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DEDICATION

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ABSTRACT OF "ON INTELLIGENT DESIGN AND BIOLOGY"

The thesis is that contrary to the received popular wisdom, the combination of David Hume's sceptical enquiry and Charles Darwin's provision of an alternative theoretical framework to the then current paradigm of natural theology did not succeed in defeating the design argument. I argue that William Paley's work best represented the status quo in the philosophy of biology circa 1800 and that with the logical mechanisms provided us by William Dembski in his seminal work on probability, there is a strong argument for the work of Michael Behe to stand in a similar position today to that of Paley two centuries ago. The argument runs as follows:

In Sections 1 and 2 of Chapter 1 I introduce the issues. In Section 3 I argue that William Paley's exposition of the design argument was archetypical of the natural theology school and that given Hume's already published criticism of the argument, Paley for one did not feel the design argument to be done for. I further argue in Section 4 that Hume in fact did no such thing and that neither did he see himself as having done so, but that the design argument was weak rather than fallacious. In Section 5 I outline the demise of natural theology as the dominant school of thought in the philosophy of biology, ascribing this to the rise of Darwinism and subsequently neo-Darwinism. I argue that design arguments were again not defeated but went into abeyance with the rise of a new paradigm associated with Darwinism, namely methodological naturalism.

In Chapter 2 I advance the project by a discussion of William Dembski's formulation of design inferences, demonstrating their value in both everyday and technical usage. This is stated in Section 1. In Sections 2 and 3 I discuss Dembski's treatment of probability, whilst in Section 4 I examine Dembski's tying of different levels of probability to different mechanisms of explanation used in explicating the world. Section 5 is my analysis of the logic of the formal statement of the design argument according to Dembski. In Section 6 I encapsulate objections to Dembski. I conclude the chapter (with Section 7) by claiming that Dembski forwards a coherent model of design inferences that can be used in demonstrating that there is little difference between the way that Paley came to his conclusions two centuries ago and how modern philosophers of biology (such as I take Michael Behe to be, albeit that by profession he is a scientist) come to theirs when offering design explanations. Inference to the best explanation is demonstrated as lying at the crux of design arguments.

In Chapter 3 I draw together the work of Michael Behe and Paley, showing through the mechanism of Dembski's work that they are closely related in many respects and that neither position is to be lightly dismissed. Section 1 introduces this. In Section 2 I introduce Behe's concept of irreducible complexity in the light of (functional) explanation. Section 3 is a detailed analysis of irreducible complexity. Section 4 raises and covers objections to Behe with the general theme being that (neo-) Darwinians beg the question against him. In Section 4 I apply the Dembskian mechanic directly to Behe's work. I argue that Behe does not quite meet the Dembskian criteria he needs to in order for his argument to stand as anything other than defeasible. However, in Section 5 I

conclude by arguing that this is exactly what we are to expect from Behe's and similar theories, even within competing paradigms, in the philosophy of biology, given that inference to the best explanation is the logical lever therein at work.

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INTRODUCTION

In the last ten years a resurgence of interest in teleological explanations for the existence of God has occurred, both from the point of view of modern cosmology and biology. The fundamental notion is that both the intricate sub-systems of the physical cosmos and those of living organisms display a remarkable adaptiveness to function such that it appears that they are designed to be that way. The physical constants of the universe display apparent fine-tuning; that is to say that if their values were only slightly different, there would be no recognisable universe. Since the probability of this universe being so is incredibly small, it is difficult to accept mere chance as an adequate explanation. That these constants were fine-tuned, that is designed to be just so, is an explanation which merits serious consideration. Developments in biology over the last two decades reveal a similar phenomenon: the complexity and detail required at the cellular and biochemical levels in order for such systems to function at all seems to lie beyond the realm of chance and selection effects. The Darwinian mechanisms simply fail to adequately account for this adaptiveness to function. Intelligent design theory has in the last ten years made significant ground in covering this explanatory gap.

That this should be the case is surprising, given that the contemporary philosophical and scientific orthodox belief is that design arguments were summarily dealt with by Hume and Darwin. Hume famously showed that the design argument drew a ridiculously weak analogy between human artefacts and biological systems, which could not lead logically to positing any properties to a designer that would be needed for the argument to count as

proof of the existence of the theistic God. Darwin provided us with a mechanism to understand how the appearance of design can come about through the blind process of chance combined with natural selection. If the new evidence in cosmology and especially in biology is susceptible to the traditional Humean and Darwinian criticisms, then the revitalised design argument has little chance of success. If the new argument is significantly different to the old biological design argument, or if the criticisms are levelled at straw men, then the new design argument provides us with compelling evidence from the lowest levels of organisation for the existence of intelligent agency at work at the highest levels.

We are in a position today to bring a far more powerful and sophisticated explanatory apparatus to bear on data that is suggestive of design. William Dembski has in a number of very recent books[1] provided an account of how to make an accurate inference to design. He makes recourse to both traditional probability theory and modern information theory, giving the most comprehensive account of design inferences yet. By analysing the probability of an event's occurring, we can assign regularity or chance explanations to it. Where neither will do, specifically in the realm of very small probability, then we are licensed to infer design if and only if the event has a certain degree of patterned complexity, which refers to information content and which Dembski terms specification. This explanatory filter will prove useful in an analysis of whether the new evidence from biology really does invoke design.

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[1] Dembski, W. A.; Eliminating Chance Through Small Probabilities; Cambridge University Press, Cambridge (1998).
Intelligent Design: The Bridge Between Science and Theology; InterVarsity Press, Downer's Grove (1999).

Among the prominent exponents of the new biological argument for design is Michael Behe. Irreducible complexity, argues Behe, is present at the sub-cellular level and is simply a level of complexity that admits of no further mechanistic explanatory reduction while retaining function. Behe's theory is not popular with the scientific orthodoxy, but his theory must be examined on its own merits. If he is correct that Darwinian and neo-Darwinian natural selection cannot account for the existence of certain irreducibly complex systems, then we are faced with *prima facie* evidence of design. If warrant to a design inference is provided on Dembski's grounds, then we have *de facto* evidence of design in biology.

1) THE DESIGN ARGUMENT: PAST INCARNATIONS AND APPARENT REFUTATIONS

1.1) Prologue to the Chapter

Every day in some part of the world police detectives look for and find evidence of a crime, which evidence they then use to form an inference as to what occurred and as to who perpetrated the act. Every day in some part of the world doctors examine their patients for symptoms and on the basis of these infer the illness that the patient is suffering from and prescribe the relevant cure. Every day in some part of the world, scientists are observing phenomena and postulating theories to account for and predict further such observations. In all of these instances, an inference is made from the presence of certain features of the world to the existence of some causal factor. In the first case, that of the detectives, the inference is to the existence of an intelligent agent. This method of establishing the existence of certain causal forces and or agents is in common and successful usage not only in everyday life, but also in science; it is by its success a legitimate method of practical reasoning. It is precisely this sort of inference that the design argument constitutes and that I will be treating.

1.2) Introduction to the Chapter

The design argument is an argument[2] in favour of the existence of God. It has in the past been particularly concerned with attempting to prove the existence of the monotheistic

[2] I shall refrain from calling this or any other theistic argument a 'proof', as is often done. Terming it a 'proof' indicates that there can be no doubt that the conclusion reached is both valid and true. Quite clearly, since the sceptic is calling exactly this into question, we cannot call any such argument a 'proof'.

God specifically of the Judaeo-Christian religion[3]. The design argument is most often named the argument from design. That is to say that design is usually taken as an initial premise, from which it is reasoned that a designer must exist. So, someone points out certain features of the world and says that these features are obviously marks of design; a design requires a designer; and so there must of necessity be one. The obvious reply to this argument is to take issue with the initial assumption, that there is indeed any design (or marks thereof) to be pointed to. If there are not, then the inference to a designer is obviously not justified. Of course, the conclusion could remain true, but it will not be valid. The argument is then easily demonstrated as being unconvincing.

I believe that it is first necessary that the existence of marks of design be verified, before arguing to the existence of a potential designer. This requires more than an appeal to brute fact, for to some it may not be as obvious as to others that *this*, say, is a mark of design. In other words, to refute an argument from design, it is simply necessary to disagree with its proponent that what said proponent points to indeed is a mark of design. I believe that in most cases this is the route that the sceptic (or the atheist, agnostic or devil's advocate) follows. From this simple analysis of what goes on in a typical design argument, we can begin to see the issues that really require treatment with regard to this particular argument for God's existence. The first issue (although this does not follow from the example given above) is that we have to address the possibility of there being a design argument at all. That is to say that we have to ask if it can ever be valid to make an inference to design. The second question that needs to be addressed is that of the

[3] References to God are throughout this dissertation, unless otherwise stated, to the God of classical Christian theism, to wit a personal, omnipotent, omniscient, omnipresent and benevolent being responsible for creating but separate from, yet capable of intervening in, the natural world.

facts, phenomena or events that are used as evidence for there being design. It must be established whether or not these can legitimately be taken as marks or instances of design.

Regarding the first question, Dembski's work has shown that the inference to design takes the form of a valid deductive argument. Immediately we see, however, that the traditional idea of an argument from design is not what has this validity. Rather, it is the inference to design. That is to say that the correct formulation of what may generically be called a design argument is an argument to or for design. This is pertinent to the second question raised above. The argument must first take the form *a priori* before it can be successful as an argument *a posteriori*. I will discuss this in detail in **Chapter Two**. Once it is established that the argument to design is deductively valid, it becomes possible to argue from design. I will be concerned with inquiring whether the current biological arguments as exemplified by Behe, are deductively valid and can thus count as a true first premise in a successful argument from design. I will treat this in detail in **Chapter Three**. The concern of the present chapter is to lay out significant parts of the history of the design argument, specifically the argument often characterized as being given from design and the supposed refutation of this argument.

I shall in this chapter present William Paley's formulation of the design argument and specifically treat his example of the heart as an instance of intelligent design in biology. Although Hume wrote before Paley; and despite the common perception even among philosophers that Hume demolished the design argument, I shall treat Paley first. This is

the natural progression of the argument; and I believe that Paley was the best representative of the natural theologians (certainly, he is taken as the representative in most discourse). I argue, after Richard Dawkins, Michael Behe and Elliot Sober, that Paley was correct, in so far as the knowledge of the day allowed; but that from our current perspective his argument was somewhat hasty. I then discuss the apparent refutation by Hume of the design argument and argue that Hume neither intended nor achieved such a refutation. Finally, I examine the challenge presented by evolutionary theory, particularly by the seminal work of Charles Darwin, to design. I argue that the model of evolution proposed by Darwin and refined by the later addition of genetic theory - that is, the mechanism of chance variation at the genetic level plus natural selection - legitimately superceded the design argument for a century or so. However, I leave it open as to whether the (neo)-Darwinian model put paid to the design argument for good and whether it (that is, the neo-Darwinian mechanism) is able today to explain everything in biology that we might legitimately call on it to explain. These issues will be revisited in **Chapters Two and Three**.

1.3) The Natural Theologians, William Paley and The Design Argument

Natural theology may be broadly described as the project of proving the existence of the God of Christianity through the scientific method[4]. The God of Christianity is traditionally a theistic God, as opposed, say, to a deistic God; His[5] attributes traditionally

[4] Speake, J. (ed.); A Dictionary of Philosophy; Pan, London (1984)
[5] Throughout this dissertation I use the capitalised form of the male pronoun when referring specifically to the Christian or theistic God, as is the common English usage.

and most importantly include omniscience, omnipotence, omnipresence and benevolence. That God possesses these attributes is taken as an analytical truth – the being possessing those attributes simply is God; if no being extant possesses all these attributes, then the hypothetical being that did would be labelled "God". Given that God possesses these characteristics, it is assumed that He is capable of any possible act of agency. The outcome of any action is known to God before the fact of its occurrence; and He is able to perform any action He chooses to. Perhaps He can arrange outcomes to suit His purposes. Given that God has these abilities through definition, it is possible to ascribe any act that cannot be ascribed to normal agency (that is, human agency) to God.

As regards the scientific method, there are competing accounts of what this consists in[6]. For the purposes of this discussion it can be taken in a broad sense as meaning the derivation of natural principles and causes and the prediction of events based on observation and repeatable experiments. So the aim of the project of natural theology was basically the valid deduction of the Christian God's existence through observing the world. The design argument is virtually synonymous with this project, for it takes observations from the world around us as evidence for the existence of a supernatural agency.

Natural theology was the dominant paradigm of scientific and religious thought for the few centuries preceding Darwin. In fact, the advent of Hume did little or nothing to

[6] Karl Popper, Thomas Kuhn, Imre Lakatos, Paul Feyerabend – all have different accounts of the scientific method, ranging from the orthodox and similar approaches of Popper and Kuhn to the drastically unconventional approach of Feyerabend. See for instance

change this situation[7]. Consider that, as pointed out above, Paley actually wrote post Hume; natural theology did not necessarily take the impact of Hume particularly seriously - but more on this later in **Section 1.4**. Paley's most influential work on natural theology was, fittingly if somewhat uninspired, titled Natural Theology[8]; he also published on revealed theology, which takes into account the testimony of miracles, personal experience and the like and which is not directly relevant to this project. In Natural Theology, Paley sets out a number of examples of natural phenomena (where by phenomena I mean both events and objects) that resemble in relevant aspects human causation or artefacts.

Paley plunged right in; he stated his thesis in the opening paragraph of Natural Theology:

> "In crossing a heath, suppose I pitched my foot against a *stone*, and were asked how the stone came to be there, I might possibly answer, that for any thing I knew to the contrary it had lain there for ever; nor would it, perhaps, be very easy to show the absurdity of this answer. But suppose I had found a *watch* upon the ground, and it should be inquired how the watch happened to be in that place, I should hardly think of the answer which I had before given, that for any thing I knew the watch might have always been there. Yet why should this answer not serve for the watch as well as for the stone; why is it not as admissible in the second case as in the first? For this reason, and for no other, namely, that when we come to inspect the watch, we perceive - what we could not discover in the stone - that its several parts are framed and put together for a purpose e.g. that they are so formed and adjusted as to produce

[7] Dembski, W..A.; Intelligent Design: The Bridge Between Science and Theology; InterVarsity Press, Downer's Grove (1999)
[8] Paley, William; Natural Theology; J. Vincent, Oxford (1828)

> motion, and that motion so regulated as to point out the hour of the day; that if the different parts had been differently shaped from what they are, or placed after any other manner or in any other order than that in which they are placed, either no motion at all would have been carried on in the machine, or none which would have answered the use that is now served by it...This mechanism being observed - it requires indeed an examination of the instrument, and perhaps some knowledge of the subject, to perceive and understand it; but being once, as we have said, observed and understood, the inference we think is inevitable, that the watch must have had a maker - that there must have existed, at some time and at some place or other, an artificer or artificers who formed it for the purpose which we find it actually to answer to, who comprehended its construction and designed its use."[9]

The example of the watch is Paley's most famous, if only because he uses it to state his thesis. This example may be standardized much as Hume's formulation of the design argument can (see Section 1.4):

(1) P has A

(2) P has B

(3) Q has A

(4) Q has B

(5) P has C

(6) Therefore Q has C

[9] Paley; Natural Theology; as quoted in Dawkins, R.; The Blind Watchmaker; Longmans, Harlow (1986); pg. 4.

Legend

P = human artefact (in this case a watch)

Q = a natural phenomenon (not stated explicitly at this point in the argument)

A = means to ends relations

B = coherence of parts

C = mind or intelligence as cause of design

The argument appears to be sound. Given that P has A, B and C, it would seem at least more probable that Q, having A and B, would have C than if Q did not have A and B. At least some arguments from analogy, then, are based to some degree on epistemic probabilities. Given that it becomes more probable that Q has C if it has A and B (given the properties of P) than if it did not, it does seem more probable that Q has C than not-C. However, what this quick analysis misses is that there may well be other properties of Q that counteract the relevance of the analogy with P. If these other properties cause our estimation of the (epistemic) probabilities of Q having C to fall, then the analogy will not work. So the validity of the argument is dependent on the list of properties relevant to the analogy being complete; any element of doubt may lead to a diminishing of the epistemic probabilities to the point where we do not accept the conclusion of the analogy. An example is useful at this point.

Say that the world is more like a vegetable than like a machine – as per Hume's example. Given the background knowledge that vegetables do not spring into place fully-grown,

we might then think that the world too cannot have sprung into existence fully-grown – that is, as it now is. However, after ascertaining that the Earth's circumference has never expanded, we would change our view that the world is like a vegetable. The probability of our believing the world is like a vegetable goes down with the belief that the world has never grown.

A further general example demonstrates that the reasoning holds for more than just analogy but also for any use of epistemic probability, even in deductive arguments.

Say Robinson Crusoe discovers a footprint in the sand of human shape and size. Given his background knowledge that only humans make such indentations in the sand when walking barefoot, we may well believe that Crusoe will think there is a human on the island. After ascertaining that it is not his own footprint, his assumption, we think, will no doubt be that there is another human on the island. If, however, Crusoe also believed that demons were in the habit of forging human footprints so as to torture lonely castaways, then we may well change our view of what Crusoe might think of the footprint's origin and implications. The probability of his believing that a human caused the footprint to be there goes down with this belief; the probability of our thinking that he will believe the footprint to be human-caused will go down on receipt of this information too.

In other words, epistemic probabilities can change (they may go up or down; or in other words the event they refer to may become more or less likely) with the receipt of further

background information regarding a situation. The form of argument used by Paley depends on there being relevant background knowledge of both sides to the analogy and that such information increases the probability of further information known of one side to apply to the other. Such an argument is always in danger of being shown to be invalid (that is, by being shown to be disanalogous) and so the conclusion is defeasible. Given that it is defeasible, it cannot be called a proof, since a proof is demonstrably and necessarily true. It may be the case that the conclusion of the analogy is true; but that certainty eludes us until all the relevant information is available.

So assuming the validity of the form of argument used by Paley; and assuming that the form is argument from analogy; and granting the truth of the premises; the conclusion certainly seems to follow, viz. that certain natural phenomena have as their cause the action of intelligent agents. The conclusion fails to follow if the background information pertaining to those natural phenomena changes - that is, the premises are altered such that the weight of probability lies against there being an intelligent cause for the natural phenomenon in question. Paley in his initial statement of the thesis, as quoted above, does not flesh out the argument by providing us with all the premises and relevant analogous properties between artefacts and natural phenomena, since he wishes to present a general formulation that might apply to various different natural phenomena. In order to see the value in setting out the argument in standardized form and examining the impact on epistemic probability of the various premises, I will proceed to examine specifically the examples of the heart and the eye as evidence for intelligent design in nature. As regards the heart, Paley writes:

> "It is evident that it must require the interposition of valves - that the success indeed of its action must depend upon these; for when any one of its cavities contracts, the necessary tendency of the force will be to drive the enclosed blood not only into the mouth of the artery where it ought to go, but also back again into the mouth of the vein from which it flowed...The heart, constituted as it is, can no more work without valves than a pump can."[10]

The heart is a biomechanical system. That is to say that it is biological in nature but mechanical in its character and operation. It may suitably be described as a pump, much as a water pump is; for the purpose of the heart - that is, it's function within the body as a whole - is to pump blood so that it may circulate and oxygenate the brain, muscles and so on. The analogy with a watch is therefore quite suitable, since in character a watch is also mechanical (this is trivially obvious). Standardizing the argument then gives us (let us call this formulation A):

(1) A watch exhibits means to end relations

(2) A watch exhibits coherence of parts

(3) The heart exhibits means to end relations

(4) The heart exhibits coherence of parts

(5) A watch has mind or intelligence as the cause of its design

(6) Therefore the heart has mind or intelligence as the cause of its design

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[10] Paley; Natural Theology

Let us arbitrarily assign an epistemic probability to the heart's having a similar cause as a watch, based on their sharing the properties listed in (1) through (4). Clearly, if we introduce another shared property and hence two new premises, the epistemic probability would go up (let us call this formulation B):

(1) A watch exhibits means to end relations

(2) A watch exhibits coherence of parts

(3) A watch's parts move in unison once per second

(4) The heart exhibits means to end relations

(5) The heart exhibits coherence of parts

(6) The heart's parts move in unison once per second

(7) A watch has mind or intelligence as the cause of its design

(8) Therefore the heart has mind or intelligence as the cause of its design

Accepting for the sake of the argument the accuracy of the new premises, it is clear that we would assign a greater probability to the conclusion. The more similarity between the two objects under comparison, the greater our expectation of other relevant similar properties existing. If, however, we introduce properties that are not shared but which are relevantly comparable, the epistemic probability of the conclusion will go down (let us call this formulation C):

(1) A watch exhibits means to end relations

(2) A watch exhibits coherence of parts

(3) A watch is made partially of materials not found naturally occurring (glass)

(4) The heart exhibits means to end relations

(5) The heart exhibits coherence of parts

(6) The heart is made entirely of materials found naturally occurring

(7) A watch has mind or intelligence as the cause of its design

(8) Therefore the heart has mind or intelligence as the cause of its design

In this case, the disparate nature of premises (3) and (6) render the conclusion (8) less epistemically certain than in formulation (A) above. It ought to be abundantly clear that the content of the premises in an argument from analogy directly lead to the epistemic probability of the conclusion's being true; that is, that the two objects or events being compared are similar in some unobserved (at least in the one case, here the heart) feature. Since there is at least this one difference in fact, Paley's example will fall in the case of a theory appearing that fully accounts for all naturally occurring objects, or at least for all objects made entirely from natural materials and without the special case of human interference.

Perhaps the best-known example of apparent design in biology is that of the eye. Paley used the eye in Natural Theology[11]; Darwin devoted much time to it in On The Origin of Species[12]; and Richard Dawkins has contemporarily used it in great detail in a number of books, perhaps most importantly in The Blind Watchmaker and Climbing Mount

[11] Paley; Natural Theology; pg
[12] Darwin, C.; On the Origin of Species;

Improbable[13]. The eye is a marvel of nature - without it, entire concepts would be non-existent, for instance visual depth, colour, much of art and so forth. The eye allows that which possesses it more freedom in its world; it enhances the richness of experience; and is itself an object of aesthetic appeal (one need only point to the famous National Geographic cover picture of the Afghan girl for proof of this contention). As the saying goes, "the eyes have it".

Dawkins waxes lyrical about the eye in his inimitable fashion, devoting an entire chapter (of ten *in toto*) to it in Climbing Mount Improbable. Not for nothing does he do this - after all, as he is quick to point out, the eye gave Darwin himself immense difficulty. Dawkins indicates the magnitude of the problem posed by the humble eye when he mentions that there exist nine identified principles on which eyes operate in the animal kingdom and that at least forty different instantiations of eyes such that each might be supposed to have evolved independently. It is enough for us to consider the example conceded by Dawkins to be the most complex and thus the most in need of explanation, that of the human eye itself.

The human eye consists of iris, lens and retina in order from front to back. Light rays bounced off objects in our path enter the eye through the cornea and are focused through the lens on to the retina at the back of the eye, from whence the optic nerve transfers the upside down image to the brain, which processes the image into a right side up picture - which is what you actually register as "seeing". Of course, that is the barest description of

[13] Dawkins, R.; The Blind Watchmaker; Longman, Harlow (1986)
Climbing Mount Improbable; Penguin, London (1996)

the function of the eye. It is considerably more complex than that. The process is more accurately (yet still in layman's terms) described as follows: light rays bounced off objects in our path and within our field of vision enter the eye through the transparent cornea. the light rays pass through the aqueous humour, a water-filled sac before entering the aperture formed by the pupil and passing through the lens. The lens focuses the light on its journey through the vitreous humour - the jelly-filled bulk of the eye - and on to the retina. Rods and cones, being light-sensitive receptors concentrated in the retina, then conspire to send the upside down image of the object via the optic nerve and a tortuous route to the image-processing centre in the brain. All this is possible because the eye is held semi-rigidly together by the sclerotic layer (the white of the eye) which in turn surrounds the choroid layer of blood vessels, which non-reflectively tint the inside of the eye to prevent light from bouncing around once it has passed through the lens. The shape of the lens itself is controlled by the ciliary muscles whilst the transparent conjunctiva protectively covers the white of the eye.

Although one does not require knowing all this in order to understand that the eye functions - and very well at that - amateur photographers might well see (note how ubiquitous the use even in metaphor of this function) the very close and famed resemblance of the camera's means of operation to that of the eye. A camera is a rigid box equipped with a diaphragm to narrow and widen the aperture (on a decent camera in any event) so as to let in more or less light, through a transparent, focusing lens and then said light is cast on to a light sensitive film. This film is later transported by circuitous routes to a photographic developing centre (I am assuming this to be a standard rather than a

Polaroid camera). The analogy should by now be obvious. The interesting point to note however is that when Paley wrote, there was no such thing as a camera, let alone one with an adjustable aperture! So where then the analogy, one might ask? The analogy might as well be to a watch, as with the heart earlier. All that is required for the argument to go through is that there exists an analogy that can be made from some part of nature to some artefact. The watch will suit us fine - much as it did Paley. However, since we have in hand the camera, so much more similar in actual operation as well as in principle of operation to the eye, I utilise it. I do not think that this constitutes an assumption of the conclusion – although the critic could point out that the camera is simply based on our observation of the human eye and that as a direct mechanical copy it is hardly surprising that the eye so closely resembles the camera! Rather, this particular analogy brings home the point with some force that objects that demonstrate this relation to those artefacts bear the marks of design. Standardizing the argument constitutes formulation A1:

(1) A camera exhibits means to end relations (viz. it exists to take images)

(2) A camera exhibits coherence of parts (viz. were there no aperture, there would be no picture; likewise were there no lens etc)

(3) A camera consists of at least certain parts (viz. the aperture, lens and film)

(4) A camera specifically manipulates light rays to form images

(5) A camera has mind or intelligence as the cause of its design

(6) An eye exhibits means to end relations (viz. it exists to see)

(7) An eye exhibits coherence of parts (viz. were any part missing, the eye would function either improperly or not at all)

(8) An eye consists of at least certain parts (viz. the cornea, lens and retina)

(9) An eye specifically manipulates light rays to form images

(10) Therefore the eye has the mind or intelligence as the cause of its design

A1 is deliberately formulated to be lengthy, to illustrate the high epistemic probability associated with the analogy. That is to say that the similarities between the camera and the eye are so many and so close that it is epistemically more probable that the conclusion goes through - that is, that the eye is, as with the camera, a product of intelligent design.

1.4) Hume

In this section I shall examine Hume's apparent refutation of the design argument as given in Parts Two through Eight and Twelve of the Dialogues Concerning Natural Religion[14]. It is commonly held that Hume refuted the design argument, showing that it relied on a ridiculously weak analogy. This was not Hume's own conclusion, although the reasoning is his. He found the design argument to be weak, not fallacious. This is brought out clearly in Part Twelve of the Dialogues. In this section, I first give the argument as Hume formulates it. I then discuss Hume's broader position on religion so as to set the stage for my argument that Hume did not refute the design argument.

1.4.1) Cleanthes' Argument

[14] Hume, David; "Dialogues Concerning Natural Religion" in Tweyman, Stanley (ed.); Dialogues Concerning Natural Religion: In Focus; Routledge, London (1984).

In Part Twelve of the Dialogues[15], Cleanthes first presents the design argument. I quote:

> "Look round the world: Contemplate the whole and every part of it: You will find it to be nothing but one great machine, subdivided into an infinite number of lesser machines, which again admit of subdivisions, to a degree beyond what human senses and faculties can trace and explain. All these various machines, and even their most minute parts, are adjusted to each other with an accuracy, which ravishes into admiration all men, who have ever contemplated them. The curious adapting of means to ends, throughout all nature, resembles exactly, though it much exceeds, the productions of human contrivance; of human design, thought, wisdom, and intelligence. Since therefore the effects resemble each other, we are led to infer, by all the rules of analogy, that the causes also resemble; and that the Author of Nature is somewhat similar to the mind of man; though possessed of much larger faculties, proportioned to the grandeur of the work, which he has executed. By this argument *a posteriori*, and by this argument alone, do we prove at once the existence of a deity, and his similarity to human mind and intelligence."[16]

Following Tweyman, we can put the argument into standardized form as follows[17]:

(1) P1, P2, P3...Pn have A

(2) P1, P2, P3...Pn have B

(3) Q has A

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[15] All reference to Hume's Dialogues is to the Dialogues Concerning Natural Religion.
[16] Hume; Dialogues; pg 109.
[17] Tweyman, Stanley; "Introduction" in Tweyman (ed.); Dialogues Concerning Natural Religion: In Focus; pg 5.

(4) Q has B

(5) P1, P2, P3 have C

(6) Therefore Q has C

Legend

P = human artefact

Q = the universe

A = means to ends relations

B = coherence of parts

C = mind or intelligence as cause of design

The argument as set out here certainly seems to be one from analogy. Given like effects, we infer like causes. However, we must ask if Hume has properly characterized either the design argument as advanced by natural theologians or in general form. I describe the form of the design inference in **Chapter Three**, where I shall return to the question of Hume's characterization of it as an argument from analogy. It suffices for now to say that he has adequately characterized the argument previously formulated by the Greeks and natural theologians and somewhat later best formulated by Paley. We must then examine Hume's conclusions as set out in the Dialogues regarding this argument; but first it will be appropriate to examine Hume's broader position on theological issues and the context of the Dialogues.

1.4.2) Hume's Position On Religion

It is not at all obvious from his work that Hume was an atheist, as has been claimed[18]. Hume did not publically profess to be an atheist. This is no bar to the claim that he indeed was; advocates of this view claim that, given the times (Hume lived 1711-76), he was not able to profess to being an atheist as to do so would cost him academic appointments and popularity. As it was, the only academic position he ever applied for was refused him, with the background charge of his being an atheist. It is certainly true that Hume's views were sceptical and damaging to the religious orthodoxy, but neither makes one an atheist. At the most we might label him an agnostic (although the term had not yet been-coined). The usual evidence advanced in favour of his being an atheist is that his anti-religious views are hidden behind the mask of irony and in the subtleties of the form that he adopted to write much of his work on religion, that of the dialogue. This is an *ad hoc* claim in my view - it is all to easy to claim that underlying an argument is a barbed shaft aimed at whatever, or a malicious motive. On Hume's own principle of ascribing only the causes strictly necessary to produce the effects, we are not justified in stating that Hume was an atheist whose apparently favourable (to religion) comments in places are only clever jibes and foils for his serious work of undermining religion.

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[18] Support for my independently-formulated argument can be found in Yandell, K.; "Hume on Religious Belief" and Nathan, G.; "The Existence and Nature of God in Hume's Theism" both in Livingston, D. & King, J. (eds); Hume: A Re-evaluation; Fordham University Press, New York (1976). Yandell argues that Hume's views cannot be put into the mouth of any one of the speakers in the Dialogues; and that in the end Hume is a kind of agnostic who believes the nature of God to be mysterious. In other words, Hume according to Yandell believes in the existence of some "God" being, but leaves it open as to exactly what kind of being this is. Nathan argues that Hume falls under the broad head of deism. Given that deism at the time incorporated a number of divergent positions, Hume's views were deistic in this broad sense, but sufficiently different to those of others to be considered on their own merits. As Nathan, I believe correctly, points out, Hume considered himself a "genuine theist". Further support for my thesis may be found in McLaughlin, P.; Philo's Embarrassment: Hume's Argument from Design; unpublished paper.

In his A Letter from a Gentleman to His Friend in Edinburgh[19], Hume explicitly defends himself against the charge that he is an atheist, the occasion for this being the loss of that very chair he had applied for. Since the opportunity to gain the chair was past, it seems incorrect to argue that he was seeking to hide his real views so as to secure a position. The charge of atheism leveled against him in his own day and which has come down to us as common historical and philosophical wisdom was simply a dirty ploy by his philosophical opponents (who were mainly theologians and clerics - many if not most of the academics of the day being so). The revolution in philosophy that Hume aimed at inciting and which he indeed did was not to the taste of his opponents; the attack *ad hominem* seemed the only or best way to prevent this revolution. In the full course of events, it has been shown not to have succeeded in the primary and implicit aim of preventing the revolution; it has unfortunately succeeded and continues to in the subsidiary and explicit aim of discrediting the man.

The importance of this view of Hume the man will become clear in short order when, as I indicated, I will argue that Hume did not claim to have refuted the design argument. For now it suffices to say that the view of Hume as atheist has informed the interpretation of Hume's treatment of the design argument in the Dialogues in a negative fashion. Working from the premise that Hume was an atheist, many commentators have claimed that Hume, mainly in the voice of Philo the sceptic, shows the design argument to be a non-starter. These commentators work in a circular fashion, their view of Hume justifying reading him as atheist and this in turn justifying their view of him as atheist.

[19] Hume, D.; An Enquiry Concerning Human Understanding with a Letter from a Gentleman to His Friend in Edinburgh and Hume's Abstract of a Treatise of Human Nature (2nd ed.); Hackett, Indianapolis (1993).

This view runs into the major problem of having to interpret the whole of the Letter from a Gentleman as tongue-in-cheek or sheer deception; the better reading, I submit, is that it is the impassioned defence of a man misunderstood by his peers. Further, the view of Hume as atheist requires a rather remarkable *ad hoc* turn around in Part Twelve of the Dialogues - certainly if one reads the sceptic Philo as Hume's voice - when Philo states plainly that he believes in a divine being[20]. Apart from these major areas of concern, there are numerous other occasions in Hume's writings when he quite clearly states that he holds what he calls a "genuine theistic" belief[21]; and not one instance where he claims to be an atheist. I believe that Hume was intellectually honest and courageous enough not to blatantly misrepresent his own position, especially on so important an issue as religious dogma.

As regards the Dialogues themselves, Hume writes them, as the title aptly indicates, in dialogue form. There are particular nuances that may be observed in this style, peculiar to the eighteenth century when Hume wrote[22]. However, it is not apparent that the particular nuance of style justifies the thought that Hume was playing a deceptive hand. Bell argues[23] that what is absent from the Dialogues is any real talk of natural religion itself; but this seems patently absurd.

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[20] Hume, Dialogues; pg. 172.
[21] Yandell in Livingston & King; Hume: A Re-evaluation; pg. 113.
[22] For an interesting analysis of Hume's use of dialogical form, see Bell, M.; Writing and Philosophy: Hume's Dialogues Concerning Natural Religion; unpublished paper.
[23] Bell; Writing and Philosophy; pg. 11

1.4.3) Hume's Conclusion on the Design Argument

As I indicated in Section 1.3.2), the sceptic Philo seems to undergo a major change in his position on the design argument in Part Twelve of the Dialogues. Philo states plainly that it is the impression on his senses of design in the world that makes him a theist:

> You in particular, CLEANTHES, with whom I live in unreserved intimacy; you are sensible, that, notwithstanding the freedom of my conversation, and my love of singular arguments, no-one has a deeper sense of religion impressed on his mind, or pays more profound adoration to the divine Being, as he discovers himself to reason, in the inexplicable contrivance and artifice of nature. A purpose, an intention, a design strikes every where the most careless, the most stupid thinker; and no man can be so hardened in absurd systems, as at all times to reject it.[24]

What is particularly striking is the use of the word "inexplicable". Is Hume suggesting that, at base, design in nature is not subject to the usual scientific mechanisms of explanation? If so, is Hume not saying precisely what Paley said some years later? Certainly, Hume does not conclude that the design argument is untenable. Rather, he concludes that, although not sufficient to demonstrate the existence of a designer through the use of formal premises and conclusion, it is nonetheless robust enough to survive logical attack due to its appeal to **common sense**. Even the greatest sceptic – even one so great as Philo – must admit that the design argument strikes him as somehow plausible, even in the face of growing

[24] Hume; Dialogues; pg. 172.

information. Quite clearly, then, the design argument is characterised by Hume as an inference to the best explanation when scientific explanations – despite their cleverness – have all failed.

Bell argues that Hume's conclusion is that divine **providence** is not necessary to account for the existence of apparent design in nature. Despite his (Bell's) brave attempt to suggest that this means that there is no place for the Divine in such explanations at all, this is not **Hume's** position. No amount of pottering about after the fact – with evolutionary theory in hand – can suggest that Hume foresaw the demise of an argument he clearly thought universal to all rational thinkers.

1.5) Darwin and Neo-Darwinism

If as I have argued in **Section 1.4** Hume did not in fact refute the design argument and it continued to have a fruitful intellectual life, it is nonetheless not the case that it enjoyed dominance into the twentieth century. The change in the fortunes of natural theology can be dated quite precisely to the reading of their joint paper by Alfred Russell Wallace and Darwin to the Linnean Society of London on July 1st 1858. By August 20th of that year, a joint paper was published; and in order to upstage (or prevent himself being upstaged by) Wallace, Darwin rushed On the Origin of Species to publication by November 24th 1859. Wallace and Darwin, although today we recognize mainly Darwin, had presented what had eluded theorists for generations, namely a workable mechanism for evolution. Evolutionary theory was nothing new; Lamarck and Malthus had already set the stage for

Darwin by the turn of the 19th century. However, natural theology in Britain (and teleomechanism in Germany, although I will not discuss this) had weathered the storm with regard to these early evolutionary hypotheses. This was mainly because these evolutionary hypotheses did not present any viable explanation as to how traits spread within a population or speciation occurred. Darwin (henceforth I will refer only to Darwin and not Wallace, for reasons that I will adduce in short order) presented a workable evolutionary mechanism: random variation combined with natural selection.

Although it would go beyond the scope of this thesis to fully describe, defend or attack Darwinism, it is important to note how and why it was that Darwinism came to dominate biological thought in the latter half of the nineteenth century at the expense of natural theology. Dembski argues after Johnson that Darwinism as an evolutionary theory did not make much ground until into the Nineteen-Thirties. Dembski cites Chauncey Wright in this regard: "It would seem, at first sight, that Mr. Darwin has won a victory, not for himself but for Lamarck."[25] Instead, Dembski and Johnson claim that Darwin was responsible for introducing within his lifetime the framework of methodological naturalism within which the scientific orthodoxy has worked for the last one hundred and forty years. It was the idea that in principle everything in the natural and observable worlds (the two are not identical[26]) is explicable in purely natural, mechanistic terms that Darwin not only popularized but made possible - hence Richard Dawkins' (in)famous statement, "...although atheism might have been logically tenable before Darwin, Darwin

[25] Dembski; Intelligent Design; pg. 84.
[26] Physics deals with the world at its lowest levels; yet not all of the entities postulated in physics are observable. Some are not even observable in principle, such as dark matter.

made it possible to be an intellectually fulfilled atheist."[27] The contention then is that Darwin's revolution was not in evolution, but in the metaphysics lying behind science. Only later, with the discovery of the work of Mendel in the field of genetics, did Darwin's mechanism come to be fully described and accepted by the scientific orthodoxy. The relevance to natural theology is that on both counts Darwinism put paid to the school of Paley, Reid and company. With methodological naturalism came an obvious aversion to appeals to the strictly metaphysical; Occam's Razor effectively became the watchword of science. The irony - that a Christian scholastic should provide the tool most devastating to Christianity and theism in general - is evident. No more was it allowed to appeal to God as an explanation for the apparent complexity in life, even if there was no suitable alternative and only purely naturalistic theory to account for these phenomena. Essentially, by redefining what counted as the "scientific method", the methodological naturalists defeated the end of the natural theologians to find proof of God according to the "scientific method". With the fashion to deny the explanatory necessity and efficacy of God also came the need to posit an alternative theory. Darwin's was the best of a possibly bad bunch; and since he had begun the revolution, it was only fitting that in him the naturalists found their man.

In adopting Darwinism, biologists were getting a theory that could indeed explain many instances of apparent design. The theory of evolution posed by Darwin certainly dealt successfully with many of the questions posed by the fact of evolution. That evolution is a fact is in any analysis clear. The breeding by humans of dogs, for instance, is an unequivocal demonstration of the selection of traits thrown up randomly. Nature of

[27] Dawkins; The Blind Watchmaker; pg. 6.

course does not make a selection in the same way; but in suiting the dog for say hunting duck, the human breeder is not doing anything that different to nature's 'favouring' dogs with the same applicable traits in areas populated by duck. That certain dogs are curiously suited to hunting duck is therefore no surprise - some, in turn, are the product of human intervention, whilst the others are the product of environmental pressures. The apparent adaptation of means to ends in the dog as an entire organism - viz. its stamina and speed, its sense of smell and hearing, its teeth and ability to swim and so forth, all suited to hunting duck - is perfectly explicable in purely natural terms. It is necessary that, given the environment certain dogs find themselves in, they adapt to that environment. In so far as they do not, they will become extinct. Since individual dogs cannot adapt within their lifetime and then pass behavioural traits on - contrary to the theory of Lamarck - nature selects, as it were, the physical traits that suit the dog to the conditions and ensure that those traits are reproduced through the simple expedient of those dogs most exhibiting the trait being the most likely to breed successfully. This is the core of the Darwinian theory; it provides, as I have argued above, a purely naturalistic account of how differences arise within species; and taking such development to its logical conclusion would appear to account for speciation.

The reason that this apparently aesthetically pleasing, rounded theory did not have immediate popularity was that the mechanism by which physical traits were passed on was unknown to the science of the day. Only with the discovery of Mendel's work did such a mechanism - genetic theory - become available. Given that, in the Nineteen Thirties, Darwinism's successful overturning of natural theology as the premier theory

accounting for apparent design in nature was assured. That Darwinism did supplant natural theology need hardly be argued for; the alternative advanced against Darwinism in the last (twentieth) and into the present century has tended to be not natural theology (or its hallmark of intelligent design) but literal creationism. In the Scopes "Monkey Trial", the Arkansas and the Louisiana cases, legislation protecting or promoting literal creationism was struck down[28]. The academically respectable theories of natural theology were not even at question. The victories, both legal and moral, that evolutionary theory obtained were not then particularly convincing, being against the straw man of literal creationism. That this straw man is set up by non-evolutionists themselves does not render the victories of the evolutionists any less hollow; but the fact that must be accepted is that evolutionary theory has won out as the scientifically accepted theory. Darwinism has also come down to us as popular folk knowledge, sometimes in forms as damaging as social Darwinism. All this may be adduced as evidence that Darwinism indeed became, over the period 1859 to 1940, the dominant theory of the development of all forms of life on earth. The promise of Hume, as some have seen it, was fulfilled in Darwin. Natural theology, or at least its central claim about life, namely that it is the product of intelligent design, is only now reviving.

[28] The trial of John T. Scopes, famously filmed as Inherit the Wind in 1960, occurred in 1925 when Scopes voluntarily faced prosecution for teaching evolution to scholars. It constituted a moral victory for proponents of evolutionary theory. The Arkansas Balanced Treatment Act 590 was struck down in 1981 as unconstitutional, since it effectively advances the interests of a religion, viz. Christianity. The similar Louisiana Creationism Act of 1981 was struck down in 1985 for the same reasons as in Arkansas. For a brief but informed discussion of all three, see Berra, T. M.; Evolution and the Myth of Creationism: A Basic Guide to the Facts in the Evolution Debate; Stanford University Press, Stanford (1990).

1.6) Conclusion to the Chapter

I have argued that the design argument was forcefully put forward by the natural theologians as typified by William Paley and that it was the dominant thesis in biology for the period roughly 1660 to 1860. The contribution of Hume in the mid-1700s, contrary to the received wisdom, did nothing to shake the foundations of intelligent design. Rather, Hume demonstrated that the conclusion of the design argument was not the God of Christianity, but simply an intelligence of the necessary degree and power to account for the instances of design used to infer the existence of that designer. The design inference as an argument continued to enjoy considerable vitality into the mid-1800's; it was only the advent of Darwin that brought an end to this explanatory hegemony. With Darwin came a new kind of metaphysical framework within which scientists would operate, namely that of methodological naturalism. This ruled out *a priori* any reference to intelligence as a causal factor in nature, putting paid to natural theology as a properly (on the new definition) scientific theory. More to the point and more legitimately, however, Darwinian evolutionary theory - random variation plus natural selection - provided an alternative that accounted for the facts while remaining within the framework of methodological naturalism. It appeared as if the design argument had met its match and sunk along with the ship that had carried it as intellectual cargo - natural theology. That this - that is, the demise of the design argument - was in fact not the case, I shall demonstrate in the following chapters with reference to the revitalized theory of intelligent design. I shall argue that, since as shown Hume did not rule out the validity of design arguments; and since Darwinian evolution is an empirical

thesis that can be falsified or found wanting on empirical grounds; the design argument remains a robust means of explaining the appearance of design in the world. The metaphysical commitments of scientists are not pertinent to this project; neither was it valid to define design out of existence by adhering to one particular such metaphysical commitment. I shall therefore give intelligent design the fair hearing it deserves and examine it on logical and empirical grounds rather than simply on the basis of my metaphysic.

2) DEMBSKI AND THE FORMULATION OF THE DESIGN INFERENCE

2.1) Introduction to the Chapter

In this chapter, I explain William Dembski's formulation of the design inference. Dembski puts it to us that there are only three explanatory apparatuses available in the attempt to explain the occurrence of any phenomenon. These three are regularity, chance and design. This he believes is an exhaustive and exclusive list. The order as given is a trumping order; that is to say that, given a regularity explanation, chance and design are excluded; and that we look first for a regularity explanation. There are some problems regarding Dembski's use of certain terms, especially his use of the term 'regularity'. I shall explain his peculiar use of these terms in their relevant sections. Furthermore, it is not self-evident that Dembski's list is exhaustive, although it seems the explanations are clearly mutually exclusive. I shall examine whether Dembski's categories are constituted broadly enough to incorporate other possible explanatory apparatuses and if so, whether they are then too broad. It is first necessary however to understand the notion of probability that Dembski bases his discussion of explanations on.

2.2) Probability

Dembski distinguishes between three levels of probability, namely high, intermediate and small probabilities (HP, IP, & SP). He maps each of these levels on to an appropriate explanatory mechanism. Dembski believes - and I agree - that by identifying the probability of X occurring, we can move towards identifying the correct mode of explanation for X occurring. It is necessary to explain the distinction between these different levels of probability before addressing the various modes of explanation. It seems at first that any distinction of high from intermediate from low probabilities is going to be purely arbitrary. At what point do we say that a probability cannot count as high, but must rather count as intermediate? It seems that any line drawn must necessarily be somewhat pedantic: if we draw this particular line at 0.75 (where this constitutes the lowest of the high probabilities), it seems absurd that a probability of 0.74 is intermediate. The practical difference between 0.75 and 0.74 seems negligible. On the other hand, even smaller differences (not necessarily between probabilities) are practically massive. There is less than 6% difference between the genetic code of the higher apes and humans[29], yet at the macro-level we are sufficiently differentiated such as to provide simple recognition of our being human and their not being human. It appears necessary to make the distinction because Dembski will use the probability of an event's occurring to indicate the correct mode of explanation. If we are, on his account, to identify that explanation, then we must first be sure of the probability of that event's occurring. In some cases, the assignation of a probability to a range (viz. HP, IP or SP) will be simple. It is the border line cases in which some analysis of the above-mentioned ranges will be useful.

[29] http://home.christianity.com/ministries/workplace_culture/scienceministries/43298.html last accessed 15 February 2003.

2.2.1) Subjective and Objective Probabilities

Part of the difficulty in assigning probabilities to events lies in the study of probability not being an exact science. There is always an element of guesswork, albeit educated, involved in assigning a probability to an event. Probability theorists are not necessarily going to agree on the exact probability ranges to be assigned to events as important and controversial as the beginning of the universe, the origin of life or the complexity of certain organs. There is the added problem of competing methods within probability theory - classical and Bayesian - between which one must decide in assigning probabilities. In the sections following, I discuss subjective and objective probabilities as they stand in classical statistical theory. Since I propose to use classical theory, I rely on Dembski's critique of Bayesianism, which holds it as being largely irrelevant to the design inference.

2.2.1.1) Bayesian Probability

As Dembski argues, Bayesianism is particularly suited to the comparative analysis of hypotheses. As more and more evidence comes in, the probabilities of the hypotheses change according to whether the evidence favours the given hypothesis or not, according to the formula[30]:

[30] http://members.tripod.com/~Probability/bayes01.htm last accessed 15 February 2003.

$$p(A_i|B) = \frac{p(B|A_i)\,p(A_i)}{\sum_i p(B|A_i)\,p(A_i)}$$

According to the weight of evidence we have 'in' at any given time, we assign different likelihoods to the truth of a hypothesis. As mentioned above, this constitutes a useful method of comparing hypotheses. Probabilities assigned prior to receiving the evidence are altered according to that evidence. It is relatively simple to determine which hypothesis is the better - that which continues to account for the phenomena in the light of increased evidence; or that which suffers the least change in probability over an extended period of time. Once one hypothesis is demonstrated to be consistently better able to predict phenomena, rival hypotheses can be relegated with a degree of certainty proportionate to the difference in success between the best and these lesser hypotheses. This procedure is exactly in accordance with Hume's injunction to apportion our belief proportionally to the evidence, or the cause to the effect.

However, this process of deciding between rival hypotheses based on their proportional ability to describe and predict phenomena - in other words, to operate on the scientific method - is not relevant to the design inference. The design inference is precisely called on when none of the rival (scientific) hypotheses can account for the phenomena under investigation. The design inference is warranted when the rival methods and theories within the scientific orthodoxy are not able to produce a single clear explanation. The design inference then eliminates these hypotheses and turns instead to design as an explanation. So as Dembski puts it, the Bayesian method is mainly comparative, but the

design inference is eliminative. The design inference does not involve the continuous weighing of hypotheses, but rules hypotheses out as being explanatorily ineffective, in so far as no one of these hypotheses has any better claim than another to being the correct hypothesis.

The Bayesian mechanism is then ruled out as being irrelevant to the work of the design inference and we fall back on classical probability theory. I discuss the role of subjective or epistemic probabilities and the role of objective or real probabilities in the following section.

2.2.1.2) Subjective and Objective Probabilities

Brian Skyrms has produced in Choice & Chance[31] an excellent introduction to the field of probability and induction. I propose to use this as the basis for my discussion of subjective and objective probabilities.

If we wish to evaluate the probability of an argument's being true, we have at least three types of probability to assign the argument. These are certainty, inductive probability and epistemic probability. Certainty means that the probability of the arguments' being true is 1. It is impossible for the argument to be incorrect. This occurs when a deductively valid argument is based on true premises. Such an argument's conclusion provides no information not already contained (perhaps implicitly) in the premises; for the conclusion to be false would contradict the truth status of at least one of the premises.

[31] Skyrms, B.; Choice and Chance: An Introduction to Inductive Logic (3rd ed.); Wadsworth, Belmont (1986).

Therefore, a valid deduction based on true premises must render a true conclusion. The probability of this is 1 or certainty. For example, we may consider this:

Premise 1: Whenever it rains there are clouds in the sky

Premise 2: It is raining

Conclusion: Therefore there are clouds in the sky

The true premises of the argument render the conclusion necessarily true. The argument is both formally valid (the conclusion follows directly from the premises) and true (rain indeed requires clouds in our world). This probability is of the objective type. It is not subject to varied information or the vagaries of the human experiment – the probability involved is 1, only 1 and must be 1, whether or not there are any minds to concern themselves with that fact about the world.

An inductive argument (or inductively probable argument) is one that is not formally valid but which nonetheless can produce a true conclusion. The premises, although they do not necessitate the conclusion, make it likely. Analytically the argument is fallacious; synthetically it may be true. Consider this example:

Premise 1: It hardly ever rains in the desert

Premise 2: This is a desert

Conclusion: Therefore it is not now raining

Although in all probability it is not raining - this being a desert - it is not necessarily true that it is not now raining. After all, it does rain sometimes in the desert; and given the premises, now is as good a time as any time for it to rain. In our experience, the chance that it rains on any given day is the same (without knowing weather patterns, whether there are clouds or not etc). Any day is as good as any other day for it to rain. However, we also know it to be true that it seldom rains in deserts (that premise is at least analytically true - part of what it is to be a desert is for it not to rain often). There is little chance of our being incorrect in our then saying that it is not now raining. So the conclusion remains probably true, even though the argument is invalid. We would be justified by experience in believing that it is not now raining; and experience is virtually a synonym for induction. Hence it is inductively probable that the conclusion is true.

Skyrms argues that the sort of probability that applies to an argument's being true is an inductive one. That is to say that the probability of the conclusion's being true is based on the assumption of the truth of the premises. In other words, given the truth of the premises, the probability of the conclusion's being true is the inductive probability of the argument as a whole. It appears then that inductive probabilities fall between being objective and subjective. However, given the involvement of minds – necessary for the process of induction to occur, through experience and experiment – inductive probabilities must surely be classified as subjective.

2.2.1.3) Epistemic Probability

Epistemic probability, as the term suggests, is concerned with the believed probability of an event's occurring. Although the actual probability of the event's occurring may hypothetically be subject to determination, it is often the case that premises necessary to reaching such a conclusion are not available to us. In other words, the necessary information required to formulate the true probability of the event's occurring is not as yet available to us and hence the true probability cannot as yet be determined. As the information comes in, we alter our belief in what the probability is that the event will occur. This is the principle on which punters place bets on horses, or bookmakers make the odds. When the bookmaker hears that a certain horse has won it's last two races, he may give it good odds on winning. If the bookmaker then hears that the horse last raced three years ago, at which time it won the two races it ran in, he is liable to lower the odds. The true odds of a horse's winning a given race are to us incalculable – even if the race is rigged, those paid to rig it may fail to do so. However, we can hold an educated opinion as to which horse is, in the ordinary course of events, most likely to win. This is an epistemic probability – it is a belief in the chances of the horse's winning, which is subject to change on the receipt of further information.

The nature of epistemic probability is essentially subjective because the information available to me is not necessarily the same as that available to you.[32] Epistemic probabilities depend on beliefs; and beliefs are usually taken to be subjective.

2.3 Probability Ranges

[32] Skyrms; Choice & Chance; pg. 15 – 16.

2.3.1 High Probability

High probabilities (HP) are probabilities that are close to 1. That is, the closer a probability is to being 1, the more obvious it is that we are dealing with a high probability. When the probability of some phenomenon occurring is 1 - a certainty - then this too counts as a high probability. There is thus no problem in establishing the upper bound of high probability. To say that something must occur is usefully put into probabilistic language by saying that that phenomenon has a 1 probability of occurring. The difficulty lies in establishing the lower bound of high probability, which as indicated above is also the demarcation between high and intermediate probability.

An example of an event of high probability is the chance of the occurrence of thundershowers tomorrow being 99% (0.99). With this forecast, we are certain enough of the occurrence of the event (that it is going to rain) to lay out a raincoat with tomorrow's clothing. Our behaviour indicates that we believe the event is more likely to occur than not, which must finally be the criterion for the event being one of HP. To some extent, induction must play a part in the process of assigning probabilities here. If tomorrow it does not rain, we would not be justified in assuming that we incorrectly assigned an HP to the event. It is neither unbelievable nor statistically anomalous for an event of probability 0.99 not to occur. By assigning a probability of 0.99, we are indicating that in 99 out of every 100 instances of these conditions pertaining, it rains. That on this occasion it does not rain is then catered for. In so far as 99 out of every 100 of such predictions in such circumstances is correct (i.e. it rains), the assigning of an HP is correct. The calling of such a probability 'HP' is also then correct.

2.3.2) Intermediate Probability

Intermediate probabilities (IP) fall between high and small probabilities. I would argue that they tend towards probability 0.5[33]. This is not simply because IP falls between HP and SP. An event of 0.5 probability has, as is obvious, an equal chance of occurring or not occurring. Now, given that I have characterized HP as tending towards 1 and given that I will later characterize SP as tending towards 0, it seems natural that 0.5 be chosen as the 'aiming point' of IP. At 0.5 probability, there is a perfect balance between an event tending towards HP or SP. In other words, it does not tend towards either. It is in this sense that the event tends towards probability 0.5.

An example of an IP event would be the chance of the occurrence of thundershowers tomorrow being 51%. That is to say that in 51 out of every 100 instances of these exact conditions pertaining, it rains. Alternatively, in 49 out of every 100 such instances, it does not rain. The chances of it raining or not raining are practically the same. That is to say that few people would actually be more sure of its raining tomorrow than not. It would not be a clever gambler who bet on an event of 0.51 probability simply in view of the probability being greater than even.

[33] The expression "tend(ing) towards requires some clarification. There is no built-in tendency for a phenomenon to gravitate towards a specific probability. The probability of X's occurring is not teleological at this level; it is not the purpose of X to tend towards, say, 1. Neither is the expression meant to indicate any real movement of the probability towards one of these three points (viz. 1, 0.5 & 0). It simply indicates the probability's lying in a range best characterised by specific reference to one of these three points.

2.3.3) Small Probability

Events of small probability (SP) can more obviously be labelled events of low probability. The use of the term "small" is peculiar given Dembski's use of "high" in HP. If he had termed these "large", it would be proper to call SP events "small". I will henceforth refer to such probabilities as LP, for 'low probabilities'. We can run a description of LP parallel to that of HP. LP events are events that are almost certainly not going to occur. The closer the probability to zero of an event occurring, the greater the certainty with which we can state it will not occur. This will of course always be a defeasible judgement unless the probability is zero. In the case of probability zero, it is accurate to term this a low probability rather than non-probability. The probability can be measured; the measurement happens to be zero. We can then characterize events of LP as tending towards 0. The lower limit of LP is thus easily established - it is 0. Events with probability 0 do not occur; given that events with probability 1 MUST occur, it is symmetrical and unsurprising that events with probability 0 CANNOT occur. The difficulty is in establishing the upper bound of LP, which serves also as the demarcation between LP and IP.

An example of an event of low probability is the chance of the occurrence of thundershowers tomorrow being 1%. This is the sort of probability that does not impact our behaviour at all. No one is liable to prepare for tomorrow raining in the light of a 1% forecast. In fact, I believe we would think somebody who prepared for it raining on the basis of such a probability irrational. It is so much more likely not to rain than to rain that the most reasonable working assumption is that it will not rain.

It is to be noted that I have not attempted to establish what the boundary probabilities (between HP and IP; and IP and LP) are. As a working suggestion, I submit the following: that we draw these lines at 0.33 and 0.66. The logic behind this is simple - we divide the maximum probability (1) by the number of ranges (3, viz. HP, IP & LP) and assign the ranges accordingly. This is at best an artificial attempt to delineate the different probabilities, but renders a consistent position. Since the lines must be drawn **somewhere**, I submit that these are the logical places to draw them. This, which I take to be the best account we can give, will nevertheless result in significant problems for Dembski's account, to be examined in **Section 2.5**.

As previously indicated, Dembski ties probability ranges to specific modes of explanation. HP maps one-to-one on to regularity explanations; IP likewise maps on to chance explanations; and LP maps either on to chance explanations or on to design explanations (where specification is present). Dembski believes that assigning a high probability to an event is nothing short of ascribing its occurrence to regularity; and *mutatis mutandi* with intermediate and low probabilities. I turn now to examine what is entailed by these different explanatory mechanisms.

2.4) Explanatory Mechanisms

2.4.1) Regularity Explanations

A regularity explanation is most strongly simply an appeal to an established law of nature. To say that X occurred due to a regularity is simply to say that X **had** to happen, given the way that the world works and the conditions pertaining immediately before X's occurrence. This is the most robust form of explanation, since it provides a universal sort of explanation: for all or most X in the situation Y, X will occur due to a regularity. Given a regularity, there is no surprise inherent in X's occurring, given that X **had** to occur. Regularity explanations then deal with events whose chance of occurring tends towards 1. For example, when I open a spring-loaded door, it slams shut *ceteris paribus*. I expect it to occur; and it must, given the laws governing force and motion. Since the door's shutting is perfectly explicable using non-intentional language, but is explicable by the language of physics, it is both unnecessary and explanatorily useless to appeal to chance or design to explain how the door shuts. Of course, **why** the door shuts can be explained in terms of my intention to move through it, or in terms of the designer's intention for it to be self-closing, but the actual mechanism of the door is sufficient to explain **how** it closes. We need not have recourse to a chance explanation - it somehow managed to shut itself because of these and those factors - nor to design explanations - it shut because Tommy, hiding behind the door, pulled it shut.

However, it appears that this is not the entire story. Notice that I characterized regularity explanations as being applicable where something **had** to occur, given the conditions pertaining in the world. Immediately the criticism arises that something might occur due to regularity, but that the event did not **have** to occur in any strict sense. It is not as though these events are logically necessary; that they cannot not occur. Rather, given

what we know about the world, if conditions remain as they are, we expect that event to occur. If conditions change, it may well not occur; if they remain as is, the event must occur, given that we have correctly read the conditions and have made an accurate prediction of the consequences of such conditions pertaining. This last statement reveals a rather important element of design inferences - that the assignation of probabilities to events relies rather heavily on a correct human reading of conditions and correct predictions based thereon. Read the conditions incorrectly; and you make an incorrect prediction. Make an incorrect prediction and you assign the wrong probability to an event occurring. Assign the wrong probability and you are liable to eliminate the wrong explanatory mechanism. This seems to be a weakness inherent in probabilistic reasoning and explanatory theory generally, rather than specifically in Dembski's theory. However, he has not accounted for this and it leaves his thesis open to the self-same criticisms of inaccuracy as are leveled at competing theories. The mistake of course can run in either direction - it does not necessarily lead to the positing of design explanations in place of regularity or chance explanations.

It might also not be obvious why regularity explanations trump chance and design explanations. Why ought regularity explanations first be sought? Are they preferable to other explanations? It is important to note that regularity explanations are synonymous with scientific explanations. Science demands a certain rigour in its theories and predictions that, of course, fits hand-in-glove with high probability. If we were to base our weather predictions on a chance or design explanation of why it rains, we would find ourselves constantly outwitted by the weather. An explanation for why an event must

always or usually occur is, due to the consistency of such events, going to be in itself a consistent explanation.

Carl Hempel, the noted philosopher of science, argued in Philosophy of Natural Science[34] that scientific explanations, which he called deductive-nomological explanations or covering laws, trump others in the following terms:

Deductive-nomological explanations satisfy the requirement of explanatory relevance I the strongest possible sense: the explanatory information they provide implies the explanandum sentence deductively and thus offers logically conclusive grounds why the explanadum phenomenon is to be expected.

Hempel freely admits that not all scientific explanations fit this model; but as this is the scientific norm and if it is true that scientific explanations logically necessarily entail the occurrence of the event under examination, then it is clear why scientific or regularity explanations must trump 'mere' inferences.

2.4.2) Chance Explanations

Chance explanations are, after regularities, the most robust. If a regularity is not operating such as to make X, the event under consideration, come about, then we next look to chance to provide an explanation. Chance events have intermediate or small

[34] Hempel, C. G.; Philosophy of Natural Science; Prentice-Hall, Englewood Cliffs (1966).

probabilities of occurring. They cannot have a high probability of occurring, since that would render them regularities. Chance is the proper mode of explanation where neither a regularity nor design can be invoked. So, if our dice come up seven the first time we throw them in a game of craps, we attribute this to chance. Given that we believe the dice to be fair, and given that the chance of the dice turning up seven is 1 in 6, it is not sensible either to believe that they had to come up seven, nor that they were subject to human intervention. Chance adequately accounts for the occurrence, since 1 in 6 is the sort of odds we do not find to be either so small as to suggest design or so large as to indicate a certainty.

A further example is useful. In a theoretical lottery, we at times may see advertised a prize amount of, say, twelve million Rand. Tickets cost two and a half Rand apiece, which is to say that when the jackpot is at R12 000 000, four million eight hundred thousand tickets have been sold. Consider that you hold one such ticket. You might think that you have a 1 in 4 800 000 chance of winning - a pretty slim chance. In fact, the chance of your winning is not based on how many tickets have been purchased, since the winning number is not drawn from the pool of tickets sold. Rather, a random number generator (the ubiquitous air-driven ball selector) produces a six-digit number. This is the winning number. When purchasing one's ticket, one chooses six numbers (from 1 to 49) and writes them on the ticket. If the numbers drawn match the numbers you chose, you win. If more than one person has the numbers correctly, then the jackpot is divided equally between them.

This convolution in effect means that one's chance of winning the lottery when the prize amount is at R12 000 000 is 1 in 10 068 347 520. This is calculated as follows: 49 x 48 x 47 x 46 x 45 x 44 (since the same number cannot be selected twice). So were one to win, the winning would be an event of incredibly small probability. However, a chance explanation is still, it is submitted, the best to account for one's winning. After all, if anyone were to win, the chances of your winning (unless you or other persons had multiple tickets, which for the purposes of the example is prohibited) are as good as anyone else's. So it is much less surprising – were you to win – that you won and not someone else – the chance being 1 in 4 800 000. In fact, it is not much less surprising than that someone won at all- since the chance of there even being a winning ticket is at worst 1 in 2097 (that is, 10 068 347 520 possible winning combinations divided by 4 800 000 possible combinations actually chosen). In other words, the chances of a winning ticket being purchased, in this example, are 1 in 2097. Although the difference in the odds is large, all are the sorts of events that we ascribe to chance – one hopes that one's lucky number will come up; and it is not surprising, considering that everyone who purchases a ticket has a lucky number that they hope will come up, that someone's lucky number really turns out to be "lucky". That is all it is – brute luck; or, in other words, mere chance.

2.4.3) Design Explanations

When an event X has failed to be explained either by regularity or by chance, then, due to the exhaustive and exclusive nature of our explanatory apparatuses, design is by

elimination the proper mode of explaining X. Design explanations are only called on when the probability of X's happening is so small as to necessarily preclude regularity. That is to say that the chance of X's happening must not 'tend towards' 1 for design to be invoked in its explanation. Neither should it 'tend towards' 0.5. In fact, according to the discussion on LP, the probability must tend towards 0. Now, many things of exceedingly small probability happen all the time and it would seem absurd to attribute all of them to design. The chance of **any given** ticket being drawn in a lottery with 10 000 000 entries is only 1 in 10 000 000; that is the chance that my ticket will be drawn and it is the chance that is realised by the winning ticket[35]. The chance that **a** (winning) ticket will be drawn is of course 1 (that is, 1 in 1), since a ticket **must** be drawn. What this example shows is that, although the chance of any given ticket being drawn is in subjective terms very small (1 in 10 000 000, the latter certainly being a large number in any non-scientific use), the event is nonetheless perfectly explicable in terms of chance (after all, some ticket had to be drawn). So there must be some further factor distinguishing events of small probability due to design from events of small probability due to chance. This factor is that of information content or patterned complexity. Dembski terms this specification. The best characterization of this is in terms of algorithms. The length of the shortest possible algorithm that can reproduce a pattern (as it occurs, in this case, in an event or object) measures information content. The longer the algorithm, the less complexly patterned the event or object. At first glance this seems counter-intuitive - surely the longer the algorithm, the more the information content and the greater the

[35] The lottery I am imagining is one where 10 000 000 tickets are available and all have been sold, on the basis of one ticket only per person. The winner is selected by drawing out a single ticket from amongst all the entries, all being in a large rotating drum.

patterned complexity? However, this is not so: consider the algorithm that would capture each of the following 'sequences' of dice rolls:

1) 2, 4, 6, 8, 10, 12, 2, 4, 6, 8, 10, 12, 2, 4, 6, 8, 10, 12, 2, 4, 6, 8, 10, 12,
   2, 4, 6, 8, 10, 12, 2, 4, 6, 8, 10, 12, 2, 4, 6, 8, 10, 12, 2, 4, 6, 8, 10, 12,
   2, 4, 6, 8, 10, 12, 2, 4, 6, 8, 10, 12, 2, 4, 6, 8, 10, 12, 2, 4, 6, 8, 10, 12,
   2, 4, 6, 8, 10, 12, 2, 4, 6, 8, 10, 12, 2, 4, 6, 8, 10, 12, 2, 4, 6, 8, 10, 12.

2) 2, 3, 2, 5, 2, 7, 2, 11, 2, 3, 2, 5, 7, 11, 2, 3, 5, 2, 7, 11, 2, 3, 2, 5, 2, 7, 2, 11,
   2, 3, 2, 5, 2, 7, 2, 11, 2, 3, 2, 5, 7, 11, 2, 3, 5, 2, 7, 11, 2, 3, 2, 5, 2, 7, 2, 11,
   2, 3, 2, 5, 2, 7, 2, 11, 2, 3, 2, 5, 7, 11, 2, 3, 5, 2, 7, 11, 2, 3, 2, 5, 2, 7, 2, 11,
   2, 3, 2, 5, 2, 7, 2, 11, 2, 3, 2, 5, 7, 11, 2, 3, 5, 2, 7, 11, 2, 3, 2, 5, 2, 7, 2, 11.

3) 6, 8, 9, 4, 3, 10, 7, 5, 7, 5, 4, 11, 7, 9, 10, 12, 7, 8, 8, 8, 3, 6, 5, 7, 9, 5, 5, 9,
   6, 10, 8, 8, 11, 5, 12, 8, 9, 7, 5, 7, 6, 7, 10, 10, 6, 11, 3, 12, 10, 5, 7, 7, 7, 6.

In the case of (1) and (2), I simply wrote down actual mathematical sequences of "throws"; (3) I obtained by physically rolling two dice that I presume to be fair (they were expensive dice; and furthermore, they were marked not with pips but with numerals – considered better as pips weight a die such that it tends to fall with "6" showing). The shortest verbal 'algorithms' that will capture these 'sequences are', respectively:

4) Two followed by the first five succeeding even numbers, the whole repeated sixteen times.

5) Two alternating with the first four succeeding prime numbers, the whole repeated sixteen times.

6) Six, eight, nine, four, three, ten, seven, five, seven, five, four, eleven, seven, nine, ten, twelve, seven, eight, eight, eight, three, six, five, seven, nine, five, five, nine, six, ten, eight, eight, eleven, five, twelve, eight, nine, seven, five, seven, six, seven, ten, ten, six, eleven, three, twelve, ten, five, seven, seven, seven, and six.

In the case of the two artificial sequences, they are easily communicated to some third party person who on the basis of this communication could accurately reconstruct the sequence of 'throws' as I have them. There is no need to repeat to them the entire sequence of numbers to accurately reconstruct the said sequences. In the case of the third 'sequence', however, there is no visible pattern (none visible to me at any rate), and therefore no obvious way of producing an algorithm that will allow for accurate reconstruction of that 'sequence'. It is necessary to repeat the entire 'sequence'. What this shows is that the more patterned a given event or object, the shorter the "algorithm" that describes it. In fact, this is even more obvious when one notes that the third 'sequence' is only half as long as the first two, yet has a longer description.

Daniel Dennett in 1991 wrote a seminal paper on patterns titled (in the imaginative fashion of philosophers) Real Patterns. It is to Dennett that we owe the notion of patterning in order to describe what we observe (although the notion is itself much older than that, it is patterning of the Dennettian sort that we are interested in). Dennett employs the concept of the pattern in his quest to drive a middle road through the polarities of modern ontology, namely realism and eliminative materialism. Dennett's project is not our current concern; but the tools that he made to craft his argument are infinitely useful.

In order to describe what he means (and thus what I mean) by the description of information by means of an algorithm, which is shorter when a pattern exists in the information, Dennett sets up the example of the bar code. The bar code is simply a set of printed dots (pixels), consisting of ten rows of ninety dots. The ninety dots are printed as ten black dots then ten white dots, the whole sequence being repeated. The result is that a single printing of "bar code" yields a row of five black blocks separated by four white blocks. This, Dennett puts it to us, is easily recognised as a pattern. More explanation is not needed - its strikes us intuitively as a pattern; things that look like that are called patterns. Dennett then introduces some (pseudo-) random "noise" into the pattern. He presents six sets (called frames) of bar code peppered with noise at percentages ranging from 1 to 50. With 1% noise, some white dots appear in the black blocks and vice versa - but so few as to allow the pattern to be still very easily distinguished. At other intermediate noise percentages, the pattern remains clearly discernible underneath the noise. At 50% interference, however, the pattern (as one might well deduce) is no longer

apparent at all. In fact, there is only noise. In order for the reader to reproduce graphically the pattern of bar code without having seen Dennett's paper, it is necessary only to read the description I gave above. In order to reproduce graphically the noisy sets of bar code, it will take more description. The description I give is certainly shorter than typing out a picture of 900 dots - if only because I did not expend 900 words on that initial description. Yet the reader could quite accurately reproduce the bar code from the description. In order to reproduce bar code with 1% noise I need only add to the description that the dots are to be numbered descriptively from left to right from 1 upwards, reverting to the left of the second row for dot number 91, the left of the third row for dot 181 and so forth. Now I need mention that, say, dots 1, 26, 34, 55, 58 etc are the opposite colour to what they should be; and the reader will be able to accurately reproduce bar code with the same 1% interference as Dennett. To produce bar code with simply 1% noise (that is, with any 9 dots reversed in colour) is even simpler.

Exactly reproducing bar code with 50% noise is a different proposition altogether, for after the description of the pattern, no less than 450 dots must be indicated as being reversed in colour. In other words, the description of bar code is going to be nearly as, as long as, or longer than a 900 dot, dot by dot representation of the bar code - in other words, an exact duplicate of the picture. As Dennett puts it:

> "A series (of dots or numbers or whatever) is random if and only if the information required to describe (transmit) the series accurately is *incompressible*: nothing shorter than the verbatim bit map will preserve the series. Then a series is not

> random – has a pattern – if and only if there is some more efficient way of describing it.
>
> ...
>
> A pattern exists in some data – is real – if there is a description of the data that is more efficient than the bit map, whether anyone can concoct it. Compression algorithms, as general-purpose pattern describers, are efficient ways of transmitting exact copies of (bar code)."

What work does this do in the design inference? The existence of a pattern in a set of data (referring to some or other event or object) of small probability calls for explanation. In the case of a long-algorithm event, no explanation other than chance is possible. As seen in the dice-throwing example, the long-algorithm event is simply a chance occurrence: the sequence in fact was derived from a random process of actual dice throwing. The short-algorithm events - the patterned events - were not the result of chance. This was obvious at first glance; the utility of the reduction to algorithms is that it allows us to detect design in cases less clear-cut than my dice sequences. This is in other words a method of detecting specification. The shorter the shortest possible algorithmic reduction of some large set of data, the more specified is the data. A further example will illustrate the validity of this reasoning.

2.4.4) The Morse Code Example

Contact is lost with an Allied merchantman on the high seas in 1940. Unbeknownst to British Naval Intelligence, a German Q-ship has captured the steamer in question. A

prize crew is put aboard with orders to make for the nearest friendly port. The former crew is held below decks. The British begin a search using aircraft and ships over a large area of ocean centred on the last known co-ordinates of the merchantman. Eventually one of the searchers picks up certain noises, call them X, on their radio-direction finder. X at face value is a random series of short and long sounds. They can be represented as follows:

..; --- ... --. .- -.-- -. --- .-. -.-. .- .--. - ..- .-. . -.. -.-. .-. . .-- .--. .-. .. ... --- -. . .-. ...

As a civilian, one may think X to be nothing more than what it appears: a random set of noises, such as are carried over the ether at all times. However, on the basis of this sequence of sounds, the Allied forces converge on the position of the ship, knowing that it had not sunk and was in enemy hands. How so? The apparent series of meaningless sounds was actually a message in Morse code, tapped out on the hull of the merchantman by the imprisoned crew. It reads as follows:

"SOS. *Gaynor* captured. Crew prisoners."

What does this example purport to show? It is an instance of the design inference at work; and since it is one based on the everyday experience of real people, it can hardly be debated that the design inference has a real application. I will work through the example through answering three questions:

a) Has X occurred, such that it is in need of explanation?

b) Is the probability of X occurring a small probability?

c) Is X specified?

a) As the example is set up, X has occurred; and in a situation (wartime) where the sort of thing that X is (a series of sounds carried over the ether), is in need of investigation (explanation).

b) Given all the sequences of 82 dots and dashes[36] in combination that are possible, the odds of this particular combination occurring are 1 in 6724. That is to say that **any** given combination of 82 dots and dashes has probability 1 in 6724 of occurring. These odds are significantly small – perhaps small enough to itself discount regularity; and since there is no match between the realised combination and any expected natural sequence of sounds (say, whale song), we are licensed to appeal to either chance or design as explanations. Regularity is excluded.

c) Given a working knowledge of Morse code, it is possible to substitute letters for the dots and dashes picked up by the searchers. The substitution turns out to make a sensible sentence in English - one that is not only intelligible, but is contextually appropriate. Given that very few such substitutions of letters into sequences of radio

[36] By dots and dashes I am of course here referring to short and long sounds, as represented above.

noise will result in intelligible, appropriate English sentences, this event is different in kind to events of an otherwise similar nature. Given that the substitution of letters for the noises renders fewer bits than in the entire bitmap (the original message; 37 characters in place of 82), there is a considerable amount of informational content in X. Previously I discussed the existence of patterns where I argued that informational content is directly proportional to compressibility. The current example is just such an instance of significantly compressed informational content. With these two considerations in mind, it can be seen that X is specified.

Given that X meets the three conditions necessary to carry through an inference to design, the Admiralty despatches a cruiser to recapture the merchantman. That the warship indeed finds the steamer **and** finds it to be in German hands **and** finds the merchant sailors in the hold, is proof that the design inference is warranted in this case. If the design inference works in at least one case - as it does - then we have *prima facie* evidence of the validity of the inference. As it is, this sort of example occurs frequently - the situation sketched above is typical of rescue missions of all types. It is the same principle that leads helicopters to drop winch ropes near square metre patches of orange in the forest. Although it is entirely possible that somewhere in the vast coniferous forests of the north there is a full square metre of orange fungi growing on the ground in a place visible to aerial observation, the better and more probable explanation is that it is the lost hiker's safety jacket.

2.5) Formal Statement of The Design Argument

Dembski gives us a symbolic formulation of the argument[37], that I shall call (A):

1) oc(E)

2) sp(E)

3) ch(E) -> SP(E)

4) VX[oc(X) & sp(X) & SP(X) -> ~ ch(X)]

5) ~ reg(E)

6) reg(E) V ch(E) V des(E)

7) des(E)

Legend

oc = occurred

E = event

sp = specification

ch = chance

-> = then

SP = small probability

V = for all X

X = any E

~ = not

[37] Dembski; The Design Inference; pg. 49.

reg = regularity

des = design

From this, claims Dembski, we see that the inference to design constitutes a valid argument within the first-order predicate logic[38]. It indeed is a valid deductive argument, given the exhaustive nature of the explanatory mechanisms Dembski entertains[39]. This then is strong evidence for the usefulness of the design inference as a means of explanation. Events or phenomena can be substituted for E and it can be formally established whether or not they are the result of design. It will be noted that the argument, both in its formal and informal instantiations, does not make any mention of the identity or nature of the designer in turn responsible for the design. It in fact makes no statement at all regarding possible candidates for the role of designer. There is good reason for this, which I shall examine in the following section.

For further reference, an abbreviated form (B) of the three main conditions for a valid design inference is as follows, where premise (3) assumes and encapsulates premises (3) to (6) of formulation (A)[40]:

(1) if oc(E)

---

[38] *Ibidem.*

[39] My thanks go to Dr Ward E. Jones of the Rhodes University Philosophy Department for establishing this. As I indicate in the textual rider, however, the validity of the argument only holds presupposing the exhaustive nature of the premises. Dr Jones pointed this out too. The inference may still be vacuous, even given the valid formulation advanced by Dembski. At worst the argument then is formally valid, but false.

[40] This is not meant as a formulation within the norms of symbolic logic. It is merely a brief description of the steps to be taken in an event's examination such that we could legitimately conclude that design is the proper mode of explanation for that event. To that effect it may be helpful to the general reader who, like myself, is not at home with formal logic.

2.5) Formal Statement of The Design Argument

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3) ch(E) -> SP(E)

4) VX[oc(X) & sp(X) & SP(X) -> ~ ch(X)]

5) ~ reg(E)

6) reg(E) V ch(E) V des(E)

7) des(E)

Legend

oc = occurred

E = event

sp = specification

ch = chance

-> = then

SP = small probability

V = for all X

X = any E

~ = not

[37] Dembski; The Design Inference; pg. 49.

(2) and sp(E)

(3) and SP(E)

(4) then des(E).

2.6) Objections to Dembski

It is appropriate at this point to consider objections to Dembski from various sources. As I have previously indicated, it does not lie within the scope of this dissertation to treat extensively the metaphysical positions undergirding Intelligent Design and its explanatory competitors. However, that there are legitimate concerns that can be expressed regarding Dembski's work is not to be ignored. Although the everyday use of the design inference cannot be denied; and although its efficacy cannot be denied; Dembski's particular formulation of the inference is open to dispute. It would be surprising were it otherwise, given the opposing metaphysical positions informing different views of the explanatory apparatuses available to us.

Sober, Stephens and Fitelson argue that Dembski does not have grounds on which to treat the design explanation differently to chance and regularity explanations[41]. More importantly, they think that Dembski throws the baby out with the bath water[42]. The design filter requires that not only a specific regularity explanation be discounted in order to get to design, but that all regularity explanations be so discounted. Yet if we are unaware of a particular regularity explanation that nonetheless exists, we cannot reject it;

[41] Fitelson, B., Stephens, C. and Sober, E.; "How Not to Detect Design – Critical Notice: William A. Dembski, The Design Inference"; in Philosophy of Science, 66 (September 1999).
[42] *Ibidem* pg. 479.

and if we move on to call on design, we may, despite Debmski's best intentions to the contrary, obtain false positive instances of 'design'. We can easily negotiate our way out of this apparent trap – when Demsbki claims that his filter cannot output false positives, he claims too much. He need not even claim this – much as Behe is later shown to do, Dembski stretches his case a little too far and a little needlessly. It is enough for the design filter to produce mainly positive results for it to be useful; and it is enough given the characterisation of design inferences as inferences to the best explanations, not as the golden road to definite explanations.

I first took issue with Dembski, in **Section 2.3.3**, regarding his use of the term "small probability" in place of the more fitting 'low probability'. I further took issue with Dembski, on more general grounds, in **Section 2.4.1** regarding the explanatory filter and the errors it may generate. However, the concerns seem minor given the general robustness of Dembski's account. Sober *et al*'s criticism is more damaging, but if we look at the design filter less rigorously than Dembski might like and see that it is a form of inference to the best explanation, then there is little problem in Dembski's account.

2.7) Conclusion of the Design Argument

As briefly alluded to in the discussion on the formal statement of the argument, the conclusion of the inference to design is not that God exists. The conclusion of the design inference is not that the Christian God exists, nor that a monotheistic god exists nor

indeed that any god or gods exists. It should be obvious from the formal statement of the argument that any event E - in other words, X (from **Section 2.5**) - is a candidate for being explained by the design inference. The process by which certain events are filtered out ensures that if the correct method of explanation is regularity or chance, then X is duly assigned the appropriate explanation and does not fall under the head of design.

However, it is also difficult to assign the correct explanations to events in the light of it being difficult to assign the correct probability ranges to events. Although false positives ought not to be generated, due to the specification requirement, there is no such guarantee regarding false negatives. It appears that Dembski's account makes light of the difficulty in assigning probabilities and by allowing false negatives weakens the explanatory efficacy of the inference to design.

3) THE NEW EVIDENCE FROM BIOLOGY: MICHAEL BEHE AND IRREDUCIBLE COMPLEXITY

3.1) Introduction to the Chapter

In this section I discuss the biological argument for design propounded by Michael Behe[43]. Behe is a biochemist of some repute who argues that at the biochemical level there is evidence of design; that is to say that certain phenomena at that level are only explicable in terms of design. Behe bases his argument on the concept of irreducible complexity. I will examine what is entailed in this concept, Behe's application of it and some criticisms of his position.

3.2) Functional Explanation or Irreducible Complexity

Before treating Behe's distinctive notion of irreducible complexity I shall briefly explain what I mean by functional explanation, a concept to which I shall constantly refer. A system is explanatorily irreducible if and only if explanatory reduction is no longer possible without forfeiting the applicability of the *explanans* to the *explanandum*. This is to say that a further, lower level of explanation is not possible. The base level of explanation is irreducibly complex if it exhibits a level of patterning sufficient to be termed 'complex', but admitting of no further explanatory reduction. This is not to say that the events, phenomena or objects are not further physically reducible. However,

[43] Behe; Darwin's Black Box

further physical reduction will be at the cost of the explanatory effectiveness of the *explanans*. This is best illustrated by example.

Behe argues that there exist certain biochemical systems, in humans for example, that are irreducibly complex. One example he uses is that of the blood-clotting, or coagulation, system. This system is comprised of various chemical components, to which individual components the system is physically reducible. However, no further explanatory reduction is possible. Although one might reduce the chemical components to their constituent atoms and then to the smaller particles constituting atoms and so forth, one would lose all explanatory efficacy. The reason is simple enough - at this level, there is no longer any applicability to biology, since we are now dealing with physics. The constituent atoms are not sufficiently differentiated from the atoms constituting anything else for an explanation in these terms to be helpful in elucidating the way blood clots.

This then is what I mean by reduction at the cost of explanatory effectiveness. The explanation of any system must retain relevance to the function of that system; otherwise it is no explanation at all of how that system works, but simply another 'black box'. This is a standard anti-reductionist move and is also seen in the work of philosophers hostile to the notion of intelligent design. Michael Ruse for instance argues to this effect in his 1989 collection of essays, The Darwinian Paradigm[44]. Ruse offers some interesting insights into the teleological nature of biology that offer support to my independent thesis. My thesis is that the modern evidence for design coming from biology is in one important sense different to the old evidence available to Paley and cohorts. It is

[44] Ruse, M.; The Darwinian Paradigm;

different in so far as orthodox biological science can no longer hold out hope for a total reduction of explanation such as to exclude design, as design exists at the most basic explanatory level available to biology. My claim is that Michael Behe and others working at the biochemical level are working at the lowest possible level of explanatory reduction that can accommodate function. That is to say that, although further reduction is possible - to the molecular level, to the stuff of physics, atoms and electrons and quarks and so forth - such reduction would, from the point of view of biology, be explanatorily useless since it excludes mention of life. At this level, evolutionary mechanisms cannot maintain a grip, since evolution requires living organisms of some description to work on. That we should not and indeed cannot appeal to physics; that we cannot escape the teleological aspect of biological organisms, is well illustrated by Ruse in the following passage, which I feel is worth quoting at length. I address points as they are made by Ruse; his comments are indented. Please note that omitted portions of text, as indicated by ellipsis, are simply elaborations of points I feel him to state clearly enough in the included portions.

> "The most striking thing about animals and plants, separating them from rocks and lakes and so forth, is that in some sense they work...Organisms do not survive and reproduce just by chance. They do so because their various features contribute to their possessors' success...Seeing, swimming, converting sunlight, these are all things that organisms do to keep going...Thus, in dealing with the organic world, you can ask what 'function' or 'purpose' a part or process plays, meaning how does it serve the end of survival and reproduction. Since rocks and lakes do not survive and reproduce (as self-subsisting, energy using entities) you do not ask about the

ends served by their parts. This end-directed thinking and language about organisms is known as 'teleology'..."[45]

Here Ruse quite clearly brings out the applicability of speaking in teleological terms about the biological sphere and how the physical - by that I mean the non-biologically physical - is different in kind to the biological. Suitable explanations in physics do not necessarily make suitable explanations in biology.

"No one seriously active in science today supposes that the stuff of organisms differs in any significant way from the stuff of inorganic matter. Proportions are different, of course, but everything quick and dead is made up of molecules, which are in turn made up of the same kinds of atoms, and so on. Moreover, today the physical and biological sciences are increasingly being brought into contact, as concepts and theories from the first domain are applied fruitfully to the second...But what about teleology? Is this something necessarily distinctive of biology, or will it vanish with the success of the physical sciences? My surmise is that there is something distinctive about teleological understanding, and that therefore it will not fade away. Or at least, if it were to fade away, something would be lost. As one who has long championed the influences of physico-chemical models of biology, I do not deny that non-teleological analyses of organic phenomena can be given. I accept for instance that much fruitful effort has been devoted to the non-teleological explication of goal-directedness. But, I would argue that if it is insisted that, in the future, only non-teleological analyses be given, then something important in our present understanding in biology would be lost...I doubt, however, that there is

[45] Ruse; The Darwinian Paradigm; pg.

much danger of this loss happening. As the physical sciences have moved into biology, it is they who have had to do the accommodating! There has been no question of eliminating teleology. Rather, the new molecular biology has taken it up with vigour. The notion of a genetic code is as artefact-like as anything in traditional biological science. Molecular genetics emphasizes the distinctive, end-fixated nature of the organic world. It does not deny it."[46]

Obviously, the conclusion that Ruse reaches is not that intelligent design is the correct approach to explaining (apparent) irreducible complexity in living organisms. Intelligent design in its present incarnation did not yet exist at the time of Ruse's writing these comments. However, he clearly supports the metaphysical idea underlying intelligent design, namely that the language and point of teleology is pertinent to biological explanation. This is an important step, since it is exactly the opposite view that holds predominance in science currently. This orthodoxy excludes intelligent design because it excludes - without much reason - teolology in biology altogether.

As talk of teleology is nothing but talk of purpose, or function, we see that there is a proper place for theories that follow a teleological line in biology. Indeed, if we are to account for the existence of functional systems at all, then we need to follow such a line. Ruse points this out clearly; Behe produces such an end-directed account of biological systems; and I agree with both that this is necessary and something particularly suited to biology, if not to physical explanations in general.

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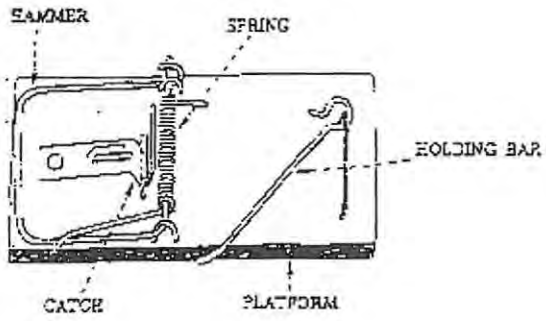
[46] *Ibidem.*

3.3) Irreducible Complexity

It remains fully to explain the concept of an irreducibly complex system, now that we at least know what explanatory irreducibility is. Explaining irreducible complexity is best done in Behe's own words:

> "By irreducibly complex I mean a single system composed of several well-matched, interacting parts that contribute to the basic function, wherein the removal of any one of the parts causes the system to effectively cease functioning."[47]

His example is that of a mousetrap, which requires a number of disparate parts to work; and without every part of which it would cease to function[48]. The attached diagrammatic depiction is Behe's own[49].



[47] Behe; Darwin's Black Box; pg. 39.
[48] Behe is of course referring to that particular item that we call a mousetrap, not to any thing that might catch mice and so in a broad sense be termed a mousetrap.
[49] Behe; Darwin's Black Box; pg.

The mousetrap requires a platform to which the other parts can be attached; without a stable base, the other parts would not stay together in such a way as to trap a mouse, if they stayed together at all. A collection of loose body panels, mechanical components, electrical components, glass, rubber and so forth only constitutes a motor vehicle once assembled. In order to assemble the motor vehicle, a chassis is required as a base (presuming the vehicle is not of monocoque construction). Likewise, the platform constitutes the base of the mousetrap and ensures that the trap can hold together over a period of time and even given the interference of a mouse.

A trigger is also required in order to set the trap off when a mouse interferes with it. If the trap would not go off, the mouse quite obviously would not be caught. It may happen that without a trigger mechanism, the trap would occasionally work just by sheer chance. However, that is not good enough. None of us would buy a mousetrap that the sales assistant assured us would work, but only on occasion; and then only once every two years (say) on average. The trigger is required for the trap to work every time; granted, it may malfunction now and again, but clearly a mousetrap that malfunctions once in two years on average is a better mousetrap than one that only functions once every two years. The latter type will have a sales life approaching nothing; the former has been on the market for decades and will no doubt continue to be. I need not stress the obvious parallel to evolutionary thinking here, as regards natural selection operating as much in the market place as in nature (if such a principle exists in nature).

The mousetrap also requires a hammer with which to pin the mouse and a spring with which to propel the hammer. It is simply useless for a platform to have a trigger mounted on it that in turn connects to nothing. Imagine a nation going to war and equipping its troops with guns without barrels and bullets - every time an enemy approached, the trooper would press his trigger and nothing would happen...leaving the enemy soldier an open shot. Such a gun would not long equip any army; certainly, any army that continued to issue such ordnance soon would be annihilated in modern combat. Likewise, the mousetrap must have both a hammer ('bullet') to strike the mouse and a spring ('barrel') with which to impart the suitable velocity and hitting power to the hammer. Otherwise, on triggering the trap, the mouse could run off happily with the proverbial cheese. Notice too that in our analogy, if the barrel of the gun was not of a sufficient length and the bullet of a sufficient weight, the enemy would not really be harmed. (Air rifles are an example of guns with bullets too small to really harm people). So it is with the hammer and spring of the mousetrap. If the hammer is not large enough to trap a significant part of the mouse; or if the spring is not hard enough to keep the hammer down against the struggles of the mouse; then the trap fails to 'trap' the mouse. A mouse that is hit by the hammer but then runs off is not 'trapped'. Thus it is not only the nature of the parts of the trap that are important, but also certain of the exact properties of those parts and the various relationships between the parts.

The mousetrap then requires at the very least all of these parts; otherwise it is not a trap properly so-called at all. An item that is named 'trap' but fails to perform as a trap is an instance of misdescription. It is the performance of the trap that counts; any combination

of the parts described above that lacks but one of the parts will fail to perform as a trap; any combination of even all of these parts that does not have the correct set of properties in each part and their interrelationships will fail to perform as a trap. Any such set of components would be a failed mousetrap. The mousetrap exhibits irreducible complexity as far as its function is concerned (it can be reduced to molecules and an explanation of its working given in terms of physics, but that would not make a mousetrap minus a part function at all, let alone any better). In fact, Behe can make his case much stronger with the example of the mousetrap. Without every part, it would not even be a mousetrap, but simply a collection of unrelated parts. One cannot label anything a 'mousetrap' simply because one designates that the object so named is a mousetrap. To be a mousetrap, the object has to trap mice - by definition. Be that as it may, we have to agree with Behe that the mousetrap exhibits irreducible complexity on his definition. It is certainly the case that if we remove the hammer (for instance), the trap would cease to function.

What are the implications of irreducible complexity for an explanatory history of the system? Imagine for a moment that artifacts (a mousetrap is an artifact) can evolve by the gradual natural selection of fortuitous random mutations. In the case of an irreducibly complex artifact such as the mousetrap, such a mechanism could not work. At any point previous to that incorporating all the parts of the trap (viz. base, trigger, hammer & spring) a precursor system would not function at all. A collection of three parts (say, trigger, hammer and spring) could not possibly perform the function of catching mice; it is difficult in fact to imagine such a "system" performing any function at all. Now, given that the parts arise singly (say, the trigger, then the spring and then the hammer), there

would be a number of such precursor systems that would need to exist in order for a fully-fledged mousetrap to eventually evolve - in fact, there would have to be at least three such intermediate stages (trigger; then trigger + spring; then trigger + spring + hammer) before the system finally existed in a functioning state (trigger + spring + hammer + base). Yet each and every one of these precursor states would be functionless; that is, they would be unable to catch mice. One would expect the system to be deselected very quickly due to its uselessness. In simple terms, were mice the food of mousetraps, mousetraps having less than the full complement of parts would starve into extinction. The implication then is that there can exist no direct path of evolution in the Darwinian sense leading to an irreducibly complex system. Any possible precursor system would not survive as it could not function; so there can be no precursor systems which lead via slight modifications to the system sought to be explained.

Behe, having established that irreducible complexity exists at least in principle, wishes to argue that certain living organisms exhibit irreducible complexity, at least at some level. It might be thought that Behe cannot argue analogously from the mousetrap, simply because it differs in a vital respect from living organisms, viz. that it is not living. Yet he simply uses the mousetrap to show that the concept of irreducible complexity is valid and in fact, apart from asking us to suspend our disbelief with regard to artifacts being able to evolve, the analogy maps on to instances of apparent design in nature. At least, we must make this our point of departure if we are to make sense of what Behe is claiming.

What does Behe then do to show that the concept is applicable to living organisms? He presents a series of complex biochemical examples, which are intelligible but couched in rather technical terms. They perform the function of showing, ostensibly, that there are systems in humans, for example, that are irreducibly complex, such as the blood-clotting system mentioned earlier. The blood-clotting system is usually referred to as the clotting cascade, because clotting relies on a number of steps rolling into each other. Not only is there a causal chain - one protein activating another and the second protein in turn activating the next - but the system is self-referential. Some proteins apparently need to be activated by proteins they in fact themselves activate!

Perhaps further explanation of this particular system is called for at this point. The example is highly technical; but the point it makes is difficult to ignore through the system's very complication. I will give a very simplified version of the sorts of things that happen when the blood clotting system starts its essential work.

Whilst on tour with the cricket team, you cut your finger in attempting to slice some biltong. The skin is pierced and a blood vessel is ruptured. Being a liquid, and liquids always following the path of least resistance, your blood begins to pour out of the wound. If it continued to do this, you would bleed to death. If you simply sealed the flesh, internal bleeding would still result in your death. It is necessary for the body to deal with stopping the flow of blood out of the blood vessel itself. The best way to do this is simply to solidify the blood - solids do not flow. There is a slight problem here, though. If the entire blood system began solidifying, very soon you would die from lack of

oxygen, since the function of the blood is to carry oxygen to the brain and muscles. So, the clotting process must be localized to the area of the cut. The blood clotting system must then identify the exact location of the opening in the wall of the blood vessel and close the hole, without either solidifying the entire system OR blocking the blood vessel in question with a large clot. The latter course would lead to losing the affected limb or even to cardiac arrest in the case of a major vessel. After identifying the location of the wound, then, the clotting system must seal only the wall of the blood vessel at that place.

As it happens, a certain protein (call it A) identifies the cut, activating another protein (call it B) which in turn activates protein C and so on. The catch is that protein (say) F is also needed to activate protein B, which performs a dual function in the system. In other words, the system has a interdependent parts built into it. Some proteins have multiple tasks, being needed to activate another protein that in turn activates the original activating protein to perform another function. If the system evolved step by step, proteins A and F would have to arise simultaneously in order for protein B to be useful. However, apart from its use in activating protein B, protein F has no function or purpose for existing until proteins C, D and E exist. Even then, proteins G through Z are necessary for the full process of clotting to occur without killing you in the process. No step-by-step development of the blood clotting system can be envisaged or indeed can be possible. In order to be at all useful (and thus not be deselected) the system must be instantiated *in toto*. This is equivalent, in Dawkins' words, to a miracle. Yet, if natural selection cannot explain how the clotting cascade came to be, then we are left with no alternative but to appeal to miracle - or the explanatorily better concept of intelligent design.

The immediate response to this might be that one can hold out for some further development in either natural selection (Darwinian) theory or for further details of how blood clotting works. Neither argument, if either of them can be dignified as such, will work. In the first place, natural selection in principle just means that gradual step by step mutations are accumulated due to their addition to the survivability of an organism over the long term. You cannot alter the theory simply to allow for the existence of such irreducibly complex systems as the coagulation system. Such an altered theory would not be the Darwinian OR neo-Darwinian mechanism at all, but an explanation of an entirely different kind. As regards the second argument, we need to recall the earlier discussion of functional irreducibility and the fact that any further reduction of biochemistry results simply in us moving into the realm of chemistry and physics. At that level, the Darwinian mechanism once again does not get a grip. Natural selection needs something living to work on; mutations do not happen at the level of the tau or neutrino but at the protein level - that is, at the level that biochemistry addresses. We have as full an explanation of the blood clotting system at that level as we need in order to show that it is indeed irreducibly complex. The scientist who holds out for further explanation may not do so for good scientific reasons, but perhaps because they are unwilling to surrender their metaphysical commitment to methodological naturalism. Although a wait and see attitude is appropriate in the field of empirical study (in other words, in any science), observation being the cornerstone of such disciplines; it is not useful where the underlying inability of a scientific discipline to further explain some phenomenon is concerned.

It would be apposite at this point to examine some of the criticisms that have or can be levelled against Behe's theory. The first is a quick logical point of my own; I will then deal with the criticisms by H. Allen Orr; before turning to more concrete concerns that I have regarding Behe's work.

3.4) Responses to and criticisms of Behe

It does not seem to me at all necessary that because some systems partially constituting us as humans are irreducibly complex, that we are then *in toto* irreducibly complex[50]. This would be an invalid form of argument, committing the fallacy of composition. I might equally by the same method point out reducibly complex systems within us and conclude that we are reducibly complex. However, Behe's argument turns on the point that Darwinism imagines a gradual process of step-by-step evolution; and an irreducibly complex system cannot have come about in such a way, since if any part of it were removed it would cease to function. Hence, any precursor system would have been useless and would have been deselected in the evolutionary process. Behe therefore appears to avoid the fallacy of composition.

H. Allen Orr is Professor of Biology at Rochester University, with a primary research focus in the genetics of adaptation[51]. His work on the evolutionary divergence of genes

[50] I introduce this because one possible use of Behe's work would be by creationists. Creationists believe in the literal truth of the creation account given in Genesis 1 and 2. They thus believe in the creation of humans, for instance, as they are *in situ*. The design theorist is not committed to this.
[51] http://www.rochester.edu/College/BIO/faculty/Orr.html last accessed 13 February 2003.

places him in a useful position to take up the Darwinist side of the rope. Orr attempts to avoid the problem of deselection for Darwinian evolutionary theory by use of example[52]. Orr points out that in the case of lungs, they evolved from intermediate stages such as airbladders, which in turn evolved from gills. Orr does not address the problems inherent in the **first** system ancestral to the lung. Surely **that** system would have to be irreducibly complex, at least at the biochemical level (it would seem that **all** biological systems are at base irreducibly complex, because, argues Behe, the cell is irreducibly complex. I shall develop this point later.) Simply postulating another precursor in an infinite regress of ancestor systems is of no use. This would be a transparent and poor attempt to sidestep the issue of explaining how it is that something like a lung (or an airbladder, or gills, or whatever) actually works. Of course, evolution **cannot** explain that, since it is not in the purview of evolutionary theory to explain how living things work, but only how they came to be as we now find them. Other fields of biological endeavour deal with the actual functioning of organisms and their organs.

Orr's central mistake is to confuse a function with a feature necessary for survival. The issue, however, is one of the emergence and continuity of function, not necessity for life. What Orr misses is that if the **function** performed by the lungs were to be removed, the organism would die. In other words, the human being as a whole **could**, after all, be taken as irreducibly complex, needing a breathing apparatus in order to continue functioning as a human being. That is why we die when we stop breathing. To replace the airbladder with a lung is like replacing a Ford Model T with a Mondeo. One may be

[52] Orr, H. Allen; "Darwin v. Intelligent Design (Again)" from Boston Review; http://www-polisci.mit.edu/bostonreview/br21.6/orr.html

more advanced, but they are still performing the same function. I like to think of irreducible complexity as functional irreducible complexity, as elaborated in **Chapter 3.2.** This fits in rather nicely, as it should, with the Darwinian story of functional adaptation, since the remarkable adaptation of means to ends in organisms is exactly the grounds of the debate between the evolutionary and the design theorist. Reiterating the Darwinian mechanism is no reply to design theory, since it merely begs the question. Unfortunately, Orr's response seems at this point to be nothing more than question-begging. In other words, Orr does not disprove the logical conclusion of Behe's thesis as applied to breathing systems; namely, that whatever system first used by our ancestors to breathe can in principle not be removed from that organism without the organism dying. By simply pointing to Darwinism, in defence of an attack aimed at that very construct, Orr effectively does not contend the point, but begs it. I submit that Orr is representative of the attitude taken by most orthodox scientists, especially in biology and especially where informed by a naturalistic outlook. Such scientists, if I might group them together for the sake of the point, are unwilling to treat criticisms of Darwinian theory on their merits, but unfortunately dig themselves behind the crumbling walls of the very fortress under attack. In philosophical parlance, that is called "begging the question". In more common language, it is to avoid the proverb "that the truth hurts".

More damaging by far to Behe is the empirical problems that attach to his work. Behe makes claims regarding the number of proteins or amino acids required for life to exist, about the number and nature of chemical constituents in the blood clotting system and the construction of bacterial flagella. Although Behe might well be quite correct in making

these statements of empirical fact, it is not quite obvious that they hold true over all times and places. In other words, although it may well have been true in 1996 that scientists believe that X proteins are necessary for life, it may equally be true in 2003 that scientists believe that X-3 proteins are necessary for life. Behe fails to properly distinguish between what scientists believe to be the facts of the matter at the biochemical level and what the facts of the matter really are. He further appears to equivocate between arguing that certain systems in humans are irreducibly complex at the biochemical level and that the cell itself is irreducibly complex. If the latter is the case, then all life is irreducibly complex. It becomes unnecessary to independently argue that biochemical systems are irreducibly complex. Which is it? Is the cell actually irreducibly complex? Or are certain higher-order biochemical systems irreducibly complex?

If Behe is to be taken seriously, he must make plain his position. The vagaries of evidence serve to change the conclusions we derive from empirical studies and thus to change our belief in something's **really** being irreducibly complex. However, if Behe's work is properly characterised as demonstrating that to the best of our current knowledge, certain biochemical systems or the cell are irreducibly complex, then he is in no worse a position that Paley two centuries before. Given the information available to us; and that further information is not likely to come in (certainly objectively less likely than in Paley's time, as we already have more information at our disposal than did he); inference to the best explanation says to believe that the systems to which Behe refers are designed.

3.5) Dembskian Analysis of Behe

In this section I analyse Behe's biological evidence and subsequent inference to design in the light of the formalised version of the argument to design provided by Dembski. The three conditions that Behe needs to meet, as laid out in **Chapter 2** are: (1) that the phenomena and systems that are put forward as evidence for or instances of design have occurred or are in place; (2) that these phenomena and systems have a small probability of occurring or being in place and (3) that these phenomena and systems admit of specification. In quasi-symbolic form once again, we must show that (B)[53]:

(1) oc(E)

(2) sp(E)

(3) SP(E)

(4) therefore des(E)

Bearing these criteria in mind, how does Behe's account fare? I look to each criterion in turn.

3.5.1 oc(E)

As regards criterion (1), issue is already joined between the design theorist and his opponents. The central evidential claim of Behe's book is that the cell displays irreducible complexity at a certain level - namely, the biochemical level. His examples of

[53] From Ch 2 of this paper.

the blood-clotting system and the like are not particularly important. They are additional to the main thesis, that the cell is finally not reducible to individual components. Unfortunately, biologists are not in agreement with Behe as to the irreducible complexity of the cell. Although the concept is sound, there are plenty of biologists who simply disagree with Behe as to the reality of the irreducible complexity of the cell at the lowest, biochemical levels. If we cannot establish that irreducible complexity has real existence, then we cannot say that event E has occurred. If E has in fact not occurred, of course, then the design inference cannot go through. Now, we know that cells exist and are at least reducible to such and such a point; but it remains unproven whether or not we have reached the last level of reduction. Since the publication of Behe's work, in fact, new evidence in biochemistry has come to light that indicates that the base number of proteins needed for a functional cell is less than was believed at the time of that publication. In short, it is not at all clear, after all, whether Behe's most important irreducibly complex system is instantiated. This rather leaves the rest of the steps as unnecessary - there MAY be irreducibly complex systems; or there may not be. Science here has legitimately held out hope for further development and may be entitled thereby to continue to do so. In order for Behe's thesis to get off the ground, then, it is necessary for us to assume the truth of his main evidentiary claim. This is (unfortunately for Behe) an inauspicious start. Nonetheless, I examine the following steps on the basis of the assumption that were irreducibly complex systems shown to exist in living organisms, these steps would be necessary in order to demonstrate that said systems are irreducibly complex and the mark or product of design.

3.5.2 sp(E)

With regard to probability, it is difficult to know whether the sorts of things Behe takes to be irreducibly complex do have a small probability of occurring. There is no independent means of establishing what this probability is. The relevant probability is that of the various parts of, say, the blood clotting system simply coming together in a way instantiating the function now fulfilled. The design theorist is going to argue that this probability is exceedingly low. The evolutionary biologist is simply going to argue that the chance of, say the blood clotting system, being the way it is, is an event of at least intermediate probability. They would point out the perceived gradual development of the system and thus show how the design inference is not warranted, since millions of probabilities that are not small have been realized to instantiate the system as is. The evolutionary biologist may even argue for the inevitability of the system turning out a certain way, that is, for a high probability and thus a regularity explanation. However, here they would be wrong simply because Darwinism is not a law of nature (it may still be refuted). The evolutionary biologist then seems to rule out the inference to design in attempting to establish the probability of the phenomena or systems Behe terms irreducibly complex. This is not justified because the design theorist is calling the Darwinian mechanism into question. It is no suitable defence for the evolutionary biologist to simply reavow their belief in the Darwinian theory.

The epistemic probability that each side assigns to say, the cell's complexity, will be informed by the very epistemological frameworks that are partly at question - methodological naturalism and intelligent design. Since any other position - literal

creationism, Lamarckianism, teleomechanism - fall directly into opposition with either of the two under examination, they cannot provide an independent probabilistic standard. If they could, they would by now have justified or renounced their own models of life; although some - like teleomechanism - are already finished as scientific research programmes.

If we are left at an impasse; or worse still, with no way of justifying the claim that system X has a small probability of being as it is, then we cannot be licensed to believe that X is the result of any particular explanatory mode on Dembski's account. No probability being assigned to the event means that one must suspend judgement on the issue until the probability can be determined. Unfortunately, this is where Sober *et al*'s critique of Dembski comes into play. However, it seems more practical to think that the real chances of things simply coming together are always going to be low; and that if this is the objective probability actually involved in the calculation of sp(E), then the design theorist is correct. No amount of fiddling with probabilistic resources can change the fact that the initial probabilities are, as required by Dembski, low.

3.5.3 SP(E)

As regards specification, it is met by the examples given. Both sides in the debate would surely grant that the eye *as it is* performs a function that is highly specified, i.e. it sees. It does not also hear or taste; it performs a function that a lesser but related system would not do as well, or could not do at all. This might actually be taken as an argument for

Behe's position, since it seems here that specification implies irreducible complexity. At the most basic level of optic systems, if something - indeed, anything - is removed, the system no longer perceives light at all. Consider for instance the gradual progression in eye evolution so beloved of Richard Dawkins.

Dawkins argues that the apparent complexity of the eye, itself a favourite example of apparent design to Paley and the natural theologians, is easily explicable in terms of evolution[54]. Given the account of evolution that Darwin advanced - that random variations plus natural selection results in adapted organisms - and given the mechanism of genetics, Dawkins believes he can utilize existing evidence from the natural world to demonstrate how, for instance, the remarkably complex human eye came to be. Dawkins points to the various kinds of eye that animal life forms now living exhibit[55]. For instance, there is the human eye which organism's complexity *qua* eye is unsurpassed. There are at the lower end of the spectrum of complexity the eyes of certain ocean-dwelling invertebrates, such as the limpet. Through examining various eyes from different parts of the animal kingdom, it is possible to find an array of eyes that exhibit an increasing degree of complexity. Ranging from a simple cup that traps light rays from a specific direction[56] through deeper cups for more directional control[57] through jelly-filled cups that filter the light and through to the human eye, we can observe an increase in the number of parts and their collaborative effort to produce a clearer, sharper and more

[54] Dawkins; Climbing Mount Improbable; Ch. 5.
[55] *Ibidem* pg. 127.
[56] *Ibidem* pg. 135 Fig. 5.3
[57] *Ibidem* pg. 136 Fig. 5.4

useful image[58]. Given this range of complexity - and given that it is quite a complete range - Dawkins argues that it is quite clear how the human eye evolved. It evolved through stages such as those now typified by certain invertebrates. Each of those eyes is fully functional as is - after all, it seems evident that these invertebrates can indeed see. Their behaviour suggests that they see; and optics (that is, the physics of light and vision) demonstrates they can see. These eyes, then, argues Dawkins, are precursor systems to the remarkable, complex human eye that design theorists claim to be God's direct handiwork[59].

Although, as I have indicated, it is not the contention of this dissertation that orthodox evolutionary theory is a failed thesis, I argue that Dawkins' account of the developmental history of the eye constitutes nothing but wishful thinking. It is, as has been derogatorily said of various evolutionist descriptions, a "just-so story"[60]. There is no evidence that the human eye evolved from such stages as is 'typified' by the other animals used in the model. In the first place, it is not obvious that the so-called simple eye is simple or that it has anything but a low probability of occurring – and as it already is specified and has occurred, it is thus a possible candidate for design. Neither human nor limpet eyes simply come into being fully intact, nor even photosensitive cells. Dawkins would have to account independently for this occurrence before making the gradualist move; otherwise the limpet eye is just another "black box", offering no explanation at all, but a biological *fait accompli*. Furthermore, to argue that the human eye evolved from such

[58] *Ibidem* pg. 177 Fig. 5.30
[59] *Ibidem* pg. 178 - 9.
[60] After Rudyard Kipling's Just So Stories, being fanciful accounts of how for instance the "Elephant Got His Trunk" or the "Giraffe Got His Neck".

stages on the basis of a comparison with other more 'primitive' animals is simply to beg the question, for it assumes the truth of gradual development - that is, of evolutionary theory. It is exactly this that is at question - can evolutionary theory, as characterized by Darwin, explain organs as complex as the eye? To appeal to gradualism in defence of gradualism is circular. Since the only reason to believe that the sort of eye that the limpet exhibits was ever a precursor to the human eye is an appeal to the truth of evolutionary theory, Dawkins' story doesn't get off the ground. There is no evidence for the belief or reason to presume that the eye of the limpet would possibly evolve further. Although the changes that Dawkins envisions in the eye of the limpet to become the eye of say the ragworm are relatively minor - the deepening of the cup, the filling of the cup with albuminous jelly - the changes that are necessary to get all the way to the human eye are a little more straining on one's credulity. That is not to say offhand that it is impossible for such a process to occur. There is, however, no actual evidence that it has occurred, only an inference to that effect. Yet ironically, the same Richard Dawkins seems unwilling to admit the validity of inferences to design.

It may seem that the discussion I have made of the eye is irrelevant to the issue of specification. However, it is not. We have already seen that prominent evolutionary biologists such as Michael Ruse believe (biological) organisms to have function and thus to be teleological in at least some limited sense. We have seen that the story other evolutionary biologists - such as Richard Dawkins - advance in an attempt to dismiss the apparently irreducible complexity of certain organs does not hold much explanatory

water. It seems clear that specification is indeed met in the cases that Behe addresses, both on an evolutionary account and on an intelligent design account.

3.5.4 The Dembskian Final Analysis

Behe's argument seems to survive a Dembskian analysis relatively well. The empirical examples that he produces fit the criteria of being instantiated (that is, having occurred) and of being (highly) specified (that is, being patterned or compressible) perfectly. The objective probabilities of their simply coming about are exceedingly low and thus all the conditions warranting an inference to design are met. That there are objections should not surprise us – if the design judgement is properly characterised as an inference to the best explanation rather than as a non-defeasible judgement never giving rise to false positives, then we should exactly expect certain of our design inferences to be weaker than others over time.

3.6 Conclusion to the Chapter

It appears that Paley's own examples of two centuries ago still stand – the eye remains virtually inexplicable, despite attempts by science to explain how it originated. The heart remains as specified today as then and as improbable of occurring just as is, springing form the ether. That is because the judgements made by Paley were of the objective probability of it being so as he subjectively knew it; and because the heart and eye indeed **are** specified. Behe then stands in exactly the same place as Paley before him; and if

Paley has thus managed to weather the storms of time, then there is reason to believe that Behe will too. After all, the argument they are forwarding is the same.

CONCLUSION

I have argued that design explanations are a legitimate mode of explanation in the natural world, of lesser explanatory rigour but equal value to regularity and chance explanations. I demonstrated by reference to Paley, as representative of the school of natural theology, that design explanations of two centuries ago took a certain character. Through a critical examination of Hume's position on not only design but religion generally, I showed that design explanations do not fall uselessly flat in the face of possible competing explanations, although they may give ground to trumping explanations. This was made clear in the introduction of the design filter devised by Dembski, which seeks to output the correct explanatory mode **given the data entered** about some or other event under explanatory consideration. I argued that there are subtle problems with Dembski's account, but that overall it is in line with the mainstream explanatory theory as put forward, for example, by Hempel.

I then introduced Behe's work on irreducible complexity as a modern example in the same vein as Paley, arguing that they stand on the same logical footing. By running Behe's examples through the design filter, it is apparent that they meet the conditions necessary to accept design as their explanation, just as even Dawkins accepts Paley's conclusion of design.

The central argument of the thesis is thus met, namely that Behe provides us, as did Paley two centuries ago, strong grounds both empirically and logically for believing that design is the proper mode of explanation for at least some of the events and phenomena in the world around us that appear designed but lack scientific explanations – that is, those

events and phenomena which not only require explanation because they exist, but which have a low probability of so existing and are specified, irreducibly complex or high carriers of information.

I leave the last word to David Hume, so long thought the enemy of design arguments, but in the view I have forwarded, perhaps their best friend:

> If the whole of natural theology, as some people seem to maintain, resolves itself into one simple, though somewhat ambiguous, at least undefined proposition, that the cause or causes of order in the universe probably bear some remote analogy to human intelligence: If this proposition be not capable of extension, variation, or more particular explication: If it affords no inference that affects human life, or can be the source of any action or forbearance: And if the analogy, imperfect as it is, can be carried no farther than to the human intelligence; and cannot be transferred, with any appearance of probability, to the other qualities of the mind: If this really be the case, what can the most inquisitive, contemplative, and religious man do more than give a plain, philosophical assent to the proposition, as often as it occurs; and believe, that the arguments, on which it is established, exceed the objections, which lie against it?[61]

FIN.

[61] Hume; Dialogues; pg 185

BIBLIOGRAPHY

Included in the Biblography are sources used as background reading in scientific data and methodologies, argument and so forth. Not all sources listed are directly referred to in the dissertation. A triple asterisk marks essential reading, thus: ***.

A) Books

1) Behe, M.; Darwin's Black Box: The Biochemical Challenge to Evolution; The Free Press, New York (1996).***
2) Berra, T. M.; Evolution and the Myth of Creationism: A Basic Guide to the Facts in the Evolution Debate; Stanford University Press, Stanford (1990).
3) Brooke, J. H.; Science and Religion: Some Historical Perspectives; Cambridge University Press, Cambridge (1991).
4) Dawkins, R.; The Blind Watchmaker; Longman, Harlow (1986).***
5) Dawkins, R.; Climbing Mount Improbable; Penguin, London (1996).***
6) Dembski, W. A.; Eliminating Chance Through Small Probabilities; Cambridge University Press, Cambridge (1998).***
7) Dembski, W. A.; Intelligent Design: The Bridge Between Science and Theology; InterVarsity Press, Downer's Grove (1999).***
8) Dembski, W. A. (ed.); Mere Creation: Science, Faith & Intelligent Design; InterVarsity Press, Downer's Grove (1998).***
9) Futuyma, D. J.; Evolutionary Biology (Third Edition); Sinauer, Sunderland (1998).

10) Hayward, A.; God's Truth! A Scientist Shows Why it Makes Sense to Believe the Bible; Thomas Nelson, Nashville (1983).

11) Hempel, C. G.; Philosophy of Natural Science; Prentice-Hall, Englewood Cliffs (1966).

12) Leakey, R. E.; The Illustrated Origin of Species By Charles Darwin; Rainbird, London (1979).***

13) Lipton, P.; Inference to the Best Explanation; Routledge, London (1991).

14) Livingston, D. W. And King, J. T. (eds); Hume: A Re-evaluation; Fordham University Press, New York (1976).

15) Mackie, J.L.; The Miracle of Theism; O.U.P., Oxford (1982).

16) Margenau, H. and Varghese, R. A. (Eds); Cosmos, Bios, Theos; Open Court, Chicago (1997).

17) Margulis, L.; Origin of Eukaryotic Cells; Yale University Press, New Haven (1970).

18) Matthen, M. and Linsky, B. (Eds); Philosophy and Biology: Canadian Journal of Philosophy Supplementary Volume 14; University of Calgary Press, Calgary (1988).

19) Maynard Smith, J. and Szathmary, E.; The Major Transitions in Evolution; W. H. Freeman, Oxford (1995).

20) Mill, J. S.; Three Essays on Religion; Watts & Co, London (1904).

21) Monod, J.; Chance and Necessity: An Essay on the Natural Philosophy of Modern Biology; (1970) Collins, London (1972).***

22) Morris, H. M.; The Twilight of Evolution; Presbyterian and Reformed Publishing Company, Philadelphia (1969)

23) Norton, D. F. (ed.); The Cambridge Companion to Hume; Cambridge University Press, Cambridge (1993).

24) Palmer, H.; Analogy: A Study of Qualification and Argument in Theology; MacMillan, London (1973).

25) Ray, J.; The Wisdom of God Manifested in the Works of the Creation; (1691) Garland, New York (1979).

26) Shepherd, J. J.; Experience, Inference and God; MacMillan, London (1975).

27) Skyrms, B.; Choice & Chance: An Introduction to Inductive Logic (Third Edition); Wadsworth, Belmont (1986).

28) Tweyman, S.; David Hume: *Dialogues Concerning Natural Religion* In Focus; Routledge, London (1994).***

29) Wells, J.; Icons of Evolution: Science and Myth? Why Much of What We Teach About Evolution Is Wrong; Regnery, Washington (2000).

30) Wolpert, L.; The Unnatural Nature of Science; Faber and Faber, London (1993).

B) Internet Resources

1) <http://www.apologetics.org>

2) <http://www.infidels.org>

3) <http://www.leadershipu.com>

4) <http://www.meta-list.org>

5) <http://www.natcenscied.org>

6) <http://www.origins.org>

7) <http://www-polisci.mit.edu>

8) <http://www.reasons.org/resources/papers>

9) <http://www.talkorigins.org/origins/faqs-qa.html>

C) Journal Articles

1) Bradshaw, D. E.; "Patterns and Descriptions" in Philosophical Papers Vol. XXVII (1998), No. 3.

2) Dennet, D; "Real Patterns" in The Journal of Philosophy (1991).

3) Fitelson, B., Stephens, C. and Sober, E.; "How Not to Detect Design – Critical Notice: William A. Dembski, The Design Inference"; in Philosophy of Science, 66 (September 1999).