

# A Classical Rhetoric of Modern Science

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## I

Philosophers of rhetoric since antiquity have held for the most part that rhetorical arguments arise from three sources. These three sources are the speaker, the audience, and the speech itself.

Philosophers of science in recent times have successfully developed rhetorics of science from the first two sources of arguments. They have constructed rhetorical conceptions of the scientist and of the scientific audience.<sup>1</sup> Yet these philosophers appear to have neglected to develop a rhetoric of science from the third source of arguments.<sup>2</sup> Their neglect seems to be unfortunate, for arguments derived from the speech itself are those essential to rhetoric.

In this paper I do not, however, intend to elaborate a rhetoric of science based on the third source of arguments. I shall not do so because a modern philosopher of science has already done so. He has developed an extensive rhetoric of modern science based on a classical conception of rhetorical proof. I refer to John Stuart Mill. My endeavors I shall therefore confine to proving merely that Mill's logic of science is in fact a rhetoric of science. We shall see that Mill's conception of induction is essentially the same as Aristotle's conception of example.<sup>3</sup>

## II

As we begin to compare their conceptions, we are able to see at once that Mill's conception of induction and Aristotle's conception of example are conceptions of processes of thought the same in kind. Mill is well known for his assertion that all inference is from particulars to particulars. Though not known so well for it, Aristotle asserts that all argument by example is from particulars to particulars.

That all inference is from particulars to particulars, Mill establishes in his *Logic* by defending his interpretation of deduction. He seems to establish this proposition with this defense because

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he writes in a polemic spirit. But whatever his reason may be, his defense does give us an initial idea of how we infer from particulars to particulars.

Mill discovers that his predecessors believed that the syllogism is a *petitio principii*. They argued that the general proposition which is the major premise assumes the particular proposition which is the conclusion (*Logic* II. iii. 2. 184–85).<sup>4</sup> But Mill himself believes that the syllogism does not beg the question. He argues that the general proposition which is the major premise is not the source of the conclusion:

From this difficulty there appears to be but one issue. The proposition that the Duke of Wellington is mortal, is evidently an inference; it is got at as a conclusion from something else; but do we, in reality, conclude it from the proposition, All men are mortal? I answer, no (*Logic* II. iii. 3. 186).

This general proposition itself rests on prior evidence, he continues, and this evidence we derive from observation:

Assuming that the proposition, The Duke of Wellington is mortal, is immediately an inference from the proposition, All men are mortal; whence do we derive our knowledge of that general truth? Of course from observation (*Logic* II. iii. 3. 186).

But individual cases are all that we may observe:

Now, all which man can observe are individual cases. From these all general truths must be drawn, and into these they may be again resolved; for a general truth is but an aggregate of particular truths; a comprehensive expression, by which an indefinite number of individual facts are affirmed or denied at once (*Logic* II. iii. 3. 186).

Mill concludes then that the general proposition which is the major premise is an inference from the particular cases observed:

But a general proposition is not merely a compendious form for recording and preserving in the memory a number of particular facts, all of which have been observed. Generalization is not a process of mere naming, it is also a process of inference. From instances which we have observed, we feel warranted in concluding, that what we found true in those instances, holds in all similar ones, past, present, and future, however numerous they may be (*Logic* II. iii. 3. 186–87).

And he implies that the syllogism merely deciphers the inference expressed in the major premise. When we infer, we may pass through a general proposition which serves as the major premise in a syllogism. But if we do so, we have already finished our inference when we formulate the general proposition:

When, therefore, we conclude from the death of John and Thomas, and every other person we ever heard of in whose case the experiment had been fairly tried, that the Duke of Wellington is mortal like the rest; we may, indeed, pass through the generalization, All men are mortal, as an intermediate stage; but it is not in the latter half of the process, the descent from all men to the Duke of Wellington, that the *inference* resides. The inference is finished when we have asserted that all men are mortal. What remains to be performed afterwards is merely deciphering our own notes (*Logic* II. iii. 3. 187).

Mill explicitly states later not only that the syllogism is not an analysis of an inference, but more importantly for us that an inference is from particulars to particulars:

In the above observations it has, I think, been shown, that, though there is always a process of reasoning or inference where a syllogism is used, the syllogism is not a correct analysis of that process of reasoning or inference; which is, on the contrary, (when not a mere inference from testimony) an inference from particulars to particulars; authorized by a previous inference from particulars to generals, and substantially the same with it; of the nature, therefore, of Induction (*Logic* II. iii. 5. 196).

Here he also adds what he has quietly assumed, that because it is from particulars to particulars, inference itself is induction.

We thus see that Mill establishes the proposition that all inference is from particulars to particulars by defending his interpretation of the syllogism. The syllogism is merely a device for applying a generalization made about some observed particulars to other particulars not yet observed.

Now Aristotle asserts a very similar proposition. He does not assert that all inference is from particulars to particulars, but he does state that all arguments by example are from particulars to particulars:

An example is apparently an argument neither from part to whole nor from whole to part but from part to part . . . (*Prior Analytics* II. xxiv. 69a13-15).<sup>5</sup>

Aristotle does not amplify this proposition in his *Logic* as does Mill. But he does amplify it somewhat in his *Rhetoric*. There he makes a similar statement:

Example proves a relation neither of part to whole nor of whole to part nor of whole to whole but of part to part—of similar to similar (*Rhetoric* I. ii. 1357b26–29).

And appropriately enough, he uses an example to illustrate his point:

For example, one might prove that because he asks for a bodyguard, Dionysius wishes to establish a tyranny. For earlier Peisistratus asked for a bodyguard, when he was scheming, and when he received one, he became a tyrant. And so did Theagenes of Megara (*Rhet.* I. ii. 1357b30–33).

Aristotle thus argues that observed particulars are evidence for a conclusion about another particular. No general proposition is used, though the particulars do fall under a general proposition:

All these examples fall under the same universal proposition, that he who wishes a bodyguard aims at a tyranny (*Rhet.* I. ii. 1357b35–36).

And we may interpolate a general proposition like this one in an argument by example, as we shall see.

We thus see that Mill argues that all inference is from particulars to particulars. And that Aristotle argues that all examples are from particulars to particulars.

### III

Induction as conceived by Mill and example as conceived by Aristotle are also processes of thought divisible by the same mid-point into the same two parts. Mill uses the general proposition to distinguish two processes within an inference, and the one process is an inductive process, the other a deductive process. But Aristotle also uses the general proposition to distinguish two processes in an example, and the one process is again inductive, the other deductive.

Mill distinguishes the two processes involved in an inference when he diagnoses the erroneous interpretation of the syllogism

inherited from his predecessors. He distinguishes the one process as an actual inference and the other as an act of registering. He states that the syllogism might appear to beg the question, if we confuse the inference with its registration:

The error committed is, I conceive, that of overlooking the distinction between two parts of the process of philosophizing, the inferring part, and the registering part; and ascribing to the latter the functions of the former (*Logic II. iii. 3. 186*).

Mill argues that the process of inference is the process by which we produce a general proposition, as we saw. He also argues that the process of registration is the process by which we note down a general proposition and interpret it. For a general proposition is both a record of an inference made and an instruction for making more. That is why we use the syllogism to draw a conclusion not from a general proposition but according to a general proposition:

All inference is from particulars to particulars: General propositions are merely registers of such inferences already made, and short formulae for making more: The major premise of a syllogism, consequently, is a formula of this description: and the conclusion is not an inference drawn *from* the formula, but an inference drawn *according to* the formula: the real logical antecedent, or premise, being the particular facts from which the general proposition was collected by induction (*Logic II. iii. 4. 193*).

Though not an analysis of an inference, the syllogism is an analysis of the interpretation of this general record:

According to the indications of this record we draw our conclusion: which is, to all intents and purposes, a conclusion from the forgotten facts. For this it is essential that we should read the record correctly: and the rules of the syllogism are a set of precautions to ensure our doing so. (*Logic II. iii. 4. 193*).

But with a reminder that all inference is induction, Mill nevertheless chooses to follow common usage to distinguish induction from deduction in the usual way. He calls the process of establishing a general proposition induction, and the process of interpreting a general proposition he calls deduction:

Although, therefore, all processes of thought in which the ultimate premises are particulars, whether we conclude from particulars to

a general formula, or from particulars to other particulars according to that formula, are equally Induction, we shall yet, conformably to usage, consider the name Induction as more peculiarly belonging to the process of establishing the general proposition, and the remaining operation, which is substantially that of interpreting the general proposition, we shall call by its usual name, Deduction (*Logic II. iii. 7. 203*).

He accepts the common distinction because of its safeguards:

And we shall consider every process by which anything is inferred respecting an unobserved case, as consisting of an Induction followed by a Deduction; because, although the process needs not necessarily be carried on in this form, it is always susceptible of the form, and must be thrown into it when assurance of scientific accuracy is needed and desired (*Logic II. iii. 7. 203*).

We see then that an inference involves two processes. We may describe one process as the inference itself, the other as the registration of the inference. The inference results in a general proposition, the registration in the application of a general proposition.

Now Aristotle argues that an example involves the same two processes. He makes his point by analyzing an example not into propositions but into terms. Instead of showing that it proves the major proposition, he argues that an example shows that the major term is predicated of the middle:

An example is when the major term is shown to belong to the middle term by means of a term similar to the third term (*Pr. Ana. II. xxiv. 68b38-39*).

What role the term similar to the minor term and the minor term itself play in an example we shall soon see.

When he distinguishes example from induction, Aristotle points out that an example also applies the general proposition established to a new particular:

Example differs from induction. Induction shows the major term to belong to the middle by means of all particulars, and it does not apply the conclusion to the minor term. Example applies the conclusion to the minor term, and it does not show the major to belong to the middle term by means of all particulars (*Pr. Ana. II. xxiv. 69a16-19*).

That example does not use all particulars is incidentally another similarity with induction as Mill conceives it (*Logic* III. iii. 3. 313-14).

#### IV

The most striking characteristic common to Mill's conception of induction and Aristotle's conception of example is that their conceptions of induction and example give these thought processes the same beginning and the same ending. Induction according to Mill begins and ends with knowledge the same as that with which example begins and ends according to Aristotle.

To show with what knowledge induction begins and ends, Mill completes his defense of deduction by analyzing the syllogism into its two premises and its conclusion. The major premise of a syllogism asserts, of course, that the major term is predicated of the middle term. But the major premise rests on our observation of particulars. This premise therefore really asserts that the major term belongs to the observed particulars:

In the argument, then, which proves that Socrates is mortal, one indispensable part of the premises will be as follows: "My father, and my father's father, A, B, C, and an indefinite number of other persons, were Mortal;" which is only an expression in different words of the observed fact that they have died. This is the major premise divested of the *petitio principii*, and cut down to as much as is really known by direct evidence (*Logic* II. iii. 6. 201).

The minor premise asserts that we know that the middle term is predicated of the minor term. Referring to the major premise, Mill argues that the minor premise links it with the conclusion:

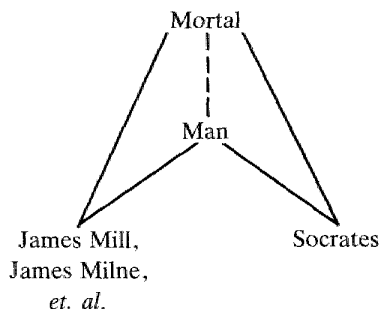
In order to connect this proposition with the conclusion Socrates is mortal, the additional link necessary is such a proposition as the following: "Socrates resembles my father, and my father's father, and the other individuals specified." By saying so we likewise assert in what respect he resembles them, namely, in the attributes connotated by the word man (*Logic* II. iii. 7. 201-2).

And by means of a syllogism, we conclude that the major term belongs to the minor. In Mill's example, that Socrates is mortal:

And we conclude that he further resembles them in the attribute mortality (*Logic* II. iii. 7. 202).

Mill has, however, left out one item of knowledge necessary for linking the major premise and the minor. At least he has not made it explicit. We must know that the middle term belongs to the observed particulars as well as to the particular in question. Otherwise we would not know how the observed particulars resemble the new particular. And, of course, we may also know through generalization that the major term is predicated of the middle. If we do, we have a more complete link between the major and minor premises.

This diagram may perhaps be helpful:



The solid lines represent what we are aware of before we draw an inference, the dotted lines what we are aware of after drawing an inference. The dotted line connecting "Mortal" with "Man" represents the proposition resulting from generalization; the dotted line connecting "Mortal" with "Socrates" the proposition concluding the inference.

We see, then, that before making an inference, we know that the major and middle terms belong to terms similar to the minor term, and that the middle term belongs to the minor term. And we see that after making an inference, we also know that the major belongs to the middle term and to the minor.

Now, Aristotle argues that an argument by example relies on our observation of particulars, as we have seen. But he also argues that what we know about these particulars is precisely what Mill argues we know about them, and that what we conclude about them is also what Mill argues we conclude.

Aristotle asserts that to have an example we must believe that the major term is predicated of a term similar to the minor term, and that the middle term is predicated of the minor term:



The middle term must be recognized to belong to the third term and the first term recognized to belong to the term similar to the third term (*Pr. Ana.* II. xxiv. 68b39–40).

But he seems to assume what he later makes explicit, that we must also believe that the middle term belongs to the term similar to the minor as well as to the minor:

. . . both particulars are subordinate to the same term and one particular is recognized (*Pr. Ana.* II. xxiv. 69a15–16).

The particular recognized would be the term recognized to fall under the major—the term similar to the minor term. And we have already seen that an example proves both that the major term belongs to the middle term and that the major term belongs to the minor. These facts we saw when we analyzed an example into its two parts.

Aristotle proves these assertions again, not inappropriately, with an example. In his example he supposes that we wish to prove that for the Athenians to fight against the Thebans would be an evil. Breaking the argument down into its two parts, he assumes that we must do this by showing that to fight against neighbors is an evil:

If we should wish to show that to fight against the Thebans is evil, one must grasp that to fight against neighbors is evil (*Pr. Ana.* II. xxiv. 69a2–4).

He argues that we prove that to fight against neighbors is an evil from particulars similar to that under consideration:

Persuasion of this, one obtains from similar particulars. For example, that for the Thebans to fight against the Phocians was an evil (*Pr. Ana.* II. xxiv. 69a4–5).

What we obviously believe about these similar particulars is that the major term belongs to them. In the application of the major premise, we must also be aware that the middle term belongs to the minor. That war with neighbors includes an Athenian war against the Thebans:

Since to fight against neighbors is evil, and to fight against Thebans is to fight against neighbors, obviously to fight against the Thebans is evil (*Pr. Ana.* II. xxiv. 69a5–7).

Here the conclusion of the argument is also obvious. The major applies to the minor.

The same diagram used to represent Mill's analysis of induction may also serve to illustrate Aristotle's analysis of example:



The solid lines again represent what we know before using an example, the dotted lines what we know after using it.

Aristotle makes his point most clearly by arguing schematically. He assigns letters of the alphabet to the terms of the argument in his example:

For example, let A be evil, B be to take up war against neighbors, C Athenians against Thebans, and D Thebans against Phocians (*Pr. Ana.* II. xxiv. 68b4–69a2).

He clearly states that we believe that the major term belongs to the term similar to the minor:

That A belongs to D is apparent, for the war against the Phocians did not turn out well for the Thebans (*Pr. Ana.* II. xxiv. 69a9–10).

And that the middle belongs to the term similar to the minor and to the minor:

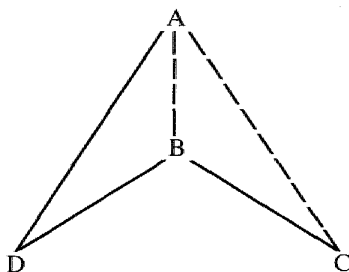
That B belongs to C and to D is apparent, for both are cases of taking up war against neighbors (*Pr. Ana.* II. xxiv. 69a7–9).

And we generalize that the major belongs to the middle:

And that A belongs to B, is shown by means of D (*Pr. Ana.* II. xxiv. 69a10–11).

We consequently conclude that the major belongs to the minor.

Our diagram may serve one final time:



We see then that before arguing by example, we are aware that the major and middle terms belong to terms similar to the minor term, and that the middle term belongs to the minor term. After arguing by example, we are aware that the major term belongs to the middle and to the minor.

One may not object that Aristotle differs from Mill in that Mill rests his evidence for the major premise on more than one particular similar to the instance in question. For Aristotle explicitly states that to prove the major, we may use more than one instance:

Persuasion concerning the relation of the middle term to the major by means of several terms similar to the third would come about in the same way (*Pr. Ana.* II. xxiv. 69a11-13).

We thus see that Mill argues that induction begins and ends with the same knowledge with which Aristotle argues that example begins and ends. What Mill argues we must know before making an induction Aristotle argues we must believe before making an example. And what Mill argues we conclude from induction Aristotle argues we conclude from example.

## V

In future inquiry we might wish to ask ourselves what our discovery about Mill's logic bodes for the philosophy of science, or rather the rhetoric of science. For Mill successfully develops a rhetoric of science from the third source of rhetorical arguments. He constructs a rhetoric of science based on a classical conception of argument by example.

But we might also ask what our discovery bodes for the history of British empiricism. Mill himself seems not to have been aware of the similarity of his logic to rhetoric. We have no evidence at all for doubting him when he states in his *Autobiography* that he discovered his conception of induction while reading Stewart's *Elements*.<sup>6</sup>

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### Notes

1. Johnstone, for example, explores in depth the philosophical problems encountered in developing a rhetoric of science based on a conception of the scientist, though he does not develop a complete rhetoric. See Henry W. Johnstone, Jr., *The Problem of the Self* (University Park: The Pennsylvania State University Press, 1970).

Perelman and Olbrechts-Tyteca develop an elaborate rhetoric or argumentation based on a conception of audience, which includes a rhetoric of science resting on a conception of the scientific audience. See Ch. Perelman and L. Olbrechts-Tyteca, *The New Rhetoric*, trans. John Wilkinson and Purcell Weaver (Notre Dame: University of Notre Dame Press, 1971).

2. Kuhn would appear to be an obvious exception to this statement, for he elaborates a theory of science based on a conception of the paradigm. But he rests his theory of the paradigm ultimately on the sociology and the psychology of the scientist. See Thomas Kuhn, *The Structure of Scientific Revolutions*, 2d ed., *International Encyclopedia of Unified Science* (Chicago: University of Chicago Press, 1970), vol. 2., no. 2.

3. Donaldson appears to recognize that Mill's conception of deduction is a conception of enthymene. He does not, however, accept Mill's logic as a rhetoric but rejects his logic as a logic. See James Donaldson, "Essential Predication and the Syllogism: J. S. Mill and Aristotle," *Laval Theologique et Philosophique* 31 (1975), 193-205.

4. John Stuart Mill, *A System of Logic*, ed. J. M. Robson and R. F. McRae, *Collected Works of John Stuart Mill*, ed. J. M. Robson (Toronto: University of Toronto Press, 1973-74), vols. 7 and 8.

5. The translations of passages from Aristotle are my revisions of the Oxford translation.

6. Quoted by John M. Robson in "Textual Introduction," *Logic, Collected Works*, vol. 7, lvi-lvii.

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