

Intelligent Design, Testability, and Heuristics

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Abstract

While many criteria of testability focus on the effect (or lack thereof) of observations on the theory, as suggested by Karl Popper, the more appropriate approach is to focus on the theory's effect on observations, as suggested by A. J. Ayer and Elliott Sober. Under this assumption, Intelligent Design fails to be testable, and Creationism either is disconfirmed or, if it is shielded from disconfirmation by the modification of other theories, fails to be testable as well. Untestable claims can provide a heuristic framework for the development of a testable theory, but to develop such a framework, Intelligent Design proponents would have to develop Intelligent Design by specifying the designer.

Keywords: testability; intelligent design; creationism; falsifiability; Elliott Sober, Bayes' theorem; heuristics

1 Introduction

The debate about Intelligent Design (ID) should be over. Critics like Fitelson, Stephens, and

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Sober,² Häggström,³ Elsberry and Shallit,⁴ Sober,⁵ and Ruse⁶ have shown convincingly and in detail how ID fails as a scientific theory, and its persistence is best explained sociologically, not by the arguments in its favor. There are many ways for a theory to fail, however, and I will investigate a very specific and arguably minor one that, again for sociological reasons, has received an inordinate amount of attention: Arguments to the effect that ID fails to be testable and therefore is plausibly not scientific.

To avoid the terminological confusions that bog down some arguments about ID and its alleged competitor evolutionary theory, I will rely on the following terminological conventions: Theories are sets of statements, and statements are interpreted sentences (where the interpretation can be empty, in which case the sentence has no meaning). A hypothesis is a theory that we want to test. Thus there is no intrinsic difference between a theory and a hypothesis; they differ in our attitude towards them. Facts are described by true statements or sets thereof. Thus a true theory (whether hypothesis or not) describes a fact. None of these concepts bear directly on how much one should trust a theory given one's evidence, that is, how well-supported or well-confirmed a theory is.

2 Testability and the demarcation of scientific theories

Any argument that ID is not scientific might be considered doomed to fail because there simply is no criterion for what makes something scientific. Laudan⁷ provides what has become probably the most famous and most influential argument to the conclusion that so far no successful demarcation criterion for science has been found, and that it is unlikely that one ever

² Branden Fitelson, Christopher Stephens, and Elliott Sober, "How Not to Detect Design—Critical Notice: William A. Dembski, *The Design Inference*," *Philosophy of Science* 66 (1999): 472–88.

³ Olle Häggström, "Intelligent Design and the NFL Theorems," *Biology and Philosophy* 22, no. 2 (2007): 217–30, <https://doi.org/10.1007/s10539-006-9040-z>; Olle Häggström, "Uniform Distribution is a Model Assumption" (http://www.math.chalmers.se/~olleh/reply_to_Dembski.pdf. Accessed 2025-11-17, archived at <https://perma.cc/PNH7-ABSM>, 2007).

⁴ Wesley Elsberry and Jeffrey Shallit, "Information theory, evolutionary computation, and Dembski's 'complex specified information,'" *Synthese* 178, no. 2 (2011): 237–70, <https://doi.org/10.1007/s11229-009-9542-8>.

⁵ Elliott Sober, *The Design Argument*, Elements in the Philosophy of Religion (Cambridge: Cambridge University Press, 2019), <https://doi.org/10.1017/9781108558068>.

⁶ Michael Ruse, "Creationism," in *The Stanford Encyclopedia of Philosophy*, Winter 2022, ed. Edward N. Zalta and Uri Nodelman (Stanford: The Metaphysics Research Lab, Center for the Study of Language and Information, Stanford University, 2022).

⁷ Larry Laudan, "The Demise of the Demarcation Problem," in *Physics, Philosophy and Psychoanalysis: Essays in Honour of Adolf Grünbaum*, ed. R. S. Cohen, Boston Studies in the Philosophy of Science (Dordrecht: Kluwer, 1983), 111–27.

will be. The core of his argument is the claim that a criterion for science has to be necessary and sufficient.⁸ The long list of criteria that are not necessary, not sufficient, or neither, and the variety of scientific endeavors then strongly suggest that no criterion for science can be found.

Many have criticized Laudan's demand for a necessary and sufficient criterion for science, but Laudan⁹ provides an argument for why it "seems unlikely" that "something less ambitious" would do the job: An only necessary condition will not allow for identifying something as scientific, and an only sufficient condition will not allow for identifying something as non-scientific. Thus, he concludes,

Without conditions which are both necessary and sufficient, we are never in a position to say "*this* is scientific: but *that* is unscientific". A demarcation criterion which fails to provide both sorts of conditions simply will not perform the tasks expected of it.

But this argument is straightforwardly invalid: To infer that one thing is scientific while some other thing is not, we only need some sufficient condition and some *possibly different* necessary condition. Laudan's demand that the two conditions be identical is supererogatory.¹⁰ Additionally, while Laudan expects a demarcation criterion to identify something as scientific or non-scientific whether it is a theory, practice, or indeed anything else, for the purposes of arguing that ID is not a scientific theory, it suffices to have a criterion that only applies to theories and that is only necessary. If ID does not fulfill the criterion, ID is not a scientific theory.

The best-known suggestion for a demarcation criterion is probably Popper's notion of falsifiability:¹¹

[T]he *falsifiability* of a system is to be taken as a criterion of demarcation. [...] I shall not require of a scientific system that it shall be capable of being singled out, once and for all, in a positive sense; but I shall require that its logical form shall be such that it can be singled out, by means of empirical tests, in a negative sense: *it must be possible for an empirical scientific system to be refuted by experience.*

Popper's elaboration of his criterion is subtle, much discussed, and problematic, but a simple

⁸ Laudan, 118.

⁹ Laudan, 118–19.

¹⁰ Sebastian Lutz, "On an Allegedly Essential Feature of Criteria for the Demarcation of Science," *The Reasoner* 5, no. 8 (2011): 125–26, <https://thereasoner.org>.

¹¹ Karl R. Popper, *The Logic of Scientific Discovery* (London: Hutchinson Education, 1959), 40–41, footnotes removed.

version states that a theory is *falsifiable* relative to compatible auxiliary assumptions if and only if it follows from some possible observation statement together with the auxiliary assumptions, but not from the auxiliary assumptions alone, that the theory is false (see the appendix, definition 4). This definition requires some unpacking: As Duhem¹² points out, the falsification of most scientific theories relies on a host of auxiliary assumptions, assumptions that are required to connect the theory to observation statements. Since the theory is to be falsifiable by an observation statement, the auxiliary assumptions alone should not already entail that the theory is false or that the observation statement is false. In other words, the auxiliary assumptions should be *compatible* with the theory (definition 2) and the observation statement should be *possible* given the auxiliary assumptions (definition 1). Unless otherwise noted, in the following all auxiliary assumptions and observation statements are assumed to fulfill these requirements, and I will usually suppress the mention of auxiliary assumptions.

As popular as Popper's demarcation criterion is, his justification for the criterion is unconvincing:¹³

My proposal is based upon an asymmetry [...] which results from the logical form of universal statements. For these are never derivable from singular statements, but can be contradicted by singular statements. Consequently it is possible by means of purely deductive inferences [...] to argue from the truth of singular statements to the falsity of universal statements. Such an argument to the falsity of universal statements is the only strictly deductive kind of inference that proceeds, as it were, in the "inductive direction"; that is, from singular to universal statements.

So Popper assumes that only deductive inferences are acceptable, that all scientific theories are universal statements, and implicitly that acceptable inferences to scientific theories must exist, concluding that scientific theories must be falsifiable. The last assumption is a hope, the first assumption renders most of our inferences (which are needed, for instance, to make plans) unacceptable, and the remaining assumption is false, since "There is a lowest temperature" is a perfectly fine scientific statement.

A better justification comes from Ayer,¹⁴ who motivates his criterion of verifiability as follows:

¹² Pierre Duhem, *The Aim and Structure of Physical Theory* (Princeton, NJ: Princeton University Press, 1954), 185.

¹³ Popper, *The Logic of Scientific Discovery*, 19.

¹⁴ Alfred Jules Ayer, *Language, Truth and Logic*, 1st ed. (London: Victor Gollanz, 1936), 97.

The function of a system of hypotheses is to warn us beforehand what will be our experience in a certain field—to enable us to make accurate predictions. [...] It is plain that on our ability to make successful predictions depends the satisfaction of even our simplest desires, including the desire to survive.

Since he construes “making predictions” as deductively entailing observation statements, for Ayer the mark of a (scientific) hypothesis is that it entails observation statements. Taking into account auxiliary assumptions, we can state that a theory is verifiable according to Ayer if and only if it entails an observation statement that is not entailed by the auxiliary assumptions alone, that is, if it makes deductive observational assertions given the auxiliary assumptions (definition 3). Assuming from now on that the negation of an observation statement is itself an observation statement, it is a theorem of logic that a theory makes deductive observational assertions if and only if it is falsifiable (claim 1). Thus Ayer’s motivation fits Popper’s criterion and falsifiability can be replaced by the making of deductive observational assertions. But Popper’s formulation of the criterion remains *psychologically* very helpful: People are for some reason overly inclusive when listing what follows from a theory, but they are much more restrained when listing what would falsify a theory.¹⁵

That a theory is falsifiable if and only if it makes deductive observational assertions shows a crucial shortcoming of falsifiability (and Ayer’s motivation), however: Central inferences in science are only probabilistic, for instance in statistical mechanics, quantum mechanics, and error theory in measurement. These theories still “make successful predictions” that allow for “the satisfaction of [...] our simplest desires,” as, for instance, decision theory explicitly allows for actions to be only probabilistically related to consequences. Therefore it is enough for a theory to make probabilistic observational assertions given the auxiliary assumptions, by which I mean that for some probabilistically compatible auxiliary assumptions (definition 5) the theory raises the probability of some probabilistically possible observation statement (definition 6). A theory raises the probability of an observation statement relative to the auxiliary assumptions if and only if the conditional probability of the observation statement given the theory and the auxiliary assumptions is higher than the probability of the observation statement given the auxiliary assumptions alone (definition 7).¹⁶ Probabilistic compatibility

¹⁵ Cf. Antony Flew, “Theology and Falsification,” *University 1* (1950): 1–8, References are to the reprint, Malcolm L. Diamond and Thomas V. Litzenburg, eds., *The Logic of God: Theology and Verification* (Indianapolis, IN: Bobbs-Merrill, 1975), 257–59.

¹⁶ That a theory raises an observation statement’s probability is equivalent to the theory and the observation statement being positively probabilistically correlated.

and probabilistic possibility are stronger requirements than compatibility and possibility. In the following all auxiliary assumptions and observation statements are assumed to fulfill these requirements.

There are two pleasing symmetries to the raising of probabilities: First, a theory raises the probability of some observation statement if and only if it lowers the probability of some (other) observation statement (claim 3). Second, a theory raises the probability of an observation statement if and only if the observation statement raises the probability of the theory (claim 4).¹⁷ From these two results it follows also that a theory lowers the probability of an observation statement if and only if some observation statement lowers the probability of the theory. Therefore a theory makes probabilistic observational assertions if and only if its probability is changed by some observation statement. Call this the *probabilistic testability* of the theory relative to the auxiliary assumptions (definition 8).

Given Ayer's motivation, it is plausible that every scientific theory *makes observational assertions*, be they deductive or probabilistic. Therefore every scientific theory is either probabilistically testable or falsifiable. In the following, I will call such a theory *testable*. Of the criteria of demarcation listed by Mahner¹⁸ most all contain testability, the making of observational assertions, or a cognate as necessary condition. Since in many accounts of explanation, a theory explains an observation statement only if it entails the observation statement or raises its probability, any account of scientific theories that requires them to explain in this way also renders the making of assertions a necessary condition. Even Laudan considers a good scientific theory to be well-confirmed,¹⁹ and thus a theory cannot be both good and scientific if it is not testable, that is, if it makes no observational assertions.

Sober²⁰ argues that probabilistic testing often has to proceed contrastively: Two theories are tested *against each other* by an observation statement if and only if their conditional probabilities for the observation statement differ. Sober²¹ then uses this concept to define that two theories are *contrastively testable* if and only if there is an observation statement that tests them against each other (definition 9). Sober introduces contrastive testability because we often know the conditional probabilities of observation statements given a theory, but because

¹⁷ Both symmetries are known from probabilistic correlations.

¹⁸ Martin Mahner, "Demarcating Science from Nonscience," in *General Philosophy of Science—Focal Issues*, ed. Theo A. F. Kuipers, Handbook of the Philosophy of Science 1 (Amsterdam: Elsevier, 2007), 519–21.

¹⁹ Kirsten Walsh, "Has Laudan Killed the Demarcation Problem?" (Master thesis, The University of Melbourne, 2009), §3.1.

²⁰ Elliott Sober, *Evidence and Evolution: The Logic Behind the Science* (Cambridge: Cambridge University Press, 2008), §1.3.

²¹ Sober, 152.

we do not know the probabilities of theories simpliciter (their “prior probabilities”), we cannot use Bayes’ theorem (claim 2) to determine their probabilities given the observations. But prior probabilities of theories are also not needed when checking whether a theory makes probabilistic observational assertions, and it indeed follows directly from the respective definitions that a theory makes probabilistic observational assertions if and only if it can be tested against a tautology. If a theory can be negated, for instance because it can be expressed as a single sentence, one can establish a similar result: The theory makes probabilistic assertions if and only if it is testable against its own negation (claim 5). This result fits with the general idea that if it makes no empirical difference whether a theory is true or false, then the theory is not scientific.²² In conclusion, then, Sober can also accept (non-contrastive) testability, or the making of probabilistic observational assertions, as a necessary condition for being a scientific theory. Therefore, he can also accept the making of observational assertions as a necessary condition.

There are two aspects of testability that still need to be filled in: We have to spell out what counts as observations and what the auxiliary assumptions are. Much hinges on the choice of auxiliary assumptions. For instance, Laudan²³ claims that creationism, the claim that the biblical god has created all life, is falsifiable and indeed has been falsified. Ruse²⁴ disputes this claim. Both are right in some respect, because the falsifiability (and hence testability) of creationism depends on the auxiliary assumptions at play. This is most obvious with young earth creationism, which claims that our universe is only a few thousand years old. Using standard physics, this is undermined by light arriving from stars that are more than a few thousand light years away. With standard physics as auxiliary assumptions, Laudan is therefore right. But one reply to the argument from far-away stars by creationists is that the light was simply created in transit. Thus by giving up standard physics, creationism becomes untestable.²⁵

It is easy to trivialize testability if the auxiliary assumptions can be chosen at will (for any

²² Cf. Wesley C. Salmon, “Verifiability and Logic,” in *Mind, Matter, and Method. Essays in Philosophy and Science in Honor of Herbert Feigl*, ed. Paul K. Feyerabend and Grover Maxwell (Minneapolis, MN: University of Minnesota Press, 1966), 368.

²³ Larry Laudan, “Commentary: Science at the Bar—Causes for Concern,” *Science, Technology, & Human Values* 7, no. 41 (1982): 16.

²⁴ Michael Ruse, “Response to the Commentary: Pro Justice,” *Science, Technology, & Human Values* 7, no. 41 (Autumn, 1982): 22.

²⁵ In *The Analysis of Mind* (London: George Allen and Unwin, 1921), 159–60, Bertrand Russell discusses the more poignant thesis that “the world sprang into being five minutes ago,” adding that he is “not suggesting that the non-existence of the past should be entertained as a serious hypothesis. Like all sceptical hypotheses, it is logically tenable, but uninteresting.”

theory, choose the sentence “If the theory is true, then in exactly one year it will rain in the Sahara”), so auxiliary assumptions should be well-confirmed, just as they have to be in general when we want to predict something from a theory.²⁶ As Sober²⁷ points out, however, one can still trivialize testability if this is the only requirement (for any theory, the statement “If the theory is true, then the earth is not a cube” is well-confirmed, and its conjunction with the theory entails something not entailed by the statement itself). One plausible solution to this problem is to demand that the auxiliary assumptions form an “honest set” (or, shorter, “be honest”), where a set of statements is *honest* if and only if each of its elements is confirmed and the set also contains every statement on which the confirmation of an element depends. Loosely, one can think of a set of honest auxiliary assumptions as tracing some (fictitious) person’s path through life, gathering justified beliefs as they go.²⁸

The observations do not have to be actual perceptions, but have to be uncontroversial in the context at hand. This is particularly simple when two theories are compared (for instance ID and evolutionary theory), for in that case, all concepts that are shared between the two theories can be treated as uncontroversial. In general, it requires a thorough understanding of the context to identify uncontroversial concepts. When it comes to ID, statements of immediate perception and simple measurement are typically uncontroversial.

3 Testability and Intelligent Design

ID is a difficult theory to pin down.²⁹ In some accounts, notable by the Discovery Institute,³⁰ ID is the claim that the assumption of a designer best explains specific phenomena, those with “complex specified information” (CSI). According to an influential textbook on ID by William

²⁶ As Matti Eklund has pointed out to me, one could argue that someone who mistakenly uses unconfirmed auxiliary assumptions for making observational assertions is still doing science, but poorly. This would fit with Laudan’s view that the relevant distinction lies not between science and non-science, but between good science on the one hand and bad science and non-science on the other. But, first, it seems reasonable to say that people who think they are following scientific rules but do not also only think they are doing science but do not. More importantly, the question is not whether someone is doing science, but whether a theory used to make observational assertions relative to unconfirmed auxiliary assumptions is thereby scientific. And the case of the mistaken researcher is no reason to think that the answer to the latter question is positive.

²⁷ Sober, *The Design Argument*, §4.3.

²⁸ Sebastian Lutz, “Empiricism and Intelligent Design I: Three Empiricist Challenges,” *Erkenntnis* 78, no. 3 (2013): 669–70, <https://doi.org/10.1007/s10670-012-9391-6>.

²⁹ Sebastian Lutz, “Empiricism and Intelligent Design II: Analyzing Intelligent Design,” *Erkenntnis* 78, no. 3 (2013): 681–98, <https://doi.org/10.1007/s10670-012-9392-5>.

³⁰ Discovery Institute, *What is Intelligent Design?*, <http://www.intelligentdesign.org/whatisid.php>. Accessed 2025-11-17, archived at <https://perma.cc/A7L7-G2HD>. Discovery Institute, 2025.

A. Dembski and Jonathan Wells,³¹ ID is the claim that given phenomena with CSI, we can infer the existence of a designer. Neither of these two claims have straightforward factual content: The Discovery Institute's claim is about an explanatory relation, and Dembski and Wells's claim is about an inferential relation. Both claims should be decidable on conceptual grounds, for instance based on the definitions of "explanation" or "inference," respectively. I will get back to these two claims after looking at an account of ID that is closer to usual empirical theories.

A substantial claim about the origin of phenomena with CSI is that all phenomena with CSI are the result of, or created by, an intelligent designer. This is the theory of ID that I will investigate in the following.

Critics sometimes call ID "intelligent design creationism," while proponents of ID typically object to this moniker. Again, I think, both sides are right in some respect: The critics are genealogically correct, because ID has its origin in creationism.³² Proponents of ID are logically correct, because creationism is, roughly, ID with the biblical god as a designer and thus entails ID, while ID does not entail creationism. So ID is not logically a specific kind of creationism. Flew,³³ who challenges the falsifiability of theism, contends that "a fine brash hypothesis [has been] killed by inches, the death by a thousand qualifications." It is my contention that ID has killed the fine brash hypothesis of creationism (with standard auxiliary assumptions) in one sweep, by replacing the biblical god by a not further specified designer or, indeed, multiple designers, possibly one for each phenomenon with CSI.³⁴ Sober³⁵ has argued in detail that because the designer is not specified in any way (and in particular not restricted to be human-like), both the intentions and the abilities of the designer are completely undetermined.³⁶ Sober³⁷ argues in a number of ways that the intentions of the designer are unknown and also gives lists of proponents of ID who state that the intentions of the designer cannot be known.³⁸

Sober's point can also be made on purely logical grounds: As long as ID only states that for every phenomenon with CSI there is an intelligent designer, that designer could be *anything*, as

³¹ William A. Dembski and Jonathan Wells, *The Design of Life: Discovering Signs of Intelligence in Biological Systems* (Dallas, TX: Foundation for Thought and Ethics, 2008), ch. 7.

³² Barbara Forrest, "Still Creationism After all these Years: Understanding and Counteracting Intelligent Design," *Integrative and Comparative Biology* 48, no. 2 (2008): 189–201, <https://doi.org/10.1093/icb/icn032>.

³³ Flew, 258.

³⁴ I thank Paul Needham for suggesting that I clarify this point.

³⁵ Sober, *Evidence and Evolution: The Logic Behind the Science*, §2.8.

³⁶ The following discussion is in part based on Lutz, "Empiricism and Intelligent Design II," 691–92.

³⁷ Sober, *Evidence and Evolution: The Logic Behind the Science*, §2.12, §2.15.

³⁸ E.g., Sober, 128, 154, n. 29.

long as the description of the designer is consistent. ID is in this sense the weakest possible theory about designers of phenomena with CSI. As a result, ID makes no observational assertions, because for any designer who would have some intention and ability with some probability, one can think consistently (and easily) of another designer who has that intention and ability with any other probability.

It is essential not to confuse this theory with stronger theories about specific designers of objects with CSI. For instance, there have been attempts to infer the designer's intentions or abilities from observations,³⁹ but the attempts assume that the designer would make design decisions similar to humans. And this assumption is unwarranted, since the designer could be completely different from humans (for instance, all-powerful and all-knowing).

There are two exceptions to this possibility of alternative designers. The first consists of cases in which observation statements can be assigned a probability independently of assuming a designer. One can then arguably justify the auxiliary assumption that if a designer created the phenomenon, the designer must have had the intention and ability to bring about the observation with the given probability. But if this probability is used to justify the auxiliary assumption, it has to be an auxiliary assumption as well if the auxiliary assumptions are honest. The other exception consists of cases in which a more specific theory of a designer, say, the biblical god, makes observational assertions and is well-confirmed by observable facts. Then this theory of the specific designer might make observational assertions, so that there would be a theory that entails that there is a designer and that also makes observational assertions. But in that case, the theory about the specific designer as a whole is an auxiliary assumption, and ID, since it is being entailed by this more specific theory, makes only assertions that are also made by the auxiliary assumption.⁴⁰ Thus, ID only assigns a probability to observational statements if the auxiliary assumptions assign the same one. Therefore ID is not testable.

Now we can go back to the claims by the Discovery Institute and Dembski and Wells: That ID is not testable means that it does not entail and neither raises nor lowers the probability of any observation statement, and this renders ID useless for all plausible accounts of explanation. Thus the Discovery Institute's claim is simply false: ID is not the best explanation of anything because it is no explanation at all. And because the probability of a theory is only raised by an observation if the probability of the observation is also raised by the theory, one cannot infer

³⁹ Casey Luskin, "The Positive Case for Design" (<http://www.discovery.org/scripts/viewDB/filesDB-download.php?id=986>. Version 3.0. No publication date given, accessed 2025-11-17, archived at <https://perma.cc/SUD6-6M9J>, 2010); Lydia McGrew, "Testability, Likelihoods, and Design," *Philo* 7, no. 1 (2004): 5–21, <https://doi.org/10.5840/philo2004711>.

⁴⁰ I thank Daniel Berntson for helping me clarify this point.

ID from any observation statement, so that Dembski and Wells's claim is false as well, at least according to probability theory. This is a fair criticism to the extent that probability theory is adequate for the inference of ID theories.⁴¹ Dembski's own account of inference has been developed as a competitor to probability theory, but has been criticized on its own terms.⁴²

4 Heuristics

In a way it is surprising that ID is not testable, because it is rather difficult to develop a theory that is neither tautological nor gibberish, but still makes no observational assertions. This may be easiest to see when considering the converse of this claim: It is very easy to change ID into a new, testable theory by conjoining it with the statement 'cats have holes in their fur where their eyes are', since the conjunction $ID \wedge$ 'cats have holes in their fur where their eyes are' asserts that cats have holes in their fur where their eyes are. More substantially, ID can be conjoined with evolutionary theory (ET), so that the new theory $ID \wedge ET$ asserts everything asserted by ET.

Since ET is falsifiable, so is $ID \wedge ET$, which therefore meets this necessary condition for scientific theories (it may fail other necessary conditions, of course). But is $ID \wedge ET$ a good scientific theory? It seems fair to say that it is not, since ID contributes no assertions, explanations, or justifications to $ID \wedge ET$. There is thus no reason for preferring $ID \wedge ET$ over ET alone,⁴³ and some reason for preferring ET over $ID \wedge ET$, since the latter contains an inert, bolted-on part.

A better way of developing a new theory of ID is to include the intentions of the designer in the theory instead of treating them as auxiliary assumptions. In other words, the new ID should specify the designer. The specification, however, should not simply rely on some statement like 'cats have holes in their fur where their eyes are' or some theory like ET and declare that the designer intends cats to have expediently located holes in their fur or intends organisms to develop according to ET, for then the new ID could just be replaced by the statement or theory in question. Instead, I suggest that developers of ID take the role of intentions in ID seriously. Intentions are absent from scientific theories outside of psychology, sociology, and similar theories about mental phenomena. In fact, theories that are used to explain non-mental phenomena other than bodily movements with the help of intentions tend to be classed as paranormal: Obvious examples are telekinesis and the law of attraction. ID is special, though,

⁴¹ L. McGrew, Timothy McGrew, "Toward a Rational Reconstruction of Design Inferences," *Philosophia Christi* 7, no. 2 (2005): 253–98.

⁴² Fitelson, Stephens, and Sober, "How Not to Detect Design"; Elsberry and Shallit, "Information theory"; Häggström, "Intelligent Design and the NFL"; Häggström, "Uniform Distribution."

⁴³ Cf. Lutz, "Empiricism and Intelligent Design I," §3.

because the intentional entity is not a human or other animal. While the law of attraction states, roughly, that one's thoughts manifest in the world (so that, for instance, thinking deeply about having a potato manifests a potato), ID states that there is someone else whose intentions manifest in the world.

ID researchers thus would do well to look for ways of eliciting the intentions of the designer in a way that is distinguishable from standard paranormal theories. For instance, ID researchers could look for effects of human intentions on the world that are more complicated than, say, thinking of a potato and getting one. The designers could, for example, systematically follow a moral code when deciding which human wishes are manifested and which are not. The law of attraction should hold for thoughts of potatoes as much as for thoughts of exploding kittens, but the mediating intelligent designers would hopefully not manifest the latter. There is also a chance that the designers respond honestly to attempts at communication, for instance by responding to questions. Finally, the designers' intentions may manifest without the involvement of humans or other animals: Writings on untouched stone, for instance, could reveal intentions if one assumes that the designers are honest (since trickster gods would write one thing but do another). The main worry with the latter two approaches is that so far no communications have been forthcoming, at least not uncontroversially so.⁴⁴

So, while the current theory of ID is untestable, there is a chance that a new theory of ID is testable, for instance if it is modified based on direct communications from the designer or designers. So far, such communications remain a pious hope, however, and as the history of revelation-based predictions has shown, there is a very real chance that this new ID will be testable, tested, and shown false.

⁴⁴ As Merel Semeijn pointed out to me, the approaches also move any such new theory of ID much closer to theism, which ID researchers might want to avoid, again for sociological reasons.

Appendix: Definitions and proofs

Definition 1. Observation statement O is possible given auxiliary assumptions A if and only if $A \not\models \neg O$.

Definition 2. Auxiliary assumptions A are compatible with theory T if and only if $T \cup A \not\models \perp$

Definition 3. Theory T makes deductive assertions relative to compatible auxiliary assumptions A if and only if there is an observation statement O such that $A \not\models \neg O$, $T \cup A \models O$, and $A \not\models O$.

Definition 4. Theory T is falsifiable relative to compatible auxiliary assumptions A if and only if there is an observation statement O such that $A \not\models \neg O$ and $\{O\} \cup T \cup A \models \perp$.

Claim 1. *If the negation of an observation statement is an observation statement, then theory T is falsifiable relative to auxiliary assumptions A if and only if T makes deductive observations relative to auxiliary assumptions A .*

Proof. $T \cup A \not\models \perp$, $A \not\models \neg O$, and $\{O\} \cup T \cup A \models \perp$ if and only if $T \cup A \not\models \perp$, $A \not\models \neg O$, and $T \cup A \models \neg O$. This holds if and only if $T \cup A \not\models \perp$, $A \not\models \neg O$, $T \cup A \models \neg O$, and $A \not\models \neg \neg O$ because, if it were the case that $A \models \neg \neg O$, then $T \cup A \models \neg \neg O \wedge \neg O \models \perp$, which is false. \square

Claim 2 (Bayes' theorem). Write O for $\{O\}$. Then

$$Pr(T|O \cup A) = \frac{Pr(O|T \cup A)}{Pr(O|A)} Pr(T|A)$$

Proof. Define $Pr^*(\cdot) = Pr(\cdot | A)$. Then $Pr(T|O \cup A) = Pr^*(T|O) = \frac{Pr^*(T \cup O)}{Pr^*(O)} = \frac{Pr^*(T \cup O) Pr^*(T)}{Pr^*(O) Pr^*(T)} = \frac{Pr^*(O|T)}{Pr^*(O)} Pr^*(T) = \frac{Pr(O|T \cup A)}{Pr(O|A)} Pr(T|A)$. \square

Definition 5. Auxiliary assumptions A are probabilistically compatible with theory T if and only if $Pr(T \cup A) \neq 0$

Definition 6. Observation statement O is probabilistically possible given auxiliary assumptions A if and only if $Pr(A \cup \{O\}) \neq 0$.

Definition 7. Set S of statements raises the probability of set Q of statements relative to set A of statements if and only if $Pr(Q|S \cup A) > Pr(Q|A)$. S lowers the probability of Q relative to A if and only if $Pr(Q|S \cup A) < Pr(Q|A)$. For the purposes of this definition, individual sentences are treated as singleton sets.

Claim 3. *T raises the probability of O relative to A if and only if T lowers the probability of $\neg O$ relative to A .*

Proof. Define $Pr^*(\cdot) = Pr(\cdot | A)$. $Pr(O|T \cup A) > Pr(O|A)$ if and only if $Pr^*(O|T) > Pr^*(O)$. Since with definition $Pr'(\cdot) = Pr^*(\cdot | T)$, $Pr^*(O|T) = Pr'(O) = 1 -$

$Pr'(\neg O) = 1 - Pr^*(\neg O|T)$, this holds if and only if $1 - Pr^*(\neg O|T) > 1 - Pr^*(\neg O)$, that is, $Pr^*(\neg O|T) < Pr^*(\neg O)$, which means $Pr(\neg O|T \cup A) < Pr(O|\neg A)$. \square

Definition 8 (Probabilistic testability). A theory is *probabilistically testable* relative to compatible auxiliary assumptions if and only if there is a probabilistically possible observation statement that changes the probability of the theory relative to the auxiliary assumptions.

Claim 4. *T is probabilistically testable relative to compatible auxiliary assumptions A if and only if T makes probabilistic assertions relative to A.*

Proof. Write O for $\{O\}$. By Bayes' theorem, $Pr(T|O \cup A) > Pr(T|A)$ if and only if $Pr(O|T \cup A) > Pr(O|A)$, and $Pr(T|O \cup A) < Pr(T|A)$ if and only if $Pr(O|T \cup A) < Pr(O|A)$. By claim 3, $Pr(O|T \cup A) < Pr(O|A)$ if and only if $Pr(\neg O|T \cup A) > Pr(\neg O|A)$. \square

Definition 9 (Contrastive testability). Theory T_1 is *testable against* theory T_2 relative to compatible auxiliary assumptions A if and only if there is a probabilistically possible observation statement O such that $Pr(O|T_1 \cup A) \neq Pr(O|T_2 \cup A)$.

Claim 5. *Assume T can be negated. Then theory T is testable against $\neg T$ if and only if it makes probabilistic assertions.*

Proof. By Bayes' theorem, $Pr(O|T \cup A) = Pr(O|\{\neg T\} \cup A)$ if and only if $\frac{Pr(T|O \cup A)Pr(O|A)}{Pr(T|A)} = \frac{Pr(\neg T|O \cup A)Pr(O|A)}{Pr(\neg T|A)}$. With $Pr^*(\cdot) = Pr(\cdot|A)$, this holds if and only if $\frac{Pr^*(T|O)Pr^*(O)}{Pr^*(T)} = \frac{Pr^*(O) - Pr^*(T|O)Pr^*(O)}{1 - Pr^*(T)}$, which in turn holds if and only if $Pr^*(T|O)Pr^*(O) - Pr^*(T|O)Pr^*(O)Pr^*(T) = Pr^*(O)Pr^*(T) - Pr^*(T|O)Pr^*(O)Pr^*(T)$, that is, $Pr(T|O \cup A) = Pr^*(T|O) = Pr^*(T) = Pr(T|A)$, which, by Bayes' theorem, is equivalent to $Pr(O|T \cup A) = Pr(O|A)$. \square

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