Pascal's Inference

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Published in *Faith and Reason*, Summer 2001

"I should be much more afraid of being mistaken and then finding out Christianity is true than of being mistaken in believing it to be true." - Pascal

Pascal's wager is not a proof of the existence of God; it is rather an encouragement to believe, a simple demonstration of the reasonableness of belief, whose main point is "you have little to lose and everything to gain." Its main outlines are captured in the accompanying matrix.

Pascal's Wager

	God is	**God is not**
believe	heaven	embarrassment
do not believe	hell	not fooled

Somewhere out beyond our perceptions a coin is tossed. If it comes up heads, God exists; tails, God does not exist. You must place your bet on one of two squares: "believe" or "don't believe." If you bet on belief, and God exists, you gain eternal life, a prize of infinite value. If you bet on belief and God does not exist, you gain nothing and lose nothing - you may perhaps feel some slight embarrassment in the instant between death and the void. If you place your bet on "don't believe," and God exists, you suffer the loss of eternal life - Pascal emphasized the loss of eternal happiness instead of the suffering of eternal damnation. If you don't believe and God does not exist, you lose nothing, and are perhaps freer to pursue your pleasures in this life.

If you are a betting man, and you admit any chance that there is a God in heaven, then the possibility that God exists, and the eternal life and eternal damnation that attach to the two bets, should convince you (or at least any reasonable person) to cast your lot with belief.

The wager is compelling, but it has an important weakness as an apology for belief: the favorite modern metaphor for non-belief is not that of the bettor, but that of the scientist. The modern mind casts itself in the role of scientist, making use of available data to infer the existence or non-existence of God. For Pascal's wager, the modern mind substitutes Occam's razor, the principle that if two theories explain a phenomenon equally well, then the simpler one is preferred.

In this metaphor, God is an unnecessarily complicated hypothesis, and may thus be rejected in favor of the hypothesis that God does not exist. The modern mind is confident that all things are explainable in natural terms; events which are seemingly inexplicable are either the result of a well-understood process which is hidden from the observer, or the result of a not-yet understood scientific principle. The history of scientific progress lends credence to the assertion that all events have a naturalistic explanation. To the modern mind, this argument is unanswerable; scientific inquiry appears to provide an objective standard by which to decide the issue of God's existence. The rejection of God's existence should be obvious to anyone who accepts scientific standards of proof. To those enamored of Occam's razor, Pascal's wager seems beside the point.

To make Pascal's wager more accessible to those who justify their disbelief in scientific terms, it should be recast as Pascal's "inference." The insight of the wager, when placed in scientific context, emphasizes the subjective nature of scientific tests, and corrects a false sense of objectivity in scientific discourse. The result of a statistical test is not independent of the judgment of the

researcher, but instead depends on the researcher's aversion to false positives and false negatives.[1] Pascal's inference makes the case, in opposition to conventional scientific practice, for minimizing the likelihood of a false negative.

No hypothesis is analyzed in isolation; each hypothesis is tested against an alternative. A modern who describes his non-belief in scientific terms will contrast the **null hypothesis** (H_0 or maintained hypothesis[2]), that God does not exist, with the **alternative hypothesis** (H_1), that God exists. If the null hypothesis is true, then the world should look a certain way: material phenomena should obey certain laws without exception, and all putative "spiritual" experience should be explainable in purely material, naturalistic terms. If the alternative hypothesis is true, the world should depart from the null hypothesis in certain predictable directions. In other words, the hypothesis that God exists should explain certain phenomena (material or spiritual) more completely than the hypothesis that he does not. In this case, it becomes more difficult to maintain the hypothesis that God does not exist.

The testing of the alternative hypothesis (God exists) against the null (He does not) is complicated by our uncertain knowledge of creation. Faced with an unexplainable phenomenon - a person "miraculously" healed of cancer, for instance - science cannot rule out the possibility that it may be the result of an as-yet undiscovered scientific principle or, more likely, that it may be the result of

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[1] For more on the subjective judgments involved in statistical tests, see Mark Blaug, The Methodology of Economics, or How Economists Explain (Cambridge: Cambridge University Press, 1992), p.21-23.

[2] We might of course, quarrel with the choice of "God does not exist" as the maintained hypothesis. Scientific practice would suggest that it should be so because "God does not exist" is a simpler hypothesis; Occam's razor would suggest that the simpler hypothesis be the maintained hypothesis. Of course, one may argue that "God exists" is the simpler hypothesis.

some well-understood process hidden from the observer. For example, the human body may fight cancer in ways science does not understand, and some claimed healings turn out to be fraudulent. Just as certainly, science cannot rule out that God exists - miracles which are in some sense explainable as chance phenomena do not preclude God's action, since God is free to act both inside and outside the laws He created and keeps in being. Given this very real uncertainty, the scientific mind should be aware that its inferences are imperfect, and may be mistaken.

In the face of this knowledge that appearances can be deceiving, a scientist must decide on a level of skepticism towards the data before him. He must determine how inexplicable the data must be without the hypothesis of God before he will accept that God exists. In short, he must decide how credulous he will be.

In choosing to accept or reject an alternative hypothesis based on observation, a scientist may err in one of two ways: he may reject that God exists when God does in fact exist, and he may accept that God exists when God in fact does not exist. The first type of error - failing to accept the alternative (God exists) when it is in fact true - is called a "type II" error. The second type of error - accepting the alternative when it is not true (saying that God exists when God does not exist) is called a "type I" error.

Returning to the matrix outlining Pascal's wager, we can recast it in terms of statistical inference. An inference about God can be true in two instances, shown by the upper left and lower right corners of the matrix. If we say that God

is, and He is, we have inferred correctly His existence; if we say that God is not, and He is not, then we have inferred correctly His non-existence. The lower left corner is an instance of type II error: we infer that God does not exist when, in fact, He does. The upper right corner is an instance of type I error: we have inferred that God exists when, in fact, He does not.

Pascal's Inference

	God is	**God is not**
believe	heaven	embarrassment (type I error)
do not believe	hell (type II error)	not fooled

As we have said, to the scientific mind, the uncertainty surrounding inference suggests that any inference may be mistaken. If you infer that God exists, you may be wrong, and commit a type I error. If you infer that God does not exist, you may commit a type II error. The level of skepticism you show for the proposition that God exists will determine how likely the two types of error are.

For example, you might choose to be relatively credulous, believing in God on the basis of healings that have not been explained by human science, or on the basis of the intricate order in nature. If your level of skepticism is as low as this, you are more likely to infer that God exists, more likely to make a type I error, and correspondingly less likely to make a type II error (since you are less likely to infer that God does not exist).

If instead you choose a high degree of skepticism, high enough so that you will not be convinced that God must exist even if thousands of people testify that they saw the sun dance and witnessed several days worth of rain dry up within minutes, or even if the universe gives testimony to a creator, then you are unlikely to infer that God exists, and are much more likely to commit type II error (inferring that God does not exist when he does) than type I error (inferring that He exists when He does not).

Thus a scientist deciding between hypotheses cannot avoid exposing himself to at least one of the errors of inference: he will either expose himself to the chance of a false positive on the existence of God, or to the chance of a false negative, or to some combination of the two. Because the level of skepticism will affect the likelihood of type I or type II error, the decision about how skeptical to be (about what evidence will be convincing) will depend on how eager the scientist is to avoid type I or type II errors.

A scientist who chooses an infinitely high level of skepticism (who will not be convinced of God's existence by any phenomenon) is implicitly refusing to expose himself to the possibility of type I error – he insures that he will never infer that God exists when He in fact does not by insuring that he never believes in God. When the unbending skeptic sets wildly stringent conditions for belief, he testifies to the fact that scientists as a group are more averse to type I errors than they are to type II errors. That is, they are more averse to rejecting a null hypothesis when it is in fact true than they are of accepting it when it is false. In the social sciences, at least, researchers usually ignore type II error entirely, and

set standards of proof with a view to keeping the probability of type I error quite low (below 5%) regardless of the probability of type II error.

A notable exception to this scientific neglect of type II error is the medical profession.[3] Because a false negative is a serious matter when testing for cancer or other life-threatening diseases, the medical profession is often willing to accept a high probability of type I error - a false positive - in order to minimize the probability of type II error - a false negative. For example, breast cancer screenings generate many false positives, and result in a lot of unfounded anxiety for women who are told they may have cancer when they in fact do not. This high probability of type I error goes hand in hand with a low probability of type II error - breast cancer screenings rarely miss cancer when it is there.

Pascal's wager can be interpreted as an argument for taking type II error more seriously. The consequence of inferring that God does not exist when in fact He does are even more alarming than the consequences of missing breast cancer when it exists – the researcher loses eternal life and its attendant infinite benefit. In contrast, the costs of type I error are minimal – perhaps some embarrassment at having acted as though God existed when in fact He did not. Pascal would argue that a strong aversion to type I error and neglect of type II error is misplaced when the hypothesis is God's existence. The extreme aversion to type I error implicit in the extreme skepticism of the atheistic scientist is recklessly imprudent.

[3] Other examples can no doubt be found in other applied professions, such as engineering, where a false negative on the hypothesis that a structure is unsafe is highly undesirable.

A recasting of Pascal's wager as an inference turns what is a powerful encouragement for belief into a sharp examination of non-belief. Pascal's inference highlights the value judgments which are inherent in scientific proof - the acceptance or rejection of an hypothesis is not a purely objective exercise, but depends importantly on the aversion of the researcher to the two types of inferential errors. The scientific mind does not want to believe in God if God does not exist, and so designs criteria of proof which make the probability of a mistaken acceptance of God's existence very small. In doing so, scientists make it more likely that they will mistakenly reject God's existence. Pascal would point out that the consequences of a mistaken rejection of God are more serious than the consequences of a mistaken acceptance. Tests of God's existence should seek to lower the probability of a false negative, even at the cost of an increased probability of a false positive.