Since the 1970s, instructors in writing-across-the-curriculum programs have used James Britton's work to provide a theoretical basis for writing to learn. But its basis in personal knowledge-making has been inadequate for a theory of how writing in subject areas actually helps students learn the lines of thought—the canons of reasoning—which are part both of understanding a discipline and of being able to "think" in it. Two concepts from classical rhetoric—aitia (the foundation of scientific thinking) and kairos (the foundation of rhetoric)—may provide a starting point for a theory that relates social and scientific thought to discourse. In this essay, I will consider aitia (cause) for its importance in reasoning and its place as the battleground between science and the humanities, and kairos (or timing, due proportion, and fitness) as the appropriate use of thought and knowledge in specific situations. Two rhetorical proofs, the enthymeme and the example, will provide a bridge between, on the one hand, the kinds of thoughts, and, on the other hand, the timing and fitness of thoughts to a specific inquiry or discourse grounded in a community.

Scientific Thought and the Concept of Aitia

In Posterior Analytics and Physics, Aristotle positioned aitia as the cornerstone of scientific discourse, for only through a knowledge of causes could scientific knowledge—the knowledge of what makes things as they are—be obtained. Aristotle identified four kinds of causes: material, formal, efficient, and final. The idea that the material of which a thing is made is a cause (or that its forms, functions, and ends are causes) may seem antithetical to our modern idea of cause. But the Ancients understood aitia as an explanatory factor; today we tend to regard as causal only efficient causes—instruments and agencies, especially antecedent agencies. Yet, the ancient view of scientific cause is still present in scientific investigation: science attempts to describe what things are made of (material cause) and what forms things have (formal cause); sometimes science uses efficient cause, in the case of catalysts, for example. In the humanities, we tend to inquire more fully about efficient causes, and we often probe final causes. This way of thinking about causality is also close
to the thinking processes we all use in ordinary circumstances. For example, we can view decision-making in composing from the four-ply structure of cause: matter (ideas and thoughts) are part of the definition of a text; efficient causes (word processor, pen, or stylus) are efficient causes contributing to the explanation of what a text is and why it is what it is. The writer's knowledge of forms of texts helps him or her select appropriate sentences, words, and discourse forms, which "cause" what the text is. These decisions are influenced by the writer's idea of final cause, the ultimate purpose of the text.

The four-ply structure of cause thus yields definition, just as it yields our definition of decision-making in the composing process. Though the parts of a definition may today proceed from empirical and analytic methods, the procedure of defining something is complex and provides a view of interlocking structures. Definition remains the starting point for inquiry and writing, indicating the direction in which inquiry, argument, or exposition may proceed, and serving as a sort of pivot, since the thesis statement in the processes of thinking and writing includes a categorical proposition (a statement of definition) in either its surface or deep structure.

The causal basis of thought (linking idea to idea in chains of causal relationships) allowed scientists to investigate a subject systematically instead of haphazardly and uncertainly. This structure of thought has not changed since ancient times; what has changed, rather, is the location of the grounds for investigation. Descartes's promotion of the cogito over the doctrine of being as the foundation of scientific thought changed the basis of a priori principles from which deductive reasoning begins; and Hume's rejection of cause based on association, which elevated empirical and analytical methods over deduction, altered the preferred method of acquiring evidence for the support of hypotheses (Grassi 68-71). Nevertheless, the basic structure of thought remains today as it was in the classical age.

The territory of science today is definition (which in a broad sense includes description) of the natural world, the spatial-temporal domain of what is measurable, what can be proven or disproven on the basis of measurement. In terms of classical aiitia, scientists since the seventeenth century have limited their domain to material and formal cause—though scientific statements more frequently assert definition and description than causality as we think of it today. Scientists in the classical age, and continuing to the seventeenth century, also took as their area of investigation that which could be known for certain, but the causal basis of facts was central to their investigations, since their method of demonstration was basically a posteriori, arguing from effects in a given experience to what they perceived to be true causes (verae causae). Because the methods for discovering and demonstrating truth have changed, scientific investigations today often fall within the realm established in ancient times for rhetoric: common assumptions of the group (in this case, adherence to the
proper procedures of hypothesizing and measuring) form part of the
syllogistic pattern of proof. While investigation may still take the prob-
lem-and-demonstration form that Aristotle identified as the pattern for
arriving at scientific truth, the writing of scientific research must include
persuasive tactics that place it in a certain theoretical, procedural school.
Thus, the writing of scientific research often has the structure Aristotle
identified for rhetoric (that is, statement and argument), at least as an outer
frame for the problem and demonstration.3

Scientific thought and discourse share with rhetoric enthymematic
and paradigmatic structures and processes. For Aristotle, these two forms
provided the structures for the proofs of rhetorical discourse and repre-
sented the thought processes of deduction and induction.

The Enthymeme and Causal Reasoning
The enthymeme, which was for Aristotle the "substance and body of
persuasion," is the substance and body of reasoning whenever theory
stands as the major premise to which facts (in the minor premise) are
related for interpretations, conclusions, or new knowledge (Rhetoric 1.1).
This relationship forms the structure of inquiry for all disciplines. Theory
guiding method and dictating definitions, relevant evidence, and proper
procedure results in conclusions, which are often new knowledge of the
provisional, contingent kind, because theories are (like enthymemes)
rooted in the common assumptions of a group and are true within the
limits of a group's definition of terms.

Theory provides the general truth or assumption as the major premise;
the fact provides the minor premise and is matched to the theory by a
common element (the middle term); the concluding premise is the solution
or new knowledge. Only in mathematical proofs may the problem of
contingencies enforced by language be avoided. For Aristotle, the power
of the enthymeme in persuasion resided in its ability to incorporate the
opinions of a group in the reasoned argument without expressing them
directly. Scientific writing today uses the enthymeme to indicate the place
of the discourse in the scientific community and to argue, however subtly,
for acceptance of its premises.4

The enthymeme has an underlying causal relationship: the theory
explains (that is, it "causes" in the Aristotelian system) the method and
selection of facts which together explain (that is, they "cause") the conclu-
sion. In a similar manner, underlying values and beliefs may originally
cause the theory. Theories are, thus, exemplary causes, a type of "end" or
"final" cause providing explanatory connections among the data to be
proven or disproven. In causal reasoning, one selects the definitions
useful in a specific case and postulates reasons why propositions follow
from one other. Within the discourse situation, the structures of the
enthymemes and examples are the surface features of the explicit and
underlying causal relationships.5

Causal reasoning operates in the two natural forms of reasoning:
induction and deduction. Aristotle asserted that the example and the enthymeme were the discourse forms of these two reasoning structures. Enthymemes are causal reasoning forms in that they are syllogisms. In deductive reasoning, the search for the middle term is the process of discovering a causal link that will bind the other two terms. The concluding premise is a statement discovered in the causal relationship. Aristotle's discussion of forming enthymemes from maxims makes this point clear: working from the maxim, the rhetor discovers or suggests the cause or reason behind it to form an enthymeme (Rhetoric 2.21). Similarly, Aristotle's discussion of the topoi considers the discovery of facts and opinions to be used as causal links in the chain of enthymemes.

The Example and Causal Reasoning
It may not be as obvious how the example, or paradigm, involves causal reasoning. Philosopher William Wallace explains that for Aristotle the example had an inductive character just as the enthymeme had a deductive one (Causality 1:11-18). As with the classical concept of cause, the classical understanding of induction differed from that which modern science adopted from the Humean tradition. Today, we regard true generalizations from inductive procedures as impossible unless every case can be tested. Aristotle, however, thought that true generalizations were possible because the human mind could see the general within the particular. The process of reasoning is from effect to cause—seeing the general causes latent in specific effects. Though science rejects certainty of cause, it nevertheless uses induction, working within a certain probability level. Students schooled in memorizing facts often do not realize that much scientific knowledge is regarded as probable. Nor do they realize that the inductive reasoning they do every day (constructing generalizations from their specific experiences) forms a basis for the generalizations they use in their deductive reasoning. This connection was obvious to Aristotle; it formed the ground of the common reasoning processes and common opinions that were the subjects of rhetorical speeches and that comprised these generalizations. Modern distrust of subjectivity has left students without a knowledge of the complexity of cause and without a knowledge of how to ground their own opinions and how to test them against other opinions. Consequently, students often do not have the resources to support their positions effectively and persuasively.

As with enthymemes, context (whether a rhetorical situation or a scientific problem) determines the tactics for selecting an appropriate example. The example, that is, must be representative and useful. As a heuristic, the example highlights similarities in two otherwise dissimilar objects. But in persuasive argument, the example suggests that because of the similarity, what is true in the one case may be true in the other. The kind of reasoning involved in noticing similarities is analogical, but in topical invention (and often in scientific discovery and technological invention) analogy is causal reasoning that suggests answers to a problem.
As James C. Raymond notes, for Aristotle the example was *paradigma*, a paradigm or pattern. As a proof, it convinced by comparing an unfamiliar pattern with a familiar one, and it included ethical, pathetical, and logical components. The rhetor selected an example according to its appropriateness to the purpose of the speaker with respect to the shared knowledge and values of the community of listeners (Aristotle, *Rhetoric* 2.20).

Modern composition textbooks treat the example in a narrow sense—that is, as a representative instance—and thus seriously distort Aristotle's conception of its nature, value, and use. Such textbooks discuss the example of a kind of support or demonstration but neglect its power in thinking and persuasion despite its recognized importance in general intelligence and creative thought. For example, analogical thinking is used to measure intelligence on IQ tests; and the Miller Analogy Test, used widely for graduate placement, requires analogical thinking in all of its 100 questions. Douglas Hofstadter asserts that the basic operation of the mind is analogical pattern-matching, a view undoubtedly arising from work with artificial intelligence. Certainly, analogy plays a crucial role in creative scientific thought. Descartes's coordinate geometry, Einstein's theory of relativity, and Watson and Crick's double helix are a few well-known scientific advances that were made through analogical thought. Edison's journals, recently made public, reveal that he worked by analogy, patterning his moving-film machine after the phonograph and the light bulb after the telegraph.

The suggestive power of analogy is what makes it useful in inquiry and persuasion. Scientists may use analogies in creative thought, looking for patterns of identity or similarity and seeking causes for a pattern's existence. Scientific thinking is also synthetic. Rarely today, since the decline of logical positivism, does science seek pure description; rather, it seeks explanatory relations among phenomena. However, the causal links of the analogies themselves do not become part of scientific proofs. Understanding that the scientist's aim is to define and describe—to answer "why" in terms of "what" and "how" by using methods proper to the discipline—is essential for students if they are to understand the difference in purpose and method between science and the humanities. Such awareness helps students place science within its proper limits: science may examine material and formal cause where measurement is possible; the humanities may examine efficient and final causes, and, by examining material and formal causes, may provide contingent results because of difficulties with accurate measurement and interpretation of results.

As understood in Aristotelian rhetoric, causal reasoning is a basic thinking process involved in induction and deduction and is used in or with all other mental operations in what we now call "critical thinking." Causal reasoning allows us to draw meaningful relationships. In a complex sequence of operations, such as is required for prediction and evaluation, causal reasoning toward definition must occur early in the
series of operations. In complex problem-solving, causal reasoning occurs at various stages of defining, describing, and analogizing; it also forms the causal links among the separate operations that allow a solution to be produced. This matrix of processes suggests that we need to pay much more attention to teaching causal reasoning. It also means that we should begin with causal reasoning and lead students progressively to an understanding of their own reasoning processes, beginning with the classical notions of cause, moving to definition, to cause-effect and effect-to-cause reasoning, and then to prediction and evaluation. Such instruction will help students understand the systematic operations they need for complex problem-solving, whether in their own disciplines, in ethical matters, or in reading and writing complex discourse. This instruction relies on students' natural thinking processes, but it makes them conscious of the processes and how to use them; thus, their thinking becomes more systematic.

Kairos: The Role of Context

Far from the typical modern view that classical rhetoric provided a rigid, static approach to discourse, it was an intricate system of ultimately inseparable parts based in the context of the community and in specific situational contexts. Grasping the system required extensive practice and substantial knowledge of human emotion and social values. The classical concept undergirding this system was kairos, which translates as "right time" and conveys the idea of timing and fitness—when to bring which abstract ideas into use in a particular situation. James L. Kinneavy, who is responsible for bringing the crucial place of kairos to our attention, demonstrates that kairos was the "cornerstone" of Plato's rhetoric: right timing was what made rhetoric an art rather than a collection of technical skills (see "Kairos" and "Translating"). As the pivot on which good rhetoric moved, kairos carried the theoretical—the intellectual, dialectical search for truth—into a specific temporal point in the practical world. For Plato, the theoretical had to be mastered in order to give birth to the practical reasoning involved in rhetoric. For freedom of inquiry to exist, knowledge of past and present was demanded, of the eternal, ideal realm as well as of the human, temporal world.

Applying theory to a specific problem in any field is a matter of right timing. Systematically learning methods of inquiry and basic thinking processes only becomes useful when the learner has grasped how and when to apply them. In Aristotle, kairos is "appropriateness," the test for use of a particular fact, argument, arrangement, or point of style. This fluid nature of "rightness in a particular case or instant" was later lost in the concept of "correctness."

Kairos involves grasping the pivotal issue on which a problem or case depends and knowing which of the learned techniques or innate thinking processes to apply to its solution. For the Ancients, kairos was an intuitive movement of mind which results in insight and is made possible by
thorough study and practice. Finding the pivotal issue in a case is still the
starting point of legal argument today, as it is in the practical affairs of
government, business, and industry. It is also the most important element
in scientific thinking, for it marks the intuitive grasp of important patterns
and syntheses that form the hypotheses to be tested. Need I mention how
important it is to students writing research papers?

Freedom of thought must operate within a structure. Insight comes
about from a knowledge of what is made possible by or within the
structure. Sometimes insight borrows knowledge (including structures)
from other domains than the immediate one; this is one reason a liberal arts
background is useful in specialized fields. Aristotle considered all knowl-
edge relevant to rhetorical art since it might become useful or necessary at
some time or another. Insight is the sudden, kairotic entrance of the
abstract realm of knowledge into a particular situation. Personal insight
in public discourse moves beyond a personal context to a situational
context of questioning and answering. It must know the conventions of
the discourse community well enough to be able to step outside of them.
Insight is an art that cannot be directly taught, but it can be promoted by
teaching the structure of thought and the context of a community's
dialogue. Plato's objection to writing in Phaedrus (69-72)—that it is discon-
ected from the family of discourse—need no longer be feared if we see
that a piece of writing, no matter what kind it is, is only one moment in the
ongoing dialectical dialogue that seeks to know truth.

Aitia and Kairos in the Classroom

While incorporating aitia and kairos into the writing curriculum cannot
assure that all students will be able to apply theory, at least they will
become aware of what the enterprise is about.

From classical rhetoric, adapted for the modern discourse of inquiry
and demonstration, we can derive a systematic framework for students to
understand thought, investigation, and writing in other disciplines. One
aim of writing-across-the-curriculum programs is to help students "fill in"
the framework with the canons of specific disciplines, to learn its questions
and answers by having them write in order to learn the canons as well as
the facts. In research on the topoi, Frank D'Angelo describes the history of
the development of thought as a drawing together of knowledge about
thought processes into increasing levels of abstraction. What Aristotle did
for the ancient world was to abstract from thousands of commonplaces—
the aids for thinking and memory in the ancient preliterate world—some
basic lines of reasoning. Aristotle's distinction between these common
topics and the topics specific to certain fields recognizes that some lines of
reasoning are not general reasoning processes but, rather, are restricted to
certain kinds of investigation and their characteristic materials and subject
matters. Aristotle's work exposed, organized, and, in some cases, estab-
lished the canons of reasoning in many fields of study. What I am advoc-
cating is that students learn what these thought processes are and that,
through writing, they learn how these processes apply in practice to the structures of inquiry, value, and belief canonized in various modern intellectual, social, and political communities. Then, I believe, we will be empowered to move writing to the center of education, where the study of discourse once stood and still belongs.?

Catholic University of America
Washington, DC

Notes

1 For a detailed history of the concept of aitia in scientific discourse, see Wallace (Causality).
2 For a fuller explanation of Aristotle’s four-ply structure of cause, see Wallace (Causality 1:13-17); for its application to teaching composition, also see Wallace (“Aitia”).
3 I do not mean that scientific method takes the form of statement and argument, but that writing reports of scientific research has more in common with Aristotle’s definition of rhetorical form than with his definition of scientific demonstration, which at that time was accomplished through syllogism. In the Rhetoric (3.13), Aristotle spoke against the set arrangement of parts, claiming that the parts of rhetorical discourse were composed of two parts (statement and argument) corresponding to the processes of problem and demonstration in dialectic.
4 In the Rhetoric, Aristotle pointed out that in persuasive discourse the example takes the place of induction and the enthymeme that of the syllogism. This does not mean that he dispensed entirely with the enthymeme in his own scientific usage. Wallace notes that one can read most of Aristotle’s works now classified as contributions to science without finding a single argument cast in syllogistic form. Usually, one premise is suppressed in his exposition, even though the reason or cause is given. According to the canons of logical reasoning, this makes such arguments enthymematic rather than syllogistic. Nonetheless, because of the special use of enthymemes in rhetorical discourse, I use the terms enthymeme and enthymematic in the rhetorical sense and not in the sense of an abbreviated syllogistic argument.
5 If Heidegger is right, and all knowledge is a matter of interpretation, then the facts themselves are also the results of enthymematic formulations. This is where modern composition theories such as that proposed by Ann Berthoff extend Aristotle’s discourse on practical reasoning in the Rhetoric to all reasoning. Our preconceptions about the world cause us to differentiate and understand the world in certain ways, thus producing our knowledge.
6 For a discussion of insight in legal reasoning, see Brand and White (131). The process of legal reasoning is an artful dance between analogical and deductive thinking; kairos describes well what must happen in the constant movement back and forth between the two processes.
7 I wish to thank Jean Dietz Moss and Lynn Z. Bloom for reading and generously commenting on drafts of this essay.

Works Cited

The Canons of Reasoning


---

ATAC Elections

Elections for officers of the Association of Teachers of Advanced Composition will be held at the ATAC special interest session of the Conference on College Composition and Communication in March 1988. Please send nominations and self-nominations to Evelyn Ashton-Jones; Division of Humanities; University of Tampa; Tampa, FL 33606. All nominees must be present at the special interest session.