EVOLUTION, EMPIRICISM, AND PURPOSENESS.

A PHILOSOPHY-OF-SCIENCE CRITICISM OF INTELLIGENT DESIGN.

Jesús Zamora Bonilla

UNED

ABSTRACT

In this paper, I shall criticise some essential aspects of the so called 'Intelligent Design Theory' (ID), from the point of view of some standard thesis in the philosophy of science. In particular, I shall criticise the notion of 'explanation' that underlies ID arguments (sections 1 and 2), in particular William Dembski's "explanatory filter", as well as the ideas about 'information' and 'probability' on which those authors base the arguments, in particular, Dembski's use of the "no free lunch theorems".

1. WHY DEMBSKI'S 'EXPLANATORY FILTER' MISREPRESENTS WHAT A SCIENTIFIC EXPLANATION IS.[1]

The most notorious argument presented in favour of the theory that asserts that living beings are necessarily the result of a conscious and deliberate act of intelligent creation, is William Dembski's 'explanatory filter' (EF).[2] According to this argument, when explaining anything, we have three alternatives: first, we shall try to explain it as the result of a *natural law*; if, on the basis of the information we have, we conclude that it is not possible that the phenomenon we want to explain is the result of a natural law, then we consider a second alternative, which consists in the assumption that the phenomenon is due to *chance*; lastly, if the chances of the phenomenon having being generated by a purely random process are too low, then we are left with no other option than the third possible explanation, which consists in the assumption that the phenomenon is the product of a *deliberate* action by an intelligent being. So the EF amounts to the thesis that *everything* is the product either of natural laws ('necessity'), of chance, or of intelligent design. Dembski, of course, adds to this schema (which, as we shall confirm very shortly, is far from being problem free) the additional premises

[1] This paper was prepared while its author was taking part in Spanish Government's research projects FFI2008-03607/FISO and FFI2008-01580/consolider-ingenio-CSD2009-0056.

[2] See, e.g., Dembski (1998), pp. 36 ff.

that the existing living beings have features that make impossible to accept that they are the product of natural laws or of chance, hence concluding that, 'necessarily', they are the children of a conscious mind.

Most criticisms of Dembski's EF have mainly insisted in the lack of basis of his claim that biological features cannot be caused by natural processes (neither known, nor unknown); I will shortly refer again in a more detailed way to this point in section 3, when discussing the ideas of information and probability, but, since this is a much more common topic, I will not concentrate too much on it,[3] and will devote the rest of this section to analyse the idea of 'explanation' that underlies the EF, and to contrast it with the ideas of explanation which have become the standard in the literature on philosophy of science.[4] The most important thing to say in this respect is that 'explanation' refers, in Dembski's argument, to what we can call more appropriately 'causation'; it is assumed that everything must have one of the three possible and alternative types of 'causes', and it is also assumed that 'explaining' something consists in *identifying* its 'cause'. Certainly, there is a strong tradition in philosophy of science claiming that scientific explanation is basically causal; scientific research, however, does not usually consists in identifying 'causes', but in *describing the way* in which the causes *cause* the phenomenon. The other two most common approaches to scientific explanation are, as it is well known, the nomologico-deductive view, and the unification view. According to the former, something is explained when it is (logically or mathematically) derived (*deduced*) from laws or regularities, whereas according to the latter, a theory is explanatory when it covers a great variety of different facts. These other two views of scientific explanation are much less favourable to the naïve notion of explanation of the EF than the causal theory, for according to the nomologico-deductive view, 'design explanations', as long as they are explicitly classified as something different from explanation from laws, fails to be a scientific explanation (for no regularity is indicated in this case), and also, according to the unification view, explanations from design fail to be successful as explanations because they do not allow to 'unify' the biological phenomena with other natural ones (for they offer a completely different kind of account of why things are as they are in the biological realm, from the account that works in physics, chemistry or geology, for example). This last comment might perhaps be contested by pointing that ID is coherent with similarly theologico-finalistic

[3] A very good selection of papers discussing or defending ID is Dembski and Ruse (2004).
[4] See Salmon (1989) for a survey.

explanations often presented for the so called ‘fine tuning’ of physical constants, and even that it is coherent as well with explanatory accounts of supposedly non natural processes, like miracles; but, even accepting that ID can be considered as a segment of a wider explanatory enterprise which has some degree of ‘unifyingness’, it is not less true that, within the processes which are able of being scientifically, i.e., experimentally studied, ID introduces a completely heterogeneous *kind* of explanation; furthermore, the other problems of the EF strategy we shall examine in the next paragraphs are so strong that the possible unification virtues of ID theory become irrelevant.

The main problem with Dembski’s EF, in connection with philosophical explications of the notion of scientific explanation, is that, even accepting that some theories about scientific explanation put causal links as the fundamental element of explanatoriness, the truth is that all the three standard views on scientific explanation I have mentioned share something that is clearly missing in the ‘explanation from design’ strategy. This common ground is the assumption that *all scientific explanation consists in a kind of description*: what the theories, models or laws that explain empirical phenomena do, is nothing else than offering a partial description of *how* the world is, what specific types of *processes* take place in the world, or according to precisely what kinds of *regularities* those phenomena are linked. The nomologico-deductive account is the weakest of the three, in being relatively agnostic or liberal about what kind of ‘laws’ or ‘regularities’ are legitimate in empirical science; the causal view demands additionally that those regularities must be descriptions of causal processes, and the unification view demands that those regularities must be applicable to several realms; but the three accounts state explicitly that *a scientific explanation starts by specifying ‘how’ something happens*, and the option for the third ‘horn’ of the EF consists, precisely, in the renounce to know anything about *the description of the process* by which living beings happened to have the features they have. We are said that such an such features of biological beings would have been impossible without conscious design, but we are not given any hint at all about *how* the supposed existence of the conscious designer *would have led* to the existence of those features, *whereas it is this ‘how-would-it-had-led-to” to we understand by ‘explanation’ in modern science*. So, Intelligent Design theory pretends to offer a scientific explanation while refusing to make the effort that turns an explanation into a scientific one, an effort that consists in showing how the phenomena to be explained can be *logico-mathematically deduced* from the description of the world given in the presumed explanation. I.e., to explain

something, *in empirical science*, consists in formulating a description of a mechanism or process (the description can, of course, be partial, and limited to some features or constraints the process is supposed to fulfil), and then inferring, from the hypothesis that this mechanism or process is real, that the phenomenon to be explained will have the properties we have discovered in it, instead of other conceivable properties.

2. WHY THE 'EXPLANATORY FILTER' IS NOT FILTER AT ALL.

Besides confusing what a scientific explanation is, Dembski's 'explanatory filter' also commits the worst mistake that can be committed while using 'disjunctive syllogism' as a method of inference: not ensuring in the first place that the proposed alternatives are *mutually exclusive* and *jointly exhaustive*. We shall see that the three horns of Dembski's filter fail to obey both conditions.

2.1. Law and chance as friends, not enemies.

Ignoring for a moment the question of deliberate purpose (the third horn), which we shall examine in the next subsection, it is simply false that explanations in science respond to some fundamental alternative between 'law' and 'hazard'. To say the list, there is no explanation 'from *mere* law'. Rather on the contrary, a typical scientific explanation of a fact (or set of facts) always contains both elements ('law' and 'hazard'), usually in a very well *integrated* way, in what is customarily known as a *model*. A scientific model consists in a number of *deterministic* equations or other constraints, together with some assumptions about the *statistical distribution* of the 'mistakes'; to this we add empirical information (e.g., measures) about concrete entities or systems, information that, combined to those equations and statistical assumptions, allows to infer other items of information (e.g., predictions). What serve to explain the facts we want to explain is the peculiar *combination* of deterministic equations and statistical assumptions about the deviations from the solutions of those equations. This means that there is simply no example in empirical science of 'explanation from (mere) laws', even in the case of deterministic theories, for there is always a stochastic element (due to measurement or specification errors) in the application of the models to the empirical facts (indeterministic models are those in which the statistical distribution of values does not only affect to measurement errors, but to the 'real' variables as well).

In a similar way, there is nothing in science like explanation 'from mere chance'. When scientists *infer* that some data are 'random', what they are saying is that it has been possible to proof that the data respond to a particular statistical distribution, or, more exactly, to what might be expected from some *specific stochastic process*. This means that scientists have discovered in this case a particular regularity, only that it consists in a *statistical regularity*, not in a deterministic one, and hence it becomes possible to *calculate the probability* that single data or sets of data show such and such properties. Obviously, different assumptions about what is the stochastic process that is actually generating the observed data, will lead to different predictions, and the statistical success or failure of these will make scientists accept or reject those assumptions. And, what is more important, there are a multitude of different stochastic processes, a variety which becomes explosive when combined with the number of different theoretical models ('combinations of laws') with which those stochastic processes can form a single 'explanation'. Alternatively, when scientists reach the conclusion that no *known* stochastic process can lead to the statistical distribution of events they empirically know, then they do not assert that 'these events are explained by hazard'; rather, what such a situation indicates is that they *do not know the explanation* of those events, for scientists are able of offering neither a theoretical model about the mechanism according to which the events are produced, nor even a stochastic model about how they are generated, i.e, they are not able of reducing the phenomena to any known *regularity*, neither deterministic nor statistical.

So, when ID theorists talk about 'explanation from chance', they should make explicit what particular mathematical assumptions about the stochastic process are they referring to, and check whether the scientific models that are actually used to try to explain what they say that cannot be explained 'by chance', fulfil those assumptions or not. The case is that usually they do not: for example, when ID's 'calculate' the probability of a particular protein being formed by computing the possible sequences of DNA, they are assuming that the stochastic process leading to the existence of the protein is *mathematically equivalent* to having an urn with infinite balls for each of the four DNA bases, and from which we extract a number of balls equal to the length of the sequence needed for our protein. Of course, the causal process leading to the existence of a given protein is *not* mathematically (and hence, *probabilistically*) equivalent to such 'bingo-like' stochastic fiction, and the inferences that can be derived from this absurd model about the probabilities that in the real world (e.g., in a world submitted to

the stochastic processes associated to Darwinian replication) such and such protein is formed are patently nonsense.

Hence, contrarily to what Dembski's EF says, scientific models do not explain 'either' through laws, 'or' through chance, but always through some specific *combination* of deterministic equations and statistical regularities (the latter can affect either to the measurement processes, or to the 'real' variables, or both). Perhaps this would not be considered as very relevant by ID's, for, in any case, they think that biological phenomena cannot be explained by *any* 'combination' of deterministic laws and statistical regularities, though, in fact, Dembski treats the two first horns of his three-horned dilemma as separate: he talks of 'explaining by laws' as if it were something like 'finding a natural law stating that *every time* that life emerges, it must *always* have such and such type of protein', which is patently absurd (scientific models *employ* 'general' laws, but the specific combination of laws that a model employs is assumed to affect to a particular type of situations, and so the model *itself* is not a '*universal* law'), and he talks of 'explaining through chance' as if it simply consisted in the 'bingo-like' model I have just criticize. No space is given in Dembski's rhetoric to allow to think in the mathematical possibilities of a combination of several universal laws and several statistical regularities applied to specific circumstances with specific constraints, which is the way scientific models proceed when trying to explain anything.

2.2. Purpose and design as a type of law.

In a similar way, 'explanation from purpose' is not as significantly different from 'explanation from laws' (or from *models*, to be more faithful to real scientific explanatory activity) as ID's want us to accept, and as to entitle the separation of intelligent purpose as an independent horn of the EF. For, after all, our empirical knowledge of the world show us that *'purpose' and 'design' are a particular type of capabilities that some empirically given entities or physical systems manifest*. Diamonds have the capacity of cutting crystal, stars have the capacity of transmuting chemical elements, tree leafs have the capacity of photosynthesising sugar, and certain types of animals (including us) have the capacity of conceiving plans and acting through purposes. Empirically, there is, hence, no reason to separate intelligent action as an ontologically different type of 'causal force', or 'explanation'. Of course, many things that can be done through the action of an intelligent animal (who, besides its intelligence, has a muscular system capable of interacting with its environment in order

to carry out the plans and goals it has conceived), cannot be done through any other known (or even conceivable) physical process. But this does not legitimise at all the conclusion that the claim 'this is due to intelligent action' is a scientifically valid explanation *per se*; what would be necessary to add to such a claim to transform it into a real explanation, is (as I said in section 1) information about how the existence of the intelligent system initiated an empirically testable *process* whose final step was the result to be explained, for it is the theory about the *causal process* (not just about the causal 'principle') what has explanatory power. This means that 'intelligence', if it has to have any meaning *as a legitimate concept within empirical science*, refers to the peculiarities of the *processes* that take place within some empirically given entities or systems; for example, we say that intelligence refers to the characteristic way in which our organisms solve the problem of finding food, but not to the way in which they solve the problem of keeping blood in circulation. Of course, we do not know all the details about how our bodies solve both problems, and it is true that we know much less about the first than about the former, but we do know at least that altering such and such parts of our brains severely distorts our capability of behaving intelligently, and that having some types of nerve system allows to display a wider range of intelligent behaviours. So, we are able to attribute a causal power to 'intelligence' in the case of animals because there is an empirically testable causal link between the assumed cognitive states of their brains, on the one hand, and their behaviour, on the other hand. If there were absolutely no way of inferring that a physical system contains something like 'cognitive states', then, no matter how complex and apparently purposeful its behaviour were, our natural response would be that this behaviour is not caused by a cognitive process, but by other properties of the system, with nothing to do with 'intelligence'.

The scientific attitude to intelligence and purpose is, hence, to take them as empirical phenomena, and limiting our claims about how they are linked to other events to the regular connections that we can empirically discover (through the common pack of scientific research strategies, from experimentation to model building to statistical analysis) between those psychological properties and these other facts. From this point of view, the regularities we happen to discover about physical systems that manifest intelligent and purposeful behaviour, will be included in a natural way in the scientific models with which we'll try to explain whatever empirical facts we like. So, in a nutshell, to separate 'explanation by intelligent design' from 'explanation by natural laws' is exactly as absurd as to claim that 'being the result of a digestion', or 'being the

result of a nucleosynthesis', are processes that deserve to be considered as a type of scientific explanation essentially different than 'being the result of the operation of natural laws'. Explanation in science is *always* explanation by laws (*cum* statistical assumptions), independently of whether those laws are the laws of chemistry, the laws of geology, the laws of physics, or the laws of psychology.

2.3. Ignorance and the real filter.

To sum up, Dembski's explanatory filter fails to fulfil the minimal demand of a disjunctive syllogism because, in the first place, the three options he presents are not independent alternatives. The real options (i.e., the one which are relevant in science) are not 'this is explained by laws', 'this is explained by hazard', and 'this is explained by design', but, instead, something like the following: 'this is explained by *this* specific model, or it is explained by *this* second specific model, or by *this* third specific model..., or by *this* n-th specific model', where each model is a particular combination of laws and statistical assumptions, and each law can belong to any possible branch of science. How many horns does such a filter contain? Obviously, as many as we are able to invent. But, in the second place, even such a magnified filter still fails to fulfil one of the essential requisites of the type of logical argument it exemplifies: *exhaustiveness*. For we are not able, of course, of imagining all the *possible* explanations of a fact, and it can be the case (and it is, in many cases!) that *we fail to find any acceptable explanation* for the phenomena we are trying to understand: perhaps there are one or several unknown types of causal process, that are responsible of those facts, i.e., our list of explanatory models can be (and it usually is!) *incomplete*, simply because of our *ignorance* of the whole list of possible explanations. So, a complete version the 'real explanatory filter' would be : 'this fact is explained by *this* specific model..., or by *this* n-th specific model, or the fact must remain as *still unexplained*'. By the way, one curious consequence of the application of Dembski's version of the EF is that, if it were correct, then we will actually have an explanation for every phenomenon, and with little effort. Unfortunately, real science seems to be not so easy.

3. ON INFORMATION AND PROBABILITY.

After having shown the ways in which the EF strategy misconceives and misapplies the nature of scientific explanation, I shall devote this section to discuss

another mistake in Dembski's work: the way in which he employs the 'no free lunch' theorems (NFL).[5] According to NFL, no search algorithm performs, on average, better than blind search (given certain assumptions about the structure of the stochastic process on which the algorithm works, for example, that it is based on a uniform distribution), and hence, selection algorithms (e.g., Darwinian processes) only 'work' if they are 'intelligently programmed' with the necessary information to perform better than random. This is a valid mathematical theorem, and hence it cannot be discussed empirically. As a mathematical truth, it can also not contradict any state of affairs that happens to be true in some possible world: both possible worlds in which god exists and worlds in which she doesn't, possible worlds in which there are animals and worlds in which there are none, would be worlds in which the NFL theorem is valid. This simple fact makes it suspect the use of the theorem to draw any *factual* conclusion. But, of course, which can be contested is the *interpretation* that ID's make of the theorem. For example, Dembski assumes that, if there is a process that leads to the emergence of something complex enough, then the process must have been 'consciously programmed';[6] but there are other alternatives: for example, it can be the case that some assumptions of the theorem do not obtain in the real process (e.g., the underlying probability distribution may not be uniform – or 'bingo-like'), *or* it can be the case that the real world contains indeed the information that the process needed to make the complex entity emerge, though this information has not been 'introduced' in the world by something like 'a mind'.[7] To understand this possibility, consider, for example, the emergence of a planetary system out of a nebula made out of gas and dust; the system originates out of the simple laws of mechanics (plus nuclear physics –in the star– and chemistry –in the planets–); the planets can have a lot of marvellous details, from seas and caves, to volcanoes and dawns; hence, we must conclude that the laws of physics and chemistry, plus the distribution of dust and gas in the original nebula, contained *all* the information needed to create such improbable details, but this does not entail that the molecules of the nebula were placed in exactly where they should be 'by an intelligent mind'.

Dembski' interpretation is founded on a confusion which deserved to be mentioned: 'information' is too messy a concept, and very often it is employed as if it

[5] See, e.g., Dembski (2002).
[6] I will not discuss in this paper Dembski's notion of "complex specified information"; see Elsberry and Shallit (forthcoming), for a survey of the arguments on this disputed notion.
[7] Cf. Häggström (2007).

had something to do particularly with *minds*, even more, as if it might only be *created* by minds. Of course, there is absolutely no theory (neither mathematical, nor empirical) about the *creation ex nihilo* of information (thermodynamics says perhaps something about its 'destruction'), in the sense that what mathematical theories say about information is simply how would a system evolve *given* that it has such and such amounts or types of information, and how would its information be 'distributed' among the parts of the system given certain conditions. But the mathematics of information is as agnostic about the 'ontological origin' of information as arithmetic is about the 'creation' of numbers; and, exactly in the same way, it is as silent about whether information has something essential to do with 'minds' as arithmetic is about whether numbers have something fundamental to do with bank accounts. ID's assert that 'mechanistic' processes cannot 'create new information' (what is disputable, at least in the sense that they can 're-allocate' information existing in the environment), and derive from this dubious premise the conclusion that this information 'must have been created by a mind'; but the NFL theorems do not make any relevant distinction between mechanistic and cognitive systems: if *no* algorithm can perform better than mere hazard, it does not mind if it is the algorithm describing the emergence of complex things by means of random mutation and natural selection, or it is the algorithm describing the functioning of someone's mind. So, any argument indicating that 'mechanistic' processes cannot make complex entities to emerge, would apply *exactly in the same way* to 'mental' processes (more on this below). Defenders of ID are, hence, committing the fallacy of assessing with different criteria 'mechanistic' and 'mental' explanations: they do not demand to the latter what they demand to the former, i.e., a clear explanation of *how* it is possible that a cognitive system (be it a physical brain, or a supernatural agent) can *reach* the cognitive state consisting in having the idea, the intention and the capability of producing the kind of complex entity whose existence we are trying to explain.[8]

[8] To put an illustrative example: imagine that Mozart had lived a creative life till his sixties. What is the probability of one of us being capable of replicating exactly one of the new symphonies Mozart would have composed in those extra third decades? Surely, it is as close to zero as we want. But Mozart himself *would*! Is this due to some 'non-mechanistic' influence of Mozart's mind on the physical universe (which wouldn't have 'by itself' the capacity of producing that piece of information –the new symphonie–)? Or is it simply beause Mozart's *brain* (taking into account both its amazing and unique structural peculiarities and the information it gained from Mozart's education and experience) contained the information needed to give birth to those marvelous (and now inexistent) works? Obviously, it is because of this second reason, and this lead us to the scientifically relevant question of 'how was it possible for a human brain to develop those capabilities', a question for which the 'information-always-comes-from-a-mind' theory is not able even of putting.

Another aspect in which Dembski's use of the ideas of information and probability are confusing is the fact that it seems to ignore what is an inescapable consequence of a theory (*T*) being an explanation of certain phenomena or empirical laws (*E*). Since a necessary requisite for *T* to explain *E* is that *E* logically derives from *T* (or, at least, from T and certain initial conditions or limiting constraints), it follows that the prior probability of *T* can be at most as high as that of *E*. I.e., the prior probability of the explanation is always not higher than that of the explained phenomena (for, it is an elementary truth of probability calculus that, if *A* entails *B*, then $p(A) \leq p(B)$; the conclusion does not change, of course, if we substitute prior by posterior probabilities). This means both that the explanation (or the set of all causes) of *E* always contains *more information* than *E* itself (or, at least, the same). This is completely analogous to the NFL theorem, but can be interpreted in a very different way than Dembski's: it entails that *the universe is essentially unexplainable!* Let me explain it: one fact 'demands' more strongly an explanation, the more improbable it is according to the rest of our knowledge; and the more 'strange' a phenomenon is (or a combination of phenomena), the more improbable must it be the theory that succeed to explain it. So, the more facts our theories happen to explain (the more successful they are), the more improbable a priori it will be that the real world happens to be a world in which those theories are true, instead of a world that is governed by different laws (or by no laws at all), and so, the more difficult it will be to find an explanation of why the world happens to obey precisely those theories.

Hence, recognising that the explanations we offer must already contain all the information that we find out in what we want to explain, does not lead us necessarily to the conclusion that this information comes from one 'mind', or from some supernatural entity, but is a simple reminder of our fate as travellers in an unended quest: we live in a universe that happens to be like it is, while it could have been of an incomputably high number of different ways, and we shall simply ignore forever why it is that our universe is the way it is. The more successful science is, the more we will be able to condense our description of the world into simple and nice theories, but this will not approach us a single millimetre to the 'metaphysical source' of the 'information' that our world contains.

Let's illustrate this point with a remake of the classic 'clock-on-a-beach' example. As defenders of ID have asserted from centuries, finding out something as complex as a mechanic clock would lead us to suspect the existence of someone who

has created, through an intelligent and conscious process, that marvellous piece of engineering. So, what to say about the existence of entities incredibly more complex than clocks, as living beings are. But let me reformulate the example in two opposed directions. First, imagine that what we discover on the beach is not a mechanic clock, but a Palaeolithic arrow point. Second, imagine that what we discover is a PET scanner. In the three cases we shall be led to the conclusion that 'somebody' has deliberately created our astonishing finding, but who? Reconsider the clock case: it has really not been created by one *single person*, but by a *society* able of developing such a *profession* as that of clockmakers, with all the division of labour and the accumulation of technical, cultural and scientific knowledge that allows a person to become a clockmaker. The stone point, being much simpler than the clock, would have been created by a much less complex society (or we don't need to suppose than it is more complex than the former). Instead, the PET scanner demands a society still more complex than the one that created the clock, with still more division of labour and more accumulation of knowledge. So, the more complex (and less probable a priori) is our finding, the more complex will necessarily be the 'explanation' of it. Hence, if discovering a living being led us to think that it is so complex that it must be the product of some intelligent mind, this mind would need to be incredibly more sophisticated than the society that is able of producing the PET scanner. And lastly, this 'creator of living beings' (or, to be more precise, the *fact* that this entity has *arrived to the idea* of creating something like a living being, has developed the *purpose* of doing it, and has collected the *means* necessary to do it) would be much more difficult to explain than the creator of the scanner (or, again, than the fact that in our society somehow the idea and the decision of creating such a thing, together with the gathering of all the means to build it). Or, to connect it again with the discussion of the NFL theorem: the fact that all the information needed to successfully starting the process of creating a living being was actually existing within the entity that actually started it, is a fact that demands *more* explanation than the existence of living beings themselves, and this is true no matter what our hypotheses about the nature of that process are. And, by the way, the fact that living beings are so much more complex than artificial things may also lead us to suspect that they are due to a *completely different kind of process*, one that is able of producing not only things as complex as snails or sequoias, but also *animal societies* able of designing arrow points, clocks or PET scanners.

So, in conclusion, the ID argument is based on the ungrounded assumption that information is *ontologically dependent* from rational minds, whereas the only thing that we can conclude from observing the existence of complex entities is that the world is such that the physical process originating those entities have been able of benefiting from *lots of information contained in the world*. Where does this information "come from" is simply a question that cannot be resolved through scientific research, nor by any other rational means, of course. It is, for us, nothing else than a *brute fact*.

REFERENCES

Dembski, W., 1998, *The Design Inference*, Cambridge, Cambridge University Press.

Dembski, W., 2002, *No Free Lunch. Why Specified Complexity Cannot be Purchased Without Intelligence*, Lanham, Rowman & Littlefield.

Dembski, W., and M. Ruse (eds.), 2004, *Debating Design. From Darwin to DNA*, Cambridge, Cambridge University Press.

Elsberry, W., and J. Shallit, forthcoming, "Information theory, evolutionary computation, and Dembski's 'complex specified information'", *Synthese*.

Häggström, O., 2007, "Intelligent Design and the NFL theorems", *Biology and Philosophy*, 22, 27-230.

Salmon, W., 1989, *Four Decades of Scientific Explanation*, Minneapolis, University of Minnesota Press.