1 Introduction

1.1 What this book is about

Broadly speaking, we human beings use two conceptual schemes or 'paradigms' to explain the world in which we find ourselves.[1] In the 'teleological paradigm' natural events are explained in terms of the same sorts of purposes, means, and goals we use to explain our own behavior. Within the 'naturalistic paradigm', the world is explained in terms of natural laws and mindless processes. The naturalistic paradigm has been enormously successful. As an underlying framework for science, this way of approaching the world has yielded a vast knowledge of natural phenomena, as well as the technology which distinguishes our modern way of life from all that came before. The teleological paradigm on the other hand is ancient and deeply intuitive. The oldest human accounts of nature were made from this perspective. The creation stories of cultures around the world – from the Babylonian account in which Merodach fashions the world from the corpse of the great Mother dragon Tiamat,[2] to the biblical story of Genesis – are examples of teleological explanations. While such explanations have been largely displaced by appeals to natural law, one product of the teleological paradigm continues to remain relevant: the family of 'design arguments' for the existence of God.

Design arguments are characterized, not surprisingly, by appeals to design. Each such argument urges us to accept that one or another aspect of the world or of things in the world is the product of purposeful, intelligent agency. That is, each design argument attempts to establish that some aspect of the natural world was designed. From there, it is a short

[1] A graceful argument to this effect was made by the pioneering psychologist C. Lloyd Morgan (1906) in his Lowell lectures.

[2] MacKenzie 1915, 138–62.

mental hop to the existence of a designer. After all, the presence of design in the world surely implies the existence of a designer. For the arguments we will examine, that designer is typically (though not always) understood to be the Christian God.

This book is a systematic attempt to determine which, if any, design arguments are convincing. Our goal is to ascertain whether any such argument succeeds – or has the potential to succeed – in establishing the existence of a god or gods on the basis of our experience of the world. To do so, we will need to survey the available arguments, isolate the essential form of the inferences made, and assess the merits of each type of inference. This book is organized into two parts. In the first part, we'll consider the major kinds of design argument from antiquity through the mid nineteenth century CE. We will attempt to classify each of these arguments with respect to its logical structure, and consider the strengths and weaknesses of each, particularly in the light of what various historical critics have had to say. In the second part, we'll turn to design arguments in the modern literature, each of which is scrutinized in detail. There are two major classes of argument to consider here: biological and cosmological. In the former class are arguments that infer an intelligent designer from the properties of organisms, or from the apparently purposeful arrangement of the parts of organisms. In the cosmological class, the argumentative focus is on the appearance of 'cosmic fine tuning' – if the values of many physical constants had been even slightly different from what they actually are, life would have been impossible. In various ways, this apparent coincidence is used to argue that the universe as a whole must have been designed.

Since our goal is to assess the merits of each argument in its strongest form, we will have to pay special attention to the structure of arguments and the ways in which some claims about the world rationally compel belief in others. I introduce some useful tools for this purpose in Chapter 2. After describing the major kinds of inference – ways in which one set of claims can provide evidence in favor of another – I explain the method of argument diagramming, a systematic approach for representing and criticizing arguments that will be used throughout this text. Aside from the basics of argument analysis, some of the design arguments we will consider demand familiarity with particular mathematical or scientific topics. Whenever this is the case, I provide a primer for the non-specialist.

The philosophical question this book sets out to address – are there any sound design arguments for the existence of God? – has been the subject of one long conversation over the past 2,000 years. While it is possible to enter this conversation and this book at any point and still extract something of value, each argument is best assessed in the context of what has come before. Some approaches, like the argument from analogy which we will study in Chapter 7, were eventually abandoned after collapsing under criticism. Some newer arguments, such as Paley's version of the argument from order (Chapter 8), were structured in a particular way expressly to avoid the criticisms that doomed older approaches. Knowing this makes assessing newer arguments a much more efficient process. The chapters of this book are intended to be read sequentially, with each building upon the last. With each new argument in the series, new conceptual tools are introduced, fresh criticisms are added to a growing stockpile, particular argument forms are abandoned, and potentially fruitful suggestions are pursued. For this reason, I encourage the reader to get a sense of the overall conversation before jumping into any particular argument.

1.2 Intuitions of design

Teleological explanations are appealing. Without giving the matter much thought, many aspects of the natural world just seem as if they were arranged that way on purpose. These reflexive reactions to the world are strong enough to have maintained the appeal of design arguments for a very long time. So before we turn our attention to the design arguments themselves, it will help to have a sense of what features of the world provoke an attribution of design in the first place.

There are three principal kinds of intuition that drive interest in design arguments. By 'intuition' I mean a pre-reflective assertion or explanation – something like a 'gut reaction'. I'll refer to the three pertinent kinds of intuition as 'purpose', 'form', and 'conspiracy'. *Purpose* pertains to the way in which parts of the world – generally living things – relate to one another. In particular, such an intuition concerns the way in which things seem to be suited to a goal that does not originate with themselves. It is difficult not to speak of the parts or behaviors of an organism without referring to the tasks they were intended to perform. For instance, the wing of a bird has a peculiar shape, an extraordinary ratio of strength to weight, and a pronounced size relative to the bird, all of which appear to be for the purpose of flying. If asked why a bird has wings, the natural response is "So it can fly." Every 'adaptation' of an organism, every trait which suits a particular organism to survival in a particular environment, gives the impression of having been intentionally arranged for the express purpose of sustaining that kind of organism. Since the bird does not design its wings or the giraffe its neck, we look elsewhere for the author of these adaptations. Of course, we cannot ignore evolution by natural selection, always the elephant in the room when discussing apparent purpose in nature. In a scientifically literate society it is difficult to suppress the evolutionary response to intuitions of purpose in the structure of organisms, namely that these structures are the product of natural selection not intelligent design. We will consider Darwin's theory in Chapter 9, and the profound impact of his work on design arguments, particularly those that appeal to adaptation in organisms, in Chapters 12 and 13. But for now, try not to draw hasty conclusions. At this stage, I merely want to bring into focus the pre-reflective impressions that continue to make design arguments compelling.

To get an idea of what I mean by intuitions of *form*, think of pyramids and clocks. Intuitions concerning form involve an immediate recognition of properties that result only or mostly from acts of intentional design. These include symmetry, geometric simplicity, order, precision, and complexity. The properties of geometric simplicity and order are everywhere in human architecture (various modernist buildings notwithstanding). On the scale of everyday human experience – characterized by lengths on the order of 1 meter – only intentional design results in the production of rectangles, circles, parallelepipeds and the like. The simple geometric form of the pyramids at Giza, the elegant geometric ratios of the Parthenon, and the precisely level surfaces of an airport runway are all recognizable products of design. Instances of geometric elegance also occur in nature, though on a smaller scale. Each snowflake has a simple sixfold symmetry – rotate one 60° around an axis through its center and it looks the same as it did before. The question, of course, is whether this sort of natural geometric property is also the product of design.

Our intuitions of form are especially strong when geometric simplicity is combined with complexity. Clocks are the classic example. Clockwork is a common metaphor in Enlightenment discussions of design. Clocks and other complicated machines involve many parts, each of which displays the sort of geometric simplicity mentioned above. Furthermore, each part of a watch plays a very specific functional role, which it would fail to perform if its shape or other physical properties fell outside of a very narrow range. When every part performs its function, the result is a coordinated series of causal relations – a spring pushes a cog which turns another, which turns another, which turns the hour hand. Various parts of the universe or perhaps even the universe as a whole seem to exhibit this sort of complex interaction, an interaction that would devolve into chaos or freeze into a static lump if some of the interactions failed to take place. This is the way Newton viewed the solar system,[3] and, as we'll see, it's the way a number of proponents of an analogical version of the design argument see the universe.

Appeals to intuitions of *conspiracy* are as old as any of the others, at least in the written record. These intuitions arise from the observation that conditions in the world are just right for life as we know it to be possible – were things ever so slightly different then humans could not thrive. The Greeks, as we will see, noted that the environment of the Aegean brings cool winds just at the time of year when the sun threatens to scorch their crops.[4] Modern cosmologists point out that if certain physical constants had slightly different values, atoms would be impossible or the universe would have imploded long ago. The intuition in either case is that such facts are the consequence of a cosmic conspiracy – someone has arranged the world so that we can live in it. We will see this intuition developed into a detailed and very modern design argument in Chapters 15 and 16.

Below are four case studies intended to highlight each of the sorts of intuition discussed above. In the first case, we are quite certain that the object in question is the product of design. In the remaining three, this fact is precisely what the various design arguments are supposed to settle.

[3] See the "General Scholium" of Newton's *Principia* (1995, 439–43), or Hurlbutt 1965, 7–8, for a modern gloss.

[4] I am referring to the mention of the Etesian winds in II.131 of Cicero's *De natura deorum* (discussed in Chapter 3).

1.3 Case study 1: the Antikythera Mechanism

In 1900, a coterie of sponge fishermen made an extraordinary discovery.[5] They had been diving for sponges in waters off North Africa, and were sailing east towards their home on the Greek island of Syme when they were caught in a violent squall. They were forced to seek shelter in the lee of a small island called Antikythera, a rocky promontory some six and a half miles long by two miles wide in the channel between Crete and Kythera (the name of the island means "Against Kythera"). Anchoring over a shallow shelf, the fishermen safely rode out the storm. When the sea had calmed, they decided to take advantage of their novel surroundings, and began diving for sponges. This was a demanding job even after the invention of the 'standard suit', a canvas outfit topped with a brass helmet that allowed divers to walk on the sea floor and stay submerged longer than their lungs alone would allow.[6] One diver, Elias Stadiatis, found something at a depth of 140 feet, but it wasn't a sea-sponge. In the muck of the sea floor he discovered the 160-foot-long remains of an ancient shipwreck. Though obscured by millennia of ocean deposits, he could see that the sunken ship had disgorged a treasure of amphorae (ceramic storage vessels) and statues of bronze and marble. Elias returned to the surface with an outsized bronze arm and dreams of riches.

After the captain of the tiny two-cutter fleet verified the find, the fishermen completed their voyage home, and promptly set about partying for six months. When it was finally time to think about business again, the fishermen consulted the Greek government about their find – presenting the bronze arm as evidence – and in no time a salvage operation was sent back to Antikythera. The sponge-divers themselves conducted the operation under the guidance of an archeologist, and were compensated for whatever they brought to the surface. Over a grueling nine months of labor that saw the death of one diver and permanent disability of two more, a spectacular array of artifacts were recovered. These included many bronze

[5] Unless otherwise noted, my account of the discovery of the Antikythera Mechanism is derived from Price 1974.

[6] Because of an imperfect understanding of decompression sickness, the introduction of the diving suit called a 'skafandro' actually made the sponge-diver's trade more risky. Between 1886 and 1910 there were some 10,000 deaths and 20,000 cases of paralysis among sponge-divers in the Aegean (Warn 2000, 37).

statues, such as the *Antikythera Youth*, and marble statues that were manufactured in pieces to be assembled at their destination. These statues were apparently copies of fourth- and fifth-century BCE works, while the wreck itself dates to between 80 and 50 BCE. The ship was a commercial vessel carrying cargo from Asia Minor to Rome when it seems it was sunk by a squall much like that which the sponge fishermen had fled.[7]

Among the objects brought back to the National Museum of Greece from the shipwreck were many formless lumps of what appeared to be either weathered marble or corroded bronze. The divers had collected these spurious artifacts in case they were pieces of something important. These unidentifiable fragments were placed into a cage in the museum, and consulted repeatedly as the statues were being reconstructed to see if they might fit in somewhere. At some point, one of these lumps of corroded copper cracked open to reveal gears and the remnants of Greek script (see Figure 1.1). It was immediately recognized as an important artifact, an obvious contrivance of sophisticated engineering minds. This was the Antikythera Mechanism.[8]

Most of us, when confronted with a bronze assemblage of gears, shafts, and inscribed plates – no matter how corroded – would immediately infer that it was the handicraft of some human designer. For most of us, this inference is made intuitively, without any conscious consideration. There is little doubt in this case that our intuitions – in particular the identification of the object as an important contrivance by the staff members of the National Museum – are correct. But what is it that motivates such a strong conclusion of design? What features of the object evoke our intuitions? Can these features alone, upon careful reflection, justify our intuitive conclusions of design? Since this is a book about design *arguments*, we are not interested in the psychological question of how each of us actually comes to conclude that an object like the Antikythera Mechanism was designed. After all, there are many irrational ways for individual people

[7] There is the unsubstantiated possibility that the ship was carrying the possessions of Cicero, whom we'll meet in Chapter 3. From 79 to 77 BCE, he resided at the School of Posidonius on Rhodes, and would have been sending his baggage home at about the time the ship in question sank off Antikythera (Price 1974, 9).

[8] For the most recent reconstruction of the remarkably complex functioning of the Antikythera Mechanism, see Freeth *et al.* 2006. The device was a sophisticated computer for forecasting a variety of astronomical phenomena.

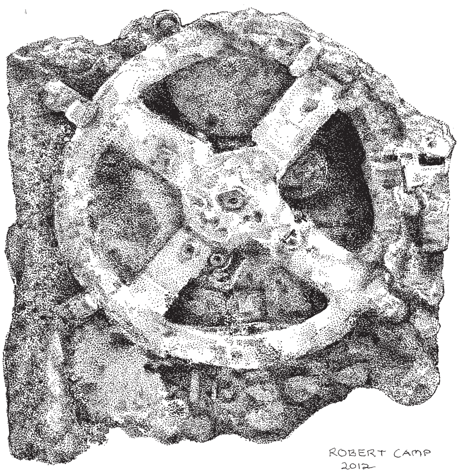

Figure 1.1 A fragment of the Antikythera Mechanism. Illustration by Robert Camp

to arrive at particular beliefs. These psychological mechanisms don't help us decide the truth of the proposition we have come to believe in. For that purpose, we need an explicit argument – we are only interested in how one might rationally justify a conclusion of design. Furthermore, we need to figure out whether any of the justifications we can provide are suitable for objects that may have a non-human provenance. The whole point of the design arguments considered in this text is to establish the existence of one or more gods, not people.

In the case of the Antikythera Mechanism, the relevant intuitions seem to be those of form. Of course, if we include writing in the set of properties we're considering, then it is obvious how an inference to human design can be made. But let's ignore the text for a moment since we want to determine whether other properties – properties that occur in controversial cases such as living things or the universe as a whole – might justify an inference of design. I suspect the staff of the National Museum would have been just as excited had the Mechanism lacked any sort of annotation. But why?

Some of the ways we might start to justify our conclusion of design on the basis of the properties related to form are, like the presence of writing, not general enough to apply to the controversial cases addressed by design arguments. We might, for instance, point out that the only known sources of gears are human engineers. The Antikythera

Mechanism contains many gears and other parts that are recognizable from other known human contrivances, and so we might be making a simple inductive inference. However, this sort of inference requires us to be familiar with many uncontroversial cases first. To apply the same inference to argue for the existence of God, we would have to have a stockpile of objects that we already know to have been designed by God. This approach won't get us far. But it seems there are some more general features we might point to in the Antikythera Mechanism that suggest a designer: the fact that many of the parts have a regular geometric shape; the fact that in combination the parts each contribute to a complicated 'function'. Even if we don't know what the function is, it seems clear that removing or altering a part – for example cutting a tooth off a gear – would ruin the delicate causal chain between the revolution of a shaft and the motion of the indicator dials. These are the sorts of features intuitively linked to design that were most famously emphasized by William Paley (see Chapter 8).

1.4 Case study 2: the bombardier beetle

To prime our intuitions about purpose, we need only look to the world of living things. The plants and animals of familiar experience possess a great number of traits – called 'adaptations' – that equip them to live a particular sort of life. For example, the extraordinary sense of smell possessed by wolves, the long legs of the cheetah, and the gnawing teeth of the rodent are all instances of traits that, at first blush, strike many as the sort of thing an engineer would have produced if tasked with providing for these animals. One particularly striking example comes from the insect world. It is the bombardier beetle (see Figure 1.2).[9]

The common name 'bombardier beetle' actually refers to more than 500 species of *Carabidae*, the family of ground beetles that includes the shiny green tiger beetles and the sun beetles, both common to northern climes.[10] What sets the bombardiers apart – and earns them their curious nickname – is their manner of defense. When provoked, the beetle

[9] The bombardier beetle is a favorite example of proponents of 'Intelligent Design', a topic considered in Chapters 12 and 13. See, e.g., Behe 1996, 31–36.

[10] Beetles are an enormously diverse group of animals, with around 350,000 known species.

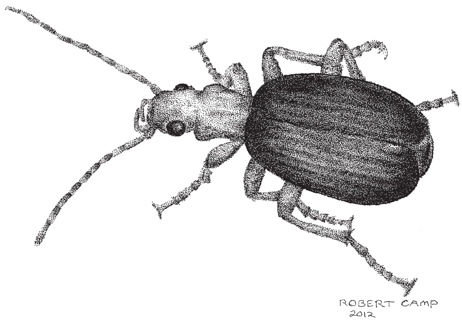

Figure 1.2 A Bombardier Beetle. Illustration by Robert Camp

explosively discharges a boiling spray of foul-smelling caustic fluid from its hindquarters. It aims this discharge at its foe with great accuracy. Each shot is accompanied by an audible popping sound, like that of a tiny bomb, hence the name bombardier.[11]

To understand how the bombardier beetle produces these little explosions, we need to look into its anatomy (Figure 1.3). The spray exits the beetle from a nozzle at the tip of its abdomen (the backend of the beetle). This nozzle connects internally to a hardened, thick-walled reaction chamber shaped like a Y. At the upper branches of the Y are valves leading into two large reservoirs. These large sac-like reservoirs are each filled by a secretory gland connected to it by a long, thin, coiled tube. The reservoirs are surrounded by muscular tissue, rather like your stomach.

Most of the time, the reservoirs are filled with what is essentially rocket fuel – a mixture of hydroquinones (the fuel) and hydrogen peroxide (a powerful oxidizer). When the beetle wants to fire its weapon, it contracts the muscles around the reservoirs, forcing this fluid into the reaction chamber. Here, the fluid from the reservoirs mixes with two sets of enzymes, biological molecules that act as chemical catalysts. Peroxide and hydroquinone normally do not react at room temperature. However, in the presence of the enzymes, they do so quickly and explosively. The hydroquinone–peroxide mixture is quickly converted into a few kinds of benzoquinones (nasty, corrosive irritants), oxygen, and water. In the process, the entire solution warms up to about 100° C and pressure builds

[11] This etymology is recounted in the anonymous *Dialogues on Entomology, in Which the Forms and Habits of Insects Are Familiarly Explained* (1819, 123). The relevant passage is quoted in Eisner 2003, 41.