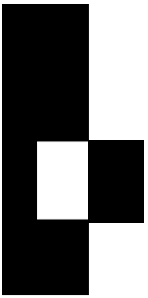

The Two Rhetorics: Design and Interpretation in Engineering and Humanistic Discourse

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Abstract

Humanistic and engineering discourses both have antecedents in classical rhetoric, but reflect two distinct traditions, one focused on production, the other focused on consumption and interpretation. Engineering discourse is primarily a rhetoric of deliberation, concerning itself with the design and production of artifacts. Humanistic discourse, on the other hand, is largely a rhetoric of reception, interpretation, and evaluation, employing argumentative topics and structures commonly associated with classical legal and ceremonial rhetoric. Representative undergraduate writing assignments from the humanities and engineering are used to illustrate these differences. An analysis of these assignments also demonstrates the potential for each rhetorical tradition to enhance and complete the discourse of the other. WAC initiatives provide a context for reuniting these two traditions into a unified rhetoric of production and consumption, of deliberation, interpretation, and judgment.

Writing and speaking are integral and defining professional activities in both engineering and the humanities. These two communities, however, differ fundamentally in how each defines itself in relation to the production and consumption of artifacts. This difference is reflected in how each defines the types of knowledge with which it is concerned and its role in their construction. These different functions privilege different kinds of discourse and largely determine specific conventions governing discussion and argument, that is, their respective *rhetorics.* In some cases these differences can make one of these rhetorics appear invisible, unimportant, or both. Winsor (1996) reports in a longitudinal study of five

novice engineers that these students viewed engineering writing as completely different from the types of writing required of them in English classes. They viewed engineering writing as inherently boring and necessarily unpersuasive. In essence, because they perceived writing in English classes to be the norm, they regarded the writing they did as engineers not to be "real" writing at all. Moreover, they did not perceive engineering writing to be a central activity of "being an engineer."

These perceptions are, however, clearly false. The differences in the two rhetorics affect how engineering writing is viewed by humanists. Twenty years ago, Carolyn Miller (1979) challenged the common perception expressed in English Departments that technical writing is a sterile vocational activity devoid of any substantial educational content. Yet these perceptions persist in the still frequent debates in English departments on the worth of teaching technical writing and its appropriateness as a subject of English studies. Furthermore, practicing engineers consistently report the frequency, central importance, and inherent value of various forms of professional communication. In a recent survey of alumni/ae at MIT, 85% of the respondents ranked "the ability to write clearly and effectively" as one of the four most essential professional skills (Perelman, 1999). Other alumni/ae surveys (Miller, Larsen, & Gatiens, 1996) and field studies, such as Paradis, Dobrin, & Miller (1985), have confirmed these reports

These inabilities to recognize the complex and rich discourse conventions inherent in each culture produce stereotypes that discourage mutually productive dialogues. Some humanists (and some novice engineers) believe engineering discourse to be the product of "eminently practical" Gradgrinds, constituted solely of facts and devoid of imagination and creativity. Some engineers, on the other hand, perceive humanistic discourse to be a form of endless babble that never answers the questions it poses. In reality, each culture's discourse has much to offer the other. By examining each culture's rhetorical conventions in terms of its basic assumptions and objectives, we can identify rhetorical elements in each discipline that may enrich and complement the other's discourse and pedagogy.

Most comparisons of humanistic and technical writing, for example Miller (1979) and Allen (1990), have grouped scientific and technical writing together as a single entity. There is a crucial distinction, however, between the practice of science and the practice of engineering that distinguishes most engineering discourse. Engineering is not pure science. Engineers do not produce abstract knowledge; they produce artifacts. This concern with concrete production, as Walter Vincenti (1990) has argued is what differentiates the objectives of engineering from the less rigidly specified goals of science. The design process drives and

informs engineering practice and engineering knowledge. Moreover, because the production of artifacts is as essential a human activity as is abstract thought, engineering is not a derivative application of science, but a richly autonomous and creative discipline. *Homo faber* defines humanity as much as *homo sapiens.* It is this central concern of engineering with the *production* of artifacts intended for *consumption* that frames its discourse and differentiates it most from the common forms of humanistic rhetoric.

While engineering discourse is grounded in the production of artifacts, humanistic discourse is largely based on their consumption, particularly the consumption of textual objects. In an analysis of the structure of American literary studies in the 1980's (particularly English departments), Robert Scholes argued that the field was organized around three binary oppositions: consumption vs. production, literature vs. non-literature, and real vs. not real. English departments, he claimed, principally value the consumption of real literature, that is, *the interpretation of literary texts,* while placing less value on the production of pseudo-literature, that is, creative writing classes (in which the texts produced are meant to be read only by the class), and even less value on the production of pseudo-non-literature, that is, composition. While the conceptualization of the categories of literature vs. non-literature and real vs. pseudo have clearly changed during the past two decades, the *consumption* of texts remains the defining activity of the humanities.

The conventions of both humanistic and engineering discourse have antecedents in classical rhetoric, but they reflect two distinct traditions, one focused on production, the other focused on consumption and interpretation. Classical theory focuses on three general types of discourse: deliberative, legal, and epideictic. Deliberative rhetoric is concerned with decisions about policy and future action, that is, with design. Legal rhetoric is concerned primarily with issues of past fact, definition, and value, that is, *interpretation and judgment,* while epideictic rhetoric (the ancestor of both the after-dinner speech and the *roast*) is concerned with the celebration or denigration, that is, a current *evaluation* of a person or thing. Engineering discourse, then, is informed by a rhetoric of design, that is, a rhetoric of deliberation, while most humanistic discourses echo back to rhetorics of interpretation, judgment, and evaluation.

Deliberative Oratory as a Rhetoric of Design

A classical deliberative speech described a proposed course of action and argued for it. Aristotle limits deliberative oratory to matters subject to human design, "to those matters that may or may not take place" and specifically excludes issues concerning scientific knowledge (I,4). Because Aristotle's model for deliberative oratory derived from the popu-

lar assemblies of the Greek *polii*, he and his successors focused much of their discussion on categories or topics of thought *(topoi)* related to the specific areas of political policy with which these institutions are concerned: finance, war and peace, defense, foreign trade, and legislation. While the focus of classical deliberative rhetoric, then, is, for the most part, on political discourse related to these specific issues, it nevertheless provides an applicable and extensible framework for deliberation in a wide variety of contexts far removed from the relatively narrow concerns of Greek and Roman assemblies.

First, Aristotle posits that the goal (*telos)* of all deliberations is to advance a community's happiness and welfare. Moreover, classical rhetoric, from Aristotle onwards, includes expediency as a principal consideration in any deliberation. Expediency is defined by the *Rhetorica ad Alexandrum*, a rhetorical manual contemporary to Aristotle's *Rhetoric*, as "the preservation of existing good things, or the acquisition of goods that we do not possess, or the rejection of existing evils, or the prevention of harmful things expected to occur" (279). However, rhetorical manuals also emphasize *the honorable* as a primary consideration. Different treatises, however, vary considerably in the comparative weight they give to each of these two values. More utilitarian works, such as the Greek *Rhetorica ad Alexandrum* and, to a lesser extent, the Latin *Rhetorica ad Herennium*, consider *expediency* to be as important as *honor*. More philosophical authors, such as Aristotle, Cicero and Quintillian, however, explicitly privilege considerations of *honor* over those of *expediency*. Several other categories, most notably, *legality* and *practicality*, were included by most authors, including Aristotle, as important topics of deliberation.

Finally, beginning with Aristotle, classical Rhetoric developed an extremely useful framework for design discourse through its development of argumentative topics concerned with deciding between greater and lesser goods. As Norman (1990) and others note, a key element in any design process is deciding on trade-offs among possible benefits. There are few cases in the real world in which one design will satisfy all the criteria or design benefits, or in Aristotle's terminology, all the various *goods* associated with a decision. In most instances, a design requires sacrificing some benefits in favor of others. Indeed, it is deliberative rhetoric's attention to the issue of competing *goods* and to procedures for deciding between them, that is, the specifications and design criteria, that defines it as a rhetoric of production rather than of consumption.

The Discourse of Engineering Design

Miller and Selzer (1985) have already delineated some common topics of argument specific to engineering reports. While their analysis of

specific documents identifies several common topics of deliberative rhetoric, such as *consequence*, they failed to include the *comparison of benefits*, an omission that may have resulted from the particular characteristics of the two engineering reports used in the study. Yet making high-level trade-offs, knowing how to frame and make choices among competing objectives, is an essential element of engineering practice. In *What Engineers Know and How They Know It*, Walter Vincenti (1990) argues that assigning values to specific criteria is an essential step in any act of design. Moreover, he notes, commonly used and defined criteria, especially those concerned with public health and safety, often become institutionalized into law, and thus also become legal considerations.

The Classical Use of Deliberative "Case Studies"

The use of privileged texts, such as Homer, as deliberative "case studies" in Greek and Roman rhetorically-based education provides an illuminating contrast to the absence of a discourse of production in modern humanistic pedogogy. In the classical world, specific plot elements of Homer and the Greek tragedies were commonly employed as occasions for student exercises in deliberative rhetoric called *suasoriae*. Students were asked, for example, to produce an oration advising Agamemnon whether or not he should sacrifice his daughter Iphigenia (Kennedy, 1994). The following excerpt from Achilles' speech in Book Nine of *The Iliad* (ll. 490 ff.) provided a widely used prompt for student exercises in deliberative oratory.

> Mother tells me,
> the immortal goddess Thetis with her glistening feet,
> that two fates bear on me to the day of death.
> If I hold out here and I lay siege to Troy,
> my journey home is gone, but my glory never
> dies.
> If I voyage back to the fatherland I love,
> my pride, my glory dies . . .
> true, but the life that's left me will be long,
> the stroke of death will not come on me quickly.

Achilles is faced with a trade-off. He must choose between two competing and mutually exclusive benefits: eternal glory and honor versus a long and happy life. His choice is not abstract but strategic. He utters these words while refusing the pleas from a delegation of Greeks begging him to rejoin the Greek forces and earn eternal glory. His choice, then, is clearly deliberative, and thus related to the types of decisions inherent in modern design. Aristotle implies in *The Rhetoric* (II, 22) that this speech was

commonly used as the basis of rhetorical exercises, although he indicates that, overall, there was only one correct approach, because the *honorable* and the *just* are always greater goods than the *expedient* and the *pleasurable*.

In sum, deliberative rhetoric asks the questions, "Should we do X?, and, if so, what is the best way to do it?" It addresses these questions by posing more specific ones:

What is the present problem?

How will X solve the problem?

What are the specific goals of doing X?

What are the alternative ways of doing X?

What are the costs and benefits of each alternative?

Finally, deliberative rhetoric poses the key issue of all engineering design processes, *optimization:*

Which alternative will result in the optimal combination of benefits less costs?

Humanistic Discourse as a Rhetoric of Interpretation, Judgment and Celebration

Engineering design discourse answers the questions, "Why should we do X, and how should we do it?" Most humanistic discourse poses quite different questions, "What does X mean, and what is its value?" It is concerned with the definition, interpretation, and evaluation of past actions and existing artifacts. While Achilles' choice provided classical rhetoric with an opportunity for exercises and instruction in deliberation, Romantic and post-Romantic humanistic traditions view it as a text to be interpreted and categorized. Indeed, rather than providing a context for rational exercises in decision making, this speech from Homer along with similar scenes from Sophocles' *Antigone*, have been used, from Hegel and Nietzsche to modern critics such as David Lenson, to help frame modern definitions of tragedy as a literary genre.

This humanistic emphasis on definition, interpretation, and judgment accompanied by common frameworks for categorizing and structuring arguments echoes back to the conventions of classical legal rhetoric. Rhetorical *topoi* were common to all three genres. *Stasis* theory, that is, argumentation based on the classification and exploration of different types of points-at-issue, was primarily used in discussions of legal rhetoric. Cicero, in *De Inventione* (1976) as well as in other works, adapts the system of *stasis* developed by Hermagoras of Temos in the second century B.C.E to identify and analyze types of disagreement in any argument. This scheme defines four categories of points-at-issue in any dispute: 1) fact; 2) definition; 3) value; and 4) jurisdiction.

Scientific and humanistic discourse each implicitly formulates sets of appropriate classes of arguments, although as Fahnestock & Secor (1988) demonstrate, they differ in the specifics of categorization and emphasis. However, the original classical legalistic formulation of points-at-issue, is particularly relevant to most arguments in the humanities. Both literary critics and historians, for example, argue different issues of fact. Historians argue whether some event did or did not occur, and, even more frequently, about its cause or its effect on subsequent events. Literary critics argue what a specific passage means, its effect on a reader, and the author's intention in writing it. The meaning of a privileged text, usually a law, the effect of something, and an individual's intent in performing an action or creating an artifact are among the common issues of fact listed by Cicero. The discourses of both historians and literary critics include discussions over definitions. Historians, for example, argue over the meaning and exact definition of terms describing historical periods and movements. Likewise, discussions of genre in literary studies are largely issues of definition. Issues of value are also central to all humanistic discourse. Historians, for example, debate about what, exactly, is valuable to study. Similarly, determining exactly what qualities make texts valuable has been and continues to be an important topic of literary scholarship. Finally, issues of jurisdiction, that is, determining who decides, who is authorized to interpret, have become increasingly central to literary debates. For example, reader-response critics and some post-structuralists have argued that readers make meaning, with some critics arguing that all interpretations of a text are equally privileged. Critics such as E. D. Hirsch (1976), on the other hand, have claimed that an author is the final arbiter of the meaning of his or her own work. In all of these areas, the primary activity is the interpretation of a received artifact, not the creation of a new one.

Ceremonial Rhetoric

The third genre of classical rhetoric was epideictic, what Aristotle called the ceremonial rhetoric of display. Deliberative rhetoric was concerned with deciding future actions; legal rhetoric was concerned with evaluating and interpreting past acts. The ceremonial oration was concerned with the present, with displaying to a public but passive audience praise or blame about someone. Furthermore, like much post-modernist literary criticism, the ceremonial oration itself sometimes became as important as its subject. It became a vehicle for a skilled rhetor to display his prowess, and during classical times was a major form of entertainment. Nevertheless, the primary function of ceremonial oratory was the celebration or denigration of someone, and we can see its legacy in humanistic essays that celebrate and denigrate a specific author, literary work, or

historical figure. Indeed, Bialostosky (1993) argues that English academic discourse is primarily epideictic, "in its focus on the interpretation and evaluation of 'existing' qualities of persons, things, or institutions to celebrate their worthiness or unworthiness" (1993, p. 20).

The Two Rhetorics in the Undergraduate Curriculum

Because each rhetoric embodies the essential and defining characteristics of its respective academic and professional discourse community, acquiring the implicit rules and structures underlying each discourse are essential steps in a student's education in each of these two disciplines. Learning and refining effective strategies for experiencing and then communicating the meaningful and pleasurable consumption of texts through close and analytical reading constitute a substantial portion of what is commonly viewed as humanistic or "liberal arts" education. Similarly, learning how to articulate and then to communicate effectively each step in the design process constitutes the core of what Vincenti defines as engineering knowledge. Comparing student writing assignments typical of each discipline will help us identify and highlight some of the essential differences between these two rhetorics.

The following assignments are from two classes at the Massachusetts Institute of Technology, where I teach and coordinate the undergraduate writing-across-the-curriculum program. The first set of assignments is from a Humanities Distribution class in Philosophy entitled, "What Is the Best Way to Live?" The design assignment comes from an advanced undergraduate class in computer systems engineering taken by almost all computer science majors at MIT.

Writing Assignments in "The Best Way to Live"

This class was taught at MIT in spring 1998 by Ralph Wedgewood, an Assistant Professor of Philosophy. The syllabus lists two principal goals for the class (Wedgewood 1998b):

> (i) The first goal is to develop knowledge and understanding of certain episodes in the history of ideas concerned with the question (which Socrates regarded as the most important question that anyone could ask), What is the best way to live? To achieve this goal, we will be reading some of the 'great books' from the history of Western ethical thought.
>
> (ii) The second and more important goal is to develop skills in the careful reading of texts, in rigorous philosophical argumentation and analysis, and in the lucid oral and written

> expression of philosophical ideas. To promote this second goal, we will (a) try to interpret the arguments and ideas expressed in these classic texts as carefully and accurately as possible (this will involve some attention to the historical context of these texts, but mostly it will involve careful analysis of the texts themselves); in addition, (b), we will also try to evaluate these ideas and arguments, to see how persuasive they are as accounts of what is the best way to live. This will not involve simply asserting your own subjective opinions; it will involve presenting carefully *reasoned objections* to rival views and *reasoned arguments* in favour of your own views.

The class objective is, in a sense, a design project. Students are asked to evaluate competing formulations and use them to develop their own design. The emphasis of the class, however, is not design but "to *interpret* these famous old texts" by Sophocles, Thucydides, Plato, Kant, J. S. Mill, Schiller, Marx, and Nietzsche (Wedgewood 1998b) through specific and carefully constructed writing assignments. These assignments are typical of those in classes that comprise the Humanities, Arts, and Social Science Distribution Requirement at MIT and, from my own experience, appear quite similar to assignments in corresponding courses at other universities (although I originally looked at the course syllabus because of the design orientation implied in its title). The following three topics are typical of the essay assignments in the class (Wedgewood 1998a):

> What do the scenes in Sophocles' *Ajax* that come after Ajax's death show, or suggest, about the ideal of being a hero? What do they add to the earlier part of the play?

> Explain how Thrasymachus analyses justice in Book 1 of Plato's Republic. Why does Thrasymachus deny that justice is a virtue? Explain at least one of the arguments that Socrates uses against Thrasymachus' view that justice is not a virtue. Formulate a serious objection to Socrates' argument and evaluate the objection.

> Explain Mill's conception of happiness or well-being, taking into account what he says in both chap. II of *Utilitarianism* and chap. III of *On Liberty*. Explain how Mill answers the objections that he thinks will be raised against his conception, including the objection that he answers by claiming, 'It is better to be a human being dissatisfied than a

pig satisfied . . .' Evaluate Mill's success at replying to these objections.

Many of these assignments are clearly related to deliberative issues, with some questions specifically asking students to address notions of competing goods. However, the specific points-of-issue students are being asked to address are largely those associated with legal rhetoric. The assignments, for example, ask them to interpret specific definitions of the *heroic, justice,* and *duty,* and to evaluate the comparative value of abstract concepts such as *justice*. In essence, the students are being asked to do two things: to consume (read) these existing artifacts critically and analytically, and to evaluate specific issues to help answer the question, "What is the best way to live?" For the most part, however, they are not being asked to do what Plato has Socrates doing in *The Republic*; they are not developing a complete and coherent set of design specifications either for an ideal society or for an exemplary individual life.

In his syllabus, Wedgewood provides his students with explicit descriptions of the three related tasks of reading, interpretation, and evaluation along with the specific types of claims students should make (see excerpt in Appendix A). He first asks students to read and reread the material and to make connections between ideas. He then states that the writing assignments will ask students to *interpret* specific texts and to *evaluate* the arguments in them. Wedgewood then defines the interpretative and evaluative claims students will be asked to make in the writing assignments and describes evidence appropriate to each kind of argument. He also excludes certain classes of evidence, such as argument from authority.

Wedgewood's differentiation between interpretative and philosophical arguments closely parallels the distinction in classical forensic rhetoric between issues of fact and issues of value. Interpretive arguments, as he defines them, derive from the "hard" data of the particular text. His concept of philosophical argument, on the other hand, is not grounded on data but on values, on "assumptions that seem intuitively plausible to as many people as possible."

A Group Design Report in Computer Systems Engineering

The following assignment describes a complex group design project for 6.033 Computer Systems Engineering, given toward the end of the 1997 spring term by Professor Frans Kaashoek of MIT and his colleagues (Kaashoek 1997). Although some elements of this particular design project may be more complex than ones at other colleges and universities, the general types of analysis and argumentation asked for are representative

of upper-level undergraduate engineering education, especially within the context of the new ABET 2000 criteria.

The writing assignments in "What is the Best Way to Live?" focused on interpreting and evaluating specific claims of value and definition, on establishing general criteria. The design report assignment, like most "real world" engineering projects, begins with accepted assumptions about abstract issues of value and definition. Students are asked to design a system to provide "*electronic e-mail pseudonyms* to protect the identity of its users." (See excerpts in Appendix B.) E-mail sent by the system should look like any other e-mail and an individual receiving a message from this source should be able to respond to it in exactly the same way they respond to other messages. Furthermore, the design should prevent any single person from identifying the person using a pseudonym to send e-mail.

The introduction to the assignment presents some background about why anonymity is a desirable quality, but it does not really argue for it nor does it invite students to evaluate this claim. Instead, the assignment asks students to conceptualize a device that will promote and further anonymity within the context of electronic communication. The assignment presents general guidelines for the design and then lists a series of issues, mostly technical, that the design teams should consider.

The assignment's framework is clearly that of deliberative rhetoric. Students are specifically told that their design process will involve choices between competing goods: "As in most system designs, trade-off and compromise is required, so you have to decide how important each desirable property is in relation to the others." Consequently students are advised to list both the benefits and disadvantages of their design. The project is, however, not just a technical problem. As in many design problems, this project raises implicit and significant questions of value, and this assignment explicitly asks students to address some of these issues. Students are prompted not just to evaluate their design technically but also in terms of its social impact, including considerations of the various ways the system could be abused. Students have to make specific claims of value. They have to determine, for example, the relative value of privacy and anonymity to an individual's right to be free from harassment and libel. The difference, however, is that in this design problem, these issues occur not as abstractions nor as already existing objects, but within the context of the production of a new artifact.

Reuniting the Two Rhetorics

Classical rhetoric included both deliberative and evaluative discourse. The two rhetorics need to be united once again. The philosophy assignments, like most exercises in humanistic discourse, ask students to

engage in a rhetoric of interpretation and evaluation. The design project in computer science, on the other hand, requires a response situated within the traditions of deliberative rhetoric. Yet within each assignment lurk the rhetorical traditions of the other. The philosophy assignments are framed within an incomplete deliberation of "the best way to live," while the computer system design requires substantial consideration of specific claims of value, definition, and jurisdiction. Merging the two rhetorics, making them visible to each other and incorporating each other's analytical modes and structures, will both enhance and complete each discipline's discourse.

Restoring Humanistic Deliberative Rhetoric

The philosophy assignments beg the kind of intellectual exercise found in Plato's *Republic*. Rather than just interpret and evaluate arguments, wouldn't there be a substantial intellectual benefit in adding exercises that then had students employ their conclusions to propose specific (and quite possibly radical and unfeasible) social policy or precepts for individual behavior? Furthermore, deliberative exercises could enhance students' reception and conception of literary texts. Deliberations around situations found in imaginative literature did not end with the demise of the classical rhetorical exercise of the *suasoriae.* Discussions among individuals on why a specific character in a film or television program should do or not do something are quite common. Would such exercises applied to literature be without merit? Finally, a humanistic deliberative rhetoric will make visible the design process inherent in every act of writing. The composing process, the production of a text, has always been a process of design, and, indeed, all rhetorics have been, essentially, strategies of designing an object, a document or a speech, to be used by a specified group of people, that is, its audience, and is created to achieve one or more specific goals. Digital media make this design process even more complex, and, consequently even more apparent. Writing almost always entails making design trade-offs in areas such as organization, specificity, clarity, and concision to fulfill an author's often competing objectives. In this sense, writers have always been and will always be engineers. Acknowledging this connection not only will break down barriers between disciplines, but it will help to demystify the writing process for our students.

Incorporating Interpretation and Evaluation into the Rhetoric of Design

While the approaches found in the rhetoric of engineering can enrich humanistic discourse, the reverse is equally true: humanistic rhetoric is necessary for effective engineering design discourse. The discourse of interpretation and evaluation is a necessary element for an effective and

complete rhetoric of design. The social, ethical, and environmental dimensions of technology are now recognized as an explicit and integral part of engineering curricula, and engineering design projects now commonly require students to evaluate and judge an artifact's effect. Windsor (1990a) and Perelman (1994) both note in their respective analyses of the discourse leading to the decision to launch the Space Shuttle *Challenger,* the need for issues of value to be included within engineering discourse and communicated within engineering communities. Humanistic discourse, like that asked of students by Wedgewood in his Philosophy class, provides the language and categories for such deliberations. Furthermore, Miller and Selzer (1985) note that legal considerations have become a common topic of engineering reports. As Vincenti (1990) observes, because designs have to conform to specific legal and governmental regulations, the clear and effective interpretation of these documents has become a crucial part of engineering knowledge and the engineering design process. And, as law schools have known for years, humanistic exercises in summarizing, interpreting, and defining elements of texts provide excellent preparation for formal legal reasoning.

Drawing upon crucial distinctions between Aristotle's approach to deliberative rhetoric and those of the purely pragmatic handbooks, such as the *Rhetorica ad Alexandrum*, Miller argues in her essay "What's Practical about Technical Writing" (1989), that technical rhetoric needs to be more than just practical guidelines. It needs to develop a *praxis*, a mode of conduct, as well. "An understanding of practical rhetoric as conduct," she argues, "provides what a teacher cannot: a locus for questioning, for criticism, for distinguishing good practice from bad" (p. 23). That *praxis*, of course, is situated within the humanistic rhetoric of interpretation and evaluation.

A Unified Rhetoric as a Common Framework for WAC

Finally, recombining evaluative and deliberative rhetorics establishes a common framework for discourse across the curriculum. It allows the humanists teaching engineering communication to validate the usefulness of both their own discourse strategies and those of their engineering colleagues. Such a framework privileges both the discourse of deliberation and the discourse of evaluation and interpretation. Situating and connecting both discourses within the rhetorical tradition will prevent humanistic writing from being devalued as exercises in useless abstractions and engineering communication from being dismissed as the mechanistic production of boilerplate documents. Instead, engineers can discover that some of their own discourse practices have antecedents in an ancient and complex tradition and that classical rhetoric offers them and their students useful strategies for writing and speaking. Aristotle's

topics on deliberation among relative goods, for example, can be adapted to provide a useful set of specific questions for the student teams engaged in the computer systems engineering design project to develop an anonymous email server. To be complete, however, these design reports also need frameworks derived from humanistic rhetoric. The student teams need to learn how to develop precise and carefully considered definitions of such terms as anonymity, free speech, and harassment. They need to learn how to identify and respond to social and ethical questions of value. Finally, their design will need to consider issues of jurisdiction by describing who will be empowered to apply these general principles to specific cases.

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Appendix A

Excerpts from the Syllabus of *The Best Way to Live* (Wedgewood, 1998b):

1. Understanding of material . . . . if your paper seems clearly to misunderstand something, it may get graded down. To make sure that you understand the material then, read carefully and slowly. Reread if necessary. Ask yourself, What does this mean? Connect up the ideas that you had while reading with the ideas expressed in lectures and recitations. Discuss the readings, and issues raised in the lectures or recitations, both in recitation and with your fellow students.

2. Quality of argument. . . . In much of your papers, the main task is to *interpret* these famous old texts. To interpret is to understand the text - see how it 'works', and what it means - and then express your understanding in a way that would enable others to understand what you do (just like literal 'interpreting'). To interpret, then, it's not enough just to repeat or excerpt from the text. You need to set out what you understand about the text *in your own words*.

. . . In deciding whether an interpretive claim needs support or not, you must simply exercise your own judgment, asking yourself, 'Could a reasonable reader disagree with what I say here?' If it seems that no reasonable reader could disagree with you, then what you say is obviously true; if not, then you must support your claim with reasons. (Under no account assume that just because *I* say something it must be obviously true!)

If your paper is going to answer the question adequately, though, you will have to make some claims that aren't obviously true. So you'll have to *argue* for these claims. If it's an interpretive claim, you may need to quote some passage from the text, and *analyse* the passage in detail.

In the more philosophical texts that we will be focusing on from now on, we typically interpret these texts by seeing them as expressing a certain *argument.* (An argument starts out from some assumptions or data, and then proceeds through a series of steps of reasoning, all designed to lend support to some conclusion.). . . . the *interpretation* of these texts is closely related to the *evaluation* of the philosophical arguments that they express. . . . if you claim that a given argument is good or bad, you should usually support your claim by giving an argument yourself. And an argument for the conclusion that some philosophical argument is good or bad is itself a philosophical argument. . . . One of the main differences between

philosophical arguments and interpretive arguments is this. The primary evidence or data for interpretive arguments is the text, whereas philosophical arguments typically start from assumptions that seem intuitively plausible to as many people as possible, and then argue from there.

Appendix B

Excerpts from Group Design Assignment in *Computer Systems Engineering* (Kaashoek, 1997):

Anonymity has become increasingly relevant to the Internet. With archivers and indexers such as DejaNews and Alta Vista, anything you say in a public forum (such as a newsgroup or mailing list) will be with you for the rest of your life. Moreover, many current forms of anonymous communication would be better served on-line. . . . Finally, anonymity can be crucial in guaranteeing freedom of speech. In the last cases in particular, people need a strong guarantee that their identity will not be compromised.

One way of achieving anonymity is to use a pseudonym. Pseudonyms have the feature that they can stand in place of an ordinary name and thereby avoid disrupting systems that depend on names. The problem with trying to use a pseudonym on e-mail is that e-mail addresses generally must be registered with some mail system administrator, and you may not want to trust that administrator with your true identity.

Your task is to design a service that provides *electronic e-mail pseudonyms* to protect the identity of its users. The key constraint in the design of your pseudonym service is that, when properly used, no single person should be able to find out the real identity behind a pseudonym. Even if a server providing the service itself is compromised (e.g., broken into or subpoenaed by authorities), it should be impossible to find out who the users of the service are. Your service should meet the following requirements:

1. The pseudonym should look like a regular e-mail address to the rest of the world. The recipient of a piece of e-mail from a pseudonymous source should be able to read and reply to the message with unmodified mail readers.

2. No single administrator should be able to discover the identity of a user.

Keep in mind that some of these requirements are negative goals, and therefore you should consider all the possible ways in which your design can be compromised. Be careful, a single unaddressed issue could be fatal to your design. In your report be sure to identify which threats your design tolerates and which not. Think things through.

There are different ways to approach this problem, each with its own merits and disadvantages. It may be difficult to achieve all properties you consider desirable at the same time. As in most system designs, trade-off and compromise is required, so you have to decide how important each desirable property is in relation to the others. . . .

Describe the protocols used by your system, the means of privacy and authentication, and the user interface(s) your system presents. Explain how your design addresses security issues (secrecy and integrity of email, privacy of the users, etc.). Evaluate your design from a technical standpoint. You should also discuss the social impact of your design. . . .

We suggest you pick one design for your anonymous email service and argue why it is a good design by evaluating your specific design choices. You can strengthen your report by contrasting it to other approaches, but do not turn your report into a survey of existing service....

Your proposal will be read mostly by skeptical prospective users and their security consultants, but also by some congressional staff people worried about both privacy and law enforcement. It is your team's job to give them a good, coherent, self-contained, well-written proposal for a design, including an evaluation of the benefits and disadvantages. . . .It is crucial that you provide enough detail for skeptical prospective users and their security consultants to evaluate the real-world feasibility of your design. To this end, your report should include at least one specific example: Describe exactly how to create a pseudonym and what happens when you send mail using a pseudonymous return address and what happens when someone replies to mail that came from a pseudonymous address. In addition, your report should describe how secure your design is; what kind of attacks can it tolerate? What kind of attacks lead to problems? Finally, your reports should also comment on social and ethical questions that a pseudonym service raises.

Do not assume you have to use existing software and do not get caught up in the details of any existing systems and support software (such as PGP). It is fine to require those with pseudonyms to make use of new or modified client software. Of course, just receiving mail from or replying to a pseudonym should not require any special software.

The key issue to keep in mind is that no single administrator should be able to discover the identity of a user. This most likely requires the service be distributed across multiple machines under the control of different administrators. . . .

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