VIRTUOUS CIRCLES

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I.

Petitio Principii is a nuisance for the categorizer of fallacies, already a thankless enough task. First, although typically classed with the so-called "informal" fallacies—*ad hominem, ad baculum,* and the rest of the Latin clan—the standard *petitio principii* is, like affirming the consequent, denying the antecedent, and the other so-called "formal fallacies," identifiable solely by its form. One begs the question in standard textbook fashion by assuming as a premise the conclusion to be proven, either immediately or mediately: that is, either in the very argument for that conclusion, or else in an argument for one of the premises of that argument, or in an argument for one of the premises of that second argument, and so on. Thus we may distinguish between *immediate standard petitiones principii* and *mediate standard petitiones principii,* or ISPPs and MSPPs respectively,

Given the transitivity of the relation of logical support, there is no logical or epistemological importance to the distinction between immediate and mediate standard *petitiones principii.*[1] An ISPP may be looked upon simply as a zero-level MSPP. Conversely, an MSPP may be converted into an ISPP by combining into the argument for the final conclusion the arguments for the premises, the premises of the premises, and so on. In particular, the remarks sometimes made about the 'size' of the circle affecting its viciousness cannot refer to this distinction.[2] An MSPP spanning several mediating arguments will no doubt stand a better chance of passing undetected, but will beg the question just as much as an ISPP.

Despite being formally identifiable, the standard *petitiones principii* differ from the formal fallacies in that their forms are of valid arguments, not invalid ones. If the premises include the conclusion, then the truth of the premises obviously insures that of the conclusion. An ISPP must be immediately valid, and so must the immediate version

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of an MSPP, in which the ancestral premises are folded into a single argument. An argument that begs the question in standard textbook fashion, then must be valid and may in fact be sound. This peculiar feature confounds the categorizers, and indeed raises the question why begging the question should be counted as a fallacy in the first place.[3]

The rub is that, despite being (sometimes)[4] formally identifiable, begging the question is not a formal fallacy, in fact is not even a *logical* failing in the narrow sense of the term, but an *epistemological* one. Deductive arguments typically have the epistemological function of *proving*. We seek to obtain knowledge of the conclusion from the knowledge that the premises are true and that the truth of premises provides sufficient reason to believe the conclusion: i.e., from the knowledge that the argument is sound. In a standard *petitio principii*, the conclusion is included among the premises, either mediately or immediately, so that one cannot know the premises to be true unless one already knows the conclusion to be true. Hence the epistemological function of *proving* the conclusion is short-circuited. Let us call an argument *circular* just in case it could not be known to be sound[5] unless its conclusion were already known. That is an epistemological failing, hence its fallaciousness is not formally explicable, even though it does obtain of some arguments simply in virtue of their form: namely, the standard textbook *petitiones principii*.[6]

In light of its epistemological character, circularity may be sub-divided according to the standard conditions of knowledge. A circular argument is one in which an assertion of soundness would not be either true, believed, or justified unless its conclusion were already true, believed, or justified respectively.[7] The difficulty with the alethic conception of circularity lies in making sense of one truth temporally preceding another. It is true of any argument to say that it would not be sound unless its conclusion were true. But what does it mean to say that the argument would not be sound unless its conclusion were *already* true? The temporal ordering of beliefs, on the other hand, is unproblematic. But the doxastic account of circularity is too dependent on psychology: one belief may presuppose another for a variety of reasons uninteresting to the epistemologist. Also, doxastic *petitiones principii* would not seem so much fallacious as impotent, if their fault is that acceptance of the argument as sound presupposes acceptance of its conclusion.

This leaves justification as that element of knowledge which is both objective and temporally orderable. Again, the 'already' is important: if we are justified in believing an argument to be sound, then, *ipso facto*, we are justified in believing its conclusion. An argument begs the question only if justification of its soundness proceeds *through* the conclusion, so that we cannot be justified in believing the argument to be sound without first being justified in believing its conclusion. In a standard *petitio principii* this occurs because the conclusion is invoked as premise for itself, either immediately or mediately. Circularity is a fallacy in arguments, then, because it undercuts their

epistemological function of providing justification for their conclusions. Although circularity is not a formal feature of arguments, it does arise in certain forms of argument, in particular, in the standard forms of *petitio principii*.

It might be argued that even the simplest ISPP is not formally recognizable, because the identification of propositions—in this case, the conclusion with a premise—is not a formal matter. Identical wording is too strict a necessary condition, and, given syntactic, semantic, and contextual ambiguities, not a sufficient condition of propositional identity, either. This is correct, but it does not differentiate the standard *petitio principii* from any other inference form: e.g., *modus ponens*. When I say that the standard *petitiones principii* are identifiable by their form, I mean only that whether an argument is an ISPP or an MSPP is a matter of its logical form. I do not claim that its logical form is lexically identifiable, any more than is the form of an instance of *modus ponens*.

II.

I have argued that the paradigm cases of begging the question discussed in introductory logic texts are formally identifiable, even though *petitio principii* is not a formal fallacy. The fallacy of *petitiones principii* lies in their *circularity*, which is not a formal feature of arguments. An argument is circular when knowledge of its soundness requires prior knowledge of its conclusion. Circularity is a vice because it defeats the argument's epistemological function of *proving*: producing knowledge of the conclusion via knowledge of the argument's soundness. Since the fallacy of begging the question involves an epistemological feature (circularity) undermining an epistemological function (proving), the fallacy is not formal or even logical in the narrow sense, even though the standard cases of *petitio principii* beg the question in virtue of their logical form.

An argument is circular if knowledge of its soundnes presupposes knowledge of its conclusion. There are two kinds of circles, corresponding to the two conditions of soundness. In the previous section we considered standard *petitiones principii*, in which the truth of the premises presupposed that of the conclusion, either immediately or mediately. The remainder of the paper will be concerned with nonstandard *petitiones principii*, in which the validity, or more generally, the correctness, of the inference presupposes the truth of the conclusion. Unlike the standard cases, these NSPPs are not formally specifiable. More interesting is that, in a variety of ways, the circularity of nonstandard *petitiones principii* need not be vicious: such circles are sometimes virtuous.

The second type of circularity is perhaps most familiar in the realm of induction, from the so-called 'inductive defenses of induction.' Some philosophers, notably Max Black, have put forth defenses of induction of the following sort:

Induction has usually been successful in the past;
Therefore, induction will probably be successful now.

In which conclusion is inferred by precisely the rule of induction under scrutiny.[8] Wesley Salmon has neatly pointed out the flaw in such a strategy:[9]

> The so-called self-supporting arguments are . . . circular in the following precise sense: the conclusiveness of the argument cannot be established without assuming the truth of the conclusion. It happens, in this case, that the assumption of the truth of the conclusion is required to establish the correctness of the rules of inference used rather than the truth of the premises, but that makes the argument no less viciously circular. The circularity lies in regarding the facts stated in the premises as *evidence* for the conclusion, rather than as evidence against the conclusion or as no evidence either positive or negative. To regard the facts in the premises as evidence for the conclusion is to assume that the rule of inference used in the argument is a correct one. And this is precisely what is to be proved.

(Salmon is here using 'conclusiveness' and 'correctness' as the inductive correlates of 'soundness' and 'validity' respectively.)

A precisely analogous situation occurs in deductive logic, in the typical soundness proof constructed in an extension of the system under review.[10] Sooner or later in the proof that the standard rules of the propositional calculus are sound, for example, something like the following reasoning is bound to appear:

If semantic result S, then *modus ponens* is truth-preserving.
S.
Therefore, *modus ponens* is truth-preserving.

As Salmon argued so convincingly, circularity bars this reasoning from the status of *proof*. Nor is its transparent validity—or even soundness— any more an adequate defense here than in the standard *petitiones principii*. Is formal semantics then based on a mistake?

III.

In his answer to this question, Michael Dummett distinguishes a merely algebraic semantics from a genuine interpretation of a formal system.[11] In a genuine interpretation, we read the deductive apparatus as a formalization of the language in which we actually assert, deny and infer. An algebraic semantics, on the other hand, treats the valuation function as "a purely mathematical object . . . which has no intrinsic connection with the uses of sentences."[12] Calling the values 'true' and 'false', as opposed to '1' and '0', is "a purely rhetorical flourish" from this perspective, inasmuch as "all that we are concerned with is an algebraic device involving functions defined over a two element set."[13]

Soundness as a result in algebraic semantics has been proved for a near plenum of incompatible logical calculi. Their incompatibility demonstrates that none of these proofs show the systems to be really sound, in the sense of codifying reliable rules of inference. (In the sense in which we might say of investment strategies or footbridges that they are sound, for instance.) Soundness in the technical sense is just a matter of mapping transformation rules onto algebraic structures, and the non-standard circularity of the typical soundness proof for a first-order system does not interfere with this project.

The reason that non-standard *petitiones principii* can be useful to the logician is that, unlike the standard variety, they are *informative*. SSPs are uninformative for the simple reason that any statement can be derived from itself. The appearance of a proposition as the conclusion of an SPP does nothing to differentiate it from any other proposition. The case is different for NSPPs, whether inductive or deductive. There is an infinity of formal systems that cannot be shown to be sound even by their own lights, and at least as many inductive rules which do not support themselves.[14] So soundness proofs, even those that are NSPPs, tell us something about the rules they underwrite, although they cannot inform us that the rules are really sound: i.e., truth-preserving rather than merely '1—preserving'. What they do show depends on the relationship between the object theory, metatheory, and the language we actually use to assert, deny, and infer.

A formal system is interpreted in the technical sense by an equally formal metalanguage. This is the sense in which the 'meanings' of the propositional connectives are provided by the evaluational matrices. There is also an intended interpretation of both the object and the metalanguage revealed when we call these matrices 'truth tables'. In a standard Tarskian semantics for a first-order logical theory, the metalanguage is a minimal extension of the object language, and both share a common intended interpretation, *viz.*, a somewhat idealized version of ordinary inferential English (or Polish, German, etc.) augmented with some set theory.[15] There is nothing sacred about this arrangement, however: the formal and informal interpretations may vary freely. The metalanguage need not be an extension of the object language, and the intended interpretations of the object and meta-languages need not be the same.

If the metatheory is not understood as a formalization of the reasoning we actually use, then plainly our semantic results are only proofs in the technical sense, and do not serve to justify belief in their conclusions. Derivations in a formal theory not grounded in actual usage are better called just that, with the term 'proof' reserved for derivations capable of providing reason to believe their conclusions. If we acknowledge the metatheory as our own, on the other hand, but not the object theory, then our soundness proofs may be proofs, all right, but not proofs of soundness in the real sense. They cannot show the

rules of a system to be truth-preserving if all talk of truth and falsity within that system is mere rhetorical flourish. At most, such proofs show the rules to be '1-preserving'.

Suppose that both the object theory and the metatheory are intended to capture formally one and the same system of inference, the one we actually use. Let us call soundness proofs constructed in such situations *internal* soundness proofs. A Tarskian soundness proof for a standard first-order logical theory constructed in a minimal extension of that theory is a paradigm case of an internal soundness proof. Only for internal soundness proofs can both the talk of *truth* and of *proof* be taken seriously. But now circularity of the non-standard variety prevents the demonstration of soundness from being a genuine proof that the theory is sound. To treat the demonstration of soundness as a proof here, rather than a mere derivation, would be to assume that the inference is correct, which would be to assume that the theory in question is in fact sound.

What then do internal soundness proofs show? Consider their foreign counterparts, soundness proofs constructed in minimal extensions of formal theories not intended to represent our actual inferential machinery, applied to these same formal theories. Since the concept of truth is not applicable in the object language, and so the metatheoretic derivations cannot be counted as proofs, these soundness proofs fail on both counts to be real: they are not really proofs, and they have nothing to do with real soundness. But the simple existence of such a derivation shows that the intended interpretation of both object and metatheory has a certain second-order coherence which might be called *self-support*. That is, it shows that when that system of inference is formalized (in the object theory) and then equipped with the wherewithal to represent that formalization (in the metatheory) one can then derive at least the technical soundness of the formal theory. But what is the virtue in a system of inference supporting itself in this way?

Recall the reason an NSPP is informative: unlike the standard variety, it is not inevitable. We might fail in our attempt to derive the soundness of a theory from within a minimal extension of that theory. If we do fail, what moral should we draw? Not that the system we intended to formalize is actually unsound, I believe. In the foreign case especially, where success would not entitle us to assume actual soundness, failure should not lead us to the opposite verdict. And in the domestic case, if it would be *petitio principii* to infer the real soundness of a logical theory from a derivation of it in a minimal extension, it would be *ignoratio elenchi* to infer its unsoundness from a failure to derive soundness.

Suppose that from within MT, a minimal extension of theory T, the soundness of T cannot be derived. If T is sound, then there is a truth expressible but not derivable in MT, and so MT would be incomplete in the sense in which Godel showed first-order arithmetic to be incomplete.[16] To distinguish the relevant sense of 'completeness' from

the converse of soundness, we shall call MT *s-incomplete*. The s-incompleteness of a metatheory MT is attributable primarily to the character of its object theory, T. We know that many theories are provably sound, at least in the technical sense, within their minimal extensions. So a theory whose minimal extension MT is s-incomplete may also be said to be incomplete in a way. We shall call these theories *ss-incomplete*.

Suppose then that we are engaged in a codification of our ordinary rules of inference and we find that a soundness proof within a minimal extension is impossible. Then either our formalization T is unsound or else it is ss-incomplete. The first would be disasterous, but the second would be at least undesirable, for much the same reasons that ordinary incompleteness would be undesirable. If T is intended to capture all those rules of inference which we rely on in practice, after all, then there is no place else to turn for a proof of their soundness but to a minimal extension. Thus if T is ss-incomplete, then either the soundness of the rules by which we reason is unprovable, or else T does not completely capture these rules.

Formal proofs of soundness and completeness then sometimes show very similar things. Note that interest beyond the mathematical for either assumes the soundness of the formal theory within which the proofs are constructed. This does not affect our understanding of a completeness proof, even when carried out in an extension of the theory in question. But a soundness proof carried out in an extension cannot be taken to show the actual soundness of rules under scrutiny, since we have already assumed this in calling our construction a *proof*. Sometimes such a soundness proof can be taken to show a sort of completeness which I have called *ss-completeness*. I have argued that ss-completeness is at least sometimes a desirable feature for a logical system, but it does not seem as important as ordinary completeness. Thus, even if, as traditional wisdom has it, soundness is more important than completeness in a logical system, formal completeness proofs are often more important than formal soundness proofs.

IV.

Michael Dummett sees another role for internal soundness proofs, those carried out within and upon a formalization of the native tongue. Dummett explains how the circularity of internal soundness proofs differs from "the usual kind" in the following way:[17]

> Now clearly a circularity of this [non-standard] form would be fatal if our task were to convince someone, who hesitates to accept inferences of this form, that it is in order to do so. But to conceive the problem of justification in this way is to misrepresent the position that we are in. Our problem is not to persuade anyone, not even ourselves, to employ deductive arguments: it is to find a satisfactory

explanation of the role of such arguments in our use of language. . . . Such an argument will, of course, be deductive in character, but that will not rob it of its explanatory power: we already engage in deductive reasoning, and therefore will be ready to admit that the conclusion of a deductive argument which strikes us as valid follows from its premises; hence in a suitable case, we shall also be ready to admit that the premises of such an argument provide an explanation for the truth of the conclusion, even when the conclusion is to the effect that deductive reasoning is justified.

Standard *petitiones principii*, due to their uninformativeness, can have neither an explanatory nor a suasive function. Non-standard *petitiones principii*, while, as we have seen, similarly blocked as a means of rational persuasion, may serve as explanations since, as Dummett notes, "in an explanatory argument the epistemic direction may run counter to the direction of logical consequence."[18] That is, the conclusion is typically better known than the premises in a deductive explanation.

How Dummett thinks soundness proofs are explanatory is not clear, at least to me. *Pace* Dummett, the clearest cases of explanatory NSPPs are found in induction, not deduction. W.V. Quine, for example, addresses the new riddle of induction by the postulation of a multi-dimensional quality space innate to our species, and the old riddle, to the extent that he believes it addressable, through the theory of evolution.[19]

. . . why does our innate subjective spacing of qualities accord so well with the functionally relevant groupings in nature as to make our inductions tend to come out right? . . . If people's innate spacing of qualities is a gene-linked trait, then the spacing that has made for the most successful inductions will have tended to predominate through natural selection. Creatures inveterately wrong in their inductions have a pathetic but praiseworthy tendency to die before reproducing their kind.

Quine emphasizes that his account is saved from vicious circularity only because his goal is explanatory, and not suasive, in Dummett's terms.[20]

If the epistemologist's goal is validation of the grounds of empirical science, he defeats his purpose by using psychology or other empirical science in the validation. However, such scruples against circularity have little point once we stopped dreaming of deducing science from observations. If we are out simply to understand the link between observation and science, we are well advised to use any available information, including that provided by the very science whose link with observation we are seeking to understand.

The circularity of Quine's argument is somewhat more elaborate than that of either Black-style defenses of induction or internal soundness

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proofs in deduction. Induction is not invoked in the argument itself, but presumably must play a role in the justification of the premises, insofar as they concern empirical biology and psychology. Quine's circle is related to our earlier non-standard circles as MSPPs are to ISPPs. Thus we may make a parallel distinction between mediate and immediate non-standard *petitiones principii*, and call Quine's argument/explanation an MNSPP.

It certainly may be questioned, quite apart from the issue of circularity, whether Quine's explanation succeeds. It might be objected that evolution could not insure the truth of our beliefs, for example, but only (at best) their observational adequacy, or usefulness, or some such pragmatic pinch-hitter. If such objections could be answered, however, something like Quine's account could very well be part of the explanation of induction's reliability; its circularity would not be an obstacle, at any rate. Quine is surely correct in that we are no more forbidden the fruits of induction in explaining induction than we are denied the use of our eyes in explaining vision. Thus I take Dummett's claim that non-standard *petitiones principii* can have an explanatory role to be confirmed by Quine's example.

Even if we accepted Black's account as an iron-clad justification of our inductive practices, on the other hand, I do not think we should ascribe to it any great *explanatory* value. This reflects an important difference between mediate and immediate NSPPs. If to explain a fact is to weave it into our fabric of theory, then in using an immediate inference we should be looping our thread about a single strand. A modest number of inferential levels "ties things together" better and provides a more satisfactory explanation. In the context of NSPPs the old saw that circles ceases to be vicious if large enough has some application. Mediate NSPPs are better suited for explaining, and maybe, within limits, more mediation is better than less in a deductive explanation. Size is an advantage, however, only if the circle is already of a somewhat different 'shape': an MNSPP, not an MSPP.

But could Quine's account be said to *justify* induction? Quine himself thinks that he escapes vicious circularity only by substituting the goal of "understanding" for that of "validation." Certainly unless we rightly credited induction already (or had some other means of justifying the premises), Quine's argument could have little value for us, either explanatory or justificatory. So Quine's argument can justify its conclusion for us only if we are already justified in believing the conclusion. Still, it may be possible for a Quinean argument to *increase* the justification of its conclusion, even if we take its function to be primarily explanatory.

The dichotomy 'explanation or justification' is false, I believe, because the assumption that an argument always has a single epistemic direction, either from premises to conclusion or the reverse, is mistaken. In the empirical sciences there is no sharp distinction between

confirming and explaining; arguments often play both roles. Since the lack of explanation counts as disconfirming, any explanation confirms to some extent. This is particularly true where the explanation provides a mechanism. Plate tectonics doesn't prove continental drift, it explains how it is possible. But the development of plate tectonics transformed a crackpot theory into a well-confirmed fact.[21] Explanation, especially of how something is possible, is often vindication. Quine's account, even if unable to provide any original justification for induction, may yet increase this justification by providing such an after-the-fact vindication of our reliance on induction.

V.

I conclude this paper with a brief sketch of how what we have seen so far applies to one of the more notorious conundrums in the history of philosophy, the so-called Cartesian Circle. For our purposes, the following caricature of Descartes' reasoning in the middle of the *Meditations* will suffice:

> If God exists, then whatever I clearly and distinctly perceive is true.
> God exists.
> Therefore, whatever I clearly and distinctly perceive is true.

I have deliberately highlighted the similarity to *modus ponens'* self-defense. Instead of inquiring into the correctness of a rule of inference, however, Descartes is asking whether conclusiveness itself is a proper cirterion of truth.[22] The interpretation of this project is a matter of some dispute, but our observations will be limited to the circularity of Descartes' argument. It should be borne in mind that the step from the perception of conclusiveness to belief is not an inference, however.

This much I hope has been made obvious by the paper so far: the Cartesian Circle really is a circle. Descartes' argument is a non-standard *petitio principii*. The status of the demonstration as a *proof*, indeed, the probative nature of any argument, depends on its conclusion, in that Descartes' argument could not justify its conclusion except to someone already justified in believing it. The never-ending series of 'solutions' to the Cartesian Circle which deny its circularity are not due to its subtlety; it has been obvious from the beginning. (Before the beginning: Arnauld pointed it out prior to the publication of the *Meditations*.[23]) They reflect rather the misconception that such circles are necessarily vicious, and the fear that any circularity in Descartes' project would defeat its purpose. Now we see several roles which Descartes' argument, despite its circularity, can play.

Assuming no other difficulties in the justification of the premises (a dubious assumption, to be sure), Descartes' demonstration, like an internal soundness proof, shows a special completeness of the system of clear and distinct apprehension when compared to the naive empiricism critiqued in the First Meditation. Through this demonstration, clear

and distinct perception is shown to support itself, unlike sensory evidence, which leads to doubts it cannot resolve. If the point of Descartes' argument is to show this self-support, then circularity of the non-standard variety would not only be permissible, but required.[24]

Descartes' argument might also be intended to play an explanatory role. (The distinction between explanation and proof was used by Descartes to reply to charges of circularity in his scientific essays.[25]) The major epistemological problem facing proponents of the new mechanistic world view was to explain how anyone could ever know anything about the world, including whether the theses of the mechanists were true or not, if the world were in fact as they described it, i.e., radically unlike our sensory perceptions of it. Randall states:[26]

> In the new world their renderings of knowledge appeared no longer as statements of a fact, but as posings of a problem. Fresh knowledge made knowledge itself seem impossible in the world it purported to describe.

If explanation is the goal, then non-standard circularity would be benign. In addition, if the object is to reply to the charge that the mechanistic world view is epistemologically self-defeating, since it renders science inexplicable, then circularity of the non-standard sort would again be required, since the opposite of self-defeat is self-support.

The value of the Cartesian Circle as an explanation might be challenged, of course, and not only for its theological character, but also for its brevity. A certain measure of inferential complexity, we have seen, is a virtue in deductive explanations. Descartes' argument, though, appears to be an *immediate* NSPP like Black's, since the truth of the conclusion is presupposed in taking that very inference to be probative. As such, it would seem to have minimal explanatory value. But Descartes' argument may be viewed as mediate as well, since clear and distinct perception is relied upon in the justification of the premises,[27] and thus it may not be bankrupt as an explanation. Quine's account has more explanatory value than Black's (or would have, if it were successfully spelled out) because it ties the success of induction to something outside the schema of induction itself, namely to biological and psychological theory. Descartes' deduction of the reliability of clear and distinct ideas is similarly mediated through metaphysics and theology, and does not consist merely in deriving the general rule, 'Whatever I clearly and distinctly perceive is true' from itself. Descartes' reasoning still strikes me as too sweeping and too theological to be a good explanation of what is vaguely called 'the reliability of reason', but these reservations are distinct from those based upon its circularity.

If Descartes' demonstration is accepted as an explanation, then it may also increase the justification of clear and distinct perception, if we are correct in maintaining that some explanations also confirm. Because the explanation of the truth of our clear and distinct ideas

might have misfired, leading to the discovery that they may not be true after all (as happened to sensory perceptions in the First Meditation), the fact that it did not misfire confirms the presumption of their truth to some extent.

These 'solutions' to the Cartesian Circle are not exclusive of one another; I suspect that all of them apply to some extent. A defense of any of them as actual interpretations of Descartes is beyond the scope of this paper, however. Here I merely suggest that interpretations of Descartes have been unnecessarily restricted by an unfounded fear of circularity.

I have argued that not all circular arguments are vicious. The kind of *petitiones principii* I have called non-standard can play a variety of useful epistemological roles. Along the way I have tried to show what we may hope for from inductive defenses of induction and deductive soundness proofs. Finally, I have sketched a cluster of 'solutions' to the Cartesian Circle, none of which demand that we deny that Descartes' demonstration is in fact circular.[28]

NOTES

[1] Cf. Woods & Walton 1982, p. 91.

[2] We shall see when the size of a circle does matter in section IV.

[3] See Copi, pp. 107-108; Robinson.

[4] We shall consider informal *petitiones principii* in subsequent sections of this paper.

[5] Or, as we shall say later in order to include non-deductive arguments, *conclusive.*

[6] Cf. Mavrodes, pp. 31-35; Sanford; Woods & Walton 1975, pp. 121-124.

[7] Cf. Nozick, pp. 239-240.

[8] Black, p. 210.

[9] Salmon, p. 47; quoted in Black, p. 215.

[10] Haack draws this parallel on p. 113.

[11] Dummett, pp. 293-294.

[12] *Ibid.*, p. 293.

[13] Dummett, p. 294.

[14] There will be non-denumerably many such inductive rules if we distinguish real-number variants of the straight rule. I owe this suggestion to Richard Grandy.

[15] See Tarski, section 2.

[16] van Heijenoort, pp. 596-617.

[17] Dummett, pp. 295-296.

[18] *Ibid.*

[19] Quine 1969, p. 126.

[20] Quine 1975, pp. 75-76.

[21] See Gould.

[22] For 'clear and distinctly perceive that' read 'have conclusive reasons for': see Doney, p. 400n.

[23] Adam & Tannery VII, p. 65; Haldane & Ross I, p. 92.

[24] This may be what Frankfurt means by the "consistency of reason." See Putnam, p. 103, for a similar use of 'consistency.' I hope to have shown that *soundness* is a better logical analogue for Descartes' concerns, however.

[25] Adam & Tannery II, p. 197; Kenny, p. 57.

[26] Randall, p. 366.

[27] As pointed out by Arnauld, *op. cit.*

[28] An early version of this paper was read before the North Carolina Philosophical Society in 1984; Gary Rosenkrantz's comments in particular were helpful. A shorter

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