Science as a Rhetorical Transaction:
Toward a Nonjustificational Conception of Rhetoric

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This essay reconceptualizes rhetoric, logic, and dialectic within a nonjustificational metatheoretical framework. It argues that science, in its various functions as a mode of inquiry into and explanation of phenomena, is a rhetorical transaction. The "logic" of scientific inference, the nature of theoretical understanding and explanation, even problems of theory choice and paradigm allegiance are intrinsically rhetorical if one abandons the traditional justificationalist conception of rhetoric as a "second rate" art which pales by comparison to logic and dialectic. Indeed, a nonjustificational approach to scientific thought makes logic and dialectic comparatively restrictive facets, or aspects, of rhetoric which have applicability to limited domains compared to the full range of rhetorical transactions.

Let us begin by viewing the context in which science came to be characterized as the accumulation of truths proven by logic (or dialectic, which employs formal logic). Here, logic and dialectic were identified as the methods of truth and proof, hence of science, in opposition to rhetoric. Based upon justificational tenets which ignore the pragmatic aspects of human conceptualization and inquiry, this view produced a model of science so remote from actual scientific practice that it is unobtainable even in principle. If one is to understand how science is rhetorical (rather than logical-dialectical) it is necessary to see how and why the justificational framework is inadequate and should be replaced.

Traditional Conceptions of Logic, Scientific Inference, and Explanation

For over two millennia mathematical systems have represented ideals of knowledge in Western thought. When the Greeks sought
to understand human knowledge they studied geometry, because it represented the highest, most perfect form of knowledge available. Compared to the beauty and perfection of eternally valid and certain Euclidean systems, mere empirical knowledge seemed flawed and degraded. Not surprisingly, science for the Greeks was first and foremost mathematics, and the resulting conception of scientific knowledge that has dominated Western epistemology has equated knowledge with mathematical derivation. That is, knowledge has been identified with proof and certainty: genuine or "valid" knowledge became proven assertion. Knowledge, proof, and truth became definitionally fused concepts: Knowledge is truth which is proven (assertion). This is the essential tenet of justificationism.¹

But not all putative knowledge claims are genuine or valid: only some inferences are (or can be) proven true. How can we determine which knowledge claims, i.e., inferences, are genuine knowledge justified as proven truth? In geometry the answer is easy: specifiable procedures exist which enable one to prove that a conclusion is a true or certain inference from given premises. Valid derivations can be shown to follow deductively from premises; they are demonstrative truths. If a conclusion does not fit the pattern of valid derivation, it is not proven true, which is to say from a justificational point of view, is not genuine knowledge at all. Logic became a separate entity when proof procedures were taken from geometry and applied as syllogisms of valid reasoning. Logic became nothing more, nothing less, than valid proof procedures divorced from any particular content or subject matter. Logic became a codified set of principles of "right reasoning" which guaranteed the validity or truth of a conclusion; it became the organon which certified knowledge claims as genuine truths and dismissed as erroneous conclusions formally invalid.

Thus, methodologists held that what one does in testing a putative knowledge claim, in proving it true, is to justify it. All genuine knowledge is by definition demonstrated to be valid. Logic is the exemplification of such demonstration: when a conclusion is justified, it follows logically from its premises. Thus, logic exemplified the laws of thought (correct thinking), or, more properly, the laws of valid reasoning: logic became the method of science in
inference, the method of science in assessment, and the method of science in explanation. Science became the epitome of logic, and vice versa. This is the framework in which justificationism became enshrined as the metatheory of the scientific endeavor.2

But justificationism is an inadequate metatheory, and the conception of science and the logic in science that it proposes is incorrect. The logic of science is not found in either assessment, explanation, or inference, at least as these areas are usually construed. Consider that justificationism ignores the pragmatic context in which science is embedded.

Pragmatics, explanation, and the function of language. Logic is one of many possible language systems, and all human language is embedded in pragmatics. Thus before looking at logic in relation to science we must consider language. I maintain that explanation is dependent upon the argumentative function of language.

Language is not often analyzed from the standpoint of pure pragmatics; perhaps the best functional analysis stems from Karl Bühler, over half a century ago. Bühler analyzed the communicative function of language into three hierarchically related functions: (1) the expressive or symptomatic function, wherein language serves to express the speaker's state of mind (thoughts, emotions, etc.); (2) the stimulative or signal function, in which language triggers or releases effects and meanings in the hearer; (3) the descriptive function, which is present to the extent that language describes some state of affairs. In *Sprachtheorie* Bühler asserted that these three functions are hierarchical in that the higher functions cannot be present unless all lower ones are present, but not vice versa: the lower functions do not entail the presence of higher ones. One may express without signaling, or express and signal without describing. But the descriptive function of language cannot occur without both the signaling and expressive functions being present. To illustrate this consider a sound in spoken language, which may be used by a speaker to express himself, and if there is no audience (neglecting soliloquy) that is the only function it can serve. If the spoken sound is received by a listener it functions as a signal or appeal, but not necessarily in the manner intended by the speaker. The sound may also, in the descriptive function, symbolize some state of affairs (often independent of either speaker or
hearer). This is a pragmatic hierarchy in the sense that it explicates functional aspects of the domain of intentionality (in Brentano's sense).

Karl Popper, one of Bühler's students, extended this analysis to a fourth hierarchical function: the argumentative function. Popper holds that argumentation cannot occur unless language is being used to describe.

An argument, for example, serves as an expression insofar as it is an outward symptom of some internal state (whether physical or psychological is here irrelevant) of the organism. It is also a signal, since it may provoke a reply, or agreement. Insofar as it is about something, and supports a view of some situation or state of affairs, it is descriptive. And lastly, there is its argumentative function, its giving reasons for holding this view, e.g., by pointing out difficulties or even inconsistencies in an alternative view.4

A child at the stage of just naming things, or a map, are cases of language which is descriptive but not argumentative. Popper also described the argumentative function as "the presentation and comparison of arguments or explanations in connection with certain definite questions or problems."5

The point to note is the equation of argumentation and explanation. Popper tells us that the explanatory function of language is identical to the argumentative function because of "a logical analysis of explanation and its relation to deduction (or argument)."6 Equating explanation with deduction, which is to say with logic, requires equating argument, as the defense of a conclusion, with deduction, i.e., with logic. These two equations guarantee the third: argument is explanation, and both are deduction.

In this abstract analysis predicates applicable to deductive syntactic systems, such as truth or falsity, consistency, derivability and implication, logical consequence, etc., are being used as predicates to describe a function of language. The explanatory framework, the distinguishing feature of both refined common sense and scientific inquiry, is thereby given the conceptual predications of formal logic. Popperians staunchly defend this line of reasoning:

If we abandon logic, we lose the power of argument: for argument consists, in essence, in showing that two claims are
incompatible. And if we abandon logic we also diminish enormously our powers of description: for to say what something is, to describe it, is at the same time to say a great deal about what it is not. And if we allow contradictions to be introduced, we permit all descriptions at once. Thus one defensive move — the scuttling of logic — forces us step by step down the hierarchy of linguistic functions. We lose the power to argue, we lose the power to describe; we are left with the powers to express and to signal.7

I agree with Popper that explanation is inherently a matter of argument, that explanatory science is an instance of the argumentative function of language within the context of pragmatics. But I think it clear that the equation of explanation, as a pragmatic concept, with deduction as a syntactic concept, mars contemporary philosophy. Explanation in growing science (actual practice) is not deduction as the latter is defined within formal logic. But if that is so, then the "logic" of science cannot be formal deduction anymore than it is induction.8

Theoretical understanding and argument. To explain a phenomenon is to conjecture a tentative theory, but the theory will not deduce the phenomenon: rather, it will argue that the phenomenon must occur given the correctness of the theory's picture of reality. It will not deduce the event in question, but demand that it occur. Only theories can explain, and all explanation is argument within a pragmatic context. Theories are arguments because they are conceptual points of view that organize observations or "data" into meaningful patterns. Theories argue for a particular pattern or way of seeing reality. In organizing a subject matter, they render it intelligible by representing the structure of phenomena with which they deal. Theories function as instruments of understanding because they are structural representations of a domain; or rather, theories are postulations that the structure of a domain is represented by a given pattern or configuration.

Russell Hanson's Patterns of Discovery9 amply illustrated the conceptual nature of facts in science by considering "the same" phenomenon as quite different phenomena when viewed as different conceptual patterns. Thus Kepler and Tycho Brahe, although stimulated by the same "optical sensibilia," perceived quite different "facts" as they watched the sunrise. Facts are, on such a
view, deep structurally ambiguous: one and the same surface-structure entity is seen to have two (or more) deep structural representations or meanings (factual attributions).

Conceived in this manner, it becomes obvious that talk about patterns is qualitatively different from talk of, say, lines and dots. Patterns are detectable, but they cannot be drawn. They can be seen, but they are not visible (as are lines and dots, etc). Consider the difference in our perception of Fig. 1 when it is labeled “Mexican on a bicycle” instead of “approaching missile.” These different patterns are not elements of the array of “optical sensibilia.”

Conceptual ambiguity: Mexican on bicycle, or approaching missile?

Twenty-twenty vision is no guarantee of seeing the Mexican on the bicycle. Patterns are not elements in an epistemic configuration. Rather, the pattern is the configuration itself. By analogy, the plot of a novel is not another cluster of words; the form of a sonata is not just another cluster of notes; the architectural design of a building is not merely more bricks and beams; the aerodynamic structure of an aircraft wing — its airfoil section — is not just more ribs and skin plates; indeed, the meaning of a proposition is not another articulated term.10

Hanson’s thesis is that theories are conceptual patterns the way that Fig. 1 illustrates perceptual patterns. Scientific theories represent the phenomena of their domains by being structural patterns that are isomorphic to the structural relations that obtain in the phenomena themselves.

But what is representation in scientific theories? What is the relation between theory and “representation” and “state of affairs” and “understanding?” Hanson put it this way:
States of affairs, that is, constellations of phenomena, are often rendered understandable and intelligible and comprehensible because some objective, structural component of those phenomena is duplicated in a corresponding structural component within some scientific theory. Scientifically understanding phenomena \( x, y, \) and \( z \) consists in perceiving what kinds of phenomena they are — how they relate one to the other within some larger epistemic context; how they are dependent upon, or interfere with, one another. Insights into such relations 'out there' are generable within our perceptions of the structure of theories; these theoretical structures function vis-a-vis our linguistic references to \( x, y, \) and \( z \) in a way analogous to how the scene stands to the tree and hill 'out there' and also to the painted patches on canvas. Thus, I suggest that in contrast to the delineation of theories as 'ideal languages' or 'Euclidean hypothetico-deductive structures,' the important function of scientific theory is to provide such structural representations of phenomena that to understand how the elements in the theoretical representation 'hang together' is to discover a way in which the facts of the world 'hang together.'

Theories are conceptual gestalts that enable one to understand by representing a potentially infinitely extended domain of data points: that is, they represent the structure inherent in actual and potential data. States of affairs are represented by theories, and that representation very literally is understanding.

But how are we to construe "representation" such that scientific theories can be properly said to represent their subject matters? Representation is a generic concept; it includes picturing or iconic representation and other variables. Scientific theories are abstract representations — and the correlation of particular theoretical words with objects is inherently conventional, as is the correlation between the symbols on a map and the terrain it represents. Thus, theories are not like pictures; instead, they are like graphs or flow charts.

He who can understand the conventions of (or read) a graph or chart representing structural characteristics of phenomena is in a position to infer to unobserved cases. With the parameters at hand, the graph plot represents an infinitude of data points that need not have been observed. Thus, theories are generative conceptual schemes; they sanction inferences to unobserved cases. Laws of
nature are not just data summaries; they are also rules of inference. To see what a theory says of a domain is to know how to infer structural properties as yet unobserved in that domain.

Now we can see the relation between representation and understanding. Theories enable us to understand a domain because they enable us to represent, in a compact and economical manner, the structural properties that obtain in the domain "out there." Not only do scientific theories represent phenomena by being structural representations isomorphic to the phenomena, but insofar as they are explanatory they simultaneously argue for the correctness of their way of seeing (or, more correctly, conceiving) the domain in question. Theories as explanations argue that their account is a true portrayal of the nature of reality.

Theoretical explanation is thus intrinsically argumentative. It always has modal force. Theories say that reality must of necessity be the way their patterns represent it to be. To reject a theory as incorrect is to say that its postulated representation does not obtain, but that does not obviate the modal force inherent in the theory. The scientist's commitment to a theory is reflected in this modal aspect: in embracing a theory the scientist is saying, in effect, "This is the way reality has to be." And this commitment is more than logic, in the form of hypothetical (if-then) reasoning, can provide.

Explanation and Logic

Explanation is, as Popper emphasized, a matter of conjecturing the nature of reality. But it is equally a matter of asserting that the structural characteristics of reality must be those which the theory postulates. The pragmatic context of human inquiry and conceptualization is intrinsically modal, and it guarantees both that theories are arguments and that the logic of science is a modal logic. If we wish to account for scientific inference in terms of logic, we shall have to abandon the traditional hypothetical, the concept of material implication, for once and for all. Science requires a different inferential schema, or mood, to capture its argumentative force.

Inference in science may be logical, but not the logic of material implication. Indeed, fragments from the Stoic logicians who
developed propositional logic in opposition to Aristotelian class logic hint at a modal inference schema that seems to embody the essence of scientific inference: the *adjunctive conditional* may be the schema of theoretical, which is to say explanatory and postulational, science.

The history of Stoic logic remains obscure, because our knowledge of Stoic doctrines derives entirely from commentators (such as Sextus Empiricus, Diogenes Laertius, and the Roman Galen) who mentioned it primarily to refute it. The best single source is *Stoic Logic*, by Benson Mates. The propositional forms we are concerned with originated with the Old Stoa, the founder of which was Zeno of Citium. Zeno was interested in language and grammar, and appears to have originated case grammar. His successor, Cleanthes, preserved Zeno's doctrines with apparently no innovation, and was succeeded in turn by Chrysippus (c.280-205 B.C.), a master logician who wrote voluminously (705 books, if Diogenes' list can be trusted). Chrysippus may have been the greatest logician of ancient times, and no doubt he is most responsible for codifying and elaborating Stoic logical theory.

The logicians of Old Stoa were concerned to find the laws of thought. They looked at logic from a pragmatic perspective and saw that language is in an argumentative mood when it is used in explanation. The Stoics were thus concerned with a propositional calculus (rather than a logic of classes, as was Aristotle) that represented the argumentative form of explanatory reasoning. Logic, for the Stoics, was always modal logic, and the laws of thought were cast in various moods or schemata. Inferential patterns were modal forms: the various inference schemata were just examples of modal force in reasoning. Thus their logic differed from Aristotle's in two major respects: first, it was a propositional calculus instead of a logic of classes; second, Stoic logic is a theory of inference schemas, whereas Aristotelian logic is a theory of logically true matrices.

Stoic logic becomes relevant for scientific inference when we examine the types of propositional connectives Stoics allowed (since for every valid argument form there is a corresponding conditional) to see what alternatives were available to the hypothetical conditional or "material implication." Like contemporary logicians,
the Stoics acknowledged implication (including Philonian implication, which is identical to modern material implication), disjunction (in both exclusive and inclusive senses), and conjunction. But they also acknowledged what was called an inferential, or adjunctive proposition. The adjunctive propositional form is characterized by "since-necessarily":

Since the first, the second necessarily and is valid only when both the antecedent and consequent are true. Its force is extremely strong, and it seems to capture the argumentative force of scientific reasoning:

Since my theory is true, the world is necessarily this way. The adjunctive connective asserts that the consequent follows necessarily from the antecedent, and that the antecedent is true.

The adjunctive proposition is a good model for science for two reasons: first, well-known inadequacies of the hypothetical conditional; second, the ability of the adjunctive proposition to capture the modal force of theoretical statements. Consider these in turn. The hypothetical makes a poor model for science because it can be valid under conditions which intuitively we reject as modeling science: for instance, it is valid when both the antecedent and consequent are false, and also when the antecedent is false. Further, there is no necessity in the relationship between antecedent and consequent in the hypothetical, and intuitively we feel that laws of nature are necessarily dependent upon theories. If our theories are true, the laws of nature are necessarily what they are. In short, attempts to fit science into hypothetical propositions lead to paradoxes and inconsistencies. This is, in essence, the reason that most theorists give for the contention that science is not logical: that its inference does not fit the amodal hypothetical conditional schema.

In favor of the adjunctive proposition as a model for scientific inference is its demand that the antecedent and consequent correspond; i.e., that the conclusion follow with necessity and that the premises be true. Thus it seems to capture the inexorability with which true theories capture relationships among events: since theoretical law $X$, then outcome $Y$ necessarily. Note also that observation of the consequent does not confirm an adjunctive proposition. Affirming the antecedent is still a fallacy due to the non-commutativity of the proposition. On the other hand, obser-
vation of a single refuting instance, i.e., failure to obtain the consequent, is ground for rejecting an adjunctive proposition. Thus at least in principle, falsifiability is retained.

It is important to note that only a **theory** can be the antecedent term of an adjunctive proposition. Theories can entail that a consequent necessarily obtain, but neither laws (whose derivative modal force stems from the theory in which they are embedded) nor factual propositions are strong enough to exhibit this conceptual necessity. Indeed, it is possession of this conceptual necessity which separates explanation, as the argumentative force of a theory, from description. This is why only theoretical science is explanatory, and descriptive science is not. The adjunctive form is the logic of explanatory science.

Thus conceptual necessity, which requires a modal propositional schema and entails an explanatory and argumentative framework, makes theories quite different from laws and facts. Even the truth of a theory must be construed differently from the truth of factual propositions. Truth is relative to conceptual frameworks, and this relativity, in combination with the analytic character of theorems of a theory within a given conceptual framework, results in theories standing or falling **en bloc**. A theory stands or falls **en bloc** in that when one of its theorems (which has the status of a synthetic, a priori statement within the conceptual scheme which is the theory) is endorsed, the remainder must also be, and when one of them is challenged they are all challenged (even though the attempted falsification may be directed at only one theorem). No theory can survive if a single one of its analytic consequences is falsified: such falsification introduces a contradiction into the theoretical system, which falsifies it in toto because whatever implies something false is false. The only successful defense of a theory so challenged is to argue that the assumed theorem is not in fact a consequence (valid derivation) within the theory at all.

**Injunction** and the **communication of argumentative discourse.** Traditional accounts portray the language of science as purely descriptive. Beginning from the truism that theories describe the nature of reality, they ignore the argumentative nature of explanatory discourse and assume that representation, the essential characteristic of science, is just description. But not only is such an
account deficient with regard to the argumentative force of theoretical explanation, it cannot account for communication in science, either among established practitioners or between apprentice and master.

At the observational level, pure description fails to provide a sufficient specification of factual data. One cannot see a fact in any descriptive sense; to see facts as such requires an interpretative framework. To be sure, facts can be described within a conceptual framework, but how does one learn and then communicate the conceptual framework?

In both communication between initiates within the scientific community and in the instruction of apprentice researchers, the argumentative mode of discourse requires injunction rather than description. Communication in science is primarily a matter of commands: correct description will not be attained unless an injunction is obeyed. Both scientific articles and research training given to novices enjoin their audiences to behave in a certain way. In this regard science very literally is a "cookbook" endeavor — it is a matter of recipes for conceiving, perceiving, and doing, and the recipes are given as injunctions. Scientific communication becomes a set of commands that will enable the researcher to have the appropriate experience: "Do this, and you will experience the world correctly!" The descriptive commentary of the scientific report becomes a description only within this injunctive framework. G. Spencer Brown conveys this with admirable clarity:

Natural science appears to be more dependent upon injunction than we are prepared to admit. The professional initiation of the man of science consists not so much in reading the proper textbooks, as in obeying injunctions such as 'look down that microscope.' But it is not out of order for men of science, having looked down the microscope, now to describe to each other, and to discuss among themselves, what they have seen, and to write papers and textbooks describing it. Similarly, it is not out of order for mathematicians, each having obeyed a given set of injunctions, to describe to each other, and to discuss amongst themselves, what they have seen, and to write papers and textbooks describing it. But in each case, the description is dependent upon, and secondary to, the set of injunctions having been obeyed first."
Rhetoric in adjunctive claiming and injunctive tuition. Since scientific discourse is inevitably adjunctive at its theoretical base and injunctive in its specifications, a theory of scientific discourse must not be based on traditional logic. To understand science as an ongoing endeavor requires a theory of the rhetoric of adjunctive argument and injunctive tuition. What is required is a theory which explains the rhetorical nature of the various uses of the argumentative mode of discourse, which is literally the essence of science. Such a theory must be a theory of rhetoric simply because the domain of rhetoric is all of pragmatics (rather than semantics or syntax) and the argumentative use of behavior (including language).

This conception of rhetoric emphasizes the intrinsic valuational or ethical dimension inherent in all scientific activity. Knowing and valuing are inseparable: “The primary and pervasive significance of knowledge lies in its guidance of action: knowing is for the sake of doing. And action, obviously, is rooted in evaluation. For a being which did not assign comparative values, deliberate action would be pointless; and for one which did not know, it would be impossible.” In the past both scientists and rhetoricians have accepted, seemingly as revealed truth, the idea that science and logic are value-free, in contrast to properly rhetorical concerns (where values were grudgingly admitted). Methodologists and sociologists of science have known otherwise for some time. Many have emphasized that the growth of knowledge and the practice of research, since they are embedded in pragmatic action, entail ethical and valuational considerations at (literally) every step.

Knowing, doing, and valuing can and must be reunited. Insofar as all involve the argumentative function, rhetoric is the domain in which that unification must occur.

The object of communication in science is always to educate the research communities involved. Science instructs us in how to conceive the universe in which we find ourselves, and it does so rhetorically since the adjunctive claims of scientific theory can only be given support by argument. The adjunctive reasoning scientists engage in is inextricably linked to injunction in tuition addressed to other scientists (and students). Scientific description can only be descriptive in virtue of being embedded in an explanatory
framework, explanations can only be explanatory in virtue of being argumentative, and arguments can only be learned by injunction. Hence, to state a fact is to argue for the warrant of the theory which necessitates it, and to teach others that it is a fact is to enjoin them to see reality as that theory commands one to see it. Whenever the scientist communicates, even the most mundane and seemingly innocuous descriptions, he is persuading his audience, literally commanding them, to adopt his point of view.

The rhetorical nature of theory choice and revolutionary reconceptualization is easy to see (and is noted below); but what must be emphasized is that there is absolutely no difference between revolutionary and normal science in this regard: tuition and communication are injunctive in both. Indeed, Spencer Brown’s remarks refer specifically to normal science tuition, and Kuhn, Polanyi, and others have discussed this aspect of scientific communication at length. Thus it is sufficient to note that this aspect of scientific tuition was known to Plato, as the interchange between Socrates and Meno’s slave in the *Meno* makes clear.

Science as a Rhetorical Transaction

The above conception of the “logic” of science in conjunction with the argumentative and injunctive nature of scientific discourse make explicit several reasons why the scientific endeavor is a matter of rhetoric rather than of either logic or so-called dialectic. Science is a rhetorical transaction in the classic Greek sense of the term: it is a nonjustificational, argumentative, and persuasive art form whose reasoning is adjunctive and whose tuition and communication are injunctive. In this regard it is instructive to examine contemporary approaches to rhetoric, in light of classic justificationist conceptions of rhetoric and dialectic. It will become clear that the methodologist interested in explaining scientific research has much to learn from a nonjustificational rhetorical theory, and that such rhetoric is as necessary a supplement to philosophy in the understanding of science as are the psychological sciences.

Influential classical doctrine held that rhetoric can at best provide true opinion, while genuine knowledge, which is certain truth unshakeable by persuasion, can be achieved only by dialectic. Plato's
Republic (533-34) makes this clear: "Dialectic, and dialectic alone, goes directly to the first principle and is the only science which does away with hypotheses in order to make her ground secure: the eye of the soul...is by her gentle aid lifted upwards. ... Dialectic...is the coping-stone of the sciences, and is set over them: no other science can be placed higher. ..." Thus, rhetoric produces only belief by argument and persuasion, and belief can at best be true opinion; but genuine knowledge is produced by dialectic. Socrates is a master dialectician in the maieutic technique, and Plato's dialogues are cast to reflect dialectic rather than rhetoric. From this framework Aristotle gave rhetoric the classic definition of a methodological technique of persuasion independent of any substantive content area.

By establishing an ideal of reasoning that cannot conceivably be attained, the justificationist framework forced theorists who have recognized the futility of "dialectic" or "scientific method" to attain certainty and proof to abandon a rational conception of contingent disciplines. It has fostered the idea that rhetoric represents a retreat from ideal, but unfortunately unattainable, critical standards. Rhetoricians have often accepted this second-rate status of the discipline in comparison to both logic and dialectic. Some, for example, many renaissance humanists, concluded that rhetorical argument is not rational. Today it is commonly held that rhetoric is not as rational as the "sciences" which employ logic and dialectic, which are assumed to be different from rhetoric.

No such conclusions are warranted, however, for they rest upon an untenable conception of rationality and an unwarranted separation of dialectic and rhetoric. Consider the rationality of rhetorical argument and the nature of criticism. The accepted premise is that if one cannot be critical, then argument is not rational. But what constitutes criticism? According to the most prevalent view, criticism consists in the search for contradictions and attempts to eliminate them. The rationality of science is thus criticism, which is the motive force of theory change:

Criticism invariably consists in pointing out some contradiction; either a contradiction within the theory criticized, or a contradiction between the theory and another theory which we have some reason to accept, or a contradiction between the
theory and certain facts. . . . Criticism is, in a very important sense, the main motive force of any intellectual development. Without contradictions, without criticism, there would be no rational motive for changing our theories: there would be no intellectual progress.¹⁸

Popper’s reason for endorsing this strong stand on the nature of criticism and its centrality to rationality is that “if one were to accept contradictions then one would have to give up any kind of scientific activity. . . . This can be shown by proving that if two contradictory statements are admitted, any statement whatever must be admitted: for from a couple of contradictory statements any statement whatever can be validly inferred.”¹⁹

But despite the validity of this proof, this identification of criticism with the search for contradictions, and both with scientific rationality, is incapable of accounting for the growth of science. No one has delighted in detailing the growth of science on inconsistent “foundations” or theories as much as Paul Feyerabend,²⁰ but Kuhn and Lakatos²¹ have also convincingly documented this charge. Paradigm exemplars of rational scientific progress discussed by virtually every historian have utilized inconsistent premises, and thus could have “logically deduced” any conclusion whatsoever.

Rhetoricians have reached a similar conclusion about the role of criticism (defined according to Popper) in argument. “I used to think of philosophical criticism primarily as the attempt to expose an internal inconsistency in the position criticized, forcing the holder of the position to revise or abandon it. . . . This interpretation assumes that consistency is the highest aim of anyone taking a philosophical position. . . . ”²²

But having seen the inadequacy of identifying rationality with criticism, and criticism with consistency, what is to be done? Johnstone provides one answer: the abandonment of rationalism.

My rationalism . . . is now a thing of the past. I no longer see philosophical argumentation as an attempt to appeal to a standard of consistency in order to get an interlocutor to revise or abandon his position. . . . It is an attempt to evoke on his part a fuller consciousness of presuppositions that may have been merely implicit in his philosophical position. . . . Thus the abandonment of rationalism has made it possible for me to adopt a view of philosophical argumentation according to
which rhetoric has a natural and proper place in the discussions and debates of philosophers.\textsuperscript{23}

Johnstone, like the majority of contemporary rhetoricians and philosophers, takes critical rationalism to be the only conception of rationalist identity. Like other neojustificationists, he assumes a forced choice between two exhaustive alternatives: critical rationalism or irrationality. Faced with this choice he abandons rationalism in favor of an existential-phenomenological irrationalism, in a retreat to commitment.\textsuperscript{24}

But a more adequate conception of rationalist identity, comprehensively critical rationalism, allows philosophical argument (and rhetoric) a place within rationalism. Within comprehensively critical rationalism the concept of criticism has no fixed, a priori definition: what constitutes criticism, or better, appropriate criticism, can be determined only in the given case. There is no statute law of criticism, only case law. Further, even in the given case, a particular identification of criticism can never be justified, but only defended by adducing good reasons, which is to say, arguments, in its favor. That is, what constitutes criticism may be subjected to critical evaluation. It may, in a given case, be perfectly rational either to conjecture a new theory on the “basis” of inconsistent foundations or to manifest the commitment to a paradigm so characteristic of normal science practice.

The point with regard to criticism and consistency is that science can be perfectly rational even though logically anything at all could have been deduced from any set of inconsistent premises that it employs. Scientific creativity can be completely illogical, unconscious, even inconsistent. So can the assessment of theories; neither proof nor consistency need enter into acceptance of a theory. Scientific theories are defended by adducing good reasons for them, not by judging them consistent.\textsuperscript{25} If the inconsistency between theory and background knowledge (and competing theories) is not sufficient to warrant rejection of either, then it is hard to see why either criticism or rationality should be identified with consistency. Both criticism and rationality can be reinterpreted within a non-justificational framework so that consistency is not identified with either. An adequate explanatory theory of rhetoric ought to explore in detail how this can be accomplished in case law determination,
where (as many rhetoricians have noted) it is uniquely focused to deal with the specifics of a given case.

The reunification of rhetoric and dialectic. But if we abandon the justificationist conception of knowledge as proven (or probable) assertion in favor of the nonjustificational notion of warranted assertion, the character of dialectic changes completely. This has been implicitly recognized by many philosophers:

The Greek expression ‘*He diatektikē (technē)*’ may be translated ‘(the art of) the argumentative usage of language.’ . . . One at least of its ancient meanings is very close to what I have described above as ‘scientific method.’ For it is used to describe the method of constructing explanatory theories and of the critical discussion of these theories, which includes the question whether they are able to account for empirical observations. . . . 26

With this admission dialectic and rhetoric merge into one another, equally utilizing comparable concepts of argument and criticism. Critical appraisal of a theory (which must always be the appraisal of competing theories rather than a single theory appraised against atheoretical facts) becomes at heart a rhetorical process; it is “dialectic” only insofar as it involves competing alternatives. 27 As contemporary rhetoricians have put it:

Anytime an affirmation is challenged, that action is rhetorical. . . . Whenever and wherever claims occur and those claims either are or might be challenged, a situation exists which can be fully explained only if *rhetorical* explanation is provided. . . . 28

The rhetorical dimension is unavoidable in every philosophical argument, in every scientific discussion which is not restricted to mere calculation but seeks to justify its elaboration or its application, and in every consideration on the principles of any discipline whatever . . . whenever [men] act on other men by means of a discourse or are acted upon, they are engaged in an activity which is of interest to the rhetorician. Man thus appears to be an essentially rhetorical animal. 29

Much of what has been said thus far is consonant with views put forward in the last two decades by an increasing number of theorists who have held that rhetoric is a way of knowing. Disenchanted with the sharp separation of logic and dialectic (as
the methods of science and therefore knowledge acquisition) from rhetoric, these theorists have focused attention on the social, psychological, and communicational aspects of the acquisition of knowledge, arguing that the human epistemic situation is inevitably rhetorical. Thus these theorists link rhetorical theory, construed as the theory of argument, to theory of knowledge: rhetoric becomes an activity of ideational discovery, and "in many circumstances humans can 'know' only through engagement in rhetorical activity." The central claim in this group of theorists is that argument (both as theoretical principles and applied practice) is fundamental to knowledge. Insofar as man is engaged in the acquisition of knowledge he is engaged in argumentation. Thus man as knower is intrinsically rhetorical, and this obviously in the practice of science. As one article put it:

Unless one is willing to argue that that [scientific] statement includes everything that could conceivably be said, and said from every conceivable vantage point — unless one is willing to argue that — one must grant that what has been told is a partial story. And the partial story told is obviously one that is advocated, for it is senseless to choose a certain story about a certain object/event and to claim at the same time that some other story is preferable. Hence, by definition, the scientific statement is rhetorical.

Theorists of this "school," as Arnold has called them, would no doubt resonate to both identification of the domain of rhetoric with the argumentative function of action and discourse and to the claim that the logic of science is adjunctive and its tuition injunctive. But while I agree with many of their claims, I do not wish to be identified with this school, and it would be a mistake to take this essay as another instance of its growing impact. The reason for this is that without exception these theorists remain justificationists. Their usual formulation argues against a comprehensive rationalist, classic justificationist picture of science (amodal logic, decisive proof or refutation, absolutistic and infallible method) and endorses a critical rationalist, neojustificationist account of rhetoric (probabilistic inference in place of certainty, situational relativism of truth and knowledge). "Often, this 'school' asserts, no human thinking can be expected to achieve certainty. When certainty is not
possible, men can only act rhetorically. . . . "34 Thus rhetoric is endorsed in a retreat from higher, but unfortunately unobtainable, critical and epistemic standards. Rhetoric is identified as the only alternative available in an uncertain world in which the apodictic proof of logic plays no role (recall Johnstone's reasoning in abandoning "rationalism"). Even though rhetoric is given "primacy" in these accounts, it still has second-rate status, as indeed it must have in a justificationist account, no matter how sophisticated it may otherwise be.

The justificational underpinnings of the "new rhetoric" need thorough exposure and documentation. Although worthwhile, this task is beyond my purpose; I note only that while this essay thoroughly endorses the interdetermination of rhetoric and epistemology (rather than the primacy of either) and the identification of rhetoric with argumentation, it does so within the confines of a nonjustificational metatheory of rationality and science. Rhetoric can be a way of knowing only if knowledge is a matter of warranted assertions rather than proven or probable assertions. Further, rhetoric's primary application is in the realm of contingency, in so-called empirical endeavors; logic remains the method of reasoning to conclusions in formal disciplines.

The scientific research community in the rhetorical transaction. The production of knowledge indispensably involves a producer interacting with an audience, if for no other reason than that argument presupposes a plurality of points of view and therefore (neglecting arguing with one's self) a community of knowers. The community structure of science has been extensively studied of late by sociologists of science, and the work of Merton, Hagstrom, Mulkay, Ziman, and others35 has begun to sketch an informative picture of the scientist as a social being. When combined with socially oriented accounts from other perspectives, such as those of Polanyi (philosophy) and Kuhn (history), the picture is considerably enhanced. But as yet there is little on the audience in science. Accounts have focused upon the research community primarily in reference to its impact upon the individual scientist. But the scientific community as a rhetorical audience, as an active constructor of the scientific dialogue and the meaning which it
manifests, has received little attention from any discipline or perspective.

As one illustration of ways in which rhetorical study of the production of knowledge can illuminate science in a novel and informative manner, consider how the research community in which he operates becomes a persona to whom a scientist must address his findings. In communicating his results the researcher is, quite literally, engaged in a dialogue with the persona representing his research community. The initial process of formulating (to himself) what he thinks he knows, what he can argue for and against, involves the researcher in an internal dialogue with what he perceives to be the point of view of his research community. Subsequent communication (from informal discussion with colleagues, through colloquium or convention presentation, to and including publication) requires the researcher to sharpen his presentation to be maximally effective to the audience persona in question. In periods of Kuhnian normal science, much of the metaphysical and/or sociological paradigm finds concrete expression in views the researcher attributes to the persona he is addressing, and this persona typifies a community of "like-minded" scholars. In revolutionary periods the persona is often hostile, opaque, disinclined to listen to "reason," etc., and the entire nature of the communication process changes accordingly.

The personae of science render intelligible another phenomenon that historical research has disclosed to be characteristic of science: the enormous discrepancy between a scientist's preachment and his research practice. When queried about their research, scientists usually respond that it conforms to one or another methodology which they take to be the personification of "good science." Thus Newton, a consummate visionary and theoretician, would utter "hypotheses non fingo" to a community of inductivist researchers in absolutely convincing fashion, because he really believed in it. Historians examining his research have found Newton to be much more speculative than he would have admitted, and one way to understand the discrepancy is to consider Newton both as a persona and also as addressing one. The ideal and the real interact in the construction of the products of science, and a rhetorical theory of
personae could be enormously informative of how that interaction occurs.

Note that the persona of ideal science, as it appears in justificationist accounts, has been a severe drawback both to the development of rhetorical theory and to the rhetorician desirous of studying science. Virtually to a man, rhetorical theorists who emphasize rhetoric as a way of knowing have been misled in their otherwise informative accounts by the justificationist persona of "objective" science coldly marching toward proven truth in amodal, value-free, and "logical" fashion. Were these theorists more inclined to look at science and its history rather than at the personification of science in justificationist philosophy and textbook history, there would be no need to apologize for rhetoric, or to assign it second-rate status compared to "dialectical" science. There is no need for sentiment such as this: "It was said [at Wingspread] that when subjects, data, and their meanings can be interpreted as asserted to simply by distinguishing facts from non-facts the 'method of rhetoric' is inapplicable, but issues on which meaning cannot be determined by fact-nonfact judgments are precisely those on which decisions can be reached only through rhetorical considerations of the choices available to men."

Another neglected aspect of the research community as a producer of knowledge in virtue of its participation in the rhetorical dialogue of ongoing research sheds light on the time-bounded character of "truth" in science. Research communities, in their capacity as auditors of scientific formulations, change their views over time. Often the change is not straightforwardly related to the accumulation of new "data," or even to significant theoretical advance. After a period in which formulations are guided by one or another cluster of directives, situations that otherwise appear identical will be treated entirely differently. An example (borrowed, with acknowledgment, from Carroll C. Arnold) from the law may help. It sometimes happens that legal precedent A, after having been the basis of judges' decisions in cases for considerable time (perhaps a generation or more), will suddenly give way to precedent B in similar cases. The switch from A to B comes about not because of new "facts," but because some feature of precedent B was explored and seen to be more applicable to these cases than the prior
The point to emphasize is that the criteria of evaluation were rhetorically created. The ascendancy of precedent B occurred as a result of rhetorical interchange between judges, juries, and attorneys. Precedent A was abandoned not because it was seen to be inapplicable (disconfirmed or falsified) — indeed it need not have been tested at all — but because it was seen as less applicable, plausible, relevant, etc., than B.

Scientific ideas have a similar time-boundness, and it is easy to cite examples of switches in theories due to rhetorical factors such as those in the hypothetical legal example. One example is the various metaphysical directives at the heart of scientific research programs which J. W. N. Watkins called "haunted universe doctrines." For example, the Cartesian directive "the universe is a clockwork mechanism" and the ether doctrine that "all matter is continuous" were replaced by Newtonian directives such as "the universe is matter in motion" and "all matter is compounded of atoms," not because they were disconfirmed (because, as metaphysical statements, they are confirmable but not refutable), but because Newtonian "theory" came through rhetorical interaction to seem a more adequate description of reality. The scientific audience, in cases such as this, is as much a factor in shaping the character of knowledge as is the theorist who initially propounds an idea. The scientific "auditor" is not an impartial bookkeeper checking the arithmetic of the scientific record book (the CPA model of logical empiricism and most rhetorical accounts); the "auditor" is rhetorically engaged, an active constructor of the products that enter the record book of the scientific endeavor.

Incomplete though they are, examples such as these indicate the extent to which science, as a rhetorical transaction, is interplay between theorist or researcher, on one hand, and the research community as audience, on the other.

From the perspective used in this essay, the vexing problem of theory choice in science takes on a new dimension. Most debate has concerned the adequacy of philosophical versus socio-psychological reconstructions of the scientific endeavor, and such
clashes as the Kuhn-Popper-Lakatos debates have been interpreted primarily in that light. But theory choice is a subject for rhetorical analysis, and an adequate rhetorical theory could add much to our understanding of science as an argumentative form of discourse within a nonjustificational framework. Kuhn's recent remarks on theory choice lead straight to rhetorical analysis, as comments such as this make clear:

Nothing about that relatively familiar thesis [that theory choice is not susceptible to logical proof] implies either that there are no good reasons for being persuaded or that those reasons are not ultimately decisive for the group. If two men disagree, for example, about the relative fruitfulness of their theories, or if they agree about that but disagree about the relative importance of fruitfulness and, say, scope in reaching a choice, neither can be convicted of a mistake. Nor is either being unscientific. To understand why science develops as it does, one need not unravel the details of biography and personality that lead each individual to a particular choice, though that topic has vast fascination. What one must understand, however, is the manner in which a particular set of shared values interacts with the particular experiences shared by a community of specialists to ensure that most members of the group will ultimately find one set of arguments rather than another decisive.39

Kuhn's last sentence summarizes the function of rhetoric in the understanding of science: rhetoric can provide a framework and theory for the explanation of decisions that result from the argumentative use of discourse, in both revolutionary reconceptualization and normal science practice. In both cases, scientists face arguments (in print and in experimentation), never data. Rhetoric will be as indispensable to the understanding of science as social and cognitive psychology.

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NOTES


2 Justificationism may be characterized as attempting to provide a theory of rationality according to which science is a rational source of knowledge. Within this framework only those claims which can be justified are accepted as genuine knowledge and, hence, as rational. Logic was the organon, or tool, which proved knowledge claims "followed" from whatever epistemological authority was accepted (usually sense experience). When it was gradually realized that empirical propositions cannot be proven, the classic justificationist quest for certainty gave way to the neojustificationist quest for near certainty (as the next best thing). Near certainty was identified with the calculus of probability, and the "logic of science" was assumed to be a probabilistic inductive logic, or confirmation theory, which was to be the method of science. For a devastating critique of justificationist rationality, see W. W. Bartley, III, The Retreat To Commitment (New York: Knopf, 1962), especially Ch. 4. For the futility of inductive logic as the inferential method of science see K. R. Popper, The Logic of Scientific Discovery (New York: Harper, 1959) and Conjectures and Refutations (New York: Harper, 1963); J. Agassi, "Towards An Historiography of Science" in History and Theory, Bieheft 2 (Middletown, Conn.: Wesleyan University Press, 1963); I. Lakatos, "Changes in the Problem of Inductive Logic," in The Problem of Inductive Logic, ed. I Lakatos (Amsterdam: North Holland Publishing Company, 1968), pp. 315-417.

3 Karl Buhler, Sprachtheorie: Die Darstellungsfunktion der Sprache (Stuttgart: Gustav Fischer Verlag, 1965).

4 Popper, Conjectures, p. 295.

5 Ibid., p. 135.

6 Ibid., p. 135.


8 Popperian arguments against inductive logic convince all who do not believe that science cannot be rational unless it is inductive (see references in Notes 1 and 2, above). Convincing arguments against deduction as the logic of science in either inference or explanation are found in Paul Feyerabend, "Explanation, Reduction, and Empiricism," in Minnesota Studies in the Philosophy of Science, Vol. 3, ed. H. Feigl and G. Maxwell (Minneapolis: University of Minnesota Press, 1963), pp. 28-97; and P. K. Feyerabend, "Reply to Criticism," in Boston Studies in the Philosophy of Science, Vol. 2, ed. R.S. Cohen and M. W. Wartofsky (New York: Humanities Press, 1965), pp. 223-61. The question then arises: having eliminated traditional interpretations, is science illogical? Below we argue that science can be both logical (and truth functional) and rational if justificational notions of logic and rationality are replaced by more acceptable ones.

9 N. R. Hanson, Patterns of Discovery (Cambridge: At the University Press, 1958).


11 Ibid., p. 240.
18 Popper, *Conjectures*, p. 316.
19 Ibid., p. 317.
23 Ibid., p. 188.
24 The proliferation of "new rhetorics" in recent years has reached epidemic proportions. Consider the switch in stated editorial policy in *Philosophy and Rhetoric* to save space for more likely to succeed articles. In its first years, editorial directive was brash, confident, even starry-eyed: the journal "publishes definitive articles on the nature, scope, and limits of rhetoric, as well as incisive answers to the question whether man necessarily engages in rhetoric . . . ." (See *P&R*. Vols. 1-6.) Then the message became one of resignation: "The editors . . . believe that the nature and scope of rhetorical activity are philosophically unsettled matters. Papers which explore rhetorical action, rhetorical art, or rhetorical experience without presupposing a priori conceptions of rhetoric are solicited" (See *P&R*. Vols. 7-9). Such positions represent a concession to a perceived dilemma in the justificationist conception of rationality which limits rationality by rendering it impossible to achieve. It begins with this simple question: Can we rationally defend the superiority of the rational way of life, of such rational procedures as the employment of scientific reasoning? According to the argument, the answer is "No," because of the limits of rationality per se. Bartley develops the argument this way in *The Retreat To Commitment:*

No matter what belief is advanced, someone can always challenge it with: 'How do you know?' and 'Give me a reason.' Unless this procedure is to go on forever, it must be halted at a 'standard,' 'criterion,' 'ultimate presupposition,' 'end,' or 'goal' whose authority is simply accepted. If all men do not cease their questioning at the same point, however, 'ultimate relativism' results. For there is no Archimedes' lever with which to decide among competing sets of ultimate standards. Even if everyone did happen to stop at the same place, there would be no way to determine whether this universal subjective standard led to objectively true statements about the world . . . . Obviously, a man cannot, without arguing in a circle, justify the rationality of his standard of rationality by appealing to that standard. Yet, if he holds certain beliefs — for example the standard itself — to be immune from the demand for rational justification and from the question 'How do you know?' he can be said to hold them irrationally or
dogmatically. And, so it is claimed, argument among men about the radically
different beliefs they hold in this way is pointless. For rational argument consists
in mutual criticism, with each man supporting all his beliefs with good reasons.
The limits of rational argument within any particular way of life, then, seem to
be defined by reference to that object or belief in respect to which commitment is
made or imposed, in respect to which argument is called to a halt (pp. 90-92).

The skeptical critic of rationalism has a *tu quoque* argument to justify rationally his
commitment to irrationality. If this argument form is valid, then one has, so to speak,
a "scientific" excuse for being unscientific! The mystic, theologian, or existentialist,
etc. who does not accept the validity of scientific reasoning is now provided with a
"scientifically valid" justification for saying "I do not accept the findings of
science!" If this argument were valid, there would be no way to justify science as a
means to knowledge, and hence no rational reason whatsoever to prefer it to other
putative sources of knowledge, including the most irrational ones!

And what is this *tu quoque* argument? It is the combination of these three premises:
(1) For the logical reasons above rationality is limited so that *everyone must* make a
dogmatic, irrational commitment.
(2) Therefore, one has a right to make whatever commitment he pleases: the scientist
to science, mystic to mystical revelation, etc.
(3) Therefore, no one may criticize anyone else's commitment, nor can anyone be
criticized for making that commitment.

Those who understand the force of the *tu quoque* adopt what Bartley calls critical
rationalism, which consists in acknowledging that rationality is limited in the sense
that it cannot be rationally justified. From my cursory examination, the "new
rhetorics" invariably instantiate one or another form of critical rationalism, with an
inevitable retreat to commitment in order to evade the *tu quoque*. The usual retreat is
to conventionalism, which gains immunity from criticism at the expense of giving up
the ability to criticize rivals. Thus journal editors quietly ask for an end to
"theoretical" papers whose sole *critical* function is to clog up the journals, and re-
quest instead the atheoretical *exploration* of what rhetoric is. This is exactly
analogous to Nelson Goodman, in *Fact, Fiction and Forecast* (Cambridge: Harvard
University Press, 1955), proposing the "new riddle" of induction, that of explicating
what an inductive inference is, in place of the "old riddle," Hume's problem of its
justification. But critical rationalism is no more successful in rhetoric than it is in
philosophy of science.

What is the alternative to critical rationalism? Bartley's answer is comprehensively
rationalism, which abandons the quest for justification, as well as the
authoritarian basis for knowledge and rationality. This permits us to characterize a
rationalist as one who holds *all* his beliefs open to criticism, as well as the
structure of the infinite regress is dissolved by identifying the essence of
rationality with criticism rather than justification. One can be critical *forever*, never
shutting off debate, without ever justifying or failing to justify a position or belief. If
criticism is the essence of rationality, it is rational to hold an unjustified belief, and
even an unjustifiable one, so long as criticism is never cut short! Indeed, justification
is not always desirable (or undesirable) for the comprehensively critical rationalist:
its merit in any given case is always "open to criticism."

This makes rationality rhetorical, in both its essential formulation and its practical
pursuit. Criticism, as the essence of rationality, is a rhetorical process which never seeks proof or ultimate commitments. Instead, it seeks to articulate and assess the merits of a position within its own unique context, thus making rhetoric a "way of knowing" without retreating to commitment or abandoning rationality.

25 See Weimer, "The Psychology of Inference and Expectation."
26 Popper, Conjectures, p. 313.

27 Robert Persig's Zen and the Art of Motorcycle Maintenance (New York: Morrow, 1974) has occasioned considerable interest among rhetorical theorists. From the standpoint of this essay two things are particularly noteworthy in this work: Persig's attempt to put rhetoric in the spotlight usually reserved for dialectic (esp. pp. 338 ff.); and the intensity of his response to the crisis in integrity faced by justificationist conceptions of rationality. Persig's intellectual honesty in pursuing justificationist rationality to its self-stultifying end led to his psychotic breakdown — unable to cope with the crisis in integrity, he abandoned rationality altogether. Persig also saw that dialectic need not dominate rhetoric, and that Aristotle's justificationist ghost need not always direct the field. Unfortunately he never succeeds in totally abandoning justificationism; his revolution overthrows dialectic for rhetoric without uniting them in a nonjustificational framework.


33 Wayne C. Booth, in Modern Dogma and the Rhetoric of Assent (Chicago; University of Chicago Press, 1974) is an illustration. After chastising Bertrand Russell for being a comprehensive rationalist, Booth endorses a weak form of critical rationalism, in opposition to "modern dogma" (comprehensive rationalism).

34 Arnold, "Inventio," p. 6.


36 A beginning attempt at redressing the balance is taken by Campbell, in "The Personae of Scientific Discourse," which is one of the few references to personae in science.


40 Normal science discourse, although it has not been emphasized in this essay, is equally susceptible to rhetorical analysis. To cite only one point, note the epideictic nature of normal science. Perelman and Olbrechts-Tyteca, in The New Rhetoric (South Bend, Ind.: University of Notre Dame Press, 1969), p. 51, could be taken as directly addressing Kuhn's conception of normal research as conservative, enshrined, status quo preservation of the values of the paradigm:
the argumentation in epidictic discourse sets out to increase the intensity of adherence to certain values, which might not be contested when considered on their own but may nevertheless not prevail against other values that might come into conflict with them. The speaker tries to establish a sense of communion centered around particular values recognized by the audience. . . . The very concept of this kind of category . . . results in its being practiced by those who, in a society, defend the traditional and accepted values, those which are the object of education, not the new and revolutionary values which stir up controversy and polemics.
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