Faith and Philosophy: Journal of the Society of Christian Philosophers

Volume 4 | Issue 4

Article 4

10-1-1987

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Recommended Citation

Otte, Richard (1987) "A Theistic Conception of Probability," *Faith and Philosophy: Journal of the Society of Christian Philosophers*: Vol. 4 : Iss. 4 , Article 4.

DOI: 10.5840/faithphil19874440

Available at: <https://place.asburyseminary.edu/faithandphilosophy/vol4/iss4/4>

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A THEISTIC CONCEPTION OF PROBABILITY

Richard Otte

Although the doctrines of theism are rich enough to support a distinctively theistic conception of probability, historically there has been little discussion of probability from a theistic perspective. In this article I investigate how a theist might view epistemic probability. A unique conception of probability naturally follows from ideas central to theism, and it is argued that this conception of probability avoids many problems associated with other interpretations of probability.

Our modern probability calculus was developed in the 17th century by thinkers such as Pascal. But although there was one probability calculus, there were two dominant interpretations of what probability was. On one view probability was an aleatory notion. Probability was a statistical concept and was used for the purposes of life insurance and annuities. The other major position considered probability to be an epistemological concept. According to this view, probability was a measure of rational degree of belief, and was useful for the purposes of decision theory and wagering in games of chance. Both of these interpretations of probability shared a common probability calculus, and both of them were called "probability". These two basic interpretations of probability have survived the test of time and are still the primary ways of interpreting probability. Although these original interpretations of probability have evolved, and new ones have been developed, the distinction between aleatory and epistemological interpretations of probability is still useful.

The first epistemological interpretation of probability was the classical interpretation. According to this view, which was promoted by Laplace, epistemic probability is the ratio of favorable to equally possible cases. Due to difficulties this interpretation faced, it became less popular and was eventually replaced by more sophisticated epistemological interpretations. Logical theories grew out of the classical theory and retained a modification of the central idea of the classical interpretation. The logical interpretation, as developed by Harold Jeffreys, J. M. Keynes, and Rudolf Carnap, construed epistemic probability as a logical relation. The amount of support a hypothesis received from some evidence was logically related to the hypothesis and the evidence. It was believed that the rational degree of belief in a hypothesis on the basis of some evidence should be equal to the logical probability of the hypothesis given the total available

evidence. One serious problem with this interpretation has been finding a logical relation which can plausibly be thought to be epistemic probability. Although it is not difficult to find a logical relation which satisfies the probability calculus, a logical relation that can be equated with rational degrees of belief has proven much more elusive. For example, upon Carnap's logical theory all universal generalizations receive probability zero, and all existential statements receive probability one. But surely these logical probabilities cannot be identified with rational degrees of belief. As a result, many philosophers have adopted subjective theories of epistemic probability.

According to the interpretation of probability developed by F. P. Ramsey and B. de Finetti, epistemic probability is to be explicated in terms of an individual's degrees of belief. A person's degrees of belief constitute that person's subjective probability function. However, we are interested in *rational* degrees of belief, and not all subjective probability functions are rational, because people have irrational systems of beliefs. A necessary condition for a person's degrees of belief to be rational is that they be internally consistent. Many subjectivists claim that internal consistency is also a sufficient condition of rationality. A set of degrees of belief are considered to be internally consistent if and only if they are coherent, which means that they satisfy the probability calculus. Thus epistemic probability is a measure of an individual's coherent degrees of belief. This interpretation of probability has been called 'personal probability' by L. J. Savage, although many philosophers refer to it as 'Bayesianism'.

Bayesianism faces difficulties because it does not appear that the constraint of coherence which is placed upon degrees of belief is adequate to characterize rational degrees of belief. The requirement that rational degrees of belief satisfy the probability calculus is both too strong and too weak. There are rational sets of beliefs which do not satisfy the probability calculus as well as sets of belief that satisfy the probability calculus but which are irrational. For example, the probability calculus requires that every necessary proposition have probability one. This implies that all mathematical truths, which are necessary, receive probability one. But it is rational for a human to believe true mathematical propositions to a degree less than one; hence some rational degrees of belief do not satisfy the probability calculus. Furthermore, it would be irrational for any human to believe all necessarily true propositions to degree one. For example, Goldbach's conjecture is either necessarily true or necessarily false. If it is necessarily true, it would be incoherent to believe it to any degree other than one. And if it is necessarily false, coherence requires it be believed to degree zero. But we would consider it irrational for a person to believe Goldbach's conjecture to degree one or zero. Hence subjective probability functions which satisfy the probability calculus are irrational. Bayesianism is a normative interpretation of epistemological probability in the sense that it attempts to characterize

rational degrees of belief. However, the requirement of coherence does not characterize rational degrees of belief. Thus we still lack anything like a deep understanding of epistemic probability.

Historically there have been close connections between epistemic probability and theism. The first application of probability to decision theoretical contexts other than games of chance was Pascal's wager. Teleological arguments are often stated in probabilistic terms, and more recent discussions of the rationality of belief in God have relied on probabilistic confirmation theory. However, even though theists have been quick to employ the concept of probability in their reasoning, they have had very little to say about probability itself. Theists have usually adopted some currently popular interpretation of probability for use in their arguments. A good example of this is Thomas Reid. Reid's discussion of "the probability of chances" is a typical discussion in terms of the classical interpretation of probability.² This is unfortunate since the doctrines of theism are rich enough to support a radically different view of epistemic probability.

In this paper I will investigate how a theist might view epistemic probability. I will then show that a certain conception of probability naturally follows from ideas central to theism, and explain how this theistic conception of epistemic probability is quite different from the other traditional epistemological interpretations of probability. Finally, I will argue that this theistic conception of probability avoids many of the problems besetting the other interpretations of probability.

Theistic Considerations on Rationality

Since epistemic probability is concerned with rational degrees of belief, the theistic doctrines relevant to epistemic probability will be those connected with the formation of rational beliefs. One relevant theistic doctrine is that humans are created in the image of God. God is a being that has knowledge, and humans were created with the capacity for knowledge and the ability to know certain propositions. Furthermore, human beings were placed in an environment in which it is possible for them to have knowledge and rational beliefs. Just as the environment we live in was designed to be habitable by creatures with bodies such as ourselves, our cognitive faculties and the environment were designed in such a way that humans can have rational beliefs and knowledge about this environment. This is not a necessary situation, because it is possible that our cognitive faculties and the environment could have been unsuited for each other. Those irreconcilable differences might have prevented us from obtaining knowledge about the environment. For example, there are possible environments in which humans would consistently produce false beliefs about the external world. Skeptics are fond of pointing out that these are possible environments. Or our

senses might consistently give rise to conflicting beliefs, and we might be quite confused. However, according to theism, there is a compatibility between our cognitive faculties and our environment. The cognitive faculties of human beings did not arise by chance, but were designed to function in such a way that knowledge would be produced. For example, our cognitive faculties may be designed in such a way that we form the belief that we see a tree when we are appeared to in a treely sort of way. In such a situation, our belief that a tree is present may be rational and count as knowledge, even though there is no good inductive or deductive argument from our experience to the existence of the tree. The belief is rational and counts as knowledge because our cognitive faculties were designed to produce that belief in those circumstances.

According to this theistic perspective, a person S's belief is rational if it is produced in S by cognitive faculties that are functioning properly.³ However, our minds do not always operate in the way in which they were designed to function; there are such things as cognitive dysfunction and mental illness. In the *First Meditation* Descartes gives examples of men who believe that their heads are made of clay, or that their bodies are made of glass. Our cognitive faculties can malfunction and fail to produce the beliefs they were designed to produce. In instances such as these the beliefs formed may not be rational beliefs. The crucial idea is that our minds and cognitive faculties have ways of functioning properly and ways of malfunctioning. Our beliefs are rational when our cognitive faculties function properly. We will say that a person with properly functioning cognitive faculties is a properly functioning cognizer. Two philosophers who have stressed this aspect of rationality are Thomas Reid and Alvin Plantinga. According to Reid, our minds are designed to produce certain beliefs in certain situations, and minds that fail to form those beliefs are defective. (p. 565) Plantinga goes further and claims that epistemic warrant or justification is best thought of as the result of a properly functioning mind.⁴ Both Reid and Plantinga connect rationality with a mind forming beliefs in the way it was designed to form beliefs.

In considering epistemic probability we are interested in rational degrees of belief. According to a theistic view of rationality, our minds are designed in such a way that in appropriate circumstances we will believe a given proposition to a certain, possibly vague, degree. In other words, a person with a properly functioning mind will have beliefs of varying degrees.⁵ These degrees of belief provide the basis for a theistic conception of epistemic probability. This view of probability was vaguely anticipated by Reid. In his discussion of probabilistic reasoning, he claimed that "in most cases, we measure the degrees of evidence by the effect they have upon a *sound understanding*, when comprehended clearly and without prejudice." (p. 691, emphasis mine) It is these ideas about rational belief that will be developed into a theistic interpretation of probability.

Probability

The above considerations on rationality indicate that the epistemic probability of a proposition can be interpreted in terms of the degree to which a person with a properly functioning mind would believe the proposition. But, of course, the degree to which a person with a properly functioning mind would believe a proposition will be dependent upon the circumstances the person is in. For example, if my faculties are functioning properly and I am appeared to in a treely sort of way, I may believe that a tree is present. But if I am not being appeared to treely, I may not believe that a tree is present. One cannot legitimately speak of what a person with a properly functioning mind would believe without specifying the circumstances that the person is in. A proposition might be very believable relative to some circumstances, and yet without warrant relative to other circumstances. Rationality is relative to a mind's epistemic situation. Accordingly, we will relativize epistemic probability to the circumstances that a person can be in. The circumstances are states of affairs that can include what situation the epistemic agent is in, as well as what he senses, remembers, and believes. For example, the state of affairs that the agent is appeared to treely, knows that $7+5=12$, and remembers having eggs for breakfast might be included in some sets of circumstances. We will write $P_C(A)$ for the probability of A relative to circumstances C .

Although the above considerations about probability present the general picture of probability from a theistic perspective, much more detail is needed in order to have an adequate conception of probability. As a first approximation, let us define probability as follows:

$P_C(A)=r$ iff r is the degree to which a person with a properly functioning mind would believe proposition A in circumstances C .

Although this is a useful first approximation of the analysis of probability we are developing, it requires modification in several directions. One immediate problem is that there may be no real number r such that r is the degree to which a person with properly functioning cognitive faculties would believe A in circumstances C . A person in circumstances C might have several different possible rational degrees of belief in a certain proposition. Rationality may also allow different properly functioning persons in the same circumstances to believe the same proposition to different degrees. In this case, there would be no single real number which is the degree to which all properly functioning cognizers would believe the proposition in the circumstances, but rather there would be a range of several rationally permissible degrees of belief. We need to modify the above account of probability to allow different persons with properly functioning minds

in the same circumstances to believe the same proposition to different degrees, as well as allow a single individual several possible rational degrees of belief. One way to do this is to use an interval to represent rationally permissible degrees of belief:

$P_C(A) = \langle x, y \rangle$ iff $\langle x, y \rangle$ is the smallest interval which contains all of the degrees to which a person with a properly functioning mind could believe proposition A in circumstances C.⁶

According to this account, epistemic probability is an interval which includes all of the degrees to which a rational person could believe the proposition. It does not require that a rational person in circumstances C have only one possible rational degree of belief in a proposition, nor does it require that all rational people in the same circumstances believe the proposition to the same degree.

One problem with this revised account of probability is that it requires each individual with a properly functioning mind to believe the proposition in question to some precise degree, which is represented by a real number. However, a properly functioning cognizer may not have precise degrees of belief in all propositions. Perhaps some rational degrees of belief are vague and cannot be represented by a single real number. For example, my degree of belief that I can ski down Mt. Shasta without falling is vague. There is no single real number which represents this probability, but rather my degree of belief in that proposition falls within a certain range. We can capture this idea by representing vague or uncertain degrees of belief by intervals instead of real numbers.⁷ Since different intervals may represent different properly functioning persons' vague degrees of belief, we let the probability of a proposition be the smallest interval that includes all of those vague degrees of belief:

$P_C(A) = \langle x, y \rangle$ iff $\langle x, y \rangle$ is the smallest interval which contains all of the intervals which represent the degree that a person with a properly functioning mind could believe proposition A in circumstances C.

This analysis of probability allows for the possibility that properly functioning cognizers may have vague degrees of belief. Of course, it also allows them to have precise degrees of belief. A precise degree of belief in a proposition equal to a real number r will be represented by the interval $\langle r, r \rangle$.

In addition to the notion of probability simpliciter, the idea of conditional probability plays an important role in probability theory. The basic idea behind conditional probability is that belief in certain propositions can affect the probability of other propositions. For example, the epistemic probability of a randomly drawn card being a diamond is affected by knowledge that it is not a club. The probability of a card being a diamond is not equal to the probability of a card being a diamond conditional on it not being a club. The intuitive idea behind

the epistemic conditional probability of A given B, written as $P_C(A/B)$, is that of how strongly A should be believed if B were fully believed. Upon our theistic conception of rationality, this intuitive conception of the conditional probability of A given B is interpreted in terms of how strongly a person with a properly functioning mind would believe A if he believed B. We can make this more precise as follows:

$P_C(A/B) = \langle x, y \rangle$ iff $\langle x, y \rangle$ is the smallest interval which contains all of the intervals which represent the degree that a properly functioning cognizer could believe proposition A if he fully believed proposition B, in circumstances C.

According to this account, the notion of conditional probability is explicated subjunctively in terms of how strongly a person with a properly functioning mind who fully believed the information conditionalized on could believe the proposition in question. If it is impossible for a person with a properly functioning mind to believe the proposition conditionalized on, then the conditional probability is undefined.⁸

Although the above account of conditional probability is close to our intuitive understanding of conditional probability, it is quite different from traditional analyses of conditional probability. Most theories of epistemic probability define conditional probability as follows:

$$P(A/B) = P(A \& B) \div P(B).$$

This definition of conditional probability has the advantage that conditional probability is defined in terms of unconditional probability without relying on additional counterfactual elements. But this advantage is illusory. One problem that immediately arises is that this definition depends upon probability being a real number and not an interval. Although it may be possible to modify this definition to account for probabilities that are intervals, it is not obvious that this definition or any modifications of it account for our intuitive understanding of conditional probability. The traditional account defines conditional probability in terms of the probability of a conjunction. But we are usually more certain about the conditional probability of one proposition on another than we are about the probability of the conjunction of those two propositions. I intuitively know what the probability of passing a test conditional on not studying is, but I am less certain about the probability of passing the test and not studying. Since we are usually clearer about conditional probability than we are about the probability of conjunctions, it is a mistake to analyze conditional probability in terms of the probability of conjunctions. Another problem is that the traditional proposal reduces the analysis of conditional probability to that of the probability of conjunctions, but no independent analysis of the probability of conjunctions is given.

The probability of conjunctions is usually defined in terms of conditional probability. Our analysis is to be preferred because it gives an independent analysis of conditional probability.⁹ Conditional probability and the probability of conjunctions may be related in the manner described by the traditional analysis, but this should be used to give an analysis of the probability of conjunctions in terms of conditional probability instead of the other way around. However, the traditional analysis of conditional probability may be adequate for statistical probability, for which we can give an independent account of the probability of conjunctions. But statistical probability and epistemic probability are quite different, and we have good reason to think that an adequate analysis of conditional probability will be different for the two of them.

I believe that the above account of epistemic probability is basically correct, but perhaps we can test it by considering some problems. These problems deal with what all persons with properly functioning minds would believe, or with what certain specific properly functioning cognizers would believe. Consider the probabilities of the following, relative to some circumstances C:

- (a) B is true but S doesn't believe it.
- (b) at least one person believes B, conditional on B is true¹⁰
- (c) at least one mind exists

The problem with (a) is that it does not appear possible for person S to believe it to a high degree. It may not be possible for person S to believe both B and that person S does not believe B. Therefore the lower bound of the interval for the probability of (a) will be very low, regardless of what proposition B is. This is problematic, because there do appear to be circumstances in which (a) is probably true and the lower bound of the interval is now low. It may be irrational for someone to have a low degree of belief in (a). The solution to this problem is to pay close attention to what the circumstances are. The circumstances C may include the state of affairs of being person S. If so, then the probability of (a) would be low, and it would be false to say that a person with a properly functioning mind in those circumstances could believe it strongly. It is rational for person S in those circumstances to have a low degree of belief in (a). Now suppose the circumstances C include the state of affairs of not being person S. In this case we have no reason to think that it will be rational to have a low degree of belief in (a), and the circumstances may be such that it would be irrational to have a low degree of belief in (a). If the circumstances are general enough to permit the person to either be person S or not be person S, then the range of rational degrees of belief in (a) may vary from very low to very high. But this is the correct result in this example. In those circumstances it is rational for person S to believe (a) to a low degree and it may be rational for some other person to believe (a) to a high degree. Since probability is degree of rational

belief, the probability of (a) must allow both person S and others to be rational. The only way this is possible is for the interval to be large enough to contain everyone's rational degrees of belief in (a).¹¹ Thus the circumstances C is very important to what the probability of (a) is.

The considerations raised by (b) and (c) indicate that upon the theory of epistemic probability presented here some propositions are very probable, even though they may be neither necessary nor likely to be true in the statistical sense. I believe that a person with a properly functioning mind would believe that he or she exists, and thus the epistemic probability of (c) would be very close to $\langle 1, 1 \rangle$. (b) is also very probable upon this theory, because any person with a properly functioning mind that fully believes R will also believe that at least one person believes R. Hence its probability will also be very high, if not $\langle 1, 1 \rangle$. Although these results may appear strange, I do not think they are evidence against the theory presented here. We are dealing with rational belief, and it is well known that necessary truth and what can or cannot be believed do not coincide. For example, some philosophers have claimed that the proposition expressed by the sentence 'I do not exist' cannot be rationally believed, even though it is not necessarily false. For similar reasons, it may be that some propositions must be strongly believed, if believed at all, even though they may be very improbable in the statistical sense. Hence I do not find propositions (b) and (c) to be problematic for this theory.

Comparison With Other Theories

The theory of epistemic probability presented above is similar to other theories of probability in some respects, but in many ways it is quite different. One obvious difference is that upon this view probability is relativized to a set of circumstances. On this view, in contrast to Bayesianism or logical theories, probability is relativized to the person's epistemic situation. Both Bayesianism and logical theories allow for probability conditional on other propositions, but neither allow for probability relativized to a person's experiences and epistemic situation. This is significant because even if we assume that a person's epistemic situation can be adequately described by a proposition, it is possible that a proposition is highly probable given a certain set of circumstances, and yet is not highly probable conditional only on a proposition describing those circumstances. It may be rational to form certain beliefs in certain epistemic situations whereas believing a proposition describing that epistemic situation does not provide enough support for the beliefs to be rationally formed.¹² This is especially true given a theistic framework. Our minds may be designed to function in such a way that we form the belief in question when we have a certain experience; we may not be designed to form the belief just on the basis of

believing we have the experience. A proposition may receive more epistemic support from certain circumstances than from believing a proposition describing those circumstances. Thus it is necessary to relativize probability to a set of circumstances in order to adequately characterize rational degree of belief.

To illustrate the problems that arise for the logical and subjective theories, consider a simple perceptual belief. Suppose a person is in the circumstances of being appeared to in a treely sort of way, and forms the belief that a tree is present. Neither the logical nor subjective theories of probability are relativized to a person's epistemic situation; therefore the rationality of believing that a tree is nearby is dependent upon a belief describing the person's experience of the tree. For this reason there are serious problems that the logical and personal theories face in connection with this example. According to the logical theory, the probability of a tree being present given a person's experience of seeing the tree will depend on the degree to which a proposition describing the person's experience partially entails that the tree exists. But there is no reason to think that this degree of partial entailment is high. The history of philosophy teaches us that we have no reason to believe that a description of my experience entails or partially entails that the external world exists. One might attempt to argue that the ratio of possible worlds in which people have tree experiences and trees exist to the worlds in which people have tree experiences is high. However, I see no reason to be optimistic about the success of such an argument. Hence, according to the logical theory we have no reason to believe that the person should have a high degree of belief that a tree exists given a description of his or her experiences.

The situation is not any better for the subjective theories. According to Bayesianism, the probability of the tree existing given the description of the experience could be infinitesimally low or extremely high. Since it is a subjective theory, wildly different degrees of belief are tolerated as being rational. I find this counterintuitive. In the absence of overriding consideration it is rational for the person looking at the tree to believe that a tree is present, and it is irrational to disbelieve that the tree is present. Neither personal probability nor the logical theory can account for what we consider to be a rational degree of belief in this example, but the theory based upon proper functioning appears to give the correct answers.

There are further problems that any theory which avoids relativizing probability to a set of circumstances by conditionalizing on a proposition describing those circumstances will face. Suppose our epistemic agent takes a philosophy class and becomes convinced that a malicious demon deceives us on our perceptual beliefs about trees. She also believes that this demon is so competent at deceiving us that we are deceived when and only when we firmly believe that we are appeared to in a treely sort of way. That is, the demon does not deceive us if

we just look at a tree and believe a tree is there; we are deceived only when we form the strong belief that we are appeared to treely. Hence she believes the following proposition:

Q: If I firmly believe I am appeared to treely, then a tree is not present (I am deceived).

Now suppose that our epistemic agent looks at a tree and is appeared to in a treely sort of way. We are interested in the probability of a tree being present in those circumstances. Since believing proposition Q is part of the epistemic situation, it will be included in the set of circumstances C. Assuming there are no other abnormal features about the epistemic situation, I propose that P_C (a tree is present) is fairly high. Our epistemic agent naturally forms the belief that a tree is present without forming any beliefs about how she is appeared to. In particular, she does not firmly believe that she is appeared to treely. Thus her belief in Q does not provide a reason to disbelieve that a tree is present. Since she does not firmly believe she is appeared to treely, she has no reason to think that the demon is deceiving her about the presence of the tree. In those circumstances it is rational to believe strongly that a tree is present, which is consistent with the analysis of probability based on proper functioning.

Now suppose that we attempt to avoid relativizing probability to a set of circumstances by conditionalizing on a proposition describing those circumstances. According to these theories, we are interested in $P(\text{a tree is present} / \text{description of circumstances } C)$. For our purposes the relevant part of the circumstances is that the epistemic agent is appeared to treely and believes Q. Hence we are interested in $P(\text{a tree is present} / \text{I am appeared to treely and I believe that if I firmly believe I am appeared to treely, then a tree is not present})$. I propose that this probability is not high. If the epistemic agent fully believes the propositions conditionalized on, it would seem improper for her to strongly believe that a tree is present. Since she fully believes she is appeared to treely, she would believe that the demon was deceiving her; therefore she should not strongly believe that a tree is present. But this seems to be the wrong result for this example. In the example given, the epistemic agent does not form any beliefs about how she is appeared to. Hence it is rational for her to believe that a tree is present.¹³

The reason this proposal gives the wrong result is that it is telling us what it would be rational to believe in circumstances different from the one given in the example. It correctly claims that it is irrational to believe the tree is present if she fully believes she is being appeared to treely, but it is incorrect to claim it is irrational to believe the tree is present if she does not form that belief about how she is appeared to. Conditionalizing on propositions describing the epistemic situation instead of relativizing probability to the epistemic situation fails because it does not distinguish between two different epistemic situations. The epistemic situation of

being appeared to *treely* and believing *Q* is very different from the epistemic situation of fully believing that one is being appeared to *treely* and believing *Q*. It is rational to believe a tree is present in the former epistemic situation, but not in the latter. The theory based on proper functioning is sensitive to these distinctions and gives the correct result because it relativizes probability to an epistemic situation. Simply conditionalizing on propositions describing those situations will give unintuitive results, because very different epistemic situations will not be distinguished.

Theories of rational belief can usefully be divided into two types: internalist and externalist theories. According to internalist theories of rationality, whether or not a belief is rational depends only upon the individual epistemic agent and not upon any factors external to the agent. Two prominent versions of this are Chisholmian and Cartesian internalism. According to these positions, whether a belief is rational is within the control of the epistemic agent. If the epistemic agent is responsible and fulfills all his intellectual obligations, then his beliefs are rational, regardless of what the agent is unaware of or how the beliefs were formed. Rationality consists in how the epistemic data is used, and since that is within the control of the epistemic agent, rationality is also within the epistemic agent's control.

In contrast to internalism, externalism holds that factors outside the agent's control are relevant to the rationality of a belief. The rationality of a belief does not consist only in whether the agent applied correct epistemic principles to the data he or she had, but it may also depend upon factors that the epistemic agent is unaware of. According to externalism, a person could diligently and responsibly fulfill all intellectual obligations and still form an irrational belief, since not all the requirements for rationality are under our control. Clearly the theistic view of rationality based on proper functioning is an externalist theory. Other externalist theories base rationality on causal connections between a state of affairs and a belief, or upon reliable belief-producing mechanisms.

From an externalist point of view rationality is not dependent only upon what the epistemic agent believes, but also upon properties of the epistemic situation of which the agent may be unaware. Hence, even if our experiences and epistemic situation could be adequately described by a proposition, and even if a proposition received as much support from believing the proposition describing the experience as it does from the experience, it would still be necessary to relativize probability to the agent's epistemic situation. The reason for this is that some aspects of a person's epistemic situation cannot possibly be contained in the propositions that are conditionalized on. In particular, aspects of the person's epistemic situation that are not believed by the person cannot appropriately be included in the propositions conditionalized on. Epistemic conditional probability expresses rational degree of belief, given that the person believes the propositions conditionalized on. Because of the requirement that a person believe the information conditionalized on, aspects of the person's epistemic situation that the person does not believe to be true cannot

be included in the information conditionalized on. In contrast to this, the relevant set of circumstances does not need to be known or even believed by the person. In the theory presented above, probability is conditional on the circumstances actually occurring, not upon the circumstances being known or believed to have occurred. Thus the set of circumstances can include aspects of the person's epistemic situation relevant to the proposition that are not believed by the person. For example, a person may be appeared to in a way that she is not conscious of; nonetheless, how she is appeared to may be relevant to some current belief of hers. Or she might be appeared to in a certain manner, but not form any beliefs about how she is appeared to. Upon theories of epistemic conditional probability, in situations such as these no proposition describing how she is appeared to is conditionalized on in order to determine rational degrees of belief. This is simply because the person does not believe she is appeared to in that manner. However, upon the theory of probability presented above, how the person is appeared to is relevant to rational belief because it is a relevant aspect of the person's epistemic situation. It is not required that the person believe that she is appeared to in that way; what matters is that how she is appeared to is a part of her epistemic situation.

Consider the following example in which an epistemic agent lacks certain beliefs about the epistemic situation. The agent is appeared to a tree, and we are interested in the probability that a tree is present conditional on the agent not being appeared to treeily:

$P_{\text{appeared to treeily}}(\text{a tree is present} / \text{not appeared to treeily}).$

This probability depends upon what a person with a properly functioning mind would believe if he were appeared to treeily, but fully believed that he was not appeared to treeily. I believe in some situations it would be reasonable for the person to believe rather strongly that a tree is not present, because he fully believes that he is not experiencing a tree. If we do not relativize probability to the epistemic situation and instead conditionalize on a proposition describing the experience, we are interested in the following probability:

$P(\text{a tree} / \text{is present appeared to treeily and not appeared to treeily}).$

This is problematic. It is undefined upon both the logical and personal theories of probability and thus those theories cannot account for situations such as this. If we interpret probability as based upon a properly functioning mind but not relativized to the epistemic situation, this may be defined. This interpretation of conditional probability assumes it is possible for a person with a properly functioning mind to fully believe both that he is and is not appeared to treeily. If this is possible, then it is unclear what is rational to believe in this situation. Certainly it is not clear that it is rational to strongly disbelieve that a tree exists; thus this result is different from that of the theory relativized to an epistemic situation. Attempting to capture all

aspects of the epistemic situation in a proposition that is conditionalized on does not give intuitively correct results in situations such as these.

One might object that it is impossible for a person to both be appeared to freely and fully believe that he is not being appeared to freely. It might be thought that our beliefs about our experiences are incorrigible. More specifically, it might be claimed that a properly functioning cognizer's beliefs about his or her experiences are incorrigible. If so, the above problem would not arise for theories that do not relativize probability to an epistemic situation.

The response to this objection is to deny that beliefs about one's experience are incorrigible, even for a person with a properly functioning mind. Consider the following variation of J. L. Austin's example in which a person looks at a magenta colored object and yet believes it is vermilion. Perhaps the person was not paying attention to his visual field, but due to no defect in his mind he believes that the object is vermilion instead of magenta. We might wonder what the probability of a person making this mistake is. According to the theory based on proper functioning, we are interested in the following:

$$P_{\text{object appears magenta}}(\text{object appears vermilion}).$$

Since a person with a properly functioning mind could be mistaken about the color of the object, and even about how the object appears to him, this probability could be greater than zero.

Now suppose we look at this from the perspective of a traditional theory which does not conditionalize on the epistemic situation. According to these theories, we should conditionalize on a proposition describing the experience.¹⁴ We would then be interested in the following probability:

$$P(\text{object appears vermilion} / \text{object appears magenta})$$

This probability is equal to zero. According to the logical and subjective theories, the above probability is equal to:

$$\frac{P(\text{object appears vermilion} \& \text{object appears magenta})}{P(\text{object appears magenta})}$$

But an object cannot appear two different colors at once; thus $P(\text{object appears vermilion} \& \text{object appears magenta})$ is equal to zero. From this it follows that the above conditional probability is equal to zero on the logical and subjective interpretations. If we adopt the counterfactual definition of conditional probability presented above, but not relativized to an epistemic situation, then the above probability is still zero. If a person with a properly functioning mind fully believed the object appeared magenta, he would believe to degree zero that it appeared vermilion. Thus the above probability is zero upon any theory that attempts to avoid relativizing probability to an epistemic situation by conditionalizing on propositions describing

experience. It appears that a view of probability relativized to an epistemic situation deals with these situations much more satisfactorily than alternative theories do.

Let us now consider other aspects of the conception of probability presented above. Like the logical theory, and unlike personal probability, the theory presented is an objective theory of probability. Even though probability is highly sensitive to what circumstances a person is in, it does not depend upon what particular person is in those circumstances.¹⁵ Unlike the theory based upon proper functioning, subjective theories allow for the possibility that two different rational persons could be in the same circumstances, have exactly the same evidence, and yet assign wildly different probabilities to all contingent propositions. This is a problem for subjectivism because not all coherent probability assignments are rational. The rationality of a belief is not dependent upon the particular person holding that belief.

One difference between the logical theory of probability and personal probability is that personal probability is a normative theory and the logical theory can be thought of as a factual theory of probability. Personal probability is a normative theory because it does not simply tell us what people's degrees of belief are; it tells us what they should be. This separates personal probability from other theories of subjective probability which merely report a person's actual degrees of belief. The logical theory views probability as a logical relation; that part of the theory makes no normative claims about rational degrees of belief. It is a factual theory that defines partial entailment in terms of a logical relation. However, the logical theory is usually supplemented with a normative claim that rational degrees of belief should be equal to logical probabilities. The theory presented in this paper is also a normative theory. It makes claims about what our degrees of belief should be in order to be rational and it excludes many degrees of belief as being irrational. It does not merely report what people do believe, but it defines probability in terms of what they would believe if their minds were functioning properly.

Another major difference between the theory presented above and the traditional theories is that neither personal probability nor the logical theory makes reference to an agent in determining whether a belief or set of beliefs is rational. According to personal probability, beliefs are rational if they satisfy the probability calculus; no reference to an epistemic agent is needed. Of course the degrees of beliefs are beliefs of an agent, but whether they are rational or not has nothing to do with the agent; rationality is based upon coherence.¹⁶ Similar considerations are true of logical theories. Probability on the logical theory is a logical relation and degrees of partial entailment are independent of any epistemic agent. Neither personal probability nor the logical theory requires reference to an epistemic agent in determining rational degrees of belief.

In contrast to the logical and personal theories of probability, the theory presented here provides an intimate connection between rational degrees of belief and an epistemic agent. Whether or not it is rational to believe certain propositions to

certain degrees does not only depend upon the propositions and their relations to each other, but it also depends upon what a person with a properly functioning mind would believe. Rationality is not analyzed as being independent of an epistemic agent in a set of circumstances. One consequence of this is that probability is also relative to a certain species. From a theistic perspective it is plausible to believe that there are rational creatures other than humans and that their minds are designed to function quite differently from the way ours function. For example, it could be the case that all mathematical truths are self-evident to non-defective members of a different species. Perhaps this is true of angels. If this is so, the degree to which a properly functioning cognizer would believe mathematical propositions would depend upon what type of person it was. Certainly not all mathematical propositions are self-evident to properly functioning human cognizers, but they may be self-evident to properly functioning angels. Thus a mathematical proposition might have a very low probability relative to humans, but have a very high probability relative to some other species. It may also be the case that some conditional probabilities are defined for some species and undefined for other species. It may be impossible for humans to believe some propositions, but for angels it may be a simple matter to believe them. If so, certain conditional probabilities will be defined for angels that are undefined for humans. What it is rational for a person to believe depends upon the way his cognitive faculties were designed to function, and this may differ among species. Since probability is dependent upon what a properly functioning cognizer would believe, probability is species relative.

Assessment of the Theory

I propose that the view of probability presented above is an improvement over traditional interpretations of epistemic probability. A theistic view of probability avoids many of the problems that face subjective and logical theories; further it does not appear to have any significant problems specific to it. However, in judging the adequacy of a certain interpretation of probability, we must make use of some criteria by which we can determine the advantages and disadvantages of it. W. C. Salmon has presented three criteria which he claims must be satisfied by any acceptable interpretation of probability.¹⁷ In what follows we will investigate whether the theory of probability presented in this article satisfies Salmon's three criteria.

Salmon's first criterion is that of *admissibility*. This requires that probabilities satisfy the probability calculus. If an interpretation of probability does not satisfy the probability calculus, it is inadmissible and hence an unacceptable interpretation of probability. Both the personal and logical theories are admissible interpretations of probability because both guarantee that probabilities satisfy the probability calculus.

In contrast to the personal and logical theories, the theistic interpretation of

probability does not guarantee that epistemic probabilities satisfy the probability calculus. Just representing probabilities by intervals instead of real numbers violates the calculus, since the probability calculus requires that probability be a real number. However there are more serious ways in which this interpretation violates the probability calculus. The probability calculus requires that every necessary proposition receive a probability of 1. Thus if the theory of probability presented here is to be admissible, it must require that a person with a properly functioning mind believe two things: 1) every necessary truth to degree 1; and 2) every logical consequence of a proposition at least as strongly as the original proposition. Perhaps this is a legitimate requirement for properly functioning cognizers of some other species, but it seems implausible to require that a properly functioning human believe every necessary truth to degree 1. There may be creatures who were designed to be logically omniscient and believe every necessary truth to degree 1, but that seems to be too strong a requirement for humans who are not logically omniscient. In defense of the criterion of admissibility many philosophers claim they are interested in ideal rationality. The relevance of this is not clear since this response concedes that humans are not logically omniscient and that it is unreasonable to require logical omniscience of a rational human. It is a mistake to require that human epistemic probabilities satisfy the probability calculus; therefore it does not count against the theory based upon proper functioning that it does not require rational degrees of belief to satisfy the calculus. The criterion of admissibility is not a legitimate criterion for human epistemic probability, although it may be a legitimate requirement for statistical probability.

Salmon's second criterion is that of *ascertainability*. An interpretation of probability satisfies this criterion if it is possible to determine the probability of propositions. The intuition Salmon is expressing with this requirement is that an interpretation of probability is useless if we cannot ordinarily know what the probability of a proposition is. One might object to the theory of probability presented here by claiming that we cannot know when a mind is functioning properly, and hence we cannot have knowledge of probabilities.

The response to this objection claims that it is possible for us to know when a person's mind is functioning properly. One reason we claim that people are mentally ill is that we believe their minds are not working properly. Thomas Reid, who incorporated the idea of a properly functioning mind into his epistemology, also thought it was possible for us to know when a mind was working properly. According to Reid, disagreements about first principles, which are the dictates of common sense, are due to defects or prejudices in our minds. (pp. 565-575). Fortunately we are able to recognize these defects and errors:

Thus I have endeavoured to shew, that, although first principles are not capable of direct proof, yet differences, that may happen with regard to

them among men of candour, are not without remedy; that Nature has not left us destitute of means by which we may discover errors of this kind; and that there are ways of reasoning, with regard to first principles, by which those that are truly such may be distinguished from vulgar errors or prejudices. (p. 575)

Of course, one can be a skeptic about probability just as one can be a skeptic about anything else. However here, as elsewhere, we need not refute the skeptic's arguments in order to be within our rights in claiming knowledge of probabilities.

Salmon's third criterion for judging interpretations of probability is that of *applicability*. An interpretation of probability satisfies this criterion if it is useful in making rational decisions and in determining what to believe. An acceptable interpretation of probability should account for Bishop Butler's saying that "Probability is the very guide of life."¹⁸ For example, personal probability is an unacceptable interpretation of probability because its subjectivity undermines any justification for using probability to make rational decisions or predictions. In order for the interpretation of probability based upon proper functioning to be acceptable it must be a useful guide to gaining knowledge and making decisions.

One might argue that we have no reason to think that a properly functioning mind can provide the basis for rational decisions. To illustrate, consider our goal to believe true propositions and not false ones. This objection questions our justification for thinking that a person with a properly functioning mind will believe true propositions more often than false ones or that such a person will make rational decisions more often than irrational ones. Perhaps our minds have been designed by a malicious Cartesian demon, and hence when functioning properly we will generally have false beliefs. A properly functioning mind could easily be a source of false beliefs.

Although this objection may be a serious problem for some theories which interpret probability in terms of a mind functioning properly, it clearly does not provide a reason for rejecting the theistic view of probability presented above. According to traditional theism, human cognitive faculties were designed in such a way that they would usually lead to true beliefs and not false ones. Reid expresses this by claiming that "... the faculties which God has given us are not in their nature fallacious" (p. 565) More recently this idea has been stated by Plantinga:

In setting out to create human beings in his image, then, God set out to create them in such a way that they could reflect his capacity to grasp concepts and hold beliefs. Furthermore, he proposed to create them in such a way that they can reflect his ability to hold *true* beliefs. He therefore created us with cognitive faculties designed to enable us to achieve true beliefs with respect to a wide variety of propositions"¹⁹

This response to the objection claims that God wants humans to have true beliefs,

and that he designed and created them in such a way that they would usually achieve this goal. Given this theistic perspective, it is reasonable to believe that a properly functioning mind would be a reliable foundation for decision making. It is this theistic framework that excludes the possibility of our minds being designed by a Cartesian demon, and allows rational beliefs and decisions to be based upon what a person with a properly functioning mind would believe. Thus, this theistic view of probability satisfies the criterion of applicability. I believe it is the only interpretation of epistemic probability which satisfies both the criterion of ascertainability and of applicability.

One interesting result of the view of probability based on proper functioning is that it is relevant to probabilistic arguments presented for many philosophical positions. Since probability is a function of what a person with a properly functioning mind would believe, many claims about what a person with a properly functioning mind would believe can now be construed as implicit probability statements. For example, John Calvin thought that in the circumstances of observing the night sky, a properly functioning human would form beliefs about the magnificence of God. According to the theory presented above, Calvin's claim would imply that in those circumstances the epistemic probability of God existing is high. However, there is a big difference between claiming that in the circumstances of observing the night sky the probability of God existing is high, and claiming that the probability of God existing conditional on a proposition describing the night sky is high. Confusing these probabilities may account for the historical popularity of teleological arguments designed to show that the probability of God existing given our observation of order in the world is high. If the view of probability presented above is correct, the debate over the teleological argument is really a disagreement over what a properly functioning mind should believe.

In this paper we have investigated how a theist might view probability. Epistemological theories of probability interpret probability in terms of rational degree of belief, and we have seen that some doctrines of traditional theism are relevant to rationality. Therefore it is entirely natural for theists to have a view of probability that is significantly different from that found in other theories of epistemic probability. I hope this paper has demonstrated some of the advantages of looking at probability from a theistic perspective.²⁰

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NOTES

1. In addition to this subjective interpretation of probability, Bayesianism usually adds requirements

about rational belief change.

2. Thomas Reid, *Essays on the Intellectual Powers of Man*, in *Philosophical Works*, with notes and supplementary dissertations by Sir William Hamilton, Georg Olms Verlagsbuchhandlung, Hildesheim, 1967, p. 695. All references to *Essays on the Intellectual Powers of Man* are to the edition of 1785, and will be denoted in the text by page numbers.

3. There are other theistic conceptions of rationality besides the one presented above. One might hold that rationality is connected with fulfilling intellectual obligations. Given this conception of rationality, a theist might have a unique perspective because of beliefs about the ontological status of those obligations and rules.

4. Alvin Plantinga, "Epistemic Justification", *Noûs*, volume XX, number 1, March 1986, p. 15. and "Positive Epistemic Status" in *Studies in Philosophy*, edited by James Tomberlin, forthcoming.

5. It is important to be clear about two fundamentally different possible interpretations of probability involving properly functioning minds. According to the position adopted in this paper, a properly functioning mind can produce degrees of belief as well as complete belief. Upon an alternative theory degrees of belief would be a measure of the degree to which a mind is functioning properly. These ways of viewing degrees of belief are not the same, and are fundamentally different. Upon one view a mind can be functioning properly without any improper functioning and yet produce degrees of belief. On the other view, when a mind is functioning properly with no amount of improper functioning, only instances of complete belief will be produced.

6. When I define $P_C(A)$ in terms of what a person with a properly functioning mind could believe, I do not mean that $P_C(A)$ is defined in terms of what it is logically possible for a person with a properly functioning mind to believe. Instead, $P_C(A)$ is defined in terms of counterfactual situations in which a person with a properly functioning mind is in circumstances C . If one were to adopt the possible worlds analysis of counterfactuals, probability would be defined in terms of the closest possible worlds in which there is a person with a properly functioning mind in circumstances C .

7. Recently it has become popular to use sets of probability functions instead of intervals to represent vague degrees of belief. One disadvantage of this method is that it seems to assume that the agent has a probability function that is a member of the set. This seems to deny the intuition that one's degrees of belief may actually be vague.

8. Upon this account some propositions are possibly true, but cannot be conditionalized on. Some philosophers consider this a reason to reject such theories of conditional probability. See Bas C. van Fraassen, "Belief and the Will", *The Journal of Philosophy*, volume LXXXI, number 5, May 1964, pp. 235-256. However, probability is relativized to a set of circumstances according to this theory, and hence it is possible to have probability relativized to partial belief in such propositions.

9. An alternative method is to follow Ramsey in defining conditional probability in terms of conditional credence, for which a Dutch book justification can be given.

10. We are interested in P_C (at least one person believes B / B is true).

11. In some situations it may be the case that for some properly functioning cognizers the rational degree of belief in proposition B is $\langle x, y \rangle$, and for another group of properly functioning cognizers the rational degree of belief in B will be $\langle y + \epsilon, z \rangle$. The probability of B in those circumstances will be $\langle x, z \rangle$, since that is the interval that includes the degrees of belief in B of all properly functioning cognizers. This does not imply that $y + .5\epsilon$ is a rational degree of belief for anyone. It may be that no properly functioning cognizer can believe B to that degree in those circumstances. Our analysis of $P_C(B) = \langle x, y \rangle$ does not claim that every real number or interval contained in $\langle x, y \rangle$ is a rational degree of belief in proposition B in circumstances C ; it only claims that all rational degrees of belief are contained in that

interval. It may be that certain values or intervals in that larger interval are not rational degrees of belief in B in circumstances C.

12. For a contrary opinion, see Phillip Quinn, "In Search of the Foundations of Theism", *Faith and Philosophy*, volume 2, number 4, October 1985, pp. 468-486.

13. A similar problem arises if the agent were to believe proposition R:

R: All beliefs believed on the basis of a belief that I am appeared to truly are unjustified.

14. One might object that this case can be handled by Jeffrey's probability kinematics. But Jeffrey's proposal deals with a situation involving uncertain evidence, and this is a situation involving mistaken evidence.

15. An exception to this is when the circumstances include the identity of the epistemic agent.

16. Other requirements such as change of belief by conditionalization and diachronic coherence may be added, but that does not affect this basic point.

17. Wesley C. Salmon, *The Foundations of Scientific Inference*, University of Pittsburgh Press, Pittsburgh, 1966.

18. Salmon, p. 64.

19. Plantinga, "Epistemic Justification", p. 15.

20. I would like to thank Chris Menzel, Jerry Neu, Del Ratzsch, Nicholas Wolterstorff, and especially Alvin Plantinga for helpful comments on an earlier version of this paper.