theory that presents a compelling case for there being only one intrinsically possible "cosmos design," the one that permits the existence of complex life like ourselves.<sup>4</sup> In a way, such a development would not remove the "coincidental" aspect of a cosmos suitable for life but would simply add the mystery of necessity to it. I will try to explain this statement by means of an analogy.

Suppose we were to divide a square into a million smaller squares by dividing each of its sides into a thousand equal parts. And suppose we took the first million digits in the decimal part of  $\pi$  and interpreted each as corresponding to one of the million squares by some simple correspondence rule (something like this: the top left square is assigned the first digit, the next square to the right is assigned the second digit, and so on). And suppose we assigned a color to each of the numbers 0 through 9 and painted each of the small squares with the color corresponding to the number assigned to it.

What would we say if the result turned out to be a meaningful picture—a landscape or a still life or something equally representational—of surpassing beauty? We certainly could *not* say that some rational being had arranged the values of the first million digits of the decimal part of  $\pi$  so that they represented a meaningful and beautiful picture, for those values are a matter of necessity; the first five are '14159' in every possible world, and none of the others is any less necessary. We should have to say that this is how things were and had to be and that nothing else could be said. But no one would expect this picture-generating power to be a feature of  $\pi$  or of  $e$  or of any other real number that turned up in the natural course of our mathematical investigations. (There are, admittedly, lots of numbers that do have this power. To find one, we need only paint a beautiful picture, divide it into a million small squares, make up two simple correspondence rules, and mechanically calculate the first million digits of the number using the picture and the rules; the remaining digits can be filled in arbitrarily.)

No doubt  $\pi$  could be "made" into a picture-generating number if the correspondence rules were made very complicated and were specially chosen for that purpose. And no doubt some million-digit sequence somewhere in the decimal part of  $\pi$  is picture-generating. What would be amazing is if the first million digits of some *mathematically fundamental* number like  $\pi$  or  $e$  were to turn out to be picture-generating according to some *simple* set of correspondence rules. This is because the three requirements "first," "fundamental," and "simple" seem somehow to be independent, and their combining to produce a picture-generating number would therefore seem to be in some sense a coincidence. To me, in my ignorance, it seems as unlikely that a "cosmos design" that was the only possible cosmos design should turn out to be life-permitting as that  $\pi$  should turn out to be picture-generating. If the only possible cosmos-design did turn out to have this feature, I'd be as amazed as I should be if  $\pi$  turned out to be picture-generating, for the many requirements on a life-permitting cosmos are independent of one another, in the same sense as that in which the requirements "the first million digits," "mathematically fundamental number," and "simple correspondence rule" are independent of one another.

If this did happen, of course, I'd simply have to accept it and admit that there was no explanation of the fact that the only possible cosmos-design was life-permitting—or rather, the only explanation there was would be of the following "double" form: it is a necessary truth that any cosmos has features X, Y, and Z, and it is a necessary truth

that life can exist only in a cosmos having features X, Y, and Z. The fact that the only possible cosmos-design was life-permitting would have an explanation only in the sense in which the fact that the fourth digit in the decimal part of  $\pi$  denotes the number of Platonic solids has an explanation: it is a necessary truth that the fourth digit in the decimal part of  $\pi$  is '5', and it is a necessary truth that there are five Platonic solids. (Readers who don't know what a Platonic solid is needn't worry. The essential point is that it is mathematically provable that there are exactly five Platonic solids, and the proof has nothing whatever to do with the fact that the fourth digit in the decimal part of  $\pi$  is '5'.)

Since it seems to me to be antecedently highly improbable that the only possible cosmos-design—if there indeed were only one possible cosmos-design—would be life-permitting, it does not seem to me that the second reply to the teleological argument has much force. If there were some good scientific reason, known to physicists, for supposing that only one cosmos-design was possible, this of course would alter matters. But there is no such reason. The motivations of those physicists looking for an "only possible theory of everything" are pretty clearly aesthetic and metaphysical. These are perfectly respectable motivations, and there is no reason in the world why physicists should not act on them. But the existence of such motivations should not be taken to imply that there is any evidence that reality is going to cooperate with them. This should be all the more evident when we remember that the history of science shows that these motivations represent a natural tendency of the human mind, one that existed antecedently to modern physics and cosmology.

Another possible reply to the teleological argument is to protest that even if the universe has been purposely fine-tuned, it does not follow that it was fine-tuned in order that creatures like ourselves should exist. Perhaps the Designer who carefully adjusted the value of the fine-structure constant and the relative strengths of gravity and the strong nuclear force and many other parameters to astonishingly exact values had *something* in mind for its carefully designed cosmos, but the fact that the cosmos is a suitable abode for rational beings was entirely irrelevant to its purposes. Perhaps we are, so to speak, the mice in the walls of the cosmos. If the mice that lived in the walls of a house were capable of contemplating such matters, they might, after a careful examination of the whole structure of the house, conclude—correctly, of course—that the house had been designed for a purpose by a rational being. And they might naturally, but incorrectly, proceed to conclude that it had been designed to be an abode for them. (The spaces between the walls are just right for mice, there is lots of food lying about that is nourishing for mice, the house is comfortable for mice even in the dead of winter, and so on. But no doubt the theologians among them would be profoundly troubled by the Problem of the Cat.)

Now this objection is not, properly speaking, an objection to the teleological argument as such (the conclusion of which is that the cosmos was designed by a rational being or beings), but to the secondary conclusion we drew from the existence of a Designer: that among the Designer's purposes in making the cosmos was to provide an abode for rational beings like ourselves. This secondary conclusion, however, seems to me to be very reasonable, given that the cosmos is a product of intelligent design. The analogy of "the mice within the walls" is defective in several important respects. The properties of mice were "settled" by evolution long before there were houses, and

houses just happen to be suitable for infestation by creatures having those properties. There are so many species that it would be surprising if a few weren't suited for living within the walls of houses. House mice exist independently of the houses they inhabit, and they infest houses because it happens that houses are suited for them. Houses are not infested by sheep (except in one episode of "Monty Python's Flying Circus") or even by rabbits because the waste spaces in houses are not suited for occupation by sheep and rabbits. (It is no wonder the spaces between the walls of a house are just right for mice: the mice would not have moved in if they were not.) If mice and no other species had evolved inside houses, and if the slightest change in the design of a house would have the consequence of rendering it uninhabitable by living things, and if houses had been designed by enormous rational mice, the analogy between the two cases would be much closer. But, it seems to me, if we knew all these things to be true, it would be at least very reasonable for us to conclude that the enormous mice *had* designed houses as abodes for common-or-pantry-variety mice.

I will now turn to a reply to the teleological argument I believe to be decisive. I said earlier that the common belief that the teleological argument had been refuted by the Darwinian account of evolution (or even by the *possible* truth of this account) was mistaken. It was mistaken because evolution is a phenomenon that occurs only within the realm of living things (or at least of self-reproducing things) and the version of the teleological argument we have been examining applies to the cosmos as a whole. And the cosmos is not a living thing or a self-reproducing thing: it is not the product of the operation of natural selection on ancestral cosmoi that reproduced themselves with variations in an environment that contained limited amounts of the resources needed for cosmic survival and reproduction.<sup>5</sup> Nevertheless, the Darwinian account of evolution does have a feature that can be adapted to the needs of the present discussion. Darwin showed how it was possible, in certain circumstances, for chance to produce results one might be initially inclined to ascribe to the purposive action of rational beings; some of the ideas on which this demonstration rests are so simple and general that they can be lifted out of the biological context in which Darwin applied them and applied to the apparent design exhibited by the cosmos.

An example will illustrate these ideas. Suppose each of the citizens of Wormsley Glen has a job; and suppose each of them has an alarm clock; and suppose each alarm clock goes off at just the right time each day to enable its owner to get up and get to work on time. For example, Alice's clock goes off at 5:36 each morning, and if it went off even a few minutes later she would frequently be late for work; as it is, she breezes into the office just under the wire every day. And Tim's clock goes off at 6:07, which is just right for letting him sleep as late as possible and still get to work on time. (And so on and so on, for every citizen of Wormsley Glen. They all have clocks that enable them to arise at the optimum time, given the time they are expected at work, the amount of time they need to deal with their morning domestic chores, the amount of time they need to travel to work, and whatever other factors in their lives may be relevant to the times at which they have to get up in the morning.)

Here, we might suppose, is an obvious case of purposive design: on the back of each of the alarm clocks there is a little knob or something that regulates the time at which the alarm rings, and all the citizens have calculated the times at which they have to get up and have set their individual alarms accordingly. But this is not so. The real expla-

nation is different and rather unpleasant. Not so long ago there were hundreds of times as many people in Wormsley Glen as there are today. Each of them was issued an alarm clock unchangeably set to go off at some particular time each day, and no returns or trading allowed. The alarm settings were in every case entirely random, and this had just the consequence you would expect: Almost every alarm was set wrong (that is, was set for a time that was not the time at which its owner needed to get up), and these wrong settings, owing to the laissez-faire economic system that prevailed in Wormsley Glen, had disastrous consequences for their owners. Sally's was set for 11:23 a.m., and she was, as a consequence, consistently late for work and lost her job and starved to death. Frank's was set for 4:11 a.m., and, once it had gone off, he could either go back to sleep and be late for work or stay up and try to deal with the demands of his job (he was a brain surgeon) without having had a good night's sleep. He chose the latter course, but his being chronically short of sleep led him to make a few serious mistakes, and he had to be let go; shortly thereafter, he starved to death.

And that is what happened to everyone in Wormsley Glen who was issued a "bad" alarm clock. (Even those whose clocks were set just slightly wrong lost their competitive edge and were eventually forced out of their jobs by more punctual and better-rested rivals.) Wormsley Glen is no welfare state, and they're all dead of starvation now. Knowing this to be the case, we can see there was no conscious purpose behind the setting of Alice's or Tim's alarms. Each of them received an alarm clock that *just happened* to be set at the "right" time, and each of them therefore survived. And this is what happened with all the other citizens of Wormsley Glen. It was statistically likely that a certain proportion of the original inhabitants would, simply by the luck of the draw, receive clocks set at the time that was right for them. And that is what happened: a certain not-at-all-surprising proportion of the original inhabitants got clocks set at the right time, and the unforfeiting social arrangements of Wormsley Glen removed everyone else from the picture.

This story is a model for the sort of circumstances in which the action of chance can mimic the productions of a rational being. A rational being, as we have said, can be aware of non-actual states of affairs and can act on values it happens to have in order to single out some of these states of affairs and cause them to become actual. The operations of chance cannot do that because chance is not aware of any non-actual states of affairs and chance has no values. What chance can sometimes do is to generate a large number of actual states of affairs, and it may happen that the world is arranged in such a way that it will proceed to eliminate from actuality all of them that do not satisfy some condition. The "surviving" states of affairs in the second case may very closely resemble the "chosen" states of affairs in the first. (I have talked of the operations of chance, but it might be better to follow Jacques Monod and talk of the "interplay of chance and necessity": chance generates a large set of actual states of affairs, and necessity eliminates all, or, at any rate, most, of the ones that do not meet its demands.)

In our story of Wormsley Glen, chance produced a large number of actual "alarm-clock situations," and the grim necessities of Wormsley Glen then proceeded to eliminate from actuality all of them but a few that closely resembled the alarm-clock situations rational beings would have chosen from among all possible alarm-clock situations to be actual. As rationality decides which possibilities are to be actual, so a

non-rational cosmos or nature may decide which actualities (which of a set of actualities generated by chance and displaying a range of characteristics as broad as the range of characteristics displayed by the set of possibilities rationality examines) are to remain actual.

According to Darwin, chance and necessity have combined in just this way—but a few factors peculiar to the evolutionary process are not represented in the schema laid out in the preceding paragraph—to produce the appearance of conscious design in living organisms. Chance produces random inheritable variations among the offspring of an organism, and nature (which, like Wormsley Glen, is no welfare state) tends to favor the preservation of those variations that contribute to an organism's ability to have descendants. The appearance of design in organisms is due to the accumulation of such useful (useful for having descendants) variations. Organisms are adapted to their environments—to the extent that they *are* adapted to their environments; adaptation is often imperfect—owing to the fact that the better adapted an organism is to its environment, the more likely it is to have descendants. It will be noted that our "alarm clock" story includes only some of the features of the Darwinian account of apparent design in living things: those not involving reproduction and inheritability.

The operations of chance can, moreover, produce an appearance of "design" (the appearance of a purposive choice among possibilities by a rational being) without actually causing anything to cease to exist. To produce the *appearance* of design, it is necessary only to render those things whose features would count against a design hypothesis unobservable. One very effective way to render something unobservable is, of course, to cause it to cease to exist. But that is not the only way. I need not destroy any green things (or even change their colors) to prevent you from observing green things. I could also remove all green things from your vicinity, or move you to a region in which there happened to be only non-green things, or render you color-blind. This consideration suggests that chance could produce the appearance of design by generating a large number of actual objects under conditions in which some "observational selection effect" allowed observers to be aware of only a few of those objects, ones having (more or less) the features a rational being would have chosen to accomplish some purpose. (The meaning of 'observational selection effect' is best explained by an example. In 1936, *The Literary Digest* predicted on the basis of a poll conducted by telephone that Alf Landon would be elected president. But Roosevelt was elected by a landslide. It turned out that a vast number of Roosevelt supporters did not have telephones, for the poll tended both to support Roosevelt and not to have telephones. An observational selection effect had rendered a large body of voters "invisible" to the editors of *The Literary Digest*.)

It is the possibility of an interplay of chance and an observational selection effect that is the undoing of the teleological argument in the form in which we are considering it. In our initial statement of the teleological argument, we asked the following question: "Might not the most obvious explanation of the fine-tuning of the cosmos be that it has *been* fine-tuned?" If the answer to this question is No, the teleological argument fails. And the answer to this question is No if even one other explanation of the fine-tuning of the cosmos is at least as good as the explanation that it has been fine-tuned. And another explanation, one at least as good, is available: an explanation that appeals to the interplay of chance and an observational selection effect.

The alternative explanation goes like this. First, the cosmos is only one among a vast number of *actual* cosmoi. (If there are people who insist on using 'the cosmos' as a name for the whole of physical reality, we could accommodate them by saying instead that what appears to us to be the whole of the cosmos is in reality a very small *part* of the cosmos. The difference between the two statements seems to me to be merely verbal. I shall continue to talk of a multitude of cosmoi, and anyone who does not like my way of talking can easily translate it into talk of a multitude of "cosmos-designs.") To see what is intended by this statement, think of our cosmos-producing machine as containing a randomizing device. The randomizing device sets the dials on the machine at random. The machine turns out a cosmos. Then the randomizing device resets the dials and the machine turns out another cosmos, and so on through a very large number of resets. Alternatively, we could suppose there were an enormous number of cosmos-producing machines, on each of which the dials were set at random, and could suppose that each machine turned out one cosmos. (Compare the alarm clocks issued to the citizens of Wormsley Glen.) Since the dial settings are random, and since the existence of life is allowed by hardly any of the possible combinations of settings, only a very small proportion of these cosmoi will be suitable abodes for life. Most of them will last only a few seconds or will contain no protons or will contain no atoms or will contain only hydrogen and helium atoms or will be composed entirely of violently radioactive matter or will be devoid of stars or will contain only stars of a kind that would burn out before evolution could get started on their planets.

We suppose, however, that there are so *many* actual cosmoi that it is statistically unsurprising that a few are suitable for life. The total number of cosmoi needed to render unsurprising the existence of even a few cosmoi that were suitable abodes for life would be enormous: perhaps comparable to the number of elementary particles in "our" cosmos, perhaps vastly greater than that. (It is hard to think of a reason to suppose the number of actual cosmoi would have to be finite. If the number of cosmoi were infinite, it would certainly not be surprising that some of them were suitable abodes for life.)

There are various conceivable mechanisms more realistic than our imaginary cosmos-producing machine that might generate an appropriate variety of cosmoi. In Chapter 7, we considered the possibility that the cosmos might have arisen as a fluctuation in some pre-cosmic analogue of the quantum field. Let us, following Milton, refer to this analogue as Chaos and Old Night—Chaos for short. Chaos is a sort of arena in which random fluctuations occur. A very few among these fluctuations are impressive enough to be called cosmoi. We suppose that the cosmoi that arise in Chaos do not resemble one another as closely as the bubbles in a pot of boiling porridge resemble one another. The differences among them—which, we must remember, are the products of chance—are, or can be, of the radical kind we should describe as differences in the laws of physics and large-scale cosmic structure: different values of the fine-structure constant, different ratios of the strength of the strong nuclear force to the strength of gravity, different numbers of electrons, and so on. And, finally, a very few of the cosmoi have just the right properties to be possible abodes for life.

One might raise the question where Chaos came from or why it is "there" at all, but that is a question pertaining to the cosmological rather than the teleological argu-