NASA Conference Publication 2203
Part 1

Technical Communication

Perspectives for the Eighties

Proceedings of the technical communication sessions at the 32nd annual meeting of the Conference on College Composition and Communication held in Dallas, Texas
March 26-28, 1981

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Technical Communication

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PREFACE

This Conference Publication contains the proceedings of the technical communication sessions at the 32nd annual meeting of the Conference on College Composition and Communication held in Dallas, Texas, March 26-28, 1981. The Program Chair for the annual meeting was James L. Hill, and we are indebted to him and to all the others who arranged the conference program.

As this proceedings suggests, technical communication has become an important subfield within 4Cs and is becoming an intrinsic part of many undergraduate curricula. Technical communication as a separate discipline, however, is relatively new. For that reason, we think it important to prepare a proceedings that can make current research available as quickly as possible.

In order to make this proceedings useful, authors of papers were asked to revise and develop the papers they actually gave. In addition, session chairs, associate chairs, respondents, and recorders were encouraged to write papers or prepare coherent statements, even if their remarks had been impromptu or they had made no substantive statements at the sessions themselves. In several instances, new material has been prepared for this proceedings. Thus, in some ways, this proceedings is more comprehensive than the sessions actually were. Unfortunately not all papers are included, as several authors wished to revise them more extensively than time permitted. With over 75 papers, however, this proceedings represents about 80 percent of those that were presented at the conference. The papers are published camera-ready as submitted by the authors.

J. C. Mathes
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Compilers

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Toward A History and Definition of Technical Writing

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WHAT IS TECHNICAL WRITING?
PROLEGOMENON TO A CONTEXTUAL DEFINITION

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INTRODUCTION

What is technical writing? The question is of more than formal interest since the various answers to it make different claims about the stance a teacher assumes in a classroom, the orientation of textbooks, and the shape of curricula.[1] Certainly such a question of identity is predictable, and even common, during the emergence of a discipline.[2] And, indeed, the question <u>has</u> been addressed often in the literature. But if technical writing is now a discipline in its own right, if it has in fact "come of age," if definitions abound, then why ask the question again?[3] Precisely because technical writing is of age and definitions abound, the time is ripe for a metaperspective on the question. The purpose of this paper, then, is <u>not</u> to offer yet another definition of technical writing but, based on an analysis of pitfalls in representative definitions, to suggest a direction for future inquiry.

PITFALLS

Past attempts to define technical writing have been found wanting. A common pitfall has been a failure to recognize the biases implicit in the use of the term "technical writing." For the term itself is laden with definitional assumptions. Thus, the constituent term "writing" implies a privileging of the written word, a privileging which is ultimately seen as unwarranted: John S. Harris laments the bias in using this term and the attendant devalorization of the oral and the graphics modes; in this spirit, he proposes substitution of the word "communicator" for "writer."[4] The constituent term "technical" is also fraught with terminological difficulties. We can't seem to agree on what "technical" means. Should it imply subject matter? A manner of treatment? And even if we could agree that "technical" implies subject matter, to take a case common in the literature, we can't seem to agree on which subjects are "technical" and which are not. Thus, Mills and Walter endorse a definition based on subject matter but ultimately express a general reservation about its validity: "Although one of the obvious characteristics of technical writing is its technical subject matter, it would be very difficult to say precisely what a technical subject is."[5] Perhaps the term is too narrow. Harris, for example, sees the need to broaden it.[6] Perhaps the term is too broad. Carolyn R. Miller would have it narrower: She sees the need to distinguish between "scientific writing" and "technical writing."[7] The problem of terminological bias is compounded when the terms selected are too closely linked to a contingent historical reality. The term "Engineering English" or "Writing for Engineers" arose, for example, because technical writing was originally offered as a service course <u>for engineers</u>.[8] Similarly, recognition of the increasing diversity of majors in technical-writing courses may underlie the recent appearance of such terms as "Technical and Professional Writing."

A second pitfall in definitions of technical writing is epistemological in origin. That is, every definition of technical writing carries assumptions about the nature of reality and these assumptions are problematical, especially when linked to an outdated epistemology. Returning to our earlier example of definitions based on subject matter, we noted objections on the grounds of felt terminological difficulties. Miller offers an objection to such definitions on <u>epistemological</u> grounds:

> Definition based on content seems at first obvious and then unworkable--no one is prepared to say which subjects are "technical." Engineering, certainly; science, of course; but linguistics? political theory? seventeenth-century music? urban planning? <u>Reality doesn't come in packages clearly marked "technical" or "nontechnical."</u> [emphasis ours] [9]

Nor are Miller's objections confined to definitions based on subject matter. She argues convincingly that textbook definitions of technical writing based on style, tone, or form as well as on subject matter are suffused with the legacy of a discredited epistemology, scientific positivism.[10] Surely one who entertains a post-positivistic view of knowledge will object to definitions such as the following: "Though subject matter and form are questionable bases on which to define technical writing, philosophic position is still a sound basis.... [T]echnical writing is concerned with demonstrable truth."[11] (But, counters our hypothetical post-positivist, knowledge is <u>created</u> and consensually validated, not <u>found</u> in an objective external reality.[12]) Or: "Our definition of technical writing [is] writing about a subject in the pure sciences or the applied sciences in which the writer informs the reader through an objective presentation of the facts."[13] (But knowledge is intersubjective, rather than objective, in nature.) Again: "The primary, though certainly not the sole, characteristic of technical and scientific writing lies in the effort of the author to convey one meaning and only one meaning in what he says."[14] (But there is not a one-to-one correspondence between words and reality.) Lastly: "Technical writing is expected to be objective, scientifically impartial, utterly clear, and unemotional."[15]

(But science is a rhetorical act.)

Other pitfalls in attempts to define technical writing trace to methodological biases. Specifically, examination of many such attempts reveals de facto predispositions toward monism, binarism, and ad hoc modelling; the attendant misuse of these techniques often provides the bases for subsequent challenges. Monism is evidenced in the view of technical writing as unified, monolithic, and singular--as "all of a piece." However, such conflation, commonly underlying early definitions, is felt to mask the diversity and richness of writing in the field.[16] Monism is heightened, of course, when technical writing, conflated to an idealized entity, is associated with a single property, e.g., stylistic simplicity. Criticisms of such monism implicitly acknowledge the diversity of technical writing by countering examples given with others drawn from elsewhere in the field. If a user manual was cited to evidence stylistic simplicity, one counters with, say, a metatheoretical discussion of stochastic processes. Similarly, if Proust's writings were used to exemplify stylistic complexity of literature, one counters with a passage from Robbe-Grillet.

Another methodological pitfall in *defining technical writing* originates in the weaknesses of binary opposition, or binarism. Binarism is the setting up of an opposition on the basis of a differential property--in the simple case, on the basis of the presence or the absence of that property. The preference for binarism is understandable: As Jonathan Culler notes, "[binarism] can express any of the relations that could be handled in other terms and leads to a simplification of both framework and description...."[17] But the strength of binarism is also its principal weakness, i.e.,

> ...[binarism] permits one to classify anything. Given two items one can always find some respect in which they differ and hence place them in a relation of binary opposition.... What it organizes are qualitative distinctions, and if those distinctions are irrelevant to the matter in hand, then binary oppositions can be very misleading, precisely because they represent factitious organization."[18]

An example might be helpful here: Harris considers the argument that technical writing is not metaphoric, whereas poetry and novels are. His refutation is in part on methodological grounds: Such an argument must "ignore the essentially metaphorical basis of language itself..."[19] Note that Harris is claiming, in effect, a factitious organization based on a misleading binarism. That is, since language is based on metaphor, and both technical writing and literature are based on language, a distinction based on the presence or absence of metaphor cannot be significant. He continues by adopting the tactic typically used to expose misleading simple binarisms, that is, one either shows the presence of a property supposedly absent or the absence of a property supposedly present. In this case, Harris cites numerous examples of metaphors widely used in technical writing.

The binarism propounded above was misleading because the distinction on the basis of the presence, and alleged absence, of a property was invalid. More representatively, a binarism is misleading when the disjunction on the basis of a qualitative difference in a property is factitious. We return to an earlier example and consider the claim, as a possible basis for defining technical writing, that it is stylistically simpler than other discourse.[20] Suppose that, in support of this claim, an excerpt from a user manual has been contrasted with a passage from Proust. To counter, one contrasts a metatheoretical discussion of stochastic processes with a passage from Robbe-Grillet and the disjunction collapses. In the final analysis, technical writing may well be stylistically simpler on the average than literature, but the overlap is so great that the proposed organization is surely factitious. Moreover, technical writing cannot be distinguished from all other discourse on the basis of a contrast with literature alone; hence, even if valid, the contrast could not establish the distinctiveness of technical writing. In more classical terms, the methodological defect is inadequate sampling.

A related class of methodological pitfalls occurs when the assignment of properties used in defining technical writing is unsystematic, or *ad hoc*. To illustrate: Rejecting previous definitions of technical writing based on subject matter, Keith N. Hull wishes to expand the definition "for the simple reason that technical writing is a broader mode of discourse than that carried on by engineers and scientists."[21] Noting that his course has "twenty-two students from eleven majors" and that "only half of these are engineers or scientists," he then asks: "How in all honesty can I define technical writing in such a way as to exclude half of my students?"[22] We would note that any definition of technical writing which must accommodate the contingent reality of the composition of a given class at a given time in a given place is clearly open to a charge of extreme ad-hocism. Hull's more formal definition of technical writing avoids such extremism, but the element of the *ad hoc* persists. His general definition of technical writing rests largely on a list of selected properties whose theoretical basis remains obscure.[23] Hull is not alone; textbooks are rife with definitions based on some collection of characteristics which do not evidence a systematic approach and may, therefore, lack descriptive adequacy.

Not that descriptive adequacy alone will suffice. Problems remain when the properties assigned to technical writing are too empirically derived. Considering attempts to define technical writing in terms of form--an implicit definition informing the many textbooks organized on the basis of report genre--Harris notes that "any definition by form or format will almost immediately become obsolete as new forms and formats appear."[24] Rather, we say that any definition reflecting a too slavishly empirical view of form is unworkable, that is, a definition must have validity beyond a fixed, extant corpus of materials. Though restricted to form, our point has wider applicability. Definitions which have merely descriptive adequacy, and only narrowly conceived descriptive adequacy at that--in short, definitions which lack generative qualities--are short-lived.

CONCLUSIONS

Such, then, are some of the pitfalls in representative attempts to define technical writing--pitfalls which have been shown to provide the bases for subsequent challenges. What general conclusions can be drawn from the analysis? Perhaps the most significant is that the various approaches discussed used largely unsystematic strategies leading ultimately to alienation. The insistence on the uniqueness of technical writing as a discipline, starting symbolically with the assignment of its name, is clearly contributory to alienation.[25] So is the characteristic methodological overemphasis on <u>distinguishing</u>, as opposed to <u>shared</u>, features. Equally contributory is the methological privileging of binarism, for binarism is inherently an agonistic notion, a one-on-one opposition, e.g., technical writing <u>versus</u> non-technical writing. The contribution of the epistemological privileging of scientific positivism to an ideology of alienation has already been discussed by such critics as Habermas and Marcuse.[26]

The alienation under discussion is manifested in several ways. On one level, it takes the form of classic dissociations from parent disciplines. Witness the dissociation of technical writing from composition implied by W. Earl Britton: "When I try to teach tech writing to students who have had the conventional first year course, I run smack into all the characteristics that I have labelled as wrong about the course."[27] Fred H. MacIntosh dissociates technical writing from literature:

> Probably the fundamental step toward preparing to teach [technical writing] courses is a basic change of attitude, a willingness to cut the umbilical tether back to the purely literary studies of most graduate English programs, and instead walk down main street with open minds, to hear the world's ideas of its language needs, not the ideas of the English departments....[28]

Dwight W. Stevenson dissociates technical writing from <u>both</u> composition and literature when he seeks to clarify "just how instruction in technical writing differs from conventional writing instruction of the sort one finds in freshman composition and in literature courses."[29] Stevenson is joined by J. C. Mathes and Peter R. Klaver in a dissociation of technical writing from composition, literature and traditional rhetoric:

> The principles taught in English composition derive from classical rhetoric, from the literary tradition, and from such humanistic educational objectives as self-awareness. Although the experienced technical writing teacher judiciously applies these principles to technical writing, he or she often finds principles derived from these sources to be quite inappropriate.[30]

The dissociation of technical writing at the disciplinary level has several correlatives. For instance, Marxist critic Stanley Aronowitz laments the "demoralization of teachers and their alienation from work" which results when their work, composition teaching, is separated from their training, literary studies.[31] Technical-writing teachers, cut off from composition as well as literature, would then presumably be seen as doubly alienated from the humanistic disciplines in which they were largely trained. Turning from the teacher to the student, we learn of an alienation originating in the dissociation of technical writing from traditional rhetoric. If traditional rhetoric views writing as a broadly humanistic discipline, then technical writing with its legacy of scientific positivism becomes a set of specialized skills practiced by a trained elite. Inculcation of this view in students may be seen, ultimately, as alienating them from a society lacking such skills.[32] Such alienation of technical professionals is, of course, yet another manifestion of that alienation known as the "two-cultures" syndrome.

SUGGESTIONS

Given our general conclusion that present definitions of technical writing are non-viable, largely unsystematic and ultimately rooted in as well as contributory to an ideology of alienation, let us return to the original question: What is technical writing? Though our purpose here is not to offer yet another definition, we can indicate--based on our analysis of previous definitions and the state of the discipline--the nature of the issues which must be addressed in the quest for a viable definition. In broadest terms, we see the need for a more theoretically based, contextual definition of technical writing. Such a definition would avoid an _a priori_ privileging of technical writing, and would evolve from creative and systematic attempts to see technical writing in relation to other forms of discourse and modes of representation. Only within such a comparative perspective can one meaningfully pose the question of the distinctiveness of technical writing. The proposed approach would transcend the one-on-one, i.e., discipline-by-discipline or feature-by-feature, approaches characteristic of previous attempts at definition. This approach would also lead to a more balanced treatment of shared and distinguishing features of technical writing. Technical writing would be viewed, not as a set of unique specialized skills practiced by a professional elite, but as one of a series of discursive possibilities for perceiving and organizing reality. Ultimately, in the broad perspective proposed, technical writing would be seen, not as an hypostasized autonomous entity alienated from the community of discourses to which it rightfully belongs, but as an interdiscursive nexus of features.

What kind of inquiry do we see as an appropriate preliminary to the post-positivistic definition of technical writing needed? Or, to take on a more manageable task here, what lines of inquiry may be congenial and fruitful for individuals trained in the humanistic disciplines, most particularly in literature? Let us begin with the observation that, from a post-positivistic viewpoint, all discourse--including technical writing--can be regarded as symbolic reconstructions of reality based on modes of intelligibility used to understand experience. Narration, one mode of intelligibility, was long regarded as the special province of literature; but theorist Jonathan Culler attests to its wider utility:

> W. B. Gallie has argued in Philosophy and Historical Understanding that the kind of understanding afforded by history writing involves not grasping causal laws but rather seeing how one thing leads to another as in a story. In other areas as well, it can be shown that the notion of understanding can be explained in terms of following a story, perceiving a narrative pattern. Thus the question of what is a story or what are the basic patterns of narrative becomes the focus of a new and important inquiry, to which literary critics [or ex-literary-critics], with their interest in plot, can make important contributions.[33]

How does a technical-writing instructor embark on this line of inquiry? Familiarity with the work of literary narratologists such as Tzvetan Todorov, Northrup Frye, and Gérard Genette provides an obvious starting point.[34] As does the work applying narrative models in history by Hayden White, in sociology by Robert Nisbet, and in anthropology by Claude Lévi-Strauss.[35] Most importantly for our purpose here, analysis of technical texts in narrative terms is needed. Gerald Holton's description of "the technical report...of the analysis of a bubble-chamber photograph" warrants reproduction in full:

> ...[The technical report] is cast largely in terms of a life-cycle story. It is a story of evolution and devolution, of birth, adventures, and death. Particles enter on the scene, encounter others, and produce a first generation of particles that subsequently decay, giving rise to a second and perhaps a third generation. They are characterized by relatively short or relatively long lives, by membership in families or species.[36]

Though Holton's treatment of technical texts is too impressionistic to serve directly as a model for the kind of discourse analysis needed, it does provide a suggestive first step in looking at technical texts not as truth but as act of narration. Ultimately, however, all such characteristically parochial one-on-one, discipline-by-discipline treatments must give way to a comparative treatment of narrative crossing traditional disciplinary boundaries.

But such comparative analysis may be undertaken on less ambitious levels as well. Consider one element of narration--description, for instance. Even a cursory glance at technical-writing textbooks exposes a striking uniformity in the treatment of description; such treatments are largely monolithic, mechanistic, and reductionistic in their failure to acknowledge the implications of such fundamental issues as context. (No doubt the typical recipe proposed for description has its roots in scientific positivism. But that is another story.) In any event, such prescriptive oversimplification seems unwarranted in the light of the rich tradition of literary description and the slowly emerging theory of description.[37] Once again, we need a cross-disciplinary, comparative study of shared discursive elements--in this case, of description. And once again, the literary background of the technical writing teacher is a valuable asset.

But our list of potentially profitable topics of inquiry can easily be extended. Holton's work on "themata" in technical discourse suggests the applicability of the literary notion of theme as a fundamental unit in the production of meaning underlying all discourse.[38] Rhetorical theory suggests other possible topics for fruitful studies. For example, rhetorical figures provide models that are applicable to a variety of discourses, including technical writing.[39] In the quest for a contextual definition of technical writing, there is much to be done.

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2. For a discussion of the importance attached to identifying distinguishing features during the emergence of a discipline, see Thomas S. Kuhn, The Structure of Scientific Revolutions, 2nd ed. (Chicago: University of Chicago Press,1970), especially ch. II.

3. For a statement of the autonomous disciplinary status of technical writing, see "Writing is for Other People," The Technical Writing Teacher, vol.6, no.2, 1979, p.38. The author, James W. Souther, notes that technical writing "is a discipline, just as is creative writing and is journalistic writing". The quotation recognizing the maturity of the discipline is from Thomas E. Pearsall, "Beyond the Basic Course: Building a Program in Technical Communication," English in Texas, vol.11, no.4, Summer 1980, p.93.

4. "On Expanding the Definition of Technical Writing," Journal of Technical Writing and Communication, vol.8, no.2, 1978, p.136. We adopt the common term "technical writing" throughout this paper as a simple convenience.

5. Gordon H. Mills and John A. Walter, Technical Writing, 4th ed. (New York: Holt, Rinehart, and Winston, 1978), p.3.

6. "On Expanding the Definition."

7. "A Humanistic Rationale for Technical Writing," College English, vol.40, no.6, Feb. 1979, p.617.

8. "On Expanding the Definition," pp.133-34.

9. "A Humanistic Rationale," p.613.

10. "A Humanistic Rationale."

11. "On Expanding the Definition," p.136.

12. For discussions of post-positivistic views of science, see especially Barry Brummett, "Some Implications of 'Process' or 'Intersubjectivity': Postmodern Rhetoric," Philosophy and Rhetoric, vol. 9, no. 1, Winter 1976, pp.21-51; Michael A. Overington, "The Scientific Community as Audience: Toward a Rhetorical Analysis of Science," Philosophy and Rhetoric, vol. 10, no. 3, Summer 1977, pp.143-64.

13. Patrick M. Kelley and Roger E. Masse, "A Definition of Technical Writing," The Technical Writing Teacher, vol.IV, no.3, Spring 1977, pp.94-97.

14. W. Earl Britton, "What is Technical Writing? A Redefinition," The Teaching of Technical Writing, eds. D.H. Cunningham and H.A. Estrin (Urbana: National Council of Teachers of English, 1975), pp.9-14.

15. Thomas E. Pearsall, Teaching Technical Writing: Methods for College English Teachers (Washington, D.C.: Society for Technical Communication, 1975), p.1.

16. For an implicit attack on monism and a testimony to the diversity of technical writing, see "Mapping the Unexplored Area," p.194: "'[T]echnical writing,' as it is almost always called, is not in fact a single course. Rather, it is a whole variety of courses...."

17. Attributed to R. Jakobson and M. Halle by Jonathan Culler in Structuralist Poetics: Structuralism, Linguistics and the Study of Literature (Ithaca, N.Y.: Cornell University Press, 1975), p.15.

18. Structuralist Poetics, pp.15-16.

19. John S. Harris, "Metaphor in Technical Writing," The Technical Writing Teacher, vol.II, no.2, Winter 1975, p.9.

20. See, for example, Edmund P. Dandridge, Jr., "Notes Toward a Definition of Technical Writing," The Teaching of Technical Writing, pp.15-20. He offers statistical evidence that "good technical writing is, on the whole, stylistically simpler than good nontechnical writing."(p.15)

21. "Notes from the Besieged, or Why English Teachers Should Teach Technical Writing," College English, vol.41, no.8, April 1980, p.882.

22. "Notes from the Besieged," p.882.

23. Hull defines technical writing "as prose constructed to convey ideas and facts with maximum clarity and authority." "Notes from the Beseiged," p. 882. Hull asserts that "clarity and authority" imply

"technical writing 1) is carefully tailored to match task and audience, 2) has a clear purpose, 3) is systematically, logically, and purposefully organized, 4) explains clearly and as fully as necessary, 5) usually deals with verifiable facts, 6) usually supports generalizations with facts, 7) logically matches facts and generalities, 8) is economical in content, organization, and style, 9) is mechanically correct, and 10) possesses the dignity of truth and restraint." (p.882) Supporting his definition, Hull notes that his students "indicate considerable satisfaction with the usefulness of such a concept." (p.883) Excepting the emphasis on "verifiable facts," which can be challenged readily on epistemological grounds, one may ask whether Hull has not in effect simply relabeled a conventional composition course.

24. "On Expanding the Definition," p.135.

25. See, for example, James W. Souther, "What's New in Technical Writing," English in Texas, vol.11, no. 4, Summer 1980, p. 79: "Technical writing, like fiction or journalism, is a separate discipline, a unique kind of writing."

26. Jürgen Habermas, "Technology and Science as 'Ideology'," Toward A Rational Society: Student Protest, Science, and Politics (Boston: Beacon Press, 1970), pp.81-122; Herbert Marcuse, The One-Dimensional Man (Boston: Beacon Press,1964).

27. "The Trouble with Technical Writing is Freshman Composition," The Teaching of Technical Writing, p.73.

28. "Teaching Writing for the World's Work," The Teaching of Technical Writing, p.27.

29. "Mapping the Unexplored Area," p.204.

30. "Technical Writing: The Engineering Educator's Responsibility," Engineering Education, Jan. 1979, p.332.

31. Stanley Aronowitz, "Mass Culture and the Eclipse of Reason: The Implications for Pedagogy," College English, vol.38, no.8, April 1977, p.772.

32. S. Michael Halloran, "Eloquence in a Technological Society," Central States Speech Journal, vol.29, Winter 1978, pp.221-27, especially p.224.

33. Jonathan Culler, "Literary Theory in the Graduate Program," The Pursuit of Signs: Semiotics, Literature, Deconstruction (Ithaca, N.Y.: Cornell University Press, 1981), pp.214-15.

34. See especially Tzvetan Todorov, "Les transformations narratives," Poétique de la prose (Paris: Seuil, 1971); Northrup Frye, Anatomy of Criticism (New York: Atheneum, 1966); Gérard Genette, Narrative Discourse: An Essay in Method, trans. J. E. Lewin (Ithaca, N.Y.: Cornell University

Press, 1980).

35. See especially Hayden White, _Metahistory: The Historical Imagination in Nineteenth-Century Europe_ (Baltimore: Johns Hopkins University Press, 1973) and _Tropics of Discourse: Essays in Cultural Criticism_ (Baltimore: Johns Hopkins University Press, 1978); Robert Nisbet, _Sociology as an Art Form_ (London: Oxford University Press, 1976); Claude Lévi-Strauss, "L'analyse morphologique de contes russes," _International Journal of Slavic Linguistics and Poetics_, vol.3, 1960, pp.122-49 and _La Pensée sauvage_ (Paris: Plon, 1962).

36. Gerald Holton, _The Scientific Imagination: Case Studies_ (Cambridge: Cambridge University Press, 1978), p.17. For further analysis, see his _Thematic Origins of Scientific Thought: Kepler to Einstein_ (Cambridge, Mass.: Harvard University Press, 1973), pp.107-9.

37. See, for example, Philippe Hamon, "Qu'est-ce qu'une description?" _Littérature_, vol.6, 1972, pp.475-82; C. Linde and W. Labov, "Spatial Networks as a Site for the Study of Language and Thought," _Language_, vol.51, 1975, pp.924-39.

38. See _The Scientific Imagination_, pp.3-24 and _Thematic Origins of Scientific Thought_, pp.11-68 and pp.91-114, _passim_.

39. Roman Jakobson's analysis of metonomy and metaphor as tropological figures underlying both two types of aphasia and the structure of discourse is perhaps the best known example. See "Two Aspects of Language and Two Types of Aphasic Disturbances," _Fundamentals of Language_ (The Hague: Mouton, 1956). For an application of Jakobson's distinction to the twentieth-century English novel, see David Lodge, _The Modes of Modern Writing_ (Ithaca, N.Y.: Cornell University Press, 1977). For an application of Kenneth Burke's four master tropes--metaphor, metonomy, synecdoche, and irony--to historical discourse, see _Metahistory_. For an application of irony and metaphor to sociological texts, see Richard H. Brown, _A Poetic for Sociology_ (Cambridge: Cambridge University Press, 1977). Once again, though, we note the need to go beyond such studies in search of an interdiscursive perspective.

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Technical Writing in America: A Historical Perspective

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The standard distinction between poetic and referential language is in part responsible for the gulf between science and the humanities, and it may also account for the distress many teachers of English feel when faced for the first time with the prospect of teaching technical writing (ref. 1). To the humanistically educated critic-scholar, the utilitarian prose of science and technology seems to defy description and analysis, so that technical writing is often approached in terms of what it is not, with emphasis on the features of "normal" rhetoric it eschews. The technical writer's goal, Joseph Priestley reminds us as early as 1761, is to "let every word stand in such a place and connection, as that its meaning shall be in no danger of being mistaken," a caveat echoed in the introduction of many of our technical writing textbooks, but which seems to divorce technical communication from other forms of linguistic experience by making language limiting and reductive rather than creative and expansive (ref. 2).

I believe that the emphasis on technical/scientific writing as radically different had blinded us to those traits it has in common with all species of composition and has caused us to neglect research on fundamental rhetorical issues. Our teaching, too, should be informed by a thorough knowledge of rhetorical theory, even if this is never communicated directly to students. A complete theory of technical discourse would include information about the attitudes and motives of writers, the situations which motivate (or coerce) them to write, the definitive features of technical style and form, the interrelationship of expression and creativity, and the functions of communication in shaping and preserving scientific networks and institutions.

These areas should be explored with respect to contemporary practice, and many researchers are presently so doing. I believe, however, that there is much to be gained by viewing them within a historical perspective. Some potential benefits of such a study, beyond those usually ascribed to historical research, include the following:

1. It would show long-term trends in technical writing and enable us to choose intelligently from the available developmental paradigms (continuum, cycle, evolution, etc.), to delineate stages, if any, in the genre's development, and to determine the relationship between scientific progress and the communication of it.

2. The written historical record concerning such subjects as the exigencies which give rise to scientific discourse or the author's attitudes

towards rhetoric may be more revealing than the stated beliefs of modern practitioners working within well-established conventions.

3. Finally, and most important, the struggle of early scientists and engineers to create viable forms of communication, to adapt and disseminate information to varied audiences, and to build acceptable channels of communication is a potentially enlightening, heretofore unexamined aspect of the history of science and technology.

This study is best carried out by teachers of rhetoric, literature, and technical writing. With well-developed critical faculties, a commitment to historical accuracy, and an orientation towards the values underlying human endeavors rather than towards the recounting--or simply counting--of the results of those endeavors, the humanities scholar is in a unique position to understand the broad implications of the history of technical writing. Specialists in the history and philosophy of science have concentrated almost exclusively on the content of scientific communication and have ignored the history of rhetoric. Brooke Hindle's ground-breaking study of the American Philosophical Society (APS), for example, ignores a large body of evidence concerning the Society's debates over the nature of scientific writing, carried on during the last decades of the eighteenth century as it initiated its Transactions, which as the first substantial scientific periodical constitutes the Society's most enduring contribution to American science (ref. 3). Those colleagues in our own departments who are at all interested in science deal only with its impact on literature. For the most part, the existing historical studies of technical writing are the unsystematic appraisals of non-scholars, hastily researched and sometimes inaccurate papers and articles scattered in out-of-the way journals and proceedings, or well intentioned but analytically unprofitable discussions of the "hidden poetry of science."

Recently I have been systematically reappraising the roots of American scientific writing; I have focused on scientific and medical societies and their publications, both because the paper and report remain the standard forms of scientific discourse and because these organizations, notably the APS, possess extensive archives and libraries of early scientific activity. I am not yet prepared to provide even in the broadest outline an overview of American scientific writing up to the present. I will, rather, describe its practice in the earliest phase, from the seventeenth century until approximately 1815, at which point specializations begin to coalesce around professional organizations and specialized journals. In doing so, I will seek to answer some of the questions posed earlier about writers, texts, and readers.

In its initial, immature phase, American science saw its essential tasks to be observation and data compilation rather than theory formulation. This situation results from the scarcity of practitioners conversant with scientific theory and the overriding influence of Francis Bacon, whose system insisted upon these as the most fruitful scientific activities, and in part from the colonial mentality in general and a two-tiered international system of "absentee landlordship in science" in which Europeans alone were granted license to interpret data gathered from peripheral sites (ref. 4). Like their counterparts in England, seventeenth-century Americans presented their observations in the unadorned, nominal style of the Royal Society, with figurative language employed only to translate unfamiliar phenomena into familiar terms, a heavily Latinate vocabulary, and a very limited technical lexicon. Samuel Danforth of Cambridge, Massachusetts, who has as good a claim as anyone to the title of first American scientist, is typical in these respects. His Astronomical Description of the Late Comet (1665) is syntactically straightforward, with very short sentences even by modern standards; ponderously learned ("This Comet is no lunary Meteor or sulphureous Exhalation, but a Celestial Luminary."); and simplistically metaphorical ("A Comet is denominated from its Coma or Bushy lock, for the Stream hath some resemblance of hair."). Since the colonial audience for such words was severely limited--amateur enthusiasts, scattered University faculty, and the clergy--the usual outlets were British publications such as the Philosophical Transactions of the Royal Society, Medical Observations and Inquiries (1757-84), and Medical Essays and Observations (1733-42), which despite their titles accepted communications on all scientific topics.

Along with the clergy, physicians constituted the largest class of scientifically literate persons in the colonies, though apparently less than one in ten had the benefits of formal education (ref. 5). A medical disaster, the outbreak of the "throat distemper" in New England during the 1730's, provided the impetus for the first extensive medical publication in America. The letters, pamphlets, and newspaper articles published at this time show the range of styles writers adopted and their awareness of different audiences. Descriptions of symptoms by a clergyman and two physicians indicate very different responses to the problem of style:

Rev. Jonathan Dickinson: "I take this Disease to be naturally an Eruptive milliary Fever. And when it appears as such, it usually begins with a Shivering, a Chill, or with Stretching, or Yawning; which is quickly succeeded with a sore Throat, a Tumefaction of the Tonsils, Uvula, and Epiglottis, and sometimes of the Jaws, and even of the whole Throat and Neck. The Fever is often acute, the Pulse quick and high, and the Countenance florid."

Anonymous (probably Dr. John Morgan): "During these appearances, the throat seem'd, as it were, full and swell'd and the patient seldom failed to complain of great soreness, had an evident hoarseness and sometimes a cough. The pulse was generally full and quick, yet attended with some remissions and even sinkings."

Dr. William Douglass: "[T]he reliquiae were thrown off by Urtications, by Vesications in several parts of the Body, by serpiginous eruptions chiefly in the face, by purulent Pustules, by Boils, by swellings and impostumations in the groin, armpits and other parts of the body" (ref. 6).

The first two passages address a lay audience and thus communicate in relatively familiar terms. The style of the clergyman and the physician are essentially indistinguishable, though Dickinson uses a slightly more technical vocabulary. Elsewhere in their articles, both suggest a humane concern for the patient, Dickinson referring at several points to the struggle of "the poor miserable Creature." Their sense of stylistic decorum also permits literary allusions and stylistic ornaments to play minor roles: Dickinson characterizes the disease as a mortal enemy, and Morgan depicts the struggle in dramatic and military images and underscores his opposition to bloodletting with an allusion to Dryden.

Douglass's description more closely resembles the jargon-laden prose for which physicians have become notorious, especially when addressing other "Gentlemen of the profession" (p. ii). Even to his colleagues, however, his elaborate phrasing is excessive: Dr. Samuel Bard, a professor of medicine at Columbia, though quoting him approvingly for his "accurate and judicious" observations, finds them needlessly obscured by his "singularity of style" (ref. 7). In fact, Douglass's high-sounding vocabulary describes such commonplace phenomena as blisters, (vesications), a spreading rash (serpiginous eruptions), and abcesses (impostumations).

In the twentieth century, the motives for producing a given piece of technical writing are conventional, clearcut, and objective: the advancement of knowledge, generation of a specific output or product, or meeting a predetermined goal. In the early years of scientific activity, motives are more diverse and tend to be stated directly. They include patriotism and the desire to create the bonds within a field of inquiry which will lead to its professionalization.

Most of the latter motives can be inferred from the writings under consideration. The most apparent are the desire to be useful, to promote professional standards, and to stimulate scientific activity in others. All three writers insist that their writing promotes the general welfare by sharing their specialized knowledge with the public. All also point with satisfaction to their professional concern for detailed observation; Morgan is exemplary: "As the State of Physic now stands, the Faculty having been amused with different Theories for many ages have concluded, that reasoning from observation and facts. . . is the only basis on which we can rest with safety" (p. 164). This Baconian emphasis is the single trait most common in all early American science and the most obvious method of distinguishing cognoscenti from amateurs. In subsequent years, a significant proportion of the papers the APS rejects are cited for their failure to observe and describe with scientific thoroughness and accuracy. Douglass is concerned not only with standards of observation (his labored vocabulary no doubt to his mind contributes to this objective), but also with using publication to establish a network of researchers cooperating on a common problem. Douglass is also careful to underline his objectivity by dissociating himself from those who publish their findings solely as a "Quack bill to procure Patients" (p. ii). Half a century later, the hope of eliciting professional cooperation motivates the editors of the <u>Medical Repository</u>, the first successful American medical journal, who see a "medical collection" of "an extensive mass of experiment [and] a various and judicious selection of facts" as the surest way to progress (ref. 8).

The need of early scientific writers to establish credibility necessitated a personal tone far removed from modern conventions of objectivity. Just as seventeenth-century correspondents to the Royal Society were careful to include code words like "ingenious and industrious" or "curious and inquisitive" gentlemen in identifying themselves and their informants, American writers in the eighteenth century always account for their sources' reliability and, if at all possible, observe phenomena with their own eyes. An excellent instance of this trait occurs in another of Dr. Morgan's papers, an account of "A Living Snake in a Living Horse's Eye" in the APS Transactions. Morgan devotes two pages to discussion of "miraculous appearances," his own opposition to "visionary speculatists," his hypothesis that the creature in question is a "filimentary production" animated by a "convulsion in the nerves," and, finally, his assurance after "the closest ocular examination" that the "snake"(actually a parasitic worm) is genuine (ref. 9).

One result of this need to establish personal credibility is a more argumentative tone in much of the writing than modern conventions would permit. Douglass, for example, refers scornfully to the "rash inconsiderate opinion[s]" and "mischievous Practice[s]" of other physicians treating the throat disorder (pp. 2-3). In this combative atmosphere, it was normal for such arguments to be quite protracted. Manuscripts in the APS archives indicate that the inventor Oliver Evans continued to inveigh in print against Benjamin Latrobe for criticizing his steam engine eleven years after the fact, even though that criticism was a single paragraph (which Evans never saw) in a draft report which Latrobe excised prior to its publication (ref. 10).

The most successful effort to impose order and standards upon scientific writing was the publication of the APS Transactions, a collection modeled closely upon the Philosophical Transactions of its parent organization, the Royal Society. The publication's history is too complex and its quality is too uneven to recount in detail here; during its initial stage of development, six volumes appeared at irregular intervals from 1769 to 1809. Its primary accomplishments are several: it imposed minimal standards for form, methodology, and style, though the latter were applied unevenly; it instituted an increasingly successful referee system to consider papers; although it usually published papers as received, it also printed the first edited and collaborative papers to appear in this country; and, most important, by distributing scientific writing far more widely than previously possible, it encouraged imitators and provided a model for potential contributors.

The most consistent standard observed in APS publications is objectivity. The Society clearly specifies in its first Transactions that its members will not "give their Opinion, as a Body, upon any subject, either of Nature or Art, that comes before them" (p. iv). Occasionally this rule resulted in minimal editing, as in a paper by John De Normandie concerning "The Therapeutic Value of the Waters of Bristol, Pennsylvania," a republication of two earlier articles (both 6 October 1768) in the Pennsylvania Journal and Pennsylvania Gazette (ref. 11). Two paragraphs are removed, perhaps because they have too much the tone of an advertisement, with references to the

Bristol springs' "more remarkable tonick powers than common springs" and "a suitable and convenient house and bathing place" under construction. Except in extreme cases, the Society's official neutrality had little impact on the form or substance of its publications; certainly, it caused the removal of very few hypotheses because they were unacceptable. Only once during this period did the Society approach breaching its operating principle by showing favoritism to one of its own members. This occurred in 1806, when an editorial committee rejected a paper on the origin of icebergs by Samuel L. Mitchell and within weeks accepted a similar one by Anthony Fothergill, who was not only a member of the society but also of the committee. Moreover, Fothergill's paper is in many ways inferior: it contains undesirable rhetorical flourishes, is based upon less precise observations, and contains a contradictory hypothesis, that icebergs are "gradually formed stratum super stratum. . . attache[d]. . . to the bottom" of the ocean, even though they are "specifically lighter than water." The committee raises the issue of the propriety of its action in its report, and the society as a whole eventually found an excuse not to publish Fothergill's paper (ref. 12). However, nowhere else in the records of this period is there evidence which so obviously calls into question the Society's neutrality.

For the most part, the Society's principle of selection is, as stated in the first volume, "the importance or singularity of the subjects, or the advantageous manner of treating them" (p. iii). The latter phrase refers to the scientific rather than stylistic manner: the use of close observation, experiments, or statistical methods rather than careful writing. Nevertheless, the record indicates that style and form were considerations in some cases. The best example is the work of Benjamin Shultz, an amateur naturalist whose work is best left cloaked in anonymity. Over a ten-year period (1797-1807), Shultz persistently submitted rather lengthy papers on noxious plants, essential oils, animal temperaments, and light. All were rejected, though Shultz sought the patronage of Thomas Jefferson and (more successfully), Dr. Benjamin Rush. Editorial comments are almost entirely negative ("extremely inaccurately written," "diffuse and irregular"), and the works themselves are models of prolixity, opacity, and confusion. His first paper, on noxious plants, is typical: the first section, eight of its thirty pages, is a rambling attempt at a review of the literature, which alludes vaguely to many theories but cites no sources; the discussion itself (sixteen pages) is poorly organized (one-quarter is excursive footnotes and nearly one-half is simply lists of Linnean nomenclature) and riddled with semi-literature metaphorical descriptions ("innocent plants," "naked. . . destitute of winged, downy, or hairy Substances." "Calyx. . . cherishing the Seeds in its bosom"); and a "Review" takes up the final six pages, again with nearly one-third of its text extraneous comments in footnotes (ref. 13). Shultz's papers are valuable only in that they indicate that minimal stylistic standards for scientific writing existed at the end of the eighteenth century, although they were never clearly articulated.

The usual form of submission was the personal letter or memoir enclosed in a letter, although more formal presentations with textual subdivisions and elaborate figures appeared even early on, including at least one "formal report" (Samuel Felsted's "Plan and Description of a Horizontal Wheel," 6 July 1798), a fair manuscript copy, bound in boards, with three well-drafted, pull-out figures. All of the papers submitted at this time are the work of individuals, but a number of published articles are collaborations and amalgamations. The most complex example of such an article is William Mugford's "An Account and Description of a Temporary Rudder," which derives from at least four sources: Mugford's original letter and description of the rudder; a newspaper account of its invention; a draft report combining the preceding items and commenting upon them; and an explanation of an illustration, apparently requested from Anthony Fothergill. The published article differs from all four sources in both substantive and stylistic details (including reinstatement of cancelled material from the draft), indicating that yet another writer or editor had a hand in it (ref. 14). The Society did not generally have the editorial resources to rework submissions so elaborately; however, upon occasion a specialist was asked to rewrite or expand promising observations. The naturalist Benjamin S. Barton performed such duties on an anonymous "Observations on the Phalaeena Tinea" (a parasitic moth which inhabits beehives). He expanded a six-page document to forty-four, in the process transforming a chronological memoir into a topically arranged report which incorporated Linnean descriptions, a review of the literature, and his own and other observations from various sources (ref. 15).

One of the APS's most important innovations was introducing committees of specialists to determine which papers were suitable for publication. The Society's minutes do not record when such review committees were first established or exactly why. Certainly, no explicit order was given. From its creation, however, the APS used ad hoc committees for such purposes as granting prizes, examining inventions, translating foreign correspondence, and seeing the first Transactions through the press. After the second volume appeared in 1786, references to such committees begin to appear in the minutes, the first on 21 December 1787; however, they are appointed, do their work, and report sporadically and haphazardly. Thirty-five such reports are extant from the period 1787-99, eighty-six from 1800-09, and twenty-three from 1810-15. These reports cover fewer than half of the papers received, and many were lost or delayed. On 27 December 1798, for example, the secretary reported on sixty-two papers received during 1797-98; two-thirds (thirty-nine) were listed as "referred," but only twenty committee actually filed reports. The archives also show embarrassing delays: Shultz's paper on noxious plants was in committee for over a year; Barton's paper on "Poisonous Honey" was read on 18 July 1794, never reported upon, and finally published only in Volume V (1802). The worst fate is Robert Patterson's, whose "An Improvement in the Common Ship-Pump" was read on 17 July 1795 but "afterwards mislaid"; it emerges in print twenty-three years later in Volume I of the new series (1818). Such delays harmed the journal's prestige and credibility, and competing periodicals were able to publish backlogged papers (four such instances were noted in the minutes in November 1812). The society's most prestigious member, Joseph Priestley, complains in 1798 that he must send "Articles. . . of considerable importance" elsewhere because the Transactions does "not answer the primary purpose of such publication, which is speedy communication of philosophical discoveries" (ref. 16).

By the opening years of the nineteenth century, the sporadic, compendious, uneven Transactions had served its purpose. It had launched American scientific publication, provided some minimal standards for both form and content, and had demonstrated a potentially workable system of manuscript selection. Most important, it had shown that American scientists could work cooperatively and objectively to disseminate the results of their research. The next stage of development, the publication of specialized journals like the American Mineralogical Journal (1810), could not have occurred, nor could such journals have taken on so modern an appearance, without the pioneering work of the APS. Thus, the first generation of scientists in the new republic made substantial progress and paved the way for the professionalization and specialization of scientific communication. Their work, with all its shortcomings and peculiarities, is recognizably the ancestor of modern technical writing; continued study of the historical record will show not only how modern conventions of writing emerged, but also how they were shaped by the socio-cultural forces, creative energies, and personal values common to all scientific, indeed, all human, endeavors.

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TECHNICAL COMMUNICATION: NOTES TOWARD DEFINING A DISCIPLINE

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Perhaps this is simply an era when simplistic solutions to complex problems becomes a dominant theme for our age. It has somehow become fashionable to make very general statements and present them as universal truths. In the field of technical communication, for instance, one can survey the definitions posited in virtually any major text and discover that each one violates every major rule of definitions. The most popular method for defining the field is to state that technical writing is any writing that supports technology or technological activities. One then is left with a hollow feeling that he/she needs a nice yardstick for measuring what "technology" is. One is also left with a nagging, perhaps niggling, doubt that there is something subversive, perhaps even anti-humanistic about "supporting technology." It seems to me that we have to stretch this definition in some ways and collapse it in others; I don't, however, want to put this effort on a Procrustean rack. I want to suggest, first, some ways in which the field can be defined in a tightly structured empirical way and, second, to posit the implications of technical communication for a humanistic education in a technological age.

Unlike any other field, with the possible exception of science writing, technical writing, strongly implies that there is a clear emphasis on the product. In this sense it is at one with the field it claims to support. We find that even in the works of such people as Herbert Simon, the key feature of technological activities is the production of artifacts. It is this informing principle of technology that, I believe, tends to obscure the definition of technical writing in all of its possible permutations. Editors in the corporate environment express their concern only about the lack of documentation for a new product; that concern is not tempered with a concomitant regard for the veracity or usefulness of the document (nor for that matter, is there any interest in the ethical dimensions of the document).

This drive for product has another deleterious effect on technical writing: it creates a focus on words as a variety of transparent symbols that work best when they don't get in the way of the user. James Kinneavy, for instance, proposes this view of referential language in support of technological activities. What is clearly (no pun intended) wrong with this perspective is that words become less than words. Their task is to slip through the reading process with the least amount of effort and to elicit as little attention as possible. Unfortunately, we know from such theorists as Michael Polanyi, Gerald Holton, Thomas Kuhn, and Larry Laudan that language and technological thought (activity) simply don't work that way. There is no such animal in the entire world as an unambiguous text (or illustration for that matter). All reading, as Iser, Rosenblatt, Bleich, and others have argued, is an interactive process informed by the readers interests and background. This counter argument is interesting for a variety of reasons. First, it refutes the reasoning that says that language is transparent. Readers do have to participate in the text; referential texts are less open to interpretation and ambiguity than a piece of fiction, but they are still open. Second, this observation supports the more realistic view of the communication process and communication models in technical writing. Until we accept the fact that there is a reader who has expectations, needs, and failings (perceptual as well as social), the supposed objective nature of technical texts will remain useless and mythical. Writing and its uses in the real world simply do not support this naive view of writing as artifact, as product.

Another view of this same perspective is the position that sees writing as a pure object that exists in some kind of vacuum. The reader is simply not part of the schema of communication. Of course, some of this thinking is informed by the general perception that much which is technical is, in fact, visual in nature. Admittedly that is a valid point when we consider that virtually every study of technical and scientific material indicates that such texts are approximately thirty percent visual. Many companies, particularly international corporations, have even increased that percentage in an attempt to deal with transcultural problems. However, it is hard to escape the needs of a literate and demanding readership.

This situation is also supported, consciously or unconsciously, by the academic and professional societies. The International Technical Communication Conference (ITCC), for example, has offered only a handful of papers on reading, as distinct from readability in over a quarter century of meetings. Most of their offerings have, indeed, focused on sophisticated mechanical crutches that analyze written material in a quantitative fashion. As Merrill Whitburn and S. M. Halloran have pointed out, none of this thinking has done anything constructive to assist ours or the writers' understanding of audience. Instead it has pointed out, and perhaps exacerbated, the tensions that exist in defining who technical writers are and what they are about. ITCC is not the only culprit. The International Reading Association has not even given lip service to audience. In fact, only three papers on college or adult audience reading perception were offered at their 1979 convention. One of those papers was by Anne Eisenberg who has indeed moved into untested territory by exploring the demands of reading scientific and technical material.

What does this lack of interest in the reader say for defining the field of technical communication, and what are the consequences of this information? Succinctly, ignoring the reader violates everything we know about communication and communication models. Even if we use the most common model--Shannon/Weaver--we have a writer, a medium, and a receiver. If we are not concerned with who gets the message we compose and send, then why are we sending it? What are we doing?

One can, of course, try to make the case that technical writing textbooks, indeed, keep audience in mind. I haven't been able to convince myself that this is true. For instance, Mathes and Stevenson go to great lengths to explore audience levels throughout an organization. What they prove is that you can be aware of those levels, not how to write to them. Walker Gibson, it seems to me, does a better job in both Persona and Tough, Sweet, and Stuffy. Admittedly, both or perhaps all of these approaches are still too subjective. Let me take a few moments to explore an empirical methodology that reaches into communicology, contemporary discourse theory, and even ethics, which I feel, tentative though it is at this point, offers a way for defining audiences, purposes, and by extension, the domain of technical communication with a great deal of precision.

My suggested model combines the work of Charles Osgood, Torgerson and the Princeton Group, Shepard and the Bell Laboratories Research Group, Woefel and the GODI Group; Richard Lloyd-Jones' efforts in primary trait characteristics for evaluating written texts; and finally, William Perry and Lawrence Kohlberg's work on ethical dimensioning. Osgood, Torgerson, and Shepard all propose some variation on dimensional scaling techniques. The flexible measurement system offered by multidimensional scales seems particularly appropriate when dealing with stimuli like words, illustrations, or other abstract concepts. Attempts to predict and explain complex socio-psychological phenomena where stimuli often have many intangible dimensions ~~has~~ created a need for such measurement techniques. Technical communication, which deals with a very specific audience (one is tempted to say social group), can benefit from the application of these measures in two ways. First, the measures, operating through a system of paired coordinate judgements, can be used to identify writing and/or professional conceptions that inform the writer's work. That is, through an interviewing technique, which bears striking similarities to Lloyd-Jones' efforts, the researcher can develop a vocabulary of important issues that the writer uses in both his/her writing and which also forms the basis for judgements about audience. These concepts are then paired and the writer is asked to determine the distance between the entire issue spectrum. What emerges is a pictogram, via computational manipulation, that defines the relationship between a variety of issues. For instance, in a pilot project performed by the GODI Group at Rensselaer Polytechnic Institute (RPI), it was discovered that graduate students in technical writing (as well as participants from academia and industry in RPI's summer institutes) exhibited a great deal of tension about their relationship to humanistic and scientific elements in their education or work. That is, they understood the nature of their work but felt uncertain about its role in relation to technology. Since the study has often been replicated, it would appear that technical writers are not certain about their "supporting" role in relation to the ends of technological activity.

Similar studies can and have been done in the work environment. One such effort looked at writers' perceptions of audience and purpose and created a programmatic model for document preparation in that environment. The study, however, pushed the multi-dimensional scaling concept further than normal. As a corollary to the writer/editor analysis, the research group did a similar analysis of the potential (and in this case clearly defined) users of the document. Even before the work was produced, before anyone put word to paper, it was obvious that there was a lack of fit between writers' perception of audience and audience expectations. That clearly defined gap in preliminary assessment became the basis for changes in text production. It also became the basis for a new editorial policy. The final part of this particular study involved follow-up observations of both populations, as well as a control group, to establish goodness of fit. The effort proved to be a phenomenal success.

Of course, this study was exhaustive and demanding on the part of the writing group. Not every company has such luxury. In defense of the expenditure of time and energy, it should be noted that subsequent studies of similar situations became much easier to accomplish (and just as productive). Once this kind of semantic mapping is established, then it can be applied in a variety of situations to determine the optimal strategies necessary to alter a particular set of relationships to achieve communication fit. This has been, admittedly, a very sketchy profile of a very complex system. Briefly summarized, the technique calls for interviews of both writer and audience to develop the concepts necessary for establishing a model of communication fit--audience perception in comparison to audience expectations, writers' methodologies in comparison to readers' habits. The output needs to approximate the decoder's capabilities. This method offers an intriguing model for coming closer to achieving such a purpose than simple platitudes about knowing your aidience; and it does so in a way that closely resembles the Lloyd-Jones model, a model that is generally considered extremely effective for assessing written material.

In addition, this dimensional technique admits of comparison with the work of William Perry and Lawrence Kohlberg in ethical development. Both of these figures, working within the framework of dimensional scaling, have created matrices that allow one to use comparative scales to make evaluations of moral and ethical development. Since their system is indeed general, we can apply the technique in a variety of areas. According to their schema, it is possible to make judgements about the underlying nature of the communication task by assessing the evident purpose of the finished document. For instance, language used solely as a tool of production (the process orientation decried earlier in this paper) is seen as a sign or symptom of very rudimentary language use. Language in this sense lacks development and engagement; it is Kinneavy's transparent text. At the opposite extreme, the other half of the pair, is language used as an analytical tool. In terms of language, words on a page, it is symptomatic of an attempt to understand the reality under consideration--a conscious tool. It is also a sign that language is viewed by both writer and reader, in this context, as a medium for personal growth. To go back to the lowest level for a moment, language is seen in its simplistic form; it is transparent; it describes situations that are clear-cut dualities: good and bad, white and black. These situations are textually closed; interpretation is both unnecessary and impossible. It is also a communication situation that rarely exists beyond imperatives. At the other end of the spectrum, we find opaque texts that call attention to themselves as artifacts, art objects, objects of delight. Such texts are open in the most general sense; they invite interpretation and possess substantial and irrefutable ambiguities.

This sense of opposition, I think, is a fundamental premise that underlies much of our thinking about the role of technical writing and the dilemma of humanistically trained writers in a technological profession. In support of engineering's role as producer of artifacts, technical writing has inherited some of the tensions, anomalies, and problems of that role. Engineering, for instance, adheres to the doctrine of objectivity which has generated a variety of writing problems that define the limits of the writer's role--personality, the presence of the author, and a discernible "voice"; objectivity, fair treatment of facts and phenomenon; and linguistic manipulation, using language as a tool to create illusion. For the sake of brevity, I would like to take only one of these issues under consideration in this paper--personality.

Personality, it seems to me, implies the presence of the writer as an identity in a work while objectivity rests on an attitude toward material. One can use the phrase, "I found that the sample weighed 128 grams," without destroying the factual nature of the observed measurement. Such a statement not only identifies the author, it places responsibility and, I suspect, is exactly what makes engineers and others apprehensive about using first person pronouns.

In effect, technical writing maintains two unwritten but implied rules about personality: it is permissible and even desirable to ignore the author's identity, voice, or stance; and the best method for communication is to devalue the individual--as both writer and reader. The consequences of such a position has implications both for communication and ethics. To examine this problem we need to examine the role of the individual in a technological society, the methods writers use to communicate in such a society, and the relation of the reader to technical material.

I would like to suggest that we view the individual in a technological society in Anatol Rapoport's terms of instrumental or intrinsic value. The former simply means that an idea, object, or device has value because it enhances something else that we value; the latter--intrinsic--means being comfortable and alive. One can obviously guess that Rapoport sees the instrumental value as inconsistent with humanistic and ethical concerns: if individuals have only instrumental value to technology, as consumers then they have no value. Lee Thayer offers a similar distinction, which neatly applies Rapoport's terms to our needs, when he discusses the ethical role of communication. For Thayer communication has two possible roles: socialization and individuation. Communication in the former sense relies on people expressing and understanding themselves in the "proper" manner without regard to fact; social "fit" is paramount, nothing else matters. (This sense, for example, typifies scientific agreement about a particular phenomenon.) In contrast, individuation in communication is characterized by language behaviors which see value (intrinsic value) in the individual. Technology, in either view, must be the receptacle of instrumental value, man of intrinsic. Once one agrees to such statements, ethics assume a much more dominant role in technological affairs, including communication.

Along with this revaluation of the individual must also come a reconsideration of the author and reader in relation to technical information.

Herbert Simon, for instance, posits an intriguing definition of a goal-seeking system (of which man is an example) that seems to me particularly appropriate to examining this relationship. Such a system, Simon maintains, has two channels (the old inner and outer environment in some ways): the afferent (sensory channels) which receive information and the efferent (motor channels) through which the environment is manipulated. Interestingly, Simon's observations parallel the work of Louise Rosenblatt who uses the term efferent in her theoretical discussions to describe the concepts to be retained after reading. While this use at first appears to be somewhat at odds with Simon's use of the term, I want to suggest that his efferent channel depicts ways of using the concepts retained by the afferent channel and, as such, both terms describe the same phenomenon as Rosenblatt's term. Rosenblatt, in fact, says that readers direct their response to referential prose outward [afferently in Simon's terms] toward concepts to be retained or actions which are textually determined.

An additional aspect of personality that must be dealt with concerns what Rosenblatt calls "selective attention." In selective attention, Rosenblatt claims that a reader adopts a focus of attention, a stance, and then selects responses relevant to the text based on that stance. She adds that this continuing process bestows interest on particular thoughts which then seem independent of consciousness; at this point the selective process sets the degree of awareness by weighting the potentiality of the text for both efferent and experiential import. The reader has the primary responsibility to manage this weighting process which, in actuality, is based on textual potential for engaging the reader in multiple, selective activities.

This sense of selectivity is at one with the concepts I discussed earlier. Selective behaviors, behaviors which define the ways in which information is actually processed, have the potential to define both the reader's and the writer's relationship to communication tasks. One does not, of course, see communication tasks as simple polarities; it is, however, possible to use this sense of polarity for good ends. One can take such paired opposites, add the element of personal interviews, multi-dimensional scaling, and ethical considerations to provide editors with a fairly descent and replicable definition of both the necessities of the writing task and the demands and expectations of the potential reader. One can also make judgements about the commitment and allegiances of both writer and audience, and, I think, place the field of technical communication squarely into a domain that has carefully defined characteristics regardless of regional aberrations. Unlike other, more subjective systems, this combination of techniques, all of which have a long history of demonstrable accuracy, has the potential for defining the field of technical communication with precision and humanity.

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MARKETING INFORMATION: THE TECHNICAL REPORT AS PRODUCT

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SUMMARY

For many R&D agencies of the federal government, including the National Aeronautics and Space Administration (NASA), the technical report constitutes a product, the primary means for communicating the results of their research to the user. The present environment of the technical report is vast, with considerable variance in report components, format, and organization. As part of the Langley scientific and technical information (STI) review and evaluation project, a review of the technical report as an effective product for information communication was undertaken. Style manuals describing theory and practice in technical report preparation; publication manuals covering such factors as design, layout, and type style; and copies of technical reports were obtained from industrial, academic, governmental, and research organizations. Based on an analysis of this material, criteria will be established for the report components, for the relationship of the components within the report context, and for the overall report organization. The criteria will be used as bench marks and compared with the publication standards currently used to prepare NASA technical reports. The comparison may reveal changes which can be made to the existing NASA standards to improve the effectiveness of NASA's technical reports as products for information communication.

INTRODUCTION

The research and development (R&D) expansion, which began during World War II, resulted in significant changes in scientific and technical information (STI) activities in the United States. These changes, which were necessary to handle the increased production of STI, included new methods of publishing, disseminating, storing, and retrieving scientific and technical information. A significant change occurred in the way in which the results of research were published. During this period, the distribution of R&D activities changed from a complete reliance on traditional journals and monographs to the widespread use of the technical report (Adkinson, 1978).

Growth of Technical Report Literature

The technical report has also been used by industry to communicate significant and complete research results. Due primarily to the federal government's support of R&D activities and the associated need to record the progress and document the results of government-sponsored research, the volume of technical report literature has grown steadily. Approximately 15,000 technical reports were produced in 1965. A decade later, in 1975, the yearly total exceeded 60,000 reports. The projected production for 1980 was established at 80,000 reports (King, 1977). The number of U.S. scientific and technical literature items by medium is shown in Table A.

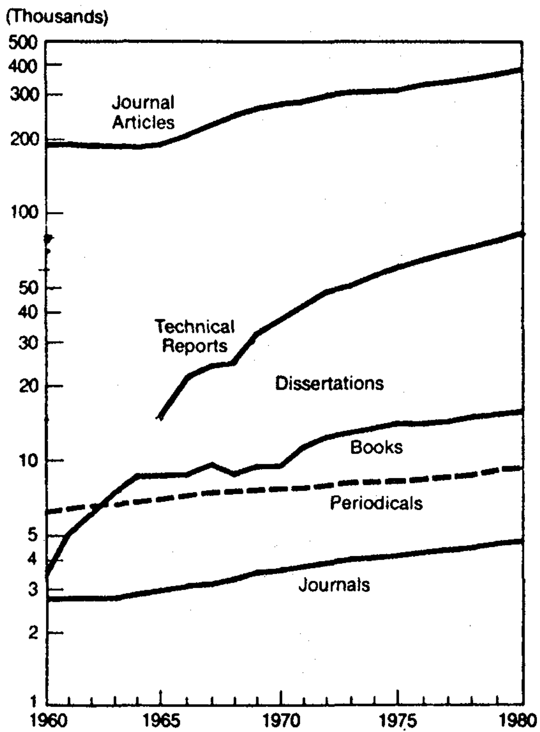

Table A. - Number of U.S. S&T literature items by medium (1960-1980)

For calendar year 1980, the National Aeronautics and Space Administration published 3,399 technical reports. Like many R&D agencies in the federal government, NASA regards the technical report as a product, the primary means of communicating research results to the user. Because of this function, NASA technical reports must be organized and written to accomplish the most effective communication of their contents.

NASA technical reports are processed into the NASA scientific and technical information system where they are distributed to industrial, academic, and public organizations; accessioned into RECON, NASA's computerized bibliographic data base; and indexed and abstracted in STAR, NASA's announcement publication for technical report literature. The NASA technical publications which are available for sale to the public can be obtained from the National Technical Information Service (NTIS) in Springfield, Virginia.

The National Technical Information Service was established as part of the Department of Commerce to simplify and improve public access to scientific and technical reports produced by federal agencies and their contractors. NASA technical reports, as well as those of other federal R&D agencies, are added to the NTIS data base. The NTIS data base may be searched through such commercial data bases as SDC's ORBIT III, Lockheed/DIALOG, and BRS.

Technical Report as Product

The technical report is a tangible product of a research effort. Although agreement exists that these reports should be organized, clearly worded, and easy to use, report producers disagree on (1) the definition of the technical report, (2) the role of the technical report in the scientific and technical environment, and (3) the arrangement of the parts of the technical report.

The definition of the technical report varies because it serves different roles in communication within and between organizations. The technical report can be defined etymologically, according to the derivation of "report" (Weisman, 1966); descriptively, according to the report content and method (DoD, 1964); behaviorally, according to the influence on the reader (Ronco, 1965); and rhetorically, according to the function of the report within a system for communicating scientific and technical information (Mathes and Stevenson, 1976).

In 1968, COSATI (Committee on Scientific and Technical Information) assembled a task group which appraised the role of the technical report in the scientific and engineering communication process. The technical report was found to be the primary recording medium for applied research and thus favored by the technologists. The technologists saw great merit in a number of features of the technical report including (1) timeliness, (2) comprehensive treatment, (3) inclusion of ancillary information, and (4) the frequent inclusion of negative results. On the other hand, the COSATI study found that scientists questioned the reliability of the technical report because of its allegedly unreviewed nature and its availability through a retrieval or archival system.

Publications manuals representing a cross-section of the scientific and technical community were examined in an attempt to discover a standard arrangement of components recommended for inclusion in a technical report. There was little agreement about the inclusion or the arrangement of components. A matrix illustrating the variety in these documents is included as an appendix.

STATEMENT OF THE PROBLEM

In February 1980, the Scientific and Technical Information Programs Division undertook the first comprehensive review and evaluation of the Center's STI program. As part of the project, a study of the technical report was undertaken to determine whether the NASA publication standards of style and organization made the technical report an effective product for transmitting information.

Purpose of Study

NASA employs uniform publication standards designed to ensure the clarity, quality, and utility of its technical reports. These standards were designed to produce reports of maximum readability and ease of comprehension, written in a style that is both logical and familiar because of its wide acceptance in technical writing. However, an evaluation of NASA publication standards had never been conducted.

Importance of the Study

A survey of the literature disclosed that little, if any, documented research existed to support or suggest criteria for assessing the effectiveness of a technical report. Consequently, a survey to establish the present environment of the technical report and to produce empirical data against which NASA publication standards could be compared was deemed essential. This paper reports the preliminary findings of the study.

RESEARCH METHODOLOGY AND PROCEDURE

The study utilized survey research to obtain input from organizations which were known to produce technical information. Addresses were compiled from two sources: the Society for Technical Communication (STC) membership and NASA's distribution list for technical reports. The study was conducted in conjunction with the firm of Graffic Traffic Studios, located in Norfolk, Virginia.

Limitations of the Study

For purposes of this study, the technical report was defined as a communication product designed to convey the comprehensive results of basic and applied research together with the ancillary information necessary for interpretation, replication, or application of the results or techniques. The study was limited to those technical reports which recorded significant scientific or technical accomplishments and which were specifically prepared for distribution outside of the originating organization. Thus, in-house memo/letter reports, the corporate "proposal," institutional reports such as periodic reports or annual reports, and the contract progress report were eliminated.

Procedure

A letter was sent to individuals representing 611 organizations in industry; academia; government; and research, trade, and professional associations. The individuals were asked to provide the following:

1. Copies of typical reports published by their organizations;
2. A copy of their style manual or the name of the commercially prepared manual (e.g., Chicago Manual of Style) if one is used;
3. A copy of the publications or graphics manual or standards covering such factors as design, layout, typography style, illustrative material, printing, binding; and
4. A form indicating the absence or presence of the requested information.

Approximately 200 pieces of literature were received from 124 organizations within the established time limits. Ninety-nine technical reports were suitable for analysis and data extraction. The data were analyzed according to established criteria. No statistical inferences were made from the findings.

FINDINGS

Of the 611 organizations contacted, 99 respondents sent material suitable for analysis and data extraction. The overall rate of return for the survey was 16.3%.

Survey Response

The 99 responses were grouped according to organization. Industrial organizations constituted the largest group in the survey population; followed by the research, trade, and professional organizations; government organizations; and the academic organizations. This grouping is shown in Table B.

Organizational Type	Requests	Responses	Percent Responding	Percent of Total Survey
Government	49	12	26.6	12.2
Industrial	426	54	12.6	54.5
Academic	76	11	14.4	11.1
Research, Etc.	60	22	36.6	22.2
TOTALS	611	99	16.3	100.0

Table B. - Survey responses by organization

Components - Their Use and Location

The material was analyzed to produce an exhaustive list of report components. Ninety-eight report producers described structural components using 98 different terms. In compiling the list, those terms which appeared to describe components having the same function were grouped. An analysis of the frequency of usage of the components disclosed that only five components were used by 50% or more of the responding organizations (see Table C).

Next, the material was analyzed to determine the location of the components within the report. No standard sequence was discovered because the components were located in almost every possible position within the report. No convention was discovered for describing the various sections of the technical report. Therefore, the three areas of traditional book publishing: front matter, body, and back matter were used to locate the components. (The front matter consists of all material preceding the main text. The body contains the investigative, analytical, or theoretical material. The back matter consists of reference material and other supplementary matter.)

Five components (cover, title page, table of contents, introduction, and appendixes) were mentioned by 50% or more of the respondents. Only the cover and the table of contents were consistent in their location within the report.

Less agreement existed about the location of the title pages, introduction, or appendixes.

The components in the exhaustive listing were refined so that they could be compared more easily with the components covered by the NASA Publications Manual. Components which appeared to have the same function were combined. For example, "List of Drawings" was combined with "List of Figures." Any component mentioned by NASA was included. The number of components was also reduced by eliminating any component used by fewer than five report producers.

The components derived from the exhaustive list were compared with the components and their recommended placement as specified in the NASA Publications Manual. The components and their placement as specified by NASA compared favorably to those contained in the refined list. The analysis did reveal variations in the number and placement of front matter components. Where body components were concerned, NASA placed the same elements in the body of the report as those contained in the refined list. A comparison of back matter components revealed certain variations, most notably in the placement of the glossary and index.

A breakdown of the five components, the percentage of use, and their location within the report is presented in Table C.

Component	%Use	Front	Body	Back
Cover	67.6	100.0	---	---
Title Page	80.0	96.2	2.5	1.2
Table of Contents	70.7	100.0	---	---
Introduction	57.5	17.5	82.4	---
Appendixes	59.5	---	1.6	98.3

Table C. - Components by use and location

Use of Style Manuals and Publication Guides

The respondents were asked to provide information relative to the use/non-use of style manuals and publication/production guides. Respondents were also asked to identify the use of commercially prepared style manuals. The responses were compiled and are presented in Table D. While the chart is phrased in use/non-use terms, mutually exclusive categories were not specified. Therefore, the percentages cannot be added to describe 100% of the sample.

	Chicago	AP	GPO	*Other Commercially Available Style Guide	Your Organization's Own Style Guide	No Style Guide Used	Publication/Production Guide	Do Not Use Publication/ Production Guide
Government	16.6	16.6	83.3	33.3	41.6	25.0	58.3	41.6
Industrial	31.4	5.5	42.5	27.7	29.6	37.0	33.3	46.2
Academic	54.5	27.2	27.2	36.3	18.1	45.4	54.5	54.5
Research, Etc.	59.0	13.6	50.0	27.2	31.8	31.8	40.9	50.0
Total Survey Average	38.3	11.1	47.4	29.2	30.3	35.3	40.4	41.6

*DeBakey, The Scientific Journal: Editorial Policies and Practices; NASA Publications Manual; NBS Communications Manual; Abbreviation and Symbol Guide; New York Times; Reisman's Style Manual for Technical Writers and Editors; "Guidelines to Format Standards--COSATI"; STC Typing Guide for Math; American Psychological Association; Editorial Manual of the AMA; Strunk & White's, The Elements of Style; Handbook of Current English; Words Into Type; CBE Style Manual; Turabian, Manual for Writers; ANSI/IEEE Std 260-1978; Geological Survey Style Manual; AIP Style Manual; ACS Style Manual; SMART Communications Inc.; MLA; Fowler; Baker; UPI Style Manual; National Education Assoc.; American Institute of Physics; Technical Manual Writing Handbook; Technical Writing Style Guide; Guide for Beginning Technical Editors; Swanson, Math Into Type; American Chemistry Society, Handbook for Authors.

Table D. - Use of style manuals and publication guides by organization

The majority of respondents relied upon a style manual to prepare technical reports; however, approximately 33% of the respondents used no style manual. The GPO manual was used by the majority (83.3%) of respondents from government operations. A majority of academic and research respondents, 54.5% and 59% respectively, used the University of Chicago Press' Manual of Style in report preparation. Respondents were almost evenly divided in the use/non-use of a publication/production guide.

SUMMARY OF THE STUDY

The study represents an attempt to assess the NASA technical report as an effective medium for information transmittal. The evaluation included the compilation of empirical data through a survey of report producers and through a survey of report components, formats, and organization following a study of current style manuals.

A survey of the literature disclosed that little, if any, documented research existed to support or suggest criteria for assessing the effectiveness of a technical report. Consequently, a survey designed to determine the present environment of the technical report and to produce empirical data against which NASA publication standards for technical reports could be compared was deemed essential.

During the analysis of the findings of the study, wide variances in the technical report were discovered. Nearly one hundred components were identified, based on the extensive array of terms. An attempt to reduce the number of components was made by combining similar components under one heading and the elimination of seldom used component terms. No standard sequence was discovered for the components, so only a general location for them could be made in terms of front, body, and back matter.

FUTURE RESEARCH

Future research will assess the adequacy of the reduced set of components, clearly define the purpose of each component, and develop evaluative criteria for each. The components of the NASA reports will be evaluated according to these criteria. Based on the tabulation of locations in common usage, alternate theoretical sequences of components will be developed and tested empirically. The NASA report will be tested against the sequence established by research.

CONCLUSIONS

The number of technical reports has increased steadily since the expansion of R&D activities began in the U.S. during World War II. The statistics compiled by Donald King for the National Science Foundation project the continued growth of this communication medium. For many R&D agencies of the federal government, the technical report is their product, the primary means used to transmit the results of their research to the user. Viewing the technical report as product, agencies of the federal government have created the necessary systems for disseminating, storing, retrieving, and otherwise making this medium available to the scientific and technical community.

The work by COSATI represents a significant treatment of the role of the technical report in the total STI communication process. While the work by COSATI represents a definitive treatment of the technical report, it did not address how to make the technical report more effective in communicating information to the user. The COSATI report recognized the need for, but stopped short of recommending uniform standards designed to enhance clarity, quality, and maximum utility. Many organizations such as NASA have developed publication standards to ensure clarity, quality, and utility of their reports and to prescribe the inclusion and arrangement of the components. The review of the literature revealed that bench marks for evaluating some of the components have been established. However, no critical evaluation of existing publication standards has been undertaken.

The preliminary findings of the NASA study revealed that (1) nearly one hundred components were used, (2) there was an apparent lack of consistency in the terms used for the components, and (3) there was an apparent lack of consistency in the location of the components. Further analysis and review of existing publication standards should be undertaken. Criteria for existing report components should be integrated and synthesized to establish a uniform standard for those components. Evaluative criteria should be developed for those components for which no criteria exist. Depending upon the purpose of the report and the audience, a standard for including specific report components should be established. Next, the proper sequence of the components should be determined. An empirical testing of these standards should be undertaken to ascertain the most effective choice and arrangement of components for transmitting information to the user.

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APPENDIX. - COMPARISON OF SIX STYLE GUIDES FOR NUMBER AND ARRANGEMENT OF COMPONENTS

COSATI	U.S. GEOLOGICAL SURVEY	HOW TO WRITE AND PUBLISH A SCIENTIFIC ARTICLE	APA PUBLICATIONS MANUAL	NATIONAL ACADEMY OF SCIENCES	NASA PUBLICATION GUIDE
Front Cover	* * *	* * *	* * *	Cover	Cover (but not described)
* * *	* * *	* * *	* * *	[Half-title page]	* * *
* * *	* * *	* * *	* * *	Frontispiece	* * *
Technical Report Standard Title Page	Title Page	Title	Title	Title page	Technical report standard title page
(with parts: abstract, authors, etc.)	(with parts: title, author)				(with abstract, title, authors)
* * *	* * *	List of authors and addresses	Author	* * *	* * *
* * *	* * *	* * *	Author's institutional affiliation	* * *	* * *
* * *	* * *	* * *	* * *	[Verso title page]	* * *
* * *	Frontispiece	* * *	* * *	* * *	* * *
* * *	Foreward	* * *	* * *	Foreward	Foreward
Preface	Preface	* * *	* * *	Preface	Preface
* * *	* * *	* * *	* * *	Acknowledgements	* * *
* * *	* * *	* * *	* * *	[Committee of panel members]	* * *
* * *	* * *	* * *	* * *	Letter of transmittal	* * *
Table of contents	Table of contents	* * *	* * *	Table of contents	Table of contents
List of illustrations	List of illustrations	* * *	* * *	* * *	* * *
List of tables	List of tables	* * *	* * *	List of tables and figures	* * *
List of abbreviations and symbols	* * *	* * *	* * *	* * *	* * *
* * *	Glossary (signs and symbols)	* * *	* * *	* * *	* * *
* * *	Abstract	Abstract	Abstract	* * *	* * *
Introduction	Beginning	Introduction	* * *	* * *	[First page of text]
Main text	Presentation of data	Materials and methods	* * *	* * *	Summary
Headings	Headings	* * *	Introduction	Introduction	Introduction
* * *	Footnotes	* * *	Method	* * *	* * *
Numbering systems	* * *	* * *	* * *	* * *	Symbols and units
* * *	* * *	* * *	* * *	Body	Main Body
* * *	* * *	* * *			Headings
Conclusions	The end	* * *	* * *	Headings	* * *
* * *	* * *	Results	* * *	Footnotes	* * *
* * *	* * *	Discussion	* * *	* * *	* * *
Recommendations	* * *	* * *	* * *	* * *	Descriptive information
Appendixes	Reference list	Literature cited	* * *	* * *	Mathematical presentations
Glossary of terms	Appendix	* * *	* * *	* * *	* * *
References	* * *	* * *	Results	* * *	Results and discussion
* * *	* * *	Acknowledgements	Discussion	* * *	* * *
Index	Index	* * *	* * *	* * *	Concluding section
Illustrations	Illustrations	* * *	References	References and notes	* * *
	Plates		* * *	Bibliographies	* * *
	Figures		Appendix	Appendixes	Appendixes
	Captions		* * *	* * *	References
Tables	Tables	* * *	* * *	Glossaries	* * *
Equations	* * *	* * *	* * *	Indexes	* * *
Composition	* * *	* * *	Tables	Tabular and graphic material	Tables
Workmanship	* * *	* * *		Tables	
				Illustrations	
				Half tones	
				Figure caption	
			Figures, graphs, illustrations	* * *	Figures
					Photographs
					Drawings
					Graphs
			* * *	Mathematics	* * *
				Symbols	
				Equations	
			* * *	* * *	Numbered items
			* * *	* * *	Makeup
			* * *	* * *	Page dimensions
			* * *	* * *	Typography

Note: *** asterisks indicate either complete absence of a particular component or absence of the component at a given location

Panel A-13

The Case Method in Technical Communication

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THE CASE METHOD IN TECHNICAL COMMUNICATION

Elizabeth R. Turpin, Chair
Houston Community College System

Welcome to Session A-13, "The Case Method in Technical Communication." My name is Elizabeth R. Turpin, of the Houston Community College System, and I will be serving as your Chair for this afternoon's session. Your Associate Chair is Pauletta Krum, of the Northeast Technical Community College, Norfolk, Nebraska. We feel we have an unusually interesting session for you this afternoon, one which should offer useful information and stimulation to all of you, whether you are old hands at teaching technical communications or are still concerned about what to teach on Monday morning.

One reason this session is a bit different from the usual conference program is that instead of being a group of papers submitted independently and selected to go together on the basis of a common topic, these papers constitute the results of a year of intensive work by the speakers as the members of the Casebook Committee of the Association of Teachers of Technical Writing (ATTW). Today's papers offer a cohesive view of what a case is, how one should be constructed, a look at what a comprehensive, "holistic" case is like, how to use cases in the classroom teaching of technical communication, how students have responded to the use of cases, and the argument for the use of cases rather than the standard research approach using the library. At the request of the Committee, it is my pleasure to extend to all of you the invitation to submit case studies to elicit reports, letters, proposals, and illustrations/graphics from students in technical communications in two- and four-year college classes. These cases, which will be considered for publication in an anthology of case studies to be published by the ATTW, can be based on a variety of technical subjects (in science, engineering, general technology, etc.) as well as being directed toward students with a variety of technical backgrounds and levels of expertise. Inquiries and manuscripts should be submitted by November 1, 1981, to John Brockmann, Division of Technology, College of Engineering and Applied Sciences, Arizona State University, Tempe, AZ 85281.

The members of the committee, and your speakers this afternoon, include John Brockmann, Chairman, to whom we owe the organization and development of the session today; Jone Goldstein and Barbara Couture, Wayne State University; Susan Feinberg, Illinois Institute of Technology, Chicago; Marcus Green, Cincinnati Technical College, Ohio; and Susan McDonald, St. Louis Community College at Meramac. During the remainder of this introduction, I will be giving you some added background about each speaker and his or her topic for today's session. Today's papers, though shortened for the oral presentation, represent material to be included in Technical Communication Casebook I.

Our first speaker this afternoon is John Brockmann, who will be explaining what a case is in the course of his topic, "The Case Method and Technical Communication Pedagogy." John currently is an Assistant Professor for Technical Communications at Arizona State University. He is co-editor with Paul Anderson and Carolyn Miller of an essay anthology, New Essays in Technical Writing and Communication to be published in 1982, in addition to authoring several recent journal articles in technical communications. John, who also has chaired the ATTW's Technical Writing Casebook Committee, is a consultant writer and in-house trainer with Sandra Pakin and Associates in Chicago; Words Unlimited in Phoenix, Arizona; and the United States Civil Service Commission.

In showing how the case method is an effective way to present real-life communication problems to students in order for them to orient to the decisions they will have to be making on the job in order to communicate effectively, John outlines the case method by: (1) defining the discrete features of cases in technical communications, (2) describing the philosophy of the case method, and (3) providing a comprehensive annotated bibliography. Having cases for students to work with gives some real-life dimensions to otherwise highly artificial assignment situations in the technical communications classroom. Teachers, for the most part, have not had available information on how to construct cases for themselves, and it is often not feasible for classes to make extensive field trips. John will be discussing the six discrete features of a case in technical communications which are important: (1) verisimilitude, (2) fullness of the rhetorical context, (3) emphasis on communication as a problem-solving technique, (4) focus on communications, (5) interconnectedness of theory and practice, and (6) difficulty, incompleteness, and openness to divergent solutions.

In applying all of these characteristics to the development of a useful case, the focus will lie in making the case a base for effective, relevant rhetorically based communication assignments to develop the ability of students to analyze needs and communication strategies to meet reader expectations in a responsible way. Because of the realistic base for good cases, students will be able to correlate effectively theory and practice in their communication assignments using a case devised on the above principles. Examining the various sources which John has brought together and annotated provides a wealth of added resource material from both technical and business disciplines.

Our second speakers are Barbara Couture and Jone Goldstein of Wayne State University in Detroit, who will be jointly presenting the topic of "How to Develop and Write a Case for Technical Writing." Barbara Couture is the Assistant Director of Composition at Wayne State while Jone Goldstein is the Coordinator of Technical Writing at Wayne, and both teach technical communication for engineers. Together they have been developing and writing cases for the past two years; recently, their casebook text has been accepted for publication. For the ATTW casebook, they have developed a full-scale "holistic" case, and a set of procedures for casewriters to use in preparing technical communications cases. Their paper here highlights both a case and casewriting procedures. In describing the case and steps to use, Couture and Goldstein explain that a case needs to include a cohesive persona of a technical professional, reflect the entire technical writing context and process, include narrated and dramatized but realistic technical and professional details of a completely factual situation, and be presented in the form of a case upon which realistic communication assignments can appropriately be based, ones which will challenge the student to resolve a communications problem effectively. The four major stages to be discussed today by your speakers include: (1) design the case, (2) collect the facts, (3) create the fiction based on the facts to develop the case, and (4) actually construct the case. Couture and Goldstein also recommend testing the case, as they have done, to assure its usefulness and validity.

To assist the user/developer of cases, Susan Feinberg, your next speaker, devised an instrument and used it to explore student attitudes statistically. Susan, whose topic this afternoon is "Evaluating the Effectiveness of the Case Method," is Director of the Technical Communications Program at Illinois Institute of Technology, where she has taught communication and writing since 1964. She has had experience in preparing and editing technical proposals and reports, as well as having published articles on technical writing for technical, medical, and communication journals. She has also conducted writing workshops in proposal and technical writing, in addition to being a writing consultant for the Educational Testing Service, Princeton, New Jersey.

Susan will be discussing an instrument she designed and tested which is based on a self-report questionnaire based upon the Writing Apprehension Test developed and tested by Daly and Miller (Research in the Teaching of English, 1975). The questionnaire's 26 items reflect three categories which encompass ideas and skills usually taught in technical communication programs: (1) rhetorical principles, (2) planning strategies, and (3) drafting skills (including ability to use data and to communicate in writing). Susan will be showing not only the results of the tests which were conducted, but the way in which the instrument was designed and validated. The pilot study she reports on suggests that an empirically-based, standardized instrument may be used to measure change in student attitude toward technical writing.

Our next speaker, Marcus Green, of Cincinnati Technical College, Ohio, is currently an instructor whose primary job is teaching composition and technical writing to engineering technology students. He has spent considerable effort in improving and developing this course, and has presented two formalized papers in this area, one in 1976, which explained course objectives, and one in 1979, Re-Evaluation and Adaption--Revising a Course to Meet Graduates' Needs. In his paper this afternoon, Marc will be discussing, "Using Case Studies to Teach an Engineering Technology Technical Writing Class."

Marc points out in his paper that students need to be aware of the objectives of a technical communications course and of how cases help to achieve them. He advocates focusing on students recognizing how to solve communication problems, identify audiences, plan written communications, present them properly and use visual aids properly. Marc explores the process of role-playing and developing class discussions to help students utilize their own intelligence, skills, and past experience in reviewing, analyzing, evaluating, selecting data and alternative solutions, etc., in planning their communications based on cases. The successful solutions, Marc explains, are based on the students' ability to deal with facts and figures based on a set of criteria, but will vary from student to student. The discussion this afternoon suggests a rating system based on standards for evaluating case solutions to determine how well they meet the assigned rhetorical tasks as well as the various managerial tasks also found in many cases.

The last speaker this afternoon is Susan McDonald, of St. Louis Community College at Meramac, where she is an Associate Professor of English. Susan has had experience as a program director of an interdisciplinary studies program, plus other activities as a newspaper journalist, Fulbright Exchange Teacher, National Endowment for the Humanities Fellow, and Modern Language Association Fellow. In her presentation this afternoon, Susan explores some additional rationale concerning the use of case studies in her topic, "Why Use Case Studies Rather Than Simulation-Gaming Techniques or Library Research?"

In her presentation, Susan emphasizes that, despite the focus on teaching initiative and creativity through simulation-gaming techniques and library research, case studies, she believes, provide greater opportunities for students to develop good skills as researchers and writers through experience in the problem-solving dimensions as they relate to real-life communication tasks. Susan also outlines some effective approaches to teamwork use of case study assignments, plus the opportunity to monitor or regulate reading level and comprehension by students. She explains that other positive aspects of using case studies relate to more realistic thinking and composing processes, including choice of organization and format. Such choices, through the use of case studies, she points out, tend to have greater relevance for the student who is utilizing the case study approach. Likewise, the student is really being ultimately better prepared to make such choices he or she will be faced with in real life as a working writer in solving communication problems.

In our session this afternoon, we have asked that you lend us your ears as we journeyed through the development and use of the case study process in teaching technical communications. Now, in the time remaining, we invite your questions, and if we run out of our allotted time, members of the speaker panel will be available to continue answering questions on a person-to-person basis. Thank you for your time, interest and attention to the presentation of the case study approach to teaching technical communications.

WHAT IS A CASE?

R. John Brockmann
College of Engineering and Applied Sciences
Arizona State University

ESSAY THREE

THE CASE METHOD AND TECHNICAL COMMUNICATIONS PEDAGOGY

The case method is an effective way to present real-life communication problems form the commerical world in tehcnical communications classrooms. This essay outlines the techniques of this method by:

* Defining the discrete features of cases in technical communications;

* Describing the philosophy of the case method; and

* Providing a comprehensive annotated bibliography.

* * * * * * * * *

The Problem

The case method can be one of the most effective ways to integrate the commerical world with the academic world. Classes may not be able to visit industrial sites physically, yet the communication problems of industrial sites can daily be brought into the classroom in the pages of a case. Recent textbooks such as Coleman and Brambley's The Technologist as Writer (Random House, 1978) and Blicq's Technically Write (Prentice-Hall, 1972) have capitalized on the case method by including sections employing it for writing practice.

However, as far as the classroom teacher is concerned, the textbook cases seem to have appeared magically, the production of textbook writers' esoteric knowledge. The teachers cannot produce cases for their own students because there are no articles, books, or courses which explain how cases are produced--at least there seem to be none. As a result, teachers are left with a few textbook cases that are soon over-used and out-of-date. So long as the methodology of the case method remains in the hands of a few textbook writers, the case method falls far short of its promise.

This essay intends to begin putting the methodology of the case method in the hands of the practicing technical communication teacher. This essay has three objectives:

* To define six discrete features of the most effective classroom cases;

* To describe the philosophy of the case method so that teachers can see how the case method can be adapted to their own uses; and

* To provide a comprehensive annotated bibliography on the case method, including analytic articles and casebooks from technical communication, as well as those from three other closely allied disciplines--engineering, business communications, and general composition.

The Definition of a Technical Communications Case

Six features can be used to describe a case in technical communication. Before going into these individual parts, one needs to observe a complete example of a technical communication's case. The next few pages come from James Brown's 1961 book, Casebook for Technical Writers. This book is the only published technical communication casebook, and it offers teachers in the 1980's the best model to imitate. The specific case from this book, which is used as an example in this essay, is a relatively short case concerning an Air Force surplus fuel valve. The case, reproduced in facsimile on the next few pages, is entitled "Dwight D. Duane and the Automatic Shutoff Valve."

Dwight D. Duane and the AUTOMATIC SHUTOFF VALVE

Background Required:

Section I – General
Section II – Basic Electricity

I

Your name is Dwight D. Duane, and, at the moment, your address is the Chloride Pilot Installation, Yarbron Corporation, Box 361, Kingman, Arizona. Not that you're anywhere near Kingman–you're up in the country north of it, beyond the little town of Chloride. It's a wild and lonely place, and nobody has ever told you why Yarbron decided to put their pilot installation out here. It *could* be because some of the stuff you are working with is tricky business. At any rate, here you are.

Your boss's name is Phil Marlowe; he's a hot-shot physical chemist from some place in the East–M.I.T., probably. His boss is Doc Sunders, Chief of Research and Development, who thought up the pilot installation in the first place. A couple of dozen other people are around the place–technicians, a few typists, etc. You figure you're about halfway up (or down) in the pecking order.

Right now the place has turned into a madhouse, as you all knew it would, because, for some reason, the Yarbron officials have decided to move the pilot installation–lock, stock, and tower–to another location, near Bakersfield, in California. They want to label all the parts, ship them to Bakersfield, and put them back together.

You're minding your own business–finishing up the summaries of the last 22 runs–as calmly as anyone could in the circumstances, when Phil barges in on you.

It's an emergency, of course. So you go with Phil to his office, and on the way he explains. The entire plant has to be described so accurately

Figure 1. Facsimile of Case from Casebook for Technical Writers

that the Bakersfield boys can put it together and start it operating as soon as the pieces arrive, without ever having seen them before. The trucks are scheduled to begin carrying the disassembled plant away the next morning; all records of what goes where have to be made before then, because those boys will take things apart faster than a tornado. Phil must leave in two hours for a Yarbron meeting in Los Angeles, Sunders is already in Los Angeles, and nobody else knows enough about the main shutoff valve to handle the job of telling anybody about it. You propose several objections to the idea of your doing anything about this problem, but Phil has thought of all of them—and not one does you any good.

"It's really a simple enough matter," Phil says. "I'll explain the valve to you; you write it up, because I don't have time to and nobody else can; and Bakersfield will be just as happy as if it knew better."

It turns out that the valve governs the flow of toluene to the main pilot unit. It sits under the toluene supply tank, Phil tells you, with only a little pump between it and the tank; and all the toluene that goes into the pilot unit must go through that valve. "It lets us stop things real fast, if we have to," Phil says. "Air Force surplus. Came off the fuel system of an airplane."

He takes you to his office in the control shack. He says, as you go in, that what they need is a write-up which tells what the valve is, what its major elements are, how it operates, and how to remove and replace it.

"It's a gate-type valve," Phil says, rummaging in his desk. "Here's an illustration of it." The illustration looks like this:

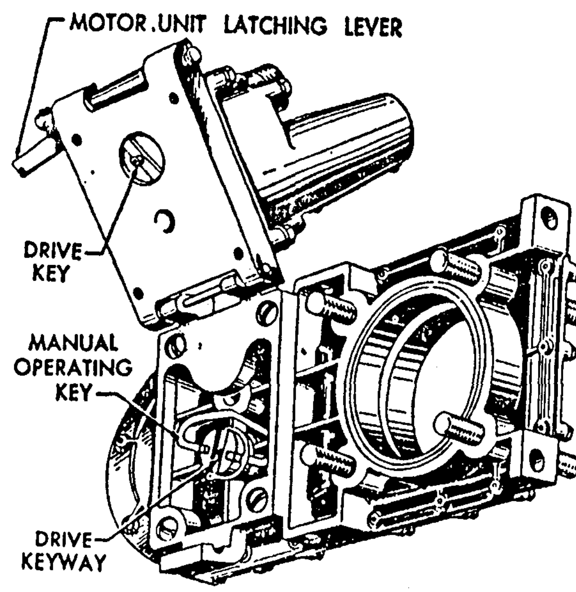

Figure 1 (cont.)

"It's called a shutoff valve; it's motor-driven, as you can see, and it has just two positions—open and closed. In the terminology, that's non-modulating. It fits 2-inch tubing; and there's a kind of flange that goes over the tubing and onto these four bolts that are sticking out here on the right side of the picture. That fit is sealed with an 'O' ring—you can see here where it fits onto the valve." And you guess, by looking, that the same thing happens on the other side.

"Now," Phil says, "it's a little tricky because of that non-modulating characteristic. The valve gate is operated by some gears in there; and when you rotate this thing with the drive keyway and the manual operating key on it through 180 degrees, that's called a 180-degree rotation of the valve. But what really happens is that this gate visible on the left slides across the opening where the tubing bolts on. Get it?"

You have to admit that you get it.

"That's what the manual operating key is for—so you can shut the thing off if the power goes out. But we've never had to use it," Phil says. "Now this motor housing drops down and latches here on the bottom: you just lift up this latching lever, let this bar on the bottom of the motor unit fit into the hook on the bottom of the valve body, and then push the latching lever down. But make sure the drive key and drive keyway are both at the same place—open or closed—or it won't indicate properly on the control panel. They'll each be at one end or the other of the 180-degree swing, of course." Then he looks at you suddenly. "Unless something's jammed," he adds, as if he just thought of it.

You decide you'd better begin taking some notes; so you stop Phil long enough to get a pencil and some paper from his desk.

"Now the motor unit," Phil says—he seems to be in a hurry. "The motor unit has another tricky little bit to it because of the non-modulating characteristic of the valve operation. The motor also rotates through only 180 degrees; it's non-modulating, too. A couple of switches inside the motor unit case stop it at each end of that 180-degree swing. They're called the open and close position limit switches."

Somehow you are moved to comment. "The top of the rotor never gets to see the bottom of the stator, does it?" and all you get for it is a dirty look.

"Being from an airplane," Phil says, "it is, naturally, a 24-volt d-c motor . . ."

"Naturally," you say.

He ignores you. ". . . and it is, of course, removable from the valve unit by removing this little rod here where it hinges."

"Fine," you say. "I've got it. Is that all?"

"No," he says. "There's just a little more."

And it turns out that there is.

Figure 1 (cont.)

II

"Now, you can't see it very well on the illustration," Phil says, "but there's a place for four electrical connections on that motor unit."

"Four?" you say, a little incredulously.

"Son," Phil says, "there's always at least four connections on *anything* that works automatically. That's known as Marlowe's law, for the brilliant guy who discovered it." And those connections, you learn, require some explaining. "As I said, it's a 24-volt, d-c system," Phil says. "The motor has to get those 24 volts, and that's two leads—they're labeled MOTOR INPUT on the case there. One of those leads goes to the generator unit, the other to the switch here on the control panel; and from that switch one lead goes to the other side of the generator." He pauses while you jot awhile. "OK?"

"OK," you say.

"The motor will run if we turn on this switch," he says, indicating the control panel. The switch is a toggle affair, with the words MAIN SUPPLY VALVE under it and OPEN on one side and CLOSE on the other. "But when it's run just so far, it'll hit one of those limit switches. The switch will shut off the motor and reverse the polarity, so it'll run back the other way when it's turned on again. The polarity reversal is a fairly simple matter; it's all contained there in the case with the switch itself, and the motor lead-in lines really go to that reversal switch first. But the shut-off business is a little more complicated. For that we've got to operate a relay here on this control switch on the panel; and that relay, anytime it operates, sort of re-cocks the control panel operating switch. Then, when the switch is flipped the other way, it really closes the connection to the motor again, and the motor operates."

"Yeah," you say.

"So we have two leads into the limit switches. They are the two d-c lead-in voltages, and they come off the motor input leads. They come out as limit switches' output: one from the open limit switch, called the OPEN OUTPUT, and the other from the close limit switch, called the CLOSE OUTPUT. The one from the open limit switch leads to an OPEN indicator lamp on the control panel and to the relay on the main control switch—it's a parallel connection. Both the indicator lamp and the relay have leads coming out of them to the other side of the generator. And the same thing goes for the close limit switch, except it goes to the CLOSED indicator lamp on the control panel."

"Well, maybe," you say.

"Of course," he adds, "inside the motor case, the two leads into the limit switches each hit both switches."

"Sure," you say.

Figure 1 (cont.)

"So the whole thing winds up like this," he says. "I can open the valve by putting the control panel switch on OPEN. When the valve is open, the OPEN light goes on, the motor stops, and everything is hunky-dory. Then, when I want to close the valve, I flip the control switch to CLOSE, the OPEN light goes out, the motor runs until the valve is closed, the CLOSED light comes on, and the motor stops. And vice versa. Neat, huh?"

You suddenly realize that the guy is *proud* of the way that valve works.

But he apparently doesn't have time to stick around. In three more minutes he's gone. Then he sticks his head in the door about forty seconds later. He is out of breath and has obviously been running.

"I forgot to tell you," he says, "there's a two-way relief valve in the body of the valve proper—to allow for thermal expansion of the stuff trapped in the tube when the gate is shut."

Then he's gone for good.

APPLIED ASSIGNMENTS

1. After telling you all about the valve and dashing off, Phil calls you from Kingman. He was waiting for the plane, he says, when he remembered that he should have told you to write up a simple explanation of how to operate the valve from the control panel, along with a brief but very clear explanation of what was going on when the valve operated, and to be sure to include emergency procedures. All of this is to go into the control panel operator's instruction manual, and that operator is probably not the most brilliant man in Bakersfield.

   Write the material for the operator's manual. (A)

2. As far as you can tell, the person who's really running the place with Phil and Sunders gone is Christine, Sunders' secretary. It's Christine who gives you your first reasonably clear idea of what you're supposed to do about the valve.

   "What they're doing," Christine says, "is they're making up a sort of self-contained report for each piece of machinery in the whole pilot plant. It's Mr. Marlowe's job to put all the reports together and write up the general systems description. What they want from you is a complete, self-contained presentation of that valve, I'm sure. Description, operation, installation and removal, warnings—anything that somebody who's going to have to have it in his pilot plant might want to know. Mr. Marlowe's not going to Bakersfield, you know." And that's how you picked up the gossip on Phil's next assignment.

Figure 1 (cont.)

Now that you know generally what you're supposed to do, you can get to work. You decide first to present a sort of block diagram of the valve and control board system, and after that the details about the valve itself. You find out that the valve has been assigned the symbol TR-3-112 in the general schematic labeling of the pieces of the plant, and that the control panel section related to the valve is CO-9-13. You can use these symbols for keys to label the whole report, so that Marlowe can put it in its proper place. The report, you figure, will be more like a description and instruction manual than anything else you've ever heard of.

Write the report. (B)

3. You complete your valve report, and Christine gets it typed in quadruplicate. Then Marlowe shows up one day, still in a hurry, and carries all the records and files away in a pickup truck. Three days after Marlowe's departure, you come into Sunders' office to clear up matters before your own departure, and Christine is waiting for you. "Mr. Duane," she says, close to tears, "somebody goofed."

This doesn't seem really remarkable, and you tell her so. Then she becomes a little hysterical and wails, "But it might have been me!" When she finally gets calm, she tells you that Albert Lederle, Superintendent of Development at the Bakersfield installation—who's even higher up in Yarbron than Sunders is—has just called from Bakersfield. He was in something of a snit because the dope on the main shutoff valve was not in the box of papers they received on how to assemble, adjust, run, and maintain that pilot plant. Lederle had said that this information was needed before morning, and somebody at Chloride Pilot Installation had better get it to him pronto, or heads would be dropping right *and* left. He was pretty emphatic, you gather. Christine says she is "*pretty* sure" the valve report was in the stuff Mr. Marlowe took off with him, but she doesn't really know—and she wails some more.

As usual, neither Phil nor Sunders is available for Lederle to get the dope from—so it's up to you. And you have only your set of notes and your memory of what went on while you listened to Phil and wrote the report. After thinking over what it is that Lederle needs and what you can give him, you drive to the Western Union office at Kingman and compose the clearest, most helpful, most informative, and most effectively organized telegram you've ever seen. You send it to Lederle collect, because the Chloride Installation budget has been recalled to Yarbron headquarters. And you get to sign your title to it, too: Assistant Design Engineer.

Write the telegram. (B)

Figure 1 (cont.)

4. You're sitting around waiting for your ride into Kingman—you're about the last man to leave the Chloride Installation area—and there's nothing much to do. Suddenly it occurs to you that the valve is complicated enough to have things go wrong with it. And when that happens, then what? you ask yourself. The answer is that you should have another valve to put in its place.

   So you kill some time by writing a letter—or the draft of a letter, for Sunders' signature—to the Air Force Surplus Office nearest Bakersfield. In the letter you try to describe the valve so that the man behind the desk in the Surplus Office can tell you what you want to know—namely, whether it is now available, where it can be obtained, and how much it will cost. You don't know the address of the Surplus Office, but you figure you can get that in Bakersfield. And getting this letter done all except for the address might save some time.

   Write the letter, for Sunders' signature. (A)

Figure 1 (cont.)

Six discrete features of a case in technical communication can clearly discerned in this case. These six features are:

1. Verisimilitude

2. Fullness of the rhetorical context

3. Emphasis on communication as a problem solving technique

4. Focus on communications

5. Interconnectedness of theory and practice

6. Difficulty, incompleteness, and openness to deivergent solutions.

Each of these features is discussed below:

1. A Case Must Have Verisimilitude

The first characteristic of a good case is one which really distinguishes it from conventional textbook exercises. It is the verisimilitude of a case. Good cases have the feel of reality both in their content and in the followup activities students are called upon to perform.

Verisimilitude of content in cases is a great drawing card for cases because it makes instruction seem more relevant to students. Relevance motivates students to excel in their academic tasks as do few other teaching techniques. G. H. Flammer wrote about this quality of cases in Engineering Education when he said:

> One of the biggest benefits realized from case studies is the student perception of the reality of the problems and their relevance to his or her immediate professional practice. Perceived relevance is a strong motivator.[1]

However "perceived relevance" is not enough. Realistic "busy-work" is as useless to the student as the non-realistic "busy-work" offered in some conventional textbooks. Assignments which accompany cases must call upon the same complex of skills that will be called upon after graduation when students are on the job.[2] Verisimilitude in assignments means that skills called for by the assignments are not artifically isolated from one another, and that the whole communication task from invention to editing to layout is involved in the student's response.

The Automatic Shutoff Valve case illustrates the quality of verisimilitude in content and assignments in a number of ways. Names, dates, and even post office box numbers--all the minutiae taken for granted in real life--are quickly laid before the reader and incorporated into the problem. All the jibes and ironic repartee of Dwight and Phil display the mark of hurried improvisation--improvisation usually absent in sterilized textbook exercises. Facts and figures concerning valve engineering are all present for the reader exactly as they would be for an expert such as Dwight Duane in real life. The verisimilitudinous urgency of the case invites the reader to participate in this fictionalized reality, to think the way Dwight thinks. Finally, verisimilitude in the case assignments is clearly evident in the choice of activities connected with the case: an operator's manual, a report, a telegram, and a business letter.

Verisimilitude is an important feature of the case method, but it is matched in importance by the second characteristic of cases, the fullness of their rhetorical context.

2. A Case Must Give Students a Full Rhetorical Context

Writers in the real world of business, commerce, and industry always write:

For a specific purpose,
To reach a definite audience, and
Within a definite role.

Cases must always include a purpose, an audience, and a writer's role if they are to reflect communication in the real world. The Automatic Shutoff Valve case includes this complete rhetorical context as illustrated by assignment three. There the purpose of the communication is to ensure proper operation of the valve in a production system. The audience for the communication is the Superintendent of Development, Albert Lederle. And the writer's role is one of an Assistant Design Engineer in a terribly tight political spot.

These three rhetorical components of purpose, audience, and role are the very elements that have been so sadly absent in standard textbooks and conventional classroom exercises. By not confronting these basic parts of a real writer's rhetorical context, textbook authors and classroom teachers have handicapped student writers. Recently composition theoreticians have given considerable attention to the effects of such an incomplete rhetorical context on students.[3] This new theoretical awareness is an additional impetus for employing the case method in the classroom. Critics may disparage the verisimilitude of cases, claiming that it panders to misguided cries for "relevance" in instruction. However, the completeness of a case's rhetorical context gives case method proponents a systematic theoretical foundation. As Wayne Booth pointed out so well in "The Rhetorical Stance," a student will always find it difficult to write until "his rhetorical problem is solved, that is, he has found a definition of his audience, his role and his argument."[4]

Writing within a role while working on a case, however, is not an end in itself, as it may be in some sociological simulation-gaming. Rather, role-playing in a technical communication case is a means for developing conflict in the fictive reality of the case--conflict that increases the psychological involvement of students. Conventional textbook exercises do not invite personal involvement from students via role-playing; instead they deal with the student only as a student and do not stretch or challenge his view of himself and his capabilities as case roles do. By not inviting a student's psychological involvement in the assignment via role-playing, conventional textbook exercises become assembly-line artifacts--useful, but drab and artificial.

One additional point about cases and roles needs to be made. The role should be consistent in the narrative description of the case and in the assignments appended to the case. Often in the assignments appended to cases, case designers address the reader as a student and not in the fictive role that was so carefully developed in the narrative text of the case. If the case writer breaks the student's assumed role by the clumsy construction of assignments, all the drama and interest quickly disappear, and the case assignment becomes just another textbook assignment.[5]

The Automatic Shutoff Valve case is a model of how to invite the student reader to play a role. The very first word in the case is "your" and the continual repetition of these second person pronouns in the text of the case, slowly replace a reader's normal role with the fictive role. The style of the case is such that the student's activity of reading duplicates the course of his assumed character's thoughts. However, the development of the case is conventionally chronological so that is is not temporally confusing. Phil, the character's antagonist, is someone everyone has had experience with and someone everyone finds irritating. And, the informality of the language draws the reader into a more intimate identification with the character.

3. A Case Must Present a Problem Which Illustrates How Communication is Part of the Problem-Solving Process

Career-oriented students, like everyone else, have learned too well to compartmentalize their experiences. To them, only courses in engineering, business management, or statistics can provide tools to solve future on-the-job problems. English, writing, and technical communication at most, provide a method of recording the solutions to problems after the fact for files or government bureaucrats.[6] As the Automatic Shutoff Valve case clearly illustrates, however, effective technical communication is often the key to solving problems. Assignment four in the case calls for a letter requesting information from the Air Force concerning a replacement valve. This letter is not just meant for Saunder's files or to fill up Dwight's empty time. This letter is the only way to get availability and cost information from a person who probably will have difficulty giving the correct information without the part's specific piece number. No calculus formula, management theory, or engineering technique can replace an effective letter in this situation. Cases in technical communication must construct their communication problems so that students see that communication is a central aspect of problem-solving in the daily life of business and industry.

4. A Case Must Be Focused on Technical Communication

Case designers must not lose tract of their original goal--to teach technical communication --in their quest for verisimilitude. The goal is not to teach statistics or flow ratios even though a great quantity of such details would increase the case's versimilitude. Digesting and solving the technical details of a case should not take up an inordinate amount of the student's time. Rather, the majority of his time and effort must be spent on the problems of communication. This necessary factor of a technical communication case is well illustrated in the model case. The Automatic Shutoff Valve case gives the readers all the electronic, mechanical, and design features of the valve. Therefore, the student does not have to spend much time doing arithmetic or geometry in order to solve the problem.

5. A Case Must Embody a Functional Relationship Between Theory and Practice

Students must be able to "discover" widely applicable principles of effective communication through the working out of the particular case. Teachers should not expect cases to do the complete job of teaching basic communication principles. However, teachers should also not expect cases to leave students mired in the idiosyncracies and pecularities of the particular case. Communication principles must be intentionally interwoven into the fabric of the case. In fact, the writing of cases begins with the principles and leads to the particulars of the case not vice versa. Robert Weiss has observed this intentional interweaving of principles into the fabric of a case when he said at a Modern Lanugage Association convention panel in 1978

> . . . the structure of each case is determined by rhetorical precept and necessarily guides the reader-writer. Further, the implied percepts are intimately connected to the subjects the students write about and are given dramatic force by the case situation.[7]

The interplay between a case's verisimilitude in the particulars of the case and its theoretical purposefulness needs to be handled in a balanced way. Material for cases cannot be taken willy-nilly from the commerical world just because it is interesting material, not can the content of a case be totally fabricated. Rather, case designers must go out to the commercial world for their case material. Then they must carefully select and arrange that material according to the theoretical principles they hope to demonstrate with it.

The interweaving of principle and particular can be seen in the very first assignment of the Automatic Shutoff Valve case. The first assignment asks the student to write an operator's manual to the plant operator in Bakersfield. In writing a particular manual for a particular person, the student will quite naturally confront the ideas and principles of audience analysis, format considerations, graphics, and procedure writing.

6. A Case Must Be Difficult, Incomplete, and Open to Divergent Solutions

Problems in the commercial world are difficult in part because they are usually surrounded by superfluous facts and issues. So it also is with a case. A case presents a problem surrounded by superfluous details. This requires students to be selective in the details they choose to use in solving the case. Conventional textbook exercises often diminish the need for student's critical selectivity by being overly sparing in the number of details they include.

Cases are also difficult because the narrative or descriptive presentation of the case problems is not the same rhetorical mode as the analytical or evaluative assignments they elicit. Because of this difference, students must become more rhetorically flexible, as they will have to be in the rhetorically mixed commercial world. Conventional textbook exercises are often in the same rhetorical mode as the responses they seek to elicit, and thus offer little challenge to the student's flexibility.

However, even through there are usually superfluous details and issues in a case, there is also a great deal of incompleteness in a case. In the classroom someone always notices a missing fact or piece of data. This incompleteness becomes an asset in stimulating classroom discussion and in forcing the student to experience what so often happens to engineers or executives in the real world. It also allows them to use their imaginations. Like the real-life engineer or business executive, the student must develop logical fictions in order to supply details and data that are missing. Case designers, however, need to be deliberate in the facts omitted from a case. There must always be a sufficient amount of data from which students can intelligently extrapolate these logical fictions.

Since extrapolation plays such a large part in the case method, cases should also be solvable by divergent solutions. A case is necessarily open to divergent solutions because it reflects the intricate variables in real situations which usually defy the efforts of strict formulas and strict dogmas to solve them. Most often a compromise between alternative solutions is the most effective technique.

The Automatic Shutoff Valve case readily illustrates how a case is difficult, incomplete, and open to divergent solutions. Assignment three of the case is made difficult because the reader is inundated with such superfluous information as the type of vehicle Phil drives. Christine's hysteria, her confusion regarding the whereabouts of the report, and the recall of the Chloride Installation's budget. The case assignment is also difficult because the narrative mode of presentation sharply contrasts with the analytical mode and abbreviated style called for by the telegram assignment.

Assignment three is incomplete because it fails to describe exhaustively the telegram's primary audience, Albert Lederle. How technically knowledgeable is he? What is his immediate communication need? With the audience and his needs largely unknown,[8] a wide variety of equally valid telegrams can solve the assignment's problem.

The six discrete features discussed above are the inner works of the case method. It should be clear from the discussion of these features that the methodology of the case method is not beyond the skills of an ordinary teacher. The next section on the philosophy of the case method reveals how easily the case method is suited to many current beliefs in education.

The Philosophy of the Case Method

The case method is based upon a philosophy of education which posits change in the environment as an ever present factor. Since change is ever-present, an education sending students out into the world equipped only with a treasury of facts and skills is an incomplete education. A true education, according to this philosophy, not only gives students a treasury of facts and skills, but it also gives students the ability to adapt these skills to a changing environment. The case method requires the adaptation of a student's repertoire of skills to the novel situation of a case.[9]

Since both problems and solutions are ever-changing according to this philosophy, students need the ability to appreciate alternative solutions to problems. To be locked into one solution resulting from one set of logical suppositions is to court blindness and obsolescence in thinking. Thus, cases are designed to be open to divergent solutions.[10]

Finally, the philosophy underlying the case method recognizes that an education geared to develop problem-solvers and designed to develop an appreciation of alternative solutions must actively involve the student. Students cannot passively incorporate others' thoughts. Students must discover principles, not just hear about them in lectures; and they must solve problems, not just read about their solutions.[11]

With these three philosophical tenets in mind, teachers can clearly see how the case method is easily adapted to many current trends in technical communication. It embodies the new emphasis on teaching the process of technical communication. It also requires students to apply their heuristic and invention techniques as few other tehcnical communication pedagogical techniques can.

Teachers of technical writing in the 1980's are well aware that only a heuristic creative pedagogy will produce students who will be successful in the 1980's and beyond. Thus, the time is right for the case method to regain a place in technical communication pedagogy.

Footnotes

[1]Gordon H. Flammer, "The Case Study: Exercise in Simulation," Engineering Education 68 (February 1977): 372.

[2]David Tedlock, "The Case Approach to Composition," College Composition and Communication, forthcoming, p. 9. See also Robert Hays, "Case Problems Improve Tech Writing Courses and Seminars," Journal of Technical Writing and Communication 6 (1976): 296.

[3]The composition theoreticians giving considerable attention to the effects of an incomplete rhetorical context on students include: Richard Larson, "Teaching Rhetoric in the High School: Some Proposals," English Journal 55 (1966); James Moffett, Teaching the Universe of Discourse, (Boston: Houghton Mifflin, 1968), p. 12; Frank D'Angelo, Process and Thought in Composition (Boston: Winthrop, 1977), p. 23; John Warnock, "New Rhetoric and the Grammar of Pedagogy," Freshman English News 5 (1976): 15; and Linda Flower and John R. Hayes, "The Cognition of Discovery: Defining a Rhetorical Problem," College Composition and Communication 31 (February 1980): 25

[4]Wayne C. Booth, "The Rhetorical Stance," College Composition and Communication 14 (October 1963): 139.

[5]For an example of this problem, look at the assignments in Mary C. Bromage's Cases in Written Communication (Ann Arbor: University of Michigan, Bureau of Business Research, 1964).

[6]Ben E. Barton and Marthalee Barton, "Bridging the Gap Between Student and Engineering Professional: The Case Method in a Technical-Communication Course," paper presented at a College Composition and Communication conference in Minneapolis, Minnesota, April 1979: 3-4, p. 13.

[7]Robert H. Weiss and John P. Field, "Cases for Composition: A Theoretical Model for Writing Instruction," (Bethesda, Md.: ERIC Document Reproduction Service, ED172194, 1979): 15.

[8]Walter Ong in his article, "The Audience Is Always a Fiction," Proceedings of the Modern Language Association 90 (1975): 5-12, suggests that all writers' audiences are implied or fictive.

[9]Arthur Stone Dewing, "An Introduction to the Use of Cases," The Case Method of Instruction, A Related Series of Articles edited by Cecil E. Fraser (New York: McGraw-Hill 1931), p. 13. See also Charles F. Fisher, "Being There Vicariously by Case Studies," In On College Teaching edited by Ohmer Milton (San Francisco: Jossey-Bass Publishers, 1978), p. 260.

[10]Dwight Little, "The Case: Milieu and Method," Journal of Business Communication 8 (Summer 1971): 31-32.

[11]Wallace B. Donham, "Business Teaching by the Case Method," The Case Method of Instruction, A Related Series of Articles edited by Cecil E. Fraser (New York: McGraw-Hill, 1931), p. 16.

Case Method Annotated Bibliography

Technical communication fledgling use of the case method necessitates that one examine not only the published work done in technical communication's but also the continuing published work done on the case method in three other disciplines--engineering, business communication, and general composition.

Thus this bibliography is not only divided into analytical articles and casebooks, but also into materials drawn from engineering, business communications, general composition, and technical communication.

From Engineering

Analytical Articles

Flammer, Gordon H. "The Case Study: Exercise in Simulation." Engineering Education 68 (February 1977): 372-373.

This article reviews the use of cases and simulation games to bridge the gap between the classroom and the workplace. It also examines various elements of each technique along with suggestions to teachers on how to implement them in the classroom.

Fuchs, Henry O. "Outside Reality Inside the Classroom." Engineering Education 61 (March 1970): 745-747.

This article discusses how cases can bring outside reality to the classroom. It examines the use and effects of cases on learning.

Kardos, Gordon. "Pointers on Using Engineering Cases in Class." Engineering Education 69 (January 1978): 347-349.

This article specifically discusses how engineering teachers can use cases in the classroom. It analyzes the instructor's role, the methods of case discussion leadership, the physical arrangement of the classroom, and teaching preparation.

Vesper, Karl H. "Teaching Objectives, Style and Effect with the Case Method." Engineering Education 62 (April 1971): 831-835.

This article describes some initial attempts to evaluate learning from the case method in engineering. Preliminary data based on student evaluations show the case method to be an effective teaching technique.

_______. "Measuring Change Produced by Case Method Instruction." Engineering Education 63 (October 1972): 37-40.

This article describes two experiments using formal evaluation techniques with students who have been taught via the case method. Neither of these evaluation techniques effectively demonstrated that case method instruction changed students measurably.

________. "An Easier Way To Teach With Engineering Cases." *Engineering Education* 69 (January 1978): 349-351.

This article points out an easier way to use cases in the engineering classroom allowing a team of students to lead the discussion of the case and to filed class questions. This method is contrasted to the teacher-centered guidance of group discussions, teacher-centered lectures on the case, and total non-guidance of the case discussion.

________ and Adams, John L. "Evaluating Learning From The Case Method." Engineering Education 70 (October 1979): 104-106.

This article analyzes how various teaching styles and techniques affect the efficacy of the case method.

Casebooks

Fuchs, Henry O. and Steidel, Robert H. *Ten Cases in Engineering Design*. (London: Longman, 1973).

This collection of ten cases puts the engineering student in the position of the professional engineer, confronts the student with incidents drawn from actual practice, and gives him an opportunity to review decisions made in the case situation as well as the outcome of the case.

From Business Communication

Analytic Articles

Brown, Leland. "Collecting Data, Preparing and Publishing a Case." *American Business Writers Association Bulletin* 5 (December 1964): 25-29.

This article describes some salient features of good cases, how they should fit the classroom situation, and how they should require students to perform a variety of tasks. This article goes on to discuss sources of case information and how the information can be collected, written, and published.

Cochran, Daniel S. and Gibson, C. Kendrick. "Putting a Square Peg into a Round Hole: Communication Models and their Application." *Journal of Business Communication* 17 (Fall 1979): 27-36.

This article makes the point that only a teaching package consisting of an integrative communication model, a systems theory, and the case method can really prepare students to communicate effectively in the work environment.

Kaye, Norman J. "The Contribution of the Case to Learning, Teaching, and Professional Advancement." American Business Writers Association Bulletin 3 (December 1964): 21-24.

This article discusses the varied uses of cases in business communication pedagogy: its use for teaching within the framework of "inquiry training," and its use for teaching in directive or nondirective ways.

Little, Dwight. "The Case: Milieu and Method." Journal of Business Communication 8 (Summer 1971): 29-36.

This article discusses the genesis of the case method in law and medicine, the features of a typical business case, how cases are solved, how to "look" at a case, and sources of case materials.

Robbins, Jan C. "Training the Professional Communicator: The Case Study Method." Journal of Business Communication 12 (Spring 1975): 37-45.

This article decries the fact that academic communication programs can educate students only up to the level of novice, or, at most, craftsman. The expert level of competence, however, is rarely attainable with the current workshop and lecture methods of instruction. This article advocates the use of the case method to advance students to the level of expert communicators.

Swenson, Dan H. "Case Method in Business Writing." In Nineteen Selected Presentations of the 44th National and 5th International ABCA Convention, 1979. Champaign, Illinois: American Business Communication Association, 1979: 191-199.

This article discusses the advantages of using cases in teaching business communications. It goes on to describe the differences between structured and unstructured cases according to their purposes and goals.

Weeks, Francis W. "How to Write Problems." In The Teaching of Business Communication. Champaign, Illinois, 1978: 223-229.

This article discusses the sources of cases, what makes a case effective, and common shortcomings of cases.

Casebooks

American Business Communication Association.
Business Communications Casebook One (1970)
Business Communications Casebook Two (1976)
Business Communications Casebook Three (1980)
Champaign, Illinois: American Business Communication Association.

These three casebooks are designed to elicit a variety of student business communication assignments: letters, memos, and reports. The cases range from five-line cases to sixteen-page cases. The newest edition includes two new sections, letters to be rewritten and large-scale organizational communication problems.

Bromage, Mary C. Cases in Communication (1964), and Nelson, Bruce A. Cases in Communication II (1967) Ann Arbor, Michigan: University of Michigan Bureau of Business Research.

These two casebooks have selected business situations chosen for the part played, for better or worse, by written communication or the lack of them. These casebooks include a discussion of how to use the case method in the classroom and twelve cases. The presentation of each case begins with a discussion of a specific technique, e.g., "using the prepared form." Then the case is given in order to reinforce the point with students.

Brown, James. Cases in Business Communication. Belmont, California: Wadsworth Publishing Company, 1962.

This casebook includes eight rather involved business cases which elicit a wide variety of business communication assignments. The cases are self-enclosed and include extensive assignment lists.

Parkhurst, Charles C. Case Studies and Problems in Business Communications. Englewood Cliffs: Prentice-Hall, 1960.

This casebook includes fifty short, simulated business situations to elicit letters, memos, and reports from student writers.

Weeks, Francis W. and Hatch, Robert A. Business Writing Cases and Problems. Champaign, Illinois: Stipes Publishing Company, 1972 and 1977.

This book with its two editions has eighty-nine short case problems. It arranges them by theoretically separate issues: informing, persuading, negative-message writing, job applications, and managing communication systems. This book also includes appendices on business letter mechanics and punctuation, and an introduction which briefs students on the case method.

From General Composition

Analytical Articles

Jarvis, Paul. "Teaching Problem-Solving." Paper presented at College Composition and Communication conference, Washington, D.C., April 1980.

This article explains how the case method is the best opportunity to teach what is presently known about writing as a process. Specifically, the case method makes writing seem real; it emphasizes problem-solving; and it provides students with a clear sense of audience. The article goes on to answer some of the practical and theoretical objections to the case method. The article ends with a five-page sample case.

Weiss, Robert H. "Assignments that Succeed: A Case Approach To Composition." Bethesda, Md.: ERIC Document Reporduction Service, ED161060, 1978.

This article explains how the case approach to composition is a successful alternative to the traditional pattern of instruction in which little attention is paid to the writing assignments given to students. Weiss explains how the case approach is based on considerations regarding students' writing interests and fears, the effects of writing for different audiences, and elements of the writing process.

_________ and Field, John P. "Cases For Composition: A Theoretical Model For Writing Instruction." Bethesda, Md.: ERIC Document Reproduction Service, ED172194, 1979.

This article advocates the use of the case method approach to composition by noting that cases can best be used to engender writing. The article goes on to suggest how teachers can implement the case method in their individual classrooms. It concludes by describing three sample cases.

Casebooks

Jarvis, Paul and Tedlock, David. Casebook Rhetoric: A Problem-Solving Approach to Composition. New York: Holt, Rinehart and Winston, forthcoming.

Weiss, Robert H. and Field, John P. Casebook for Composition. Boston: Little Brown and Company 1979.

This casebook contains some self-contained cases in which all information is available and some open cases calling for some type of research. These cases call for reports, speeches, summaries, condensations, biographies, and letters--all with an obvious purpose in their particular case context. The cases cover a wide range of rhetorical problems from a wide range of disciplines.

From Technical Communication

Analytic Articles

Barton, Ben F. and Barton, Marthalee S. "Bridging The Gap Between Student and Engineering Professional: The Case Method in a Technical Communications Course." A Paper presented at the College Composition and Communication Conference, Minneapolis, Minnesota, April 1979.

This article discusses the use of the case method in technical communication. It explains how the method helps students to analyze open-ended problems, to adapt their communications to varied audiences' needs, and to practice team report writing.

Hays, Robert. "Case Problems Improve Tech Writing Courses and Seminars." Journal of Technical Writing and Communication 6 (1976): 293-298.

This article explains the usefulness of case problems, suggests ways and criteria for their preparation, and offers a brief example of a case.

Jobst, John. "Problem-Solving Techniques in Technical Writing." In Proceedings of the 27th International Technical Communication Conference. (n.p.: Society for Technical Communication, 1980), p. R-51-R-55.

This article presents several problem-solving teaching techniques, among them the case method. The author believes that these methods force students to generate their own ideas on solving communication problems and lead to the acquisition of the principles involved in the writing process.

Mascolini, Marcia and Freeman, Caryl P. "The Case for Cases." The Technical Writing Teacher 7 (Spring 1980): 125-6.

This article describes how teachers at Western Michigan University are using cases in Freshman English to turn it into an introductory course in business writing. Cases allow freshman to practice the kind of writing and thinking they will do in their careers. The article goes on to describe the advantages of using cases in Freshman English.

Skarzenski, Donald. "A Problem-Solving Case For Technical Writing Courses." The Technical Writing Teacher 5 (Spring 1978): 97-98.

This article presents a sample memo problem case and describes how it can be specifically used in a class.

Casebook

Brown, James. Casebook for Technical Writers. Belmont, California: Wadsworth Publishing Company, 1961.

This book contains fourteen self-contained cases calling for students to produce feature stories, instructions, letters, reports, speeches, proposals, abstracts, book reviews, manuals, memos, progress reports, telegrams and eight different types of graphic presentations. The cases demand a variety of student backgrounds ranging from a general background to a background in basic electronics and chemistry, to a background in advanced chemistry and mathematics. Each case is presented in sufficient, narrative detail to offer a full rhetorical context to students.

THIS ESSAY IS PART OF AN ANTHOLOGY ENTITLED TECHNICAL COMMUNICATIONS CASEBOOK I THAT IS BEING SUBMITTED FOR PUBLICATION TO THE ASSOCIATION OF TEACHERS OF TECHNICAL WRITING (ATTW).

"How To Develop and Write a Case for Technical Writing"

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Over the past few years, we have written cases of different sizes and shapes for teaching technical writing to engineers at Wayne State University. Originally, we adopted the case approach for some assignments because our sophomores and juniors lacked technical expertise and professional knowledge of the engineering world. Classroom experience soon proved to us that cases could indeed make up for students' lack of information and professional awareness. We also found out that cases were good exercises even for advanced students, providing realistic practice in specific writing tasks or isolating particular skills in the composing process.

In writing and testing various types of technical writing cases, however, we gradually developed a special kind of case which narrates the experiences of one technical person engaged in the problem-solving process in a professional rhetorical situation.[1] Told from the limited point of view of this professional who writes as part of his or her job, the tale--replete with realistic technical data and contextual information--follows him as he confronts the communication problems which are an integral part of his technical task, recounting events without definitive assignments or evident communication solutions. These answers then must be created by the student who assumes the persona of the professional and writes whatever documents are appropriate.

We call this long, realistic fiction a "holistic" case. Rather than presenting technical information in a slight rhetorical frame, rather than isolating skills or tasks, rather than dictating exercises for which there is a known solution, rather than asking students to role-play a character, a holistic case realistically encompasses the whole of the technical writing process. A holistic case allows students to experience the total communication act in which the technical task and data are fully integrated into the rhetorical situation. A holistic case gives students the opportunity to perform in a realistic context, using all of the skills and knowledge required in communication on the job. Despite the fact that other kinds of cases have a valid place in technical writing courses, we believe that the holistic case most fully exploits the advantages of the case method for students of professional communication.

The salient components of a holistic case are the <u>persona</u> of the technical professional, the <u>facts</u> about the technical problem and the real company, the <u>fiction</u> created on the basis of those facts, and the <u>form</u> of the case itself adapted for students.

The <u>persona</u> that the student must adopt furnishes the entry point into the case, a professional role in the situation, but not a personal identity or character--rather a way for each student to "live" the case by assimilating his or her individuality to the professional mask. The origin for any valid case, however, lies in its facts, the base of real information about real people with real technical problems and real writing tasks in real organizations. The numbers must fit, the data must correlate as well as a technical report with the real world. The case must go beyond, or behind, this information, however, to recreate the facts into a whole, into a fiction which enables the student reader to "believe" and thus to experience the complexity of the real world of work in process. Finally, the form of the case must furnish a suitable vehicle for students to learn communication principles and skills, and to become engaged in the whole of the writing process, creating individual solutions in the form of professional documents--memos, letters, reports, proposals.

These components of a holistic case presuppose the process for developing it. The would-be case writer, however, should be aware of the procedures necessary to produce a case that meets this description, and so we are outlining here a set of guidelines for instructors who wish to write holistic cases in technical communication.[3] The four major steps relate directly to developing the noted components, the persona, facts, fiction, and case form. These stages are:

First -- Design the case: Plan the goals and objectives for the students who will assume the persona, and establish the real-world source of information.

Second -- Collect the facts: Conduct the interviews, and research the technical and rhetorical information about a specific problem in a real organization.

Third -- Create the fiction: Transform the facts into a realistic fiction which could have happened to a technical professional on the job.

Fourth -- Construct the case: Recast the fiction into a functional instrument for students to write professional documents.

In the design and construction stages, the writer must aim to turn the materials into a document that will work in technical communication courses. However, the collection and creation stages are of chief significance; in them the writer must connect the case to real events that actually occurred inside some firm, and then write a believable narrative representing what might have happened on the basis of those facts. As the Harvard casewriters in business administration have insisted, cases must be built on thoroughly investigated, real situations; "armchair" cases, concocted from general principles, a patchwork of anecdotes, and the casewriter's practical experiences from here and there, are academic monstrosities that only purport to be real.[4] After finding the facts, however, the writer must shift his efforts to fabricating a story. A communication case cannot be written without empirical data; it cannot be constructed on facts alone in the mode of the business or engineering case. A "facts-only" case, like an armchair model, is distorted, but for a different reason: it lacks the heart of the rhetorical matter--the people problems, the messiness of interaction, the political dimension.

The process of collecting data and creating a story is a real dialectical interaction of fact and fiction. The fact about the real problem originates the fictional image which, in turn, must be validated in terms of the real-world's possibilities. In short, the case must be realistic, not necessarily real in every detail; the fiction must be plausible, for no matter how real and true, without <u>seeming</u> to be so, the case will not be accepted as representing professional experience by its readers.[5] In developing a case, therefore, the casewriter must go back and forth between the story, the data base, and its source, the interviewees. The casewriter thus works backward from the finished product (say, a final written report) to recover the developmental process and environment. Even during the collection stage, he must reach beyond the written documents and technical data to recover the "stuff" of human relationships behind the project. Out of these fragments of reality, then, the casewriter creates a fiction, a whole and credible experience that <u>might</u> generate the actual documents produced. The student, reading the case, reverses these procedures, developing written products by re-enacting the process.

Stage 1 - DESIGNING THE CASE

The objective of the first stage is to plan the case objectives and procedures in light of the target students and a real-world contact person. Basic principles of effective case design, as outlined by John Brockmann,[6] should govern all stages of the procedures for holistic cases. However, even in the initial preparation, the development of a holistic case differs from cases focusing on the facts or aiming for specific tasks or skills (writing a progress report or a report with a comparison section). Instead of identifying specific objectives for the writing to be produced from the case, you should adopt the development of general principles, strategies, and skills of technical communication as your goals. A holistic case will present a real communication situation involving writers in basic rhetorical principles such as report design based on audience analysis, in planning strategies such as selection of relevant information from masses of detail, and in skills such as revision for reader efficiency. Thus, rather than designing the case with specific assignments in mind ("a trip report in memo format"), you should follow the lead of the empirical evidence, giving full play to the complexities discovered.[7] In fact, throughout the procedures you should question your methods and your manuscript to ensure that you are not adjusting the facts to meet academic preconceptions either about the target students or your professional contacts.

<u>1.1 Define the target students</u> by their career goals, their current status, and their potential use of the case in the classroom.

Although the range of students who can profitably use a case extends well beyond a particular occupation, students have the strongest motivation and educational experience in cases where the persona of the technical professional closely defines their own career goals. The profession, the occupational setting, the employee position, and the writing tasks of the persona should all be at least reasonable and relatively imminent for the student audience.

Although the facts in the real world are primary, the case must present technical information within the students' capabilities, must assume only professional expertise within their knowledge, and must demand reading and writing tasks within their competency.

Although the situation should display the principles inherent within it, the potential classroom application cannot be ignored as a factor in many decisions; without some control, many cases would grow like topsy until they could never be used without major surgery.

1.2 Select the real-world contact by the organization and by the technical professional as writer.

Select an organization of type, size, and activity pertinent to the profile of the target students. Consider, however, the accessibility you have to that organization through an appropriate employee within it--someone who meets your criteria for profession, technical field, position, and writing tasks. Although you may need supplementary or "sponsoring" contacts within the company who have sufficient authority to provide access to documents, to present the supervisory or institutional perspective, or to furnish entree to other offices or units, your most essential contact is the technical professional who must write as part of his or her position, within the company ranks.

Although a management sponsor could assign a writer to work with you on the case project, you will do best to work through your personal acquaintances or contacts developed during the course of consulting or other business-industrial activities. The personal approach is advisable because the resource writer must be willing, even eager, to participate in the case development. Not only must he devote many hours in interviewing time (far more than most firms would allow on the job), but he must be open, revealing much about his firm and his co-workers--and himself. The resource professional must become your true partner in the educational enterprise. The overriding pre-condition for collecting the data for a good holistic case, therefore, is to find such a strong contact person.

Stage 2 - COLLECTING THE FACTS

The objective of the collection stage is to reconstruct a subjective view of a complete communication event by amassing technical and rhetorical details. Your interviews of the technical professional, the main method for collecting this information, should be a sequence of meetings which facilitate his responses, gradually allowing you to share his world. These interviews have three functional stages: to introduce the case project, to research the technical facts and rhetorical record, and to explore the rhetorical situation in depth.

In all your interviews, aim to get the respondent to talk freely and openly about the subject by using techniques of exploratory interviewing. (Tape-recording will help here by allowing you to be an undistracted, encouraging listener.) Let the flow of interaction, subtly guided by your open-ended questions, govern the meetings. Seek all documents generated by the project and then use the writing as a probe in subsequent discussion. Eventually, pose some closed questions and request that the respondent elaborate upon and verify your record. Overall, however, let the exploratory approach prevail and thus ensure a case built upon real happenings, not academic preconceptions.

2.1 Introduce the case project. Prerequisite for the success of the interviewing are the initial meetings in which you engage the technical professional in the project, pledge anonymity to him, and select the communication problem for the project.

Engage the respondent. While establishing rapport with your respondent through receptive interviewing about his work, you can learn much about the routine of his position, unit, communication, and the company--background material that will bear upon the case. Most people like to talk about their jobs; if you show genuine, uncritical interest, you will encourage the flow of information and probably get to look at samples of the writer's memos, letters, and reports. In these initial encounters, you should also explain your methods for researching the case and your educational objectives, particularly how students will use the finished case. Otherwise, some respondents, especially those familiar with business administration or engineering cases, might approach your project with serious misconceptions.

Pledge anonymity. Of chief importance in the first sessions is to state your ethics as a casewriter and your responsibilities to the respondent and his firm. You should pledge anonymity to the contact, both within and without the company; you should promise protection of institutional identity and proprietary information; and you should outline your proposed distribution of the case and methods for disguising information. You can gain the technical person's confidence by promising to submit the case manuscript for his approval; if necessary, you can relieve him of any burden for proprietary information by clearing the facts with the organizational sponsor. Throughout the case project you should carefully maintain the anonymity of the firm, its products, and its personnel, leaving nothing in the case manuscript that could be traced back to its source and never referring orally to your contacts by name or firm. Such care is necessary to protect yourself, as well as your sources. Contrary to the business case which is facts, the holistic communication case deals with subjective impressions and dramatic representations of probable actions. Securing formal company releases for such information would not only be extremely difficult, but the shadow of the request for such permission could kill the case before it is born. Few individual writers would provide the kind of information you need if management were scheduled to peruse the case prior to its release; in fact, even the possibility of such inspection could undermine the trust and confidence necessary for interviewing.

Select the communication problem. After you establish the cooperative structure and the procedures of the case project, you should ask to screen the technical professional's communication for material appropriate for the case. Encourage him to elaborate on the circumstances of a document, so you can uncover possibilities, as well as acquaint him with the holistic case approach. Criteria for selecting a project include the governing objectives and principles (for example, is the matter routine?), as well as pragmatic considerations (does the material lend itself to various solutions; does it have some focus and shape as a distinct event?). Obviously, you should avoid projects the respondent cannot remember well or which did not fully engage him. Your screening should also eliminate problems that are technically inappropriate for any of several reasons, but chiefly because they are highly sensitive subjects from the firm's perspective. On the one hand, technical information must be up to date so that students will view it as current; on the other hand, it must not be so top secret that your contacts will fear to discuss it openly. Corporate protection of technical information is a fact of business which you must take into account--better to drop the highly proprietary project at the first negative sign than to scrap it after a big investment of time.

2.2 Research the technical facts and the rhetorical record. The second set of interviews should build up a picture of all the facts on the selected project, but particularly the technical facts. The technical problem, the steps in the technical problem solving, the data obtained, the solutions--all aspects of what the technical professional perceives as his "real job"--should be covered in great detail, far beyond what seems relevant to writing a case, much less alone writing a report. Moreover, you should seek your respondent's help in whatever analysis and interpretation you require to adequately understand the technical information.

Beginning with the technical problem solving is a strategy for success as a holistic case researcher. The technical focus convinces your respondent that the project is a serious education activity for his profession, one worthy of his efforts. It will also fully establish your working relationship. Part of his trust and willingness to go forward from this point, to try deeper waters, stems from his recognition that you grasp his technical problem and understand what he is doing. At the same time, his role as your teacher is well defined because you have focused on the technical subject; your subsequent efforts to learn about his rhetorical situation will not be thwarted by his desires to tell the English professor what he or she wants to hear.

As soon as the survey of the technical information is well in hand, you should begin to collect the facts about the rhetorical situation, the organizational record and official memory of the evolution of a problem or a project: who assigned the task to whom, and so on. Even at this level, you may be struck by how much the respondent cannot remember or never knew. Try to trigger his memory with provocative questions, or simply by chatting about the topic, encouraging him to recollect. If the gaps disclose a substantial amount of important material the contact never did know, try to locate other persons within the company who can furnish the missing pieces. Keep in mind, however, what omissions characterized your primary contact's view; these gaps will become important as you create the fiction.

2.3 Explore the rhetorical situation in depth. The third set of interviews aims to go behind the official record to discover what actually happened, why it happened, and how it happened. Although these exploratory meetings should not be confused with therapy sessions, they are similar in one objective: to encourage the respondent to delve into his memory to recover the experience as fully as possible, including what was never acknowledged nor intended to be retrieved.

On the simplest level, you should try to reconstruct the technical events and the problem-solving process, including its rhetorical component, as it really happened, rather than in the "official version." At the point of writing up any investigation, reality undergoes a filtering and reordering to fit the constraints of the document; the dead ends and detours are often buried in a lab or log book; the finished paper or report which ignores the circuitous route becomes history--the truth. The case writer must write a new record full of the jumbled omissions and misunderstandings as well as facts and knowledge. To achieve this end, your main task is to alleviate the contact's embarrassment, even anxiety, in tearing down the neat image invoked by the written product so he will be committed to recovering the flux of life which it ordered and shaped.

In-depth interviews should also try to recover information the respondent probably views as extraneous: the interaction impinging on the writing (the discussion at the coffee machine and the confrontation over the telephone). This is information which a typical technical professional believes to be separate from the task and its completion. Since he considers it to be at best irrelevant and at worst an obstruction, usually he has suppressed his memory of it; with little recognition of its significance to the reality of the problem-solving process in action, he will only respond appropriately if you guide him back over the territory, with many "and then what happened" questions.

Beyond recovering the actual behavior of participants in the events, you should also evoke the writer's impressions of things and his analysis of motives, his own included. Aiming to elicit his responses, you can ask him to recount an event in detail, and then ask to explain it or tell how he felt about it. Another technique is to re-play a tape and then ask him to interpret and elaborate upon it. The subjective reactions you seek (the key to portraying the situation fully and from the writer's point of view) may be difficult to recover, even if the respondent is willing and open; he may never have consciously confronted what "really was going on," or he may have simply forgotten the unpleasantness. For most respondents who feel comfortable with the interviewer, however, eventually the flood-gates will open with the personal views, what is essentially "my side of the story." These responses are, of course, akin to informal conversation with its gripes and gossip, what is usually heard over the bar or in the carpool, remarks which are self revelatory but not therapy.

Stage 3 - CREATING THE FICTION

The objective of the third stage is to transform the record of real-world facts into a fiction through which the student can experience the full communication process on the job.

Though you began with information about the real technical problems at a real firm, you cannot write up this data into a case. No matter how focused your information collection on the specific problem, other problems and tasks impinge upon it, denying it a tidy shape and a satisfactory ending. No matter how in depth the transcripts of your tapes or full your details on the other employees, you do not know most of these people nor the full reasons for their acts; they remain shadowy figures in your imagination. Obviously, then you must take all these facts and impressions and create out of them a fiction, a story with close correlation to the "hard facts" of the technical data and the organizational procedures, but with primary fidelity in all other respects to the sense of reality in the story, to the truth of its fictional world in which the reader must place his belief. Thus, for example, you must invent the dialogue for not only the persona of the technical professional, but for all the other employees as well, fashioning words that could have been said--telling a tale.

Techniques of the storyteller that can transform the facts and impressions into a narrative are as various as the art of fiction. Certain strategies, however, are essential to produce a realistic fiction capable of interesting and engaging student readers, while readily lending itself to adaptation into a functional case. These are creating a persona which restricts the point of view to the writers and offers the reader a way into the fiction; developing well-realized characters in a realistic setting; planning a plot which traces the writer's experience of trying to solve a problem; and modeling language on the discourse types through which the writer gains access to the information.

3.1 Create a persona which restricts the point of view to the technical professional and pulls the reader into the fictional world. You should write a story which strictly defines the persona's view on this world, limiting the fiction to his direct experience of and response to people, events, and information. The image of this technical professional must be one with which the students can identify because of the relevance of the occupation and of the demonstrated professional competence. If readers are to project themselves into the mask of the technical professional, however, you must devise the persona to minimize the distance between the image and the reader. Most obviously you should limit the explicit characteristics of the professional person. Do not provide a name, assign a sexual or ethnic identity, suggest anything about a private life, nor mark any strong personality traits, especially not quirks or incompetencies. The objective thus is to create a persona that invites the reader not to role-play a character but to assimilate his or her individuality into the professional mask. Such a persona is a vehicle through which the reader can experience the real-world of work and develop his or her own genuine professional voice.

3.2 Develop well-realized characters in a specified setting. Contrary to the persona's neutrality as a character, the surrounding employees in this technical narrative should be fully developed characters portrayed in a rich accumulation of mundane detail. From your factual record, select fragments and then fabricate the missing pieces to complete a coherent picture of real but fully disguised persons operating in what seems to be a faithful reproduction of a real organization. Overloading the details, you should emphasize the relevant points to create whole characters whose behavior is believable, whose actions exhibit their significant traits, and whose total characteristics add up to coherent if one-sided professionals. Individual actions should be invented to demonstrate motivations, and personal speech rhythms must be established, along with behavioral motifs. These features will allow you to compress as much personality as possible into limited narrative time. Your aim is to create a fiction that "shows" more than it "tells" so that the reader will be involved directly with the persons in action in a solidly specified world and forced to analyze the whole situation for himself.

3.3 Plan a plot that traces the writer's experience of trying to solve a problem. Because real projects don't have tidy beginnings and endings, you must define and shape certain events to represent in the fiction. Also, most real projects absorb only a part of an employee's day; your story must clearly represent that fact without overburdening the reader. A real project may have three aspects, two of which you might eliminate; it may have two phases separated by years, which you might collapse into a single time frame; it may have unsupportable complexities, which you might suppress to a couple of salient issues. Your factual records, in short, should be modified to develop a plot structure which will help you to tell a realistic but captivating story, involving the reader in what will happen next and encouraging him to seek answers for the dilemmas confronted by the persona.

The plot of this fiction should be built upon the individual technical professional's active involvement in the problem-solving process, both in its technical and rhetorical aspects. The ordering of the action, then, should be determined by the chronological pattern of the persona's growth to knowledge, not by when an event occurred. In the real world, the technical professional must cope with whatever he knows at the moment; thus a case plot should not "organize" data but feed information to the reader in the order it would come naturally to an employee on the job. Although much of the information, particularly the technical data, should be presented descriptively to condense the story, significant communication actions like interviews and meetings should be dramatized in part, both to heighten reader interest and to cause him to deal with the interaction directly. Thus, the plot line must reinforce the reader's understanding of the problem as in a state of becoming through presenting information that is full of gaps, repetitions, contradictions, and always subject to new interpretation.

3.4. Draft the fiction simulating the types of communication in which the writer originally got the information. The story should be drafted in forms most closely approximating the modes of discourse actually used in the real situation. Some transmission may be in the form of documents--a memo assigning the problem, for example. You can either use real documents (disguising them appropriately), or you can draft them, closely imitating models you observed. Most of the language of the fiction, however, should be in conversational discourse, some in narrative form, but much in dialogue. In other words, the fiction should be written in forms totally unrelated to the documents that the case should generate. (This principle is particularly important for technical data which should not be ordered into patterns beyond the log or lab book.)

Using your interviewing tapes, try to capture the oral language of the particular work place, toning down the jargon as necessary to make it easily intelligible and to avoid caricaturing the technical persons. Write much of the fiction in the "internal" language of the persona, so that he can explain for himself what he is doing, what he is finding out, and how he responds to the situation. The style of these "mutterings" should not attempt to represent any modified stream of consciousness, but rather should represent an internal monologue, readily understandable to the world outside the self.

Stage 4 - CONSTRUCTING THE CASE

The objective of the case construction stage is to adapt the fiction into a functional instrument for students to use in writing professional documents. There are five main steps: revising the fiction so that the communication solutions remain open questions for the individual student; adapting it so that it focuses clearly on the communication process; screening the information according to students' backgrounds; adapting the information to functional use; and formatting and validating the case for the classroom.

4.1 Revise the fiction so that the communication solutions are left open to the individual student. In the real world, there is no one correct response, no one defined solution, but rather a range of possibilities of greater or lesser effectiveness in solving a communication problem. Moreover, these options are not equally pertinent to all writers. The student thus should have the burden of creating the communication answer that is both appropriate for the facts, but also for the synthesis of the persona and his or her individual self. If this truly open situation is to prevail, however, you must revise the fiction to ensure that you have not "loaded the dice" for a specific response or been unduly influenced by the actual documents produced by the technical professional you interviewed.

4.2 Adapt the fiction to focus on the communication process. The process of resolving communication problems introduced in a technical fiction can be very time consuming, but crucial to developing student skills in assessing the context for writing. Time students spend reading, researching, analyzing technical problems, however, is time not available for their communication learning. Although data should not be recast into non-narrative forms (as it might be presented in an actual report), you should reduce the student reading and analysis time as much as possible without destroying the rhetorical impact of the case. Most rhetorical information should be of some potential relevancy in defining the audience and purpose of the communication; the details for background or providing overload should be reduced to a reasonable amount commensurate with the goals of selecting the relevant from the mass. More important, the technical information should be analyzed within the case, usually in the internal monologues of the persona and the dialogues with peers. The point is that the students' major efforts should be devoted to confronting the composing process as an integral part of the technical task, and to confronting the whole of that process, not merely the drafting of an assigned piece. They should have to begin at the beginning by defining what is truly their own problem, analyzing their audience, figuring out their purpose, so that they can set about producing the documents that will meet their ends.

4.3 Screen the information in the story according to the needs of the students. Judging the target populations' technical and professional expertise, you should screen all the technical information, professional activities, and organizational methods to determine where the students will need explanations or elaborations to use the case with ease. Asking representative students to read the manuscript and noting their difficulties will facilitate your task here. To avoid destroying the verisimilitude of the case, identify all information the students need which is inappropriate for the persona to think or talk about (for example, defining a term common to an industry but little known elsewhere) and place these items in the case apparatus: a background statement, footnotes, and appendices.

4.4 Screen the fiction for its functional application to writing. In reconstructing the process through which the technical professional solved his problems and wrote his documents, you may have inadvertently left out critical pieces of information, failed to emphasize certain points, or unintentionally contradicted messages. You may have insufficiently disguised some information or confused the picture through your efforts to disguise it. By attempting to write the possible documents based on the case yourself, and by subsequently assigning them to representative students, you can determine if the information base in the case has integrity and is applicable to producing writing. The critical questions to answer here are: Is there anything that a real writer would know in this situation that is not made apparent for the student? Is there any problem with the case information that is caused by the inadequacy of the case rather than by its attempt to mirror the imperfect real world?

4.5 Format the case and validate it for classroom use. Once you have completed the case manuscript, you should divide and format it into units that can be used easily by students in reading and writing up the information. You should prepare a possible list of assignments that could grow out of these materials, and you should validate these tasks by classroom use, preferably under other instructors. (Can they teach communication skills with this case without getting caught up in problems inherent in the case itself? Does the case facilitate their job?) Finally, you should submit the case to your technical partner for validation of authenticity. After all the adjustments, you must feel satisfied that every piece fits, every identity is sufficiently disguised, and the story "tells it like it is" on the job.

Passing your resource person's review determines that your case is true. However, the final hurdle is the target student audience's acceptance of the case as both real and relevant. We believe that one of our student's anonymous comments attests to this strength in a holistic case. She wrote: "The case gives you a real feeling of what it will be like when you are out on a job and you have to write a report."

THIS ESSAY IS PART OF AN ANTHOLOGY ENTITLED TECHNICAL COMMUNICATIONS CASEBOOK I THAT IS BEING SUBMITTED FOR PUBLICATION TO THE ASSOCIATION OF TEACHERS OF TECHNICAL WRITING. (ATTW)

NOTES

1. We have been influenced by reading business administration, business communication, and engineering cases, and by numerous discussions of the case method by educators in all of these fields, and now also in general composition. For example, see Andrew R. Towl, To Study Administration by Cases. Boston: Harvard University, 1969; Malcolm P. McNair, ed. The Case Method at the Harvard Business School. New York: McGraw-Hill Book Company, 1954; Dwight Little, "The Case: Milieu and Method," Journal of Business Communication, No. 8 (1971), 29-35; Karl H. Vesper, Engineers at Work: A Casebook. Boston: Houghton Mifflin, 1975; Robert H. Weiss and John P. Field, "Cases for Composition: A Theoretical Model for Writing Instruction" (ERIC ED 172 194); and David Tedlock, "Confessions of a Textbook Writer," College English, 42, No. 2 (1980), 167-70.

2. For samples of cases demonstrating some of these various characteristics see James Brown, Casebook for Technical Writing. Belmont, CA: Wadsworth Publishing Co., 1961; Howard Schultz and Robert G. Webster, Technical Report Writing. New York: David McKay Company, Inc., 1962; Ron Blicq, Technically-Write! 2nd ed. Englewood Cliffs, NY: Prentice-Hall, Inc., 1981; Peter Coleman and Ken Brambleby, The Technologist as Writer. New York: McGraw-Hill Book Company, 1971; Francis W. Weeks and Kitty O. Locker, Business Writing Cases and Problems. Champaign, IL: Stipes Publishing Company, 1980.

3. Guidelines for writing communication cases are very minimal. See Francis W. Weeks, "How to Write Problems," in The Teaching of Business Communication. Ed. George H. Douglas. Champaign: American Business Communication Association, 1978.

4. James W. Culliton, "Writing Business Cases," in McNair, p. 268.

5. Numerous writers on the case method have discussed this issue. See for example, Robert Hays, "Case Problems Improve Tech Writing Courses and Seminars," Journal of Technical Writing and Communication, 6 (1976), 293-298.

6. R. John Brockmann, "The Case Method and Technical Communications Pedagogy," in this publication.

7. Many case theorists have discussed the interrelationship of principles with the empirical evidence; see John Brockmann (above) and Robert H. Weiss, who takes the precepts approach to case construction in "Assignments that Succeed: A Case Approach to Composition," (ERIC ED 161 060), p. 16. Professor McNair of the Harvard case school defined the problem by noting that a case is, on the one hand, "not just an example," but also on the other hand, not "a photographic slice of life" (in Towl, p. 65). The danger we see in arranging material to suit suit principles is that the case can wind up supporting preconceived notions rather than what actually happens in the real world. (See Culliton, pp. 259 and 268.) The whole rationale for the case approach, after all, is to get students to begin with "evidence rather than general principles." (Thomas C. Raymond, Problems in Business Administration: Analysis by the Case Method. New York: McGraw-Hill Book Company, 1955, p. 3.

EVALUATING THE EFFECTIVENESS OF CASE METHOD INSTRUCTION IN TECHNICAL COMMUNICATION

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INTRODUCTION

Believing that evaluation is an integral part of any project and that no project is complete until the evaluation task is accomplished, we wanted to evaluate the effectiveness of the case method as an instructional technique in improving technical writing. Many times biases for or against a particular method of instruction or a rhetorical theory are held without any quantitative basis for support of the theory; more work on evaluating theories systematically must be done, if possible. Thus, the purpose of this paper is to discuss the development of a self-report instrument that attempts to measure changes in attitude toward technical communication and to present the results of the pilot study in which the case method instruction was a factor in the change.

Using the standards for developing a case set forth by Goldstein and Couture, we designed an evaluation instrument to measure the effect of case instruction on student attitude toward technical communication. This self-report instrument is based on a model developed and tested by Daly and Miller (Research in the Teaching of English, 1975), who studied writer attitude and apprehension toward writing. The most important objective of any evaluation is to provide information for improving the program.

INSTRUMENT DEVELOPMENT

The criteria for measuring attitude toward case method instruction were divided into three categories:

1. Rhetorical principles of technical writing, such as audience analysis; rhetorical purpose; problem definition

2. Planning strategies, such as selection; analysis; solutions; organization

3. Drafting skills, such as the ability to communicate in writing and to use data

Then 26 items reflecting these categories were composed into a Likert-type

	LIKERT-TYPE SCALE FORMAT FOR ATTITUDE MEASUREMENT	STRONGLY AGREE	AGREE	UNDECIDED	DISAGREE	STRONGLY DISAGREE
(+) 1.	I enjoy writing reports supported by detailed facts.	5	4	3	2	1
(+) 2.	I like to include quantitative material (numbers and data) in my technical reports.	5	4	3	2	1
(+) 3.	I want to influence the audience's acceptance of my written ideas.	5	4	3	2	1
(-) 4.	The material in this course discouraged me from identifying and defining practical problems.	5	4	3	2	1
(+) 5.	I feel I can communicate technical material in writing.	5	4	3	2	1
(-) 6.	Presenting and selling my ideas in a technical paper makes me nervous.	5	4	3	2	1
(-) 7.	I don't enjoy reading about or recommending alternative solutions to a problem.	5	4	3	2	1
(+) 8.	The material in this course increased my knowledge of how professionals (such as engineers) work and what they write about at work.	5	4	3	2	1
(+) 9.	The material in this course increased my ability to distinguish between fact and opinion.	5	4	3	2	1
(-) 10.	I have a difficult time organizing my ideas in a technical report.	5	4	3	2	1
(-) 11.	What professionals such as engineers do and write about at work is a mystery to me.	5	4	3	2	1
(+) 12.	It is easy for me to include and interpret data in a report.	5	4	3	2	1
(-) 13.	I dislike reporting and interpreting data in writing.	5	4	3	2	1
(+) 14.	The material in this course increased my ability to identify and define practical problems.	5	4	3	2	1
(-) 15.	When I am presented with an overload of material, I have difficulty stating the practical problem.	5	4	3	2	1
(+) 16.	I enjoy reading about a problem and recommending a solution in writing.	5	4	3	2	1
(+) 17.	Organizing my ideas in a report is an easy task for me.	5	4	3	2	1
(-) 18.	I am not good at using quantitative material (numbers and data) in my writing.	5	4	3	2	1
(-) 19.	Writing a technical paper is an unpleasant task for me.	5	4	3	2	1
(-) 20.	Discriminating between fact and opinion is a frustrating experience.	5	4	3	2	1
(+) 21.	I enjoy describing a course of action in writing.	5	4	3	2	1
(+) 22.	I enjoy presenting and selling ideas in a technical paper.	5	4	3	2	1
(-) 23.	Meticulous attention to detail in technical writing seems to be a waste of time.	5	4	3	2	1
(-) 24.	Describing a course of action in writing is a frightening experience.	5	4	3	2	1
(+) 25.	Given a large amount of material, I feel confident about identifying and defining a practical problem.	5	4	3	2	1
(-) 26.	Concern for the reader's acceptance of the information in my written reports is a waste of time.	5	4	3	2	1

FIGURE 1 - LIKERT-TYPE SCALE FORMAT FOR ATTITUDE MEASUREMENT

scale format, each with 5 possible responses. The items had a variance of positive and negative statements listed in random order to prevent any biased response and to provide a method for evaluating concurrence. See Figure 1 for the questionnaire.

RESEARCH DESIGN

For this pilot study, we looked at questionnaires distributed to a maximum of 196 students in technical writing classes at two institutions. The students were divided into two groups: Group 1 had the case method instruction; Group 2 had instruction in technical communication other than by the case method. The questionnaire was distributed twice over a period of three weeks toward the end of the semester. The assumption was that both programs would change a student's attitude toward technical communication. The instruction did produce a change, a positive shift in attitude from Time 1 to Time 2, in Group 2 as well as in Group 1, because both groups were receiving instruction. For purposes of this pilot study we decided to look at group attitudes using the mean rather than at individual attitudes. We felt the group measure to be more stable for this pilot study since we had to test the attitudinal instrument also. Table 1 illustrates the positive shift in student response to Item 17: Organizing my ideas in a report is an easy task for me.

Table 1: Positive Shift in Student Response

ITEM 17							
GROUP 1							
TIME	0	1	2	3	4	5	ROW TOTAL
1	3	3	25	32	44	4	111
2	1	2	12	26	51	7	99
GROUP 2							
1	1	1	14	31	29	5	81
2	0	0	8	28	41	8	85

APPARENT TRENDS

To establish apparent trends, we had to adjust the negative items. The normal procedure in attitude measurement is to change the scaling so the responses are comparable numerically to responses for positive items. Tables 2 and 3 illustrate the correlation between the paired positive/negative items, after the negative items have been rescaled.

Table 2: 99% to 97% Correlation Between Paired Items

ITEM 1		
TIME	1	2
GROUP 1	3.37	3.55
2	3.54	3.80
ITEM 23 (ADJUSTED SCALING)		
GROUP 1	3.39	3.60
2	3.57	3.78

Table 3: 97% to 90% Correlation Between Paired Items

ITEM 17		
TIME	1	2
GROUP 1	3.19	3.50
2	3.29	3.58
ITEM 10 (ADJUSTED SCALING)		
GROUP 1	3.09	3.14
2	2.99	3.22

The scores for Group 1 (case method instruction) indicated that the greatest positive shift in mean response occurred in items falling within Category 2 - Planning strategies, such as selection; analysis; solutions; organization. A specific look at two more items will show the shift in mean response and indicate those areas in which we do well in technical writing courses(see Tables 4 and 5).

Table 4: Positive Shift in Student Response

ITEM 3							
GROUP 1							
TIME	0	1	2	3	4	5	ROW TOTAL
1	1	2	4	31	58	15	111
2	0	0	2	20	60	17	99
GROUP 2							
1	0	1	0	13	39	28	81
2	0	0	1	8	46	30	85

Table 5: Positive Shift in Student Response

ITEM 12							
GROUP 1							
TIME	0	1	2	3	4	5	ROW TOTAL
1	0	4	15	39	49	4	111
2	1	2	14	24	51	7	99
GROUP 2							
1	0	0	8	24	41	8	81
2	0	0	6	21	50	8	85

Item 8(The material in this course increased my knowledge of how professionals work and what they write about at work.) gave a disturbing shift in student response (see Table 6). Yet in an anecdotal question asking about cases, a student said, "Cases help a writer put himself in engineer's shoes;" and another student offered, "Cases present actual, real life engineering problems." Perhaps the word "increased" raised an anticipation not met. One student suggested that engineers be invited into the classroom to give first hand experience about technical reports.

Table 6: Enigmatic Shift in Student Response

ITEM 8							
GROUP 1							
TIME	0	1	2	3	4	5	ROW TOTAL
1	0	3	8	13	50	37	111
2	1	1	5	23	44	25	99
GROUP 2							
1	0	2	3	5	33	38	81
2	0	2	3	13	33	34	85

CONCLUSION

This pilot study suggests that an empirically-based, standardized instrument may be used to measure change in student attitude toward technical communication and that the case method of instruction is a viable option in technical communication instruction. However, this questionnaire measures only attitude; it does not attempt to correlate improved attitude with improved writing performance.

This instrument, part of a pilot study, is now ready to be tested in a formal study and may be used in any technical writing class to measure attitude toward technical communication. If you would like to participate in the study, please send inquiries to S.G. Feinberg, Dept. of Humanities, Illinois Institute of Technology, Chicago IL 60616.

If students have the last word in case method instruction, it is with this sensible viewpoint: "It is quite difficult to write a report based on a case which is not familiar to you.... Using cases, however, is made much simpler when the professor reviews them with you. Therefore I believe cases should be used if enough time is taken to go over them in class."

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USING CASE STUDIES TO TEACH AN ENGINEERING TECHNOLOGY TECHNICAL WRITING CLASS

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INTRODUCTION

Many teachers of technical writing must often confront the problem of making students realize the necessity of learning technical communication skills. The main obstacle in their way seems to be that the writing done in the classroom setting lacks purpose or relevance to an on the job writing situation. As a result, many writing assignments simply become a means of completing the course satisfactorily. The case method provides instructors a means of dealing with this shorcoming and teaching the various technical communication skills in real world situations rather than as isolated classroom writing tasks. Students have a much stronger motivation to participate because they can now use their own abilities, intelligence, and experiences in writing solutions to communication problems with a purpose to a specific audience.

EXPLAINING CASE METHOD OBJECTIVES

In order for instructors to use the case method as an effective classroom tool and to motivate participation in cases, students must be aware of the objectives of the course and how cases facilitate achieving them. Therefore, instructors should take the time to explain the objectives and the technical writing skills that are at the heart of the course itself. Specifically, this explanation should focus on solving communication problems, identifying an audience, planning written communications, presenting written communications properly, and using visual aids correctly.

Case studies used as a basis for writing assignments will be effective in helping students center upon the problems they must solve. The case study approach will illustrate why it is necessary to state the purpose of any assignment clearly and in terms appropriate to the reader. The students will then have to consider the possible solutions to the case and evaluate them based on some set of criteria presented in the case. For example, a group of students in an air conditioning class might propose to an elderly home owner an equipment and cost estimate to install central air conditioning in his seventy-five year old home.

Instructors can also use case studies to increase students' awareness of the audiences to be addressed in various communications. Instructors can use a case study to have students recognize the audience in such terms as professional background, personality, and position within a company or organization. In turn, students would have to be aware that the audience might not share their field of interest. In particular, technical language would be wasted on an accountant who would be making a decision based on cost to an organization.

Case studies also allow instructors to emphasize the importance of planning in the students' writing. If a writing unit dealt with proposals, instructors could offer that type of case to the entire class for discussion of such things as clarifying the subject, considering the audience, or determining what type of action must be taken to formulate a solution to the case. Instructors would get immediate responses from the students and could correct misconceptions that might occur. They would also be able to direct the discussion so that would consider any elements they might otherwise omit.

Used properly, case studies will be effective in giving the students insights into the proper ways to present the various elements that characterize technical communications. A particular case might concentrate on proper phrasing in a set of instructions or why description of individual parts is important to a mechanism description. In yet another case, the emphasis might be on something as simple as the layout form and content of a business letter.

Visual aids are an integral part of technical communication, and students must learn to use them as effectively as their other skills. Case studies can give the students practice in constructing visual aids, but instructors would have to be certain those required by a particular case would be relevant to the students' various technologies.

Many of the course assignments rely heavily on the students' own familiarity with their particular career choice. Therefore, it is important that cases also be directly related to their career field and challenge their knowledge and expertise. The alternative in many situations is lack of motivation and apathy toward the course. Realistic cases force students to take action toward a solution and make them realize what will be expected of them on the job.

INTRODUCING THE CASE METHOD

The success of the case study method as a teaching technique will be dependent to a large extent on how well instructors explain its purpose to the students and the benefits they can secure from it. Consequently, the introduction should contain information on its development and its use in an engineering technical writing class.

The case method involves writing a "true" situation describing a problem that people are trying to solve.[1] Therefore, in an engineering class, cases are presented in a realistic context, provide students a communication problem to solve, a purpose for solving the problem, and an audience for the communication of that solution. Because cases center on communication and not technical and engineering problems, cases give instructors the opportunity to have students practice the different types of writing common to business and industry. Instructors must then stress to students that the writing problems encountered will reflect situations they will find in the real world and the types of people whom they will confront and have to deal with effectively in these situations.

Instructors should place a special emphasis on the benefits the students should receive from the case method because a great deal of the successful impact of this method lies with the students' desire to participate fully and better themselves professionally. Therefore, they must illustrate to the students that the case method will make the following contributions to their development of their communication skills.

It will make them recognize the importance of communication as part of their professional life.

It will allow them to utilize the types of writing germane to their career preference.

It will make them consider a specific audience and gear their writing toward that audience.

It will make them plan the necessary steps to complete the case successfully.

Also, the case method will help students develop certain managerial skills.

It will discourage their making snap judgements.

It will discourage believing in or looking for the "correct" answer.

It will train them to discuss things with others and to experience the broadening value of interacting with one's equals.[2]

ROLE PLAYING

Cases should allow students to play a role in order to increase interest and desire to become more personally involved. Role playing can bring relevance and more credibility to cases because students now have the opportunity to formulate possible solutions and carry out decisions as an individual who is part of the case. However, instructors must be aware that role playing in a technical writing class is not an end in itself. The purpose of the case is to compel students to solve problems and then communication solutions to a given audience. Further, instructors must also realize that role playing can present several obstacles. According to Peter Klaver, the experience students have had working and communicating in an organizational context ranges widely. Therefore, the need for simulation ranges from zero to total. Also, many students have trouble living with the role and become impatient and hostile to the "game" they have to play particularly when it interferes with what they understand to be the real work they need to do as students.[3]

Instructors who come to terms with these and other problems and decide to use role playing as part of the case should begin their introduction with some of the background concerning the purpose of role playing in cases. They should then continue by explaining the values the students themselves should gain through the technique. Emphasis should be placed on their being able to carry out thought or decision, changing attitudes by playing specified roles, becoming aware of and sensitive to the feelings of others, discovering personal faults, and learning to control emotions.[4]

How students conduct themselves in various roles will be one of the key factors to the success of the role playing exercise. Instructors must stress that a role is a parallel of real life and real world situations. Students are the characters they are playing. Their personal motivations, attitudes, and beliefs are the same as their character's. As their views change through normal discussion and persuasion, so do those of their character. The key to successful role playing is participation without doubt or question in that role and to play it as if it were a situation they might face under a similar set of circumstances.

CONDUCTING DISCUSSIONS ABOUT CASES

Because their part in the discussion of a case has a direct influence on the ways the student participants will think, make judgements, and form attitudes and convictions, instructors must think of themselves not as discussion leaders but as discussion guides. Accordingly, they must realize their role is to make sure that students understand the issues of the case and then function as expeditors, arbitrators, and molders of the issues involved in the case.

Instructors must realize that their first task is to articulate the case so that all the students are aware of the various issues involved. With an analysis of the issues, instructors can correct misconceptions or fill in gaps in thinking. Several questions concerning the case might lead to better comprehension or shed new light on it completely for some students. An alternate method of determining issues would be for the students themselves to explain the issues in the case as they see them. Karl Vesper suggests that with this method, instructors would also have a team prepare a comprehensive analysis. After individual students presented their facts, the student team would present theirs. With a much more detailed analysis than the individual students, the team could then answer questions from the class and direct a general discussion of the problems involved in the case.[5] As the discussion begins, instructors must be aware of their role of meeting the objectives of the discussion itself. Initially, they should establish an atmosphere which allows for free and direct comments, and they should prepare an environment so that students can interact with other students. As mentioned, their main task is that of a guide controlling the orderly progress of the class through the case and toward a solution. The steps, which force students to rely on their own intelligence, use of skills, and past experiences, include the following:

Reviewing the case content
Stating the problems
Collecting the relevant information
Developing alternatives
Evaluating the alternatives
Selecting a course of action
Scheduling the selected solutions[6]

However, instructors must avoid controlling to the point that new ideas are destroyed or not said at all. A good discussion allows the students to originate ideas, deal with technical and managerial issues, establish priorities, practice skills, and cover material without a lot of instructional interference.[7] Instructors must also be good listeners. As listeners they will readily know the direction the discussion is taking and whether it should be changed. Being aware of the feelings and attitudes of the students as they speak will help instructors know if they are grasping the significant aspects of the case. Listening to comments and conclusions will help instructors determine when to question, elaborate, restate, or supplement issues as the discussion continues. Instructors must see themselves not only as unobtrusive evaluators of students and discussion but also as participants in the discussion directing the students toward positive action.

SOLUTIONS TO CASES

The successful solution of a case is the result of the students' ability to deal with facts and figures based on a set of criteria. However, different but nevertheless correct solutions to cases occur because the students participating in them are divergent in personality, professional values, personal backgrounds, and pet concerns. Unless the solutions are totally unacceptable or beyond the scope of the case, instructors should not judge them as wholly correct or incorrect as one might consider the answer to a math problem. They should realize that varying degrees of solutions are possible or that a number of solutions are possible and acceptable. Failure to consider alternate solutions or lesser degrees of solutions on the part of instructors would smother the students' individual initiative and cause them to narrow their thinking to only those things they believe the instructor wants to hear. To evaluate the solutions to a case most effectively, instructors should have a set of standards which solutions must meet. First, they should successfully meet the rhetorical tasks set forth in the case and then the managerial tasks also found in many cases.

A rating system set up by instructors can balance the overall standings of the solutions depending on how well they meet each of the following technical communication skills.

The communications are acceptable in solving the problem presented
The communications are appropriate for the audiences they address
The communications are properly presented
The communications conform to the conditions given in the case
The communications will give results worth the effort expended

A separate rating system set up by instructors can also rate these managerial tasks.

The solution can be implemented
The solution is easy to implement
The solution is the most obvious to those affected
The solution is economical to implement
The solution is equitable to those affected

As the solutions are rated by these criteria, one will generally emerge as the more acceptable for the particular case. Rarely will any solution finally selected satisfy each criterion to the highest degree. Often times problems arise with the solutions. Therefore, the instructors' balancing of these divergent case solutions must show that the optimum is the one that effectively solves the case and minimizes the effects on the personnel involved.

NOTES

[1]Malcom E. Shaw, et al. Role Playing: A Practical Manual for Group Facilitators (San Diego: University Associates, 1980), pp. 14-15.

[2]Norman R.F. Maier, et al. The Role Playing Technique (La Jolla: University Associates, 1975), pp. 1-2.

[3]Peter R. Klaver. "Writing as Engineers and Writing in Class: Simulation as Solution and Problem." Technical and Professional Communication, Thomas M. Sawyer, ed. (Ann Arbor: Professional Communication Press, Inc., 1977), pp. 158-161.

[4]Maier, pp. 2-3.

[5]Karl H. Vesper. "An Easier Way to Teach With Engineering Cases." Engineering Education. 68 (January 1978), p. 350.

[6]Gordon Kardos. "Points on Using Engineering Cases in Class." Engineering Education. 68 (January 1978), p. 347.

[7]Kardos, p. 347.

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WHY USE CASE STUDIES RATHER THAN

SIMULATION-GAMING TECHNIQUES

OR LIBRARY RESEARCH?

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As teachers of technical communication, we have several choices among methods of teaching our students. Many of us have been trying to get away from obsession with teaching formats or with teaching the classical rhetorical modes. We have been experimenting with methods which present the student with a more challenging and true-to-life situation of needing to conduct research in a problem-solving context--and not thinking about organization or format until research and thinking are complete. Simulation-gaming techniques attempt to teach initiative and creativity; library research has also been used for this purpose. However, case studies provide the greatest opportunities to engage the students in problem-solving situations in which they develop skills as researchers and writers.

Emphasis on structure has been a great strength and a major limitation of traditional writing courses. Students need to learn organization, yet too often they have learned little else. Formats have been taught excessively in technical writing courses without sufficient instruction in audience analysis or invention. The modes of traditional rhetoric have undeniable value for teachers and for students, yet too often assignments find apprentice writers cramming and distorting their material into rigid designs or formulae. At best, the student is unable to function outside the artificiality of classroom assignments.

Some of the artificiality of classroom assignment is alleviated by the nature of the technical writing class itself. Students in business and technical fields who produce mediocre work in traditional freshman composition became competent writers in their own fields as a result of a writing course geared to their future writing needs at work.[1] The congruence of the students' and instructor's goals do not solve the artificiality problem, however. Students are still very far from the conditions under which they will be writing on the job. Cases replicate the complicated problems of professional writing better than any other type of assignment, especially in use of sources, purposes, audience analysis, thinking and composing process, and choice of organization and format.

Seldom is a writer's task in the business and technical worlds anything like the essayist's charge to sit down and create out of his or her imagination, memory, intellect or observation. Technical writers are often given stacks of reading material supplied by others and told to gather whatever additional information they need in whatever way they can. St. Louis colleagues working at McDonnell-Douglas and Emerson Electric tell me that they are often given conflicting information which they must reconcile. They spend a great deal of time talking on the telephone or soliciting information or explanations in person. This interpersonal give-and-take is difficult to duplicate in any method. The case study method can nevertheless simulate the complexities and contradictions of the technical writer's sources.

The oral exchange of information may be stimulated by conducting at least one or two team or group case study assignments. Oral communication ranked high among needed skills in which students desired more instruction when St. Louis Community College conducted a survey of enrolled students in fall, 1980. The case study method employed in teams or groups could help an able but inexperienced student to gain skills and confidence. It could also help an instructor to help a clearly deficient student and to encourage that student to take a semester course in oral communication.

Another pedagogical aspect of the case study method as a provider of source material is that the reading level can be regulated and comprehension monitored. Appropriate reading level must be a consideration in selecting materials for introductory courses. A minority of students will probably have trouble reading at a high enough level to understand and analyze the information in the cases. Simulation-gaming or library research are methods that can provide camouflage for such students. Poor reading is an increasing problem even at "non-open-door" colleges and universities. Such students will not complete our writing courses or their business, engineering or technical writing programs unless they read at the tenth grade level. The case study method can help us find students' reading problems in time to get them the instruction that is their only hope of completing their programs.

An instructional method that I would recommend even for good students using the case study method is the summary or precis. Technical writers need to be able to grasp the central idea and essential information in what they read. They also need to be able to distill them into brief and accessible forms. The case study method provides material very suitable to these purposes.

All these efforts to gather and comprehend source materials make sense to students using the case study method because they can see the purposes to which their final written product will be put. As John Brockman has emphasized in his definition of a good case study, purpose is essential to a "complete rhetorical context,"[2] and is the most difficult aspect of rhetorical context to provide in a writing class. An assignment that is an exercise only in not compelling for the students, as all writing teachers know. Library research assignments, unfortunately, are worthwhile exercises, but still exercises, with the information collected, analyzed and communicated to no discernible purpose. The "real world" sorts of purposes of case studies--including persuasion--are so much more comprehensible to students, in addition to providing more accurate simulation of the work environment and better writing.

The other problematic part of the complete rhetorical context missing from most writing assignments is audience. We all know how skilled our students become in writing for us, but that this is not the practice they need for their future lives. Case studies provide audiences other than the teacher, and are very specific in describing purpose and audience. Consequently over the course of the semester students have the chance to write for a number of different audiences. The audience, as Father Ong has taught us, is always a fiction,[3] and it takes an experienced writer to be able to imagine and project such a creation. Writing for a number of audiences is the best way to develop this experience in the shortest possible time.

Thinking and composing processes are also different in the case study method than in library research or simulation-gaming. The former is inappropriately academic for technical writing, with temptations either merely to summarize or to subordinate all else to a startling new "thesis." In the case study method problem-solving sorts of thinking processes are encouraged rather than looking for forms or thesis statements to fit the existing information. If the standard library paper is too product-oriented, simulation-gaming is too exclusively preoccupied with process. For technical writers there is always an outcome to brainstorming and other creative aspects of composing. Simulation-games stimulate these capacities, but to the neglect of the solitary writing process which is its inevitable conclusion in the life of a working writer.

The end of the process should be the choice of organization and format, and it is in the case study method. As I have said before, technical writing has been too obsessed with format. The case study method leads the student through a natural sequence of complex material, stated purpose and audience without strict specifications on the written product. The student must therefore apply problem-solving and decision-making to the choice of organization and format as the student will often be required to do as a working writer.

The case study method does not solve all instructional problems in teaching writing or in teaching technical writing. It has particular assets for all writing courses, but especially for technical writing courses, in which students are preparing for a lifetime of complex and challenging "complete rhetorical contexts." The case study method is thoroughly problem-solving in orientation and provides the student the best possible chance to prepare to be an effective problem-solver as a working writer.

NOTES

1. MacIntosh, Fred H., "Teaching Writing for the World's Work," The Teaching of Technical Writing, ed. D.H. Cunningham and H.A. Estrin, Urbana, Illinois: National Council of Teachers of English, 1975, p. 24.

2. Brockman, John R., "The Case Method and Technical Communications Pedagogy," unpublished manuscript, 1980.

3. Ong, Walter, S.J., "The Audience Is Always A Fiction," PMLA (1975), p. 9.

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PANEL B-10

TEACHING GRAPHICS

IN TECHNICAL COMMUNICATION:

A PRIMER FOR BEGINNING TEACHERS

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The panel presented a cross-section of useable ideas in the teaching of graphics in technical communication.

One panelist presented, using overhead transparencies, the standards for evaluating graphics used in technical reports.

Another panelist demonstrated the use of free, inexpensive, or home-made teaching aids for instruction in graphics.

In addition, a comprehensive bibliography of useful references for the instructor of graphics was presented.

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SELF-EDUCATION IN GRAPHICS FOR TEACHERS OF TECHNICAL WRITING:

AN ANNOTATED BIBLIOGRAPHY AND SUGGESTED READING PLAN

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Graphics are becoming increasingly important in technical communication. Besides the obvious value in clarifying a message, both for the writer during the planning/writing stage and for the audience, current research in how we think and learn points more and more toward the importance of visualization. Consequently, an awareness of graphics is important not only for our students, who need instruction in aids to clear thinking and communication, but also for ourselves.

While we recognize the need for knowledge about graphic communication, few teachers of technical writing have been trained in graphics. Sorting through the plethora of material available on the subject, seeking information appropriate for our needs, may seem a formidable task. The following annotated bibliography and suggested reading plan are offered as a guide for other teachers of technical communication who wish to make graphics an integral part of their teaching. This list of texts is by no means exhaustive, nor is exclusion of any a denial of its merit. Of all those I have examined in my own struggle to educate myself, however, these seem to me the most accessible and the most useful.

A BRIEF READING PLAN

For those who would like a comprehensive view of graphics in a very short time, I suggest beginning with Matthew Murgio's book, for a survey of the whole field of graphics. The second step, and most crucial in effective teaching of graphics, is a personal application of graphic techniques. Henning Nelms' book is an excellent guide, even for people who think they cannot draw. For people with elementary school-aged children, Lee J. Ames' book could turn this step into a delightful parent-child project.

To expand personal applications to include classroom use, James L. Adams' book is superb. It also makes a good bridge into the theory behind the importance of graphics. The single best book on this topic, essential for conviction and adaptability in teaching, is Gyorgy Kepes' essay collection. Finally, for an understanding of the mechanics of graphic production, Arthur T. Turnbull and Russell N. Baird's text provides a good overview.

For the convenience of those who wish to pursue one area more thoroughly or to substitute another text in this basic reading plan, I offer the following classification of the recommended texts:

Survey of the field of graphics: Bowman, Hamilton, Murgio

Detailed instructions in generating graphics: Ames (for children), Enrick, Katzenburg, Nelms

Graphic production: Broekhuizen, Turnbull and Baird

Theory behind the importance of graphics: Arnheim, Kepes, Restak

Classroom applications: Adams, Tebeaux, Titen

Reference: Gates (type style) and Society for Technical Communication (terminology)

This suggested reading plan stresses the integration of graphics concepts into every phase of the technical communication class and beyond. It emphasizes that graphics are not merely decorations; graphics are a way of thinking.

AN ANNOTATED BIBLIOGRAPHY

Adams, James L. *Conceptual Blockbusting: A Guide to Better Ideas*. 2nd ed. New York: Norton, 1979.

This book's intention is to make the reader "more conscious of the creative process, various blocks that inhibit it, and various tricks that can augment it" (p. 10). Working from the assumption that thinking, like any other human activity or skill, can be improved, this text offers examples and exercises (primarily involving vision) in problem-solving. The exercises are fun and easily adapted for classroom use. Many of Adams' suggestions seem made to order for technical writing classes, from invention techniques to graphic charting of organization.

Ames, Lee J. *Draw Draw Draw*. New York: Doubleday, 1962.

This children's book stresses the pleasure of drawing and leads the reader through playing with lines, shapes, and dots, to faces, human figures, and favorite objects. Without any technical vocabulary or theory, the reader is introduced to graphics vocabulary (point, line, texture, etc.), design, proportion, and perspective.

This book is an excellent choice for a parent-child self-education project.

Arnheim, Rudolf. *Visual Thinking*. London: Faber and Faber, Ltd., 1970.

This book explains why graphics is so important to us. Arnheim concludes that visual perception is fundamental to thinking. He examines the way the eye works and juxtaposes it with the way the mind works. We know, for instance, that we are not limited to flat representation reconstruction of the physical limited view. In the very act of visual perception, cognition--thinking--is happening. We see a part of an object, one side or angle of it, and we recreate the whole in our vision. As we follow Arnheim's explanation, we begin to understand *why*.

Bowman, William J. *Graphic Communication*. New York: John Wiley and Sons, 1968.

This rhetoric of graphics is concerned with "the design of the graphic figure [,]. . .the language elements available to design, and the communicative purposes toward which design is aimed" (p. vii). It demonstrates the influence of focus and purpose on the choice of graphic illustration, reviews the language of visual art: "a vocabulary of form elements, a grammar of spatial organization, an idiom of volumetric perspective, and a syntax for phrasing the image" (p. 9). Design, then, is

the translating of concepts into visual representations according to purpose. Applications demonstrate the manipulation of language--texture, color, etc.--to achieve subtle variations of emphasis in showing "what," "how," "how much," and "where."

Broekhuizen, Richard J. *Graphic Communications*. Bloomington, Ill.: McKnight Publishing Co., 1979.

This text describes in detail the processes in production of graphic communication: design (principles of design, typography, layout), image generation (various machines, including computers, techniques, and devices that aid in preparing the copy and the illustrations), preproduction (paper choice), production (kinds of printing: relief, screen process, gravure, planographic, continuous tone photography, office copying and duplicating), and finishing, binding, and packaging. An overview of graphic communication careers is especially helpful for students. The text is easy to read and thoroughly illustrated.

Enrick, Norbert Lloyd. *Effective Graphic Communication*. Princeton: Auerbach, 1972.

This excellent book examines the construction and design of various kinds of charts: those for numerical information (review of fundamental graph forms and more sophisticated combination and synthesis forms), flow charts (process, procedure, dependency, organizational, etc.), decision charts (binary, multiple choice, tree designs), charting grids to aid in designing visual presentation of data (includes samples of grid styles and templates), tabular forms (uses a flow chart to illustrate the process of generating tabular charts), decision structure tables (insures that data needed for routine decisions is at hand and minimizes danger of overlooking necessary detail). It also discusses screen projection of graphic aids, documentation, and designing forms to collect and report data. Check lists for chart and tabular design are included.

Gates, David. *Type*. New York: Watson-Guptill, 1973.

Part One presents the style categories of type, placing them in historical perspective and describing their distinguishing characteristics. Part Two presents complete alphabets of certain typefaces in several type sizes, organized by style categories. The text gives a good overview of the range of type faces and is a convenient reference for identifying a particular type.

Hamilton, Edward A. *Graphic Design for the Computer Age: Visual Communication for All Media*. New York: Van Nostrand Reinhold Co., 1970.

The overview of graphic techniques and their historical contexts is useful for a general definition of the scope of graphic communication. Of particular interest are the last two chapters, 21 and 22, (pp. 156-81), which explain the ways a graphic designer can make use of the computer, and point to the wide application, present and future, of computer graphics.

Katzenberg, Arlene Chmil. *How to Draw Graphs*. Kalamazoo, Michigan: Behaviordelia, Inc., 1975.

Designed for psychology students, this programmed text leads the reader from identifying and analyzing the appropriate data to be graphed through the basic construction of graphs, meeting APA specifications. Ten "rules" are presented sequentially, with ample illustrations for the reader to test comprehension: "1) center the graph; 2) label the axes; 3) print the labels parallel to the axes; 4) place the grid marks; 5) scale at equal intervals; 6) plot the data points; 7) connect the data points; 8) write the legends; 9) use geometric forms; 10) limit one graph to a page" (p. v). This book makes very few assumptions of knowledge and is ideal for the reader with little math background.

Kepes, Gyorgy, ed. *Education of Vision*. New York: George Braziller, 1965.

This collection of essays rests on two assumptions:

> First, that there is a fundamental inter-dependence between perception and conception, between the visual and the rational. The experimental evidence in support of the idea that sensory functions belong to an interdependence system--that there is a primordial unity of sensory and motor processes--is extended to include a corresponding interdependence between the sensory and the intellectual: between art and science. And second, that because the visual factor has been for so long misunderstood and consequently neglected, there is an urgent need today for a re-evaluation of the education of vision.
>
> (P. vii)

The essays begin with three psychologists' analysis of our visual perceptions as they influence the way we think, further develop visual abilities, and create. The second group of essays explore ways vision facilitates understanding of our physical environment. The third group "deals with concrete techniques for visual education" (p. vi), and the fourth group offers a brief overview of current visual education.

Murgio, Matthew P. <u>Communication Graphics</u>. New York: Van Nostrand Reinhold Co., 1969.

Beginning with the value of visual representation of information, kinds of data amenable to charting, and the benefits and perils of charting, this text explains how to chart information: understanding the basic geometric designs used in charting various kinds of information to particular purposes, the mechanics of organizing and designing the data chart, the use of pictorial charts, and the impact of color. Substantial consideration is given to preparing live presentation of the visual data: choice of medium (hand-out, chalk board, overhead, film, etc.), planning with the facilities and the particular audience in mind, and the performance. A brief overview of computer capacity with the cathode-ray tube and potential in graphic communication concludes.

Nelms, Henning. <u>Thinking with a Pencil</u>. New York: Barnes and Noble, Inc., 1957.

This book is "intended for two groups: (1) those who wish to use drawing as a tool for thought and communication but lack the knowledge of how to make a drawing and (2) those who are accustomed to draw but want to enlarge their graphics vocabularies and extend the range of fields in which they can apply the abilities that they already possess" (p. vii). It describes and illustrates various kinds of charts (which take little or no drawing skill), labeling techniques (reducing representational drawings to more diagramatic kinds of rendering), tracing and stick figures, proportion, measurement, and alignment, and fixed-line construction. Nelms emphasizes seeing and using the geometric shapes inherent in things and explains ways of treating numerical data and using mechanical aids.

Restak, Richard M., M.D. <u>The Brain: The Last Frontier</u>. New York: Werner Books, 1979.

A highly readable explanation of how the brain works. Of particular interest to those of us concerned with language and the impact of vision is ch. 10, "The Jekyll and Hyde Solution" (pp. 187-231), which explores the relation between right and left brain.

Society for Technical Communication. <u>A Glossary of Graphics and Technical Art Terms</u>. Washington, D. C.: STC, 1971.

A handy reference tool for unfamiliar terms.

Tebeaux, Elizabeth. "Using Computer Printouts to Teach Analysis and Graphics." Journal of Technical Writing and Communication 11, no. 1 (1981), 13-22.

Tebeaux suggest using computer printouts of membership lists as a source for generating graphic aids. The exercise gives students first-hand practice in using computer printouts, in analyzing data, and in constructing appropriate charts.

Titen, Jennifer. "Application of Rudolf Arnheim's Visual Thinking to the Teaching of Technical Writing." The Technical Writing Teacher, 7, no. 3 (Spring 1980), 113-8.

Titen offers a very specific lesson plan and classroom exercise suggestions.

Turnbull, Arthur, and Russell Baird. The Graphics of Communication. 4th ed. New York: Holt, Rinehart and Winston, 1980.

Primarily concerned with the mechanics of graphics, the text describes elements of communication; verbal (type), visual (illustrations and color), and design (layout), then traces the actual production process. The strength of the text is its insistence on context. Set against the broader background of communication theory, the historical developments of each element are considered in their influence on traditional practice, with special emphasis on current computer impact.

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TEACHING GRAPHICS IN TECHNICAL COMMUNICATION CLASSES

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ABSTRACT

Because graphic aids can often convey and clarify information more efficiently and accurately than words alone, it is difficult to find technical writing that does not use graphics. Yet because many technical communication teachers are recycled literature or composition teachers who are not trained to use or to teach the use of graphic aids, many are reluctant to do so and others are frustrated in their attempts. Still others are stifled because they do not have budgets or equipment that provide for slides or other relatively expensive methods of acquainting students with a wide variety of graphics. This paper suggests ways of accumulating and presenting graphic illustrations on a shoestring budget: collecting graphics from companies' annual reports and laminating them for workshop use or putting them on a flip chart for classroom presentation, creating overhead transparencies to demonstrate different levels of effectiveness of graphic aids, and bringing in graphic artists for question/answer periods or in-class workshops. Also included are an extensive handout as an introduction to graphics, sample assignments, and a selected and annotated bibliography.

TEACHING GRAPHICS IN TECHNICAL COMMUNICATION CLASSES

Illustrations in books date back to fifteenth century woodcuts, and today's sophisticated variety of technical graphics grew out of a need to make relatively complex subjects easily understandable. World War II forced industry to build new, complex products; this created a need for technical illustrations to help train workers, and thus accelerated the growth of graphic illustration. Today the visual media is used for training and instruction in business and industry, government, and education. Graphic aids are used to convey and clarify information, to show trends and relationships--to bridge a communication gap, to enable nonspecialists to grasp specialized information. Perhaps because we are undergoing a video revolution, perhaps because of our increasing sales to non-English speaking markets where graphics can help explain the products, perhaps because of the decreasing communication skills of our work force, graphic aids are becoming more and more widely used and more and more important.

Because many technical communication teachers are recycled literature or composition teachers who are not trained to use or to teach the use of graphic aids, many are reluctant to do so and others are frustrated in their attempts. Yet it is difficult to find technical writing that does not use graphics; indeed, many types of statistical or complex data are difficult or even impossible to convey by words alone. Often this information can be conveyed much more efficiently and accurately by pictures, graphs, diagrams, tables, or other graphic aids.

We've all heard the now overworked cliché that a picture is worth a thousand words, but that's not always true. (I had that startling revelation a few years back when I assigned an 800-1000 word essay in my freshman composition class and one student showed up with a picture!) Sometimes it takes a lot of words to explain a picture--but something seen is often better understood and better remembered, more thought-provoking and more palatable.

Realizing the importance of graphic illustrations in technical communication, I set out to learn about them. I too have a background in literature but through a fortunate set of circumstances wound up teaching technical communication. In pursuit of literature degrees I of course wrote a lot of papers, but I never used graphics in them. So this was initially my weakest area in technical communication. I was a bit wary of and intimidated by anything new to me and by technology and the gadgets that go with it--afraid to try my hand at creating graphics (much less try to teach others how to use graphics), confident that the minute I tried something new and even semi-complicated in the classroom, Murphy's Law would immediately go into effect.

But, determined to become at least halfway proficient in this area, I began to note and study how others use visual aids--the kinds of information they present and its overall effectiveness for a particular audience and a particular purpose. I wrote to several major companies, asking for their annual reports--all chock-full of delightful graphic illustrations. (Perhaps because they assumed I was a potential stockholder, they were all very gracious about adding my name to their mailing lists--so now I'm under a constant barrage of annual reports.) Many of these illustrations are large enough to be used in a flip chart, and some of the smaller ones I've laminated so students can examine them in in-class graphics workshops. For my flip chart I purchased a very inexpensive ($4) artist's sketchpad, and I've found that this works as well as slides or other presentations requiring more costly or complex equipment. The flip chart is simple and quick to produce, it requires no special lighting or equipment, it can easily be changed or added to, and it's economical. (Some of us who choose to live and work in the Ozarks get paid partly in scenery, so we have to cut all the corners we can.)

Another method that is almost as easy and inexpensive to prepare and use is overhead projection. The projector is simple to operate--even for non-technical liberal arts folks--and can be used in normal lighting. I use multiple overlays to demonstrate different levels of effectiveness in graphic illustrations. I can face my students during the presentation; and I can write, draw, or point out items as I speak.

Still another profitable method of acquainting students with the use of graphics is to invite a specialist to class--someone from the school's technical illustration department (if it has one), or a graphic artist from the community. I've found that people with these skills are happy and proud to share them with others, and I think my students benefit from an informal question-answer session with an expert.

I certainly do not profess to be a graphics expert; I have not specialized in graphic illustration and I teach no courses in that subject. Nor do I profess to produce graphic artists. But in my technical communication classes I work with students from a variety of majors, many of whom will get no training in graphic illustration elsewhere. Because I believe graphic illustration is an important aspect of technical communication and also important to these future professionals, I try to at least make my students aware of the needs for and possibilities of visual aids--and when, where, why, and how to use them. I try to acquaint the students with the wide variety of graphic aids used today, but I stress the basics: tables, line graphs, bar graphs and pie graphs, organization charts and flow charts, photographs, and drawings. I do not cover such topics as orthographic drawings, perspective illustrations, schematic diagrams, or axonometric illustrations--because I see no profit in spending time discussing methods of illustration for which neither I nor they have the equipment or expertise. Moreover, I believe those who will be expected in their careers to produce such illustrations will no doubt get training on the job or in graphics or technical illustration courses. (I do, however, provide sources for any who wants to tackle more complicated illustrations.)

I require my students to use graphics in their definition and process papers and in their major technical reports. I accept reproductions of others' illustrations, and I believe there's some value for the students even in this. But of course I'm more favorably impressed with the illustrations they design and produce. I realize that they have limited (if any) experience, and I understand their initial lack of confidence. Though most of them rely on a few basic illustrations (tables or simple graphs), I stress that there's little that's sacred about technical illustrations, and I urge them to be creative. I encourage them to try their hand at color, not only for its attractiveness but also because it has high memory value and promotes association. I introduce them to Chart Pak and Transfer Type, systems of rub-off lettering, and show them that even their fellow students and their totally unartistic teacher can produce professional-looking illustrations with the help of these systems. I'm pleased if they leave the class with an appreciation for the value of graphics and an understanding of how to adapt graphics to different audiences and different purposes, how to integrate them into the text, and a few general principles for their use.

Let's not be illiterates in a strange and unknown area, intimidated by technology and all that goes with it. Realizing the importance and increased use of graphic illustration, let's help prepare our students, our future professionals, to be better communicators--to be able to communicate with more than mere prose. If we do less, we do them a great disservice.

GRAPHIC AIDS

Introduction

Graphic aids are visual supplements to verbal presentations. They may be quantitative, emphasizing numerical values, or qualitative, emphasizing relationships. They are compact presentations of data that enable readers to visualize a great deal of information at a glance. Tables, graphs, charts, drawings, diagrams, photographs, and maps are examples of graphic aids.

Illustrations in books date back to fifteenth century woodcuts, and today's sophisticated variety of technical graphics grew out of a need to make relatively complex subjects easily understandable. World War II forced industry to build new, complex products; this created a need for technical illustrations to help train workers, and thus accelerated the growth of graphic illustration. Today visual media are used for training and instruction in business and industry, government, and education. Graphic aids are used to convey and clarify information, to show trends and relationships--to bridge a communication gap, to enable nonspecialists to grasp specialized information. Perhaps because we are undergoing a video revolution, perhaps because of our increasing sales to non-English speaking markets where graphics can help explain the products, perhaps because of the decreasing communication skills of our work force, graphic aids are becoming more and more widely used and more and more important.

General Principles

Sight is probably the most highly developed of our senses, and for most of us something seen can be better understood and more easily remembered. Graphic illustrations can often attract attention and provoke thought much more readily than can pages of text. (See, for example, Figures 1 and 2 below.)

Figure 1.

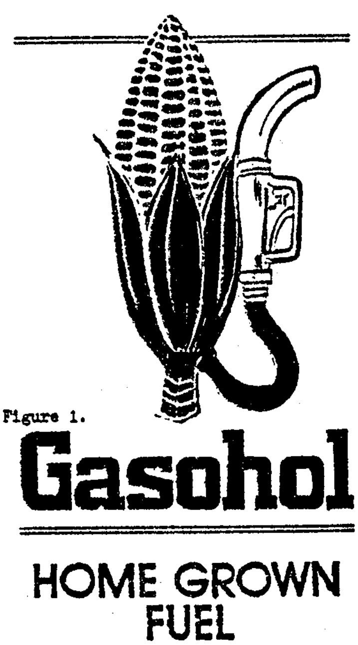


Figure 2.

Also, we are a tv/comic book generation, and we are more likely to be interested in illustrations than in straight prose. Yet graphic aids must be functional, not just embellishment. And if they are to be effective and meaningful--or even palatable--they must be well designed and well placed.

Certainly a graphic aid should be chosen with a particular audience in mind. Whatever is most suitable for the audience and for the purpose of the presentation, whatever will communicate best, should be used. Graphics should not be cluttered with unnecessary information; nor should they be used indiscriminately, for they can distort, mislead, and confuse.

Each graphic aid should be numbered and titled, and each of its parts should be appropriately labeled. If the graphic was taken from another source, that should be identified parenthetically after the title or beneath the illustration. If the graphic was developed with data from another source, that too should be noted.

Although most graphic aids are created to support an immediate verbal presentation, their ultimate use may extend far beyond their immediate objective. If they are worthwhile, they will probably be reproduced--and this usually means in black and white. So they should be planned so that they'll be reproducible; that is, they should not depend on color for their meaning. But this does not mean that color should be avoided; indeed, the use of color can make graphics much more appealing and thus more likely to attract and maintain interest.

Ideally, graphic aids should be placed within (never before) the text where they are discussed--as near as possible to the most pertinent text. General, supplementary aids that might interrupt the reading of the text should be reserved for an appendix. The reader should be referred to the graphic when it is most appropriate for him to look at it.

Tables

Tables contain two or more parallel columns of data. (All other types of graphic aids are called "figures.") Though they are less appealing and interesting than pictorial presentations, they are excellent for organizing and depicting statistics. Tables are usually the best means of presenting large amounts of data concisely and exactly.

Informal tables, which are merely a continuation of the text, do not require a frame, a number, or even a title. They are used to break up a page of text and to make explanations brief and simple.

Formal tables require more white space and should be titled, numbered, and cross referenced. All columns must be labeled (in parallel grammatical form). Whole numbers are aligned by the right-hand digits, and others are aligned by the decimal points.

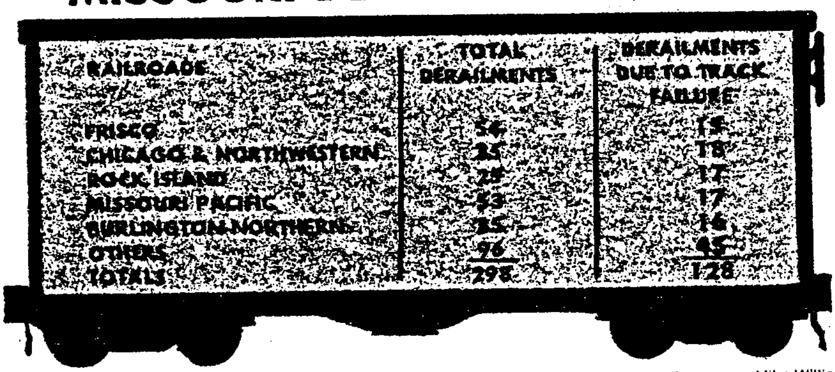
Tables I and II below illustrate two approaches to table-making; Table II obviously tries to embellish the statistics with a pictorial background.

Table I. Number of Persons by Age and Sex: 1970

Age	Male	Female
Total persons in U.S.	98,912,192	104,299,734
Under 5 years............	8,745,499	8,408,838
5 to 14 years	20,759,233	19,986,482
15 to 24 years............	17,551,116	17,890,253
25 to 44 years............	23,448,593	24,546,641
45 to 64 years............	19,992,043	21,817,726
65 to 74 years............	5,437,084	6,998,372
75 years and over	2,978,624	4,651,422

Table II

MISSOURI DERAILMENTS 1979



RAILROADS	TOTAL DERAILMENTS	DERAILMENTS DUE TO TRACK FAILURE
FRISCO	54	15
CHICAGO & NORTHWESTERN	25	18
ROCK ISLAND	28	17
MISSOURI PACIFIC	53	17
BURLINGTON NORTHERN	35	16
OTHERS	96	45
TOTALS	298	128

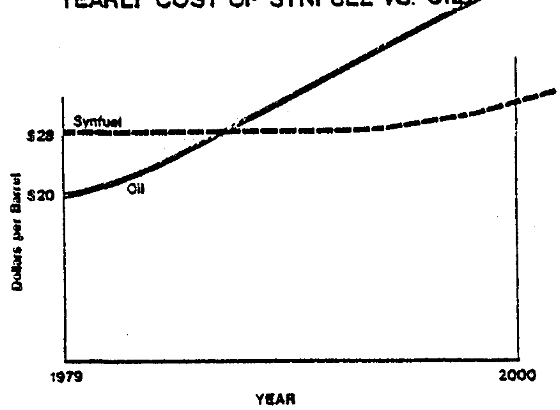
Illustration / Mike Willis

These figures for 1979 are provided by the Missouri Public Service Commission.

Graphs

Graphs present statistical quantities visually so that trends, changes, and cycles can be readily identified. They can be used to illustrate data that would require more time for study and analysis if it were presented in a table. Usually they are not as precise or accurate as a table, but they can make a point more strikingly (see Figure 3).

Figure 3
YEARLY COST OF SYNFUEL VS. OIL



Though they deal with numerical quantities, graphs emphasize change rather than amount. (Sometimes the terms "graphs" and "charts" are used interchangeably. In this guide they are used interchangeably except "chart" is also used to describe visual aids that deal with non-statistical information, such as the organization chart and the flow chart.)

Graphs have horizontal scales (usually for plotting independent variables) and vertical scales (usually for plotting dependent variables). Each scale must be labeled, of course, as must any symbol used in the graph.

Line graphs use one or more lines to depict changes in the value of a variable quantity (or quantities). (See Figures 4 and 5.) They visually dramatize trends, amounts, and results over a period of time; they are good for comparing series and are most commonly used to present data corresponding to consecutive time periods. (See Figures 6 and 7.)

Figure 4.

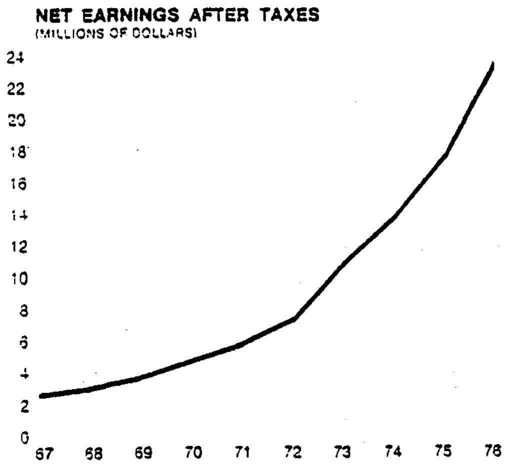
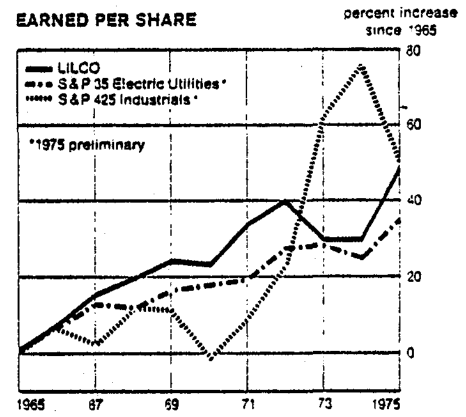


Figure 5.



The 48% increase in LILCO's earnings per share since 1965 has been greater than that of the Standard and Poor's electric utility average and almost equal to that of the industrial average.

Figure 6.

Sound capitalization ratios consistently maintained.

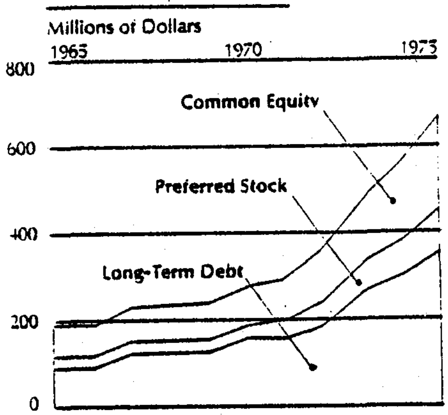
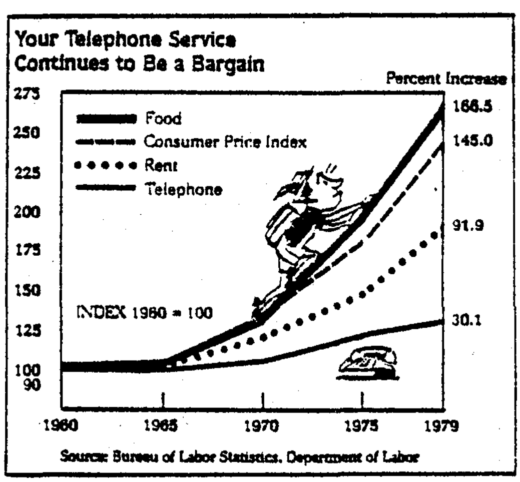


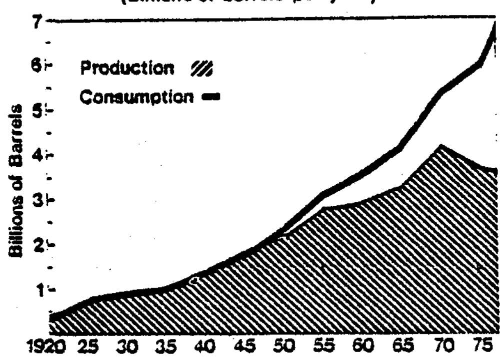
Figure 7.



When the lines of a graph depict a continuous natural process, they may be smoothed or "faired"; otherwise, lines are drawn from point to point. When a series of lines are used the layers they create can be filled in with different colors or shading patterns; this is called a layer graph (also called a surface or strata graph). (See Figure 8.)

Figure 8.

U.S. PRODUCTION AND CONSUMPTION, ALL OILS, 1920-1977
(Billions of barrels per year)



Bar graphs, rectangular blocks of color or shading on a simple grid, are perhaps the simplest type of visual aid to prepare and to understand. They provide striking comparisons between a limited number of items. They may be drawn either horizontally or vertically; usually vertical bar graphs (also called column graphs) show the amount or size of one item at different periods of time (see Figures 9 and 10), whereas horizontal bar graphs show different amounts of more than one item at the same time (see

Figure 9

Earnings (Loss) Per Share
Source: Summary of Operations, Item 2, Form 10-K

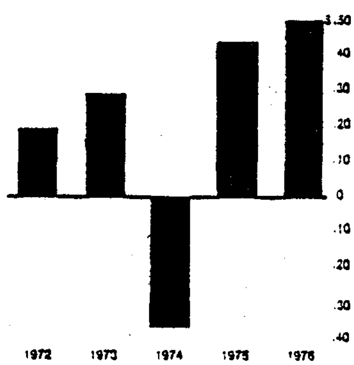


Figure 10.

Population of the United States

Total Number of Persons in Each Census: 1790-1970

Number in Millions

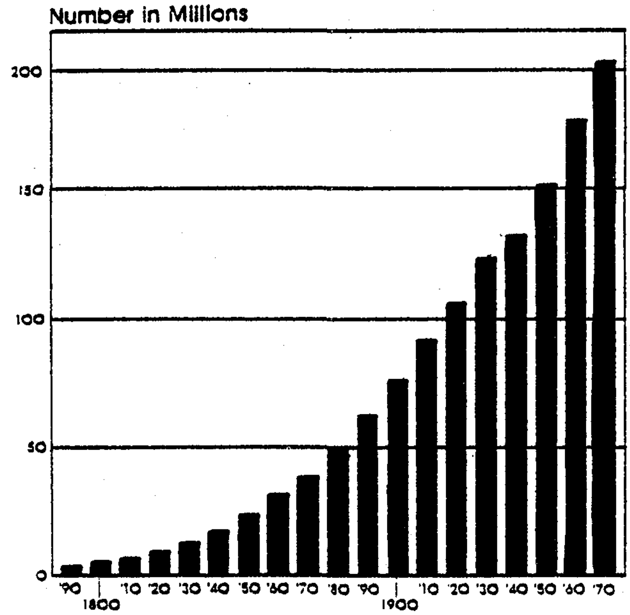


Figure 11). Sometimes a combination line-bar graph is used to compare two or more variables (see Figure 12).

Figure 11.

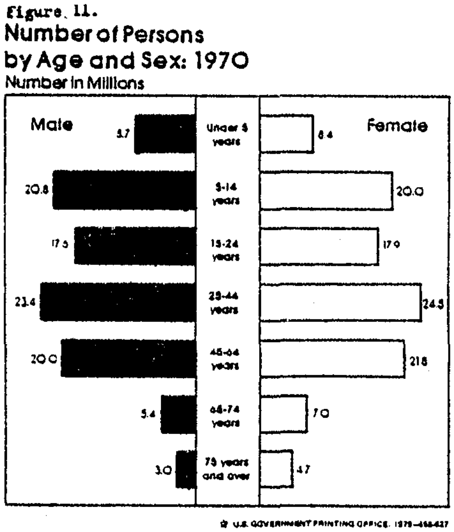
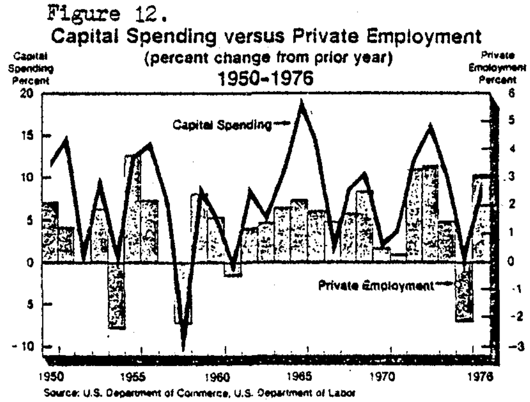
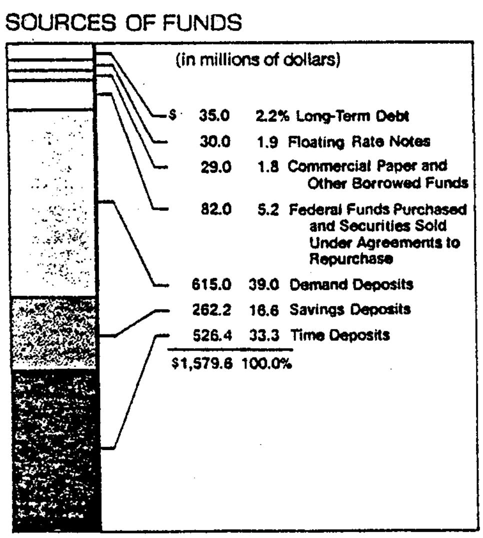


Figure 12.



In addition to the multiple bar charts just discussed, a <u>subdivided bar graph</u> (also called 100% bar graph) can be used to depict the relative size or percentage of each of the parts of a whole (see Figure 13). Segments can be differentiated from each other by colors, shading, or texturing.

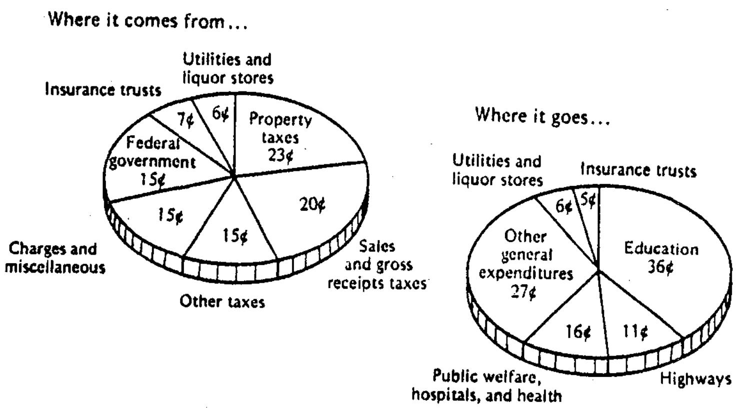
Figure 13.



<u>Pie graphs</u> (also called circle or sector graphs) vividly depict divisions of a whole into its component parts. The circumference of the circle represents 100%, and it is divided into segments (or slices) representing proportions or percentages of the whole. The pie is first sliced at the 12:00 o'clock position, and moving clockwise the slices are cut in order of descending size. (See Figure 14.)

Figure 14.

The state and local government dollar, 1970. (U.S. Bureau of the Census)



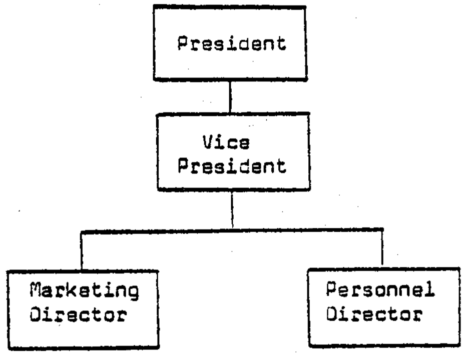
Pie graphs are perhaps not the most accurate way to present data, but they make it easy to compare parts to each other and to the whole. And they have a strong visual impact, a dramatic emphasis. They are most effective when there are few divisions and a wide range of proportions. Generally there should not be more than six or eight sections; very small percentages probably show up more vividly in a bar graph.

<u>Charts</u>

As noted earlier, graphs can also be called charts, but here the word "chart" takes on an additional meaning and refers to graphic aids depicting non-statistical information.

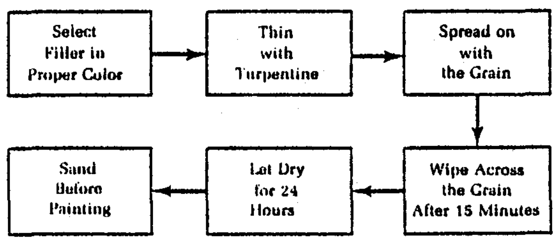
<u>Organization charts</u> present not statistical data but rather the distribution of functions, personnel, and authority within an organization. They are an excellent way to show lines of authority and levels of responsibility. The organization chart on the next page depicts one company's executive hierarchy.

Figure 15. Executive Hierarchy



Flow charts depict various steps of a process or the flow of a product from beginning to completion, as can be seen below. The steps are represented by geometrical figures or by drawings suggesting their actual appearance.

Figure 16. Preparing Wood for Painting



Photographs

Photographs provide realism and authenticity; in technical writing they are used not only to assist verbal description but also to prove the truth of assertions (see Figure 17). Photographs are limited, however: they can show only the surface, and sometimes they unavoidably present insignificant facts. Also, they are often difficult and costly to reproduce.

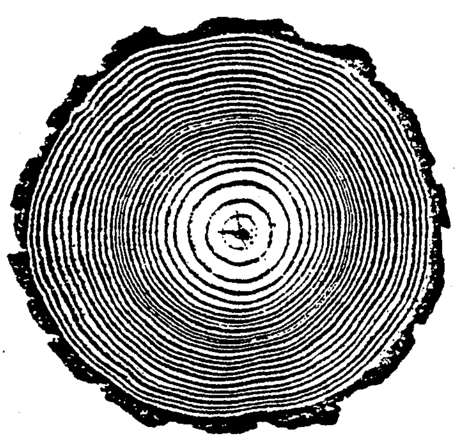


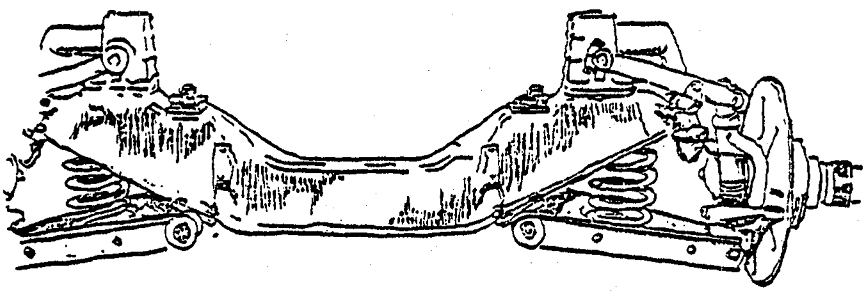
Figure 17.

Explosive growth. The cross section below is from a 27-year-old Southern pine in an unmanaged forest. On the left, a tree of the same age in a managed forest, producing over 3 times the wood fiber per acre.

Drawings

Drawings are often fairly complex and require some skill to produce. This does not mean, however, that amateurs can't put them to good use; note the neat illustration below, drawn by a student. Drawings are often the best method of picturing the relative shape and location of objects, and they have two advantages over photographs: they can picture the interior as well as the exterior of an object, and they can omit the insignificant and emphasize the significant.

Figure 18. Front End from a 1965 Chevrolet Corvair.



ASSIGNMENTS

● 1. (From journals, reports, brochures, etc.) collect and bring to class samples of graphic aids, along with their captions and supporting text. Be prepared to discuss their effectiveness.

● 2. Convert the following information into a table.
Texas County, Missouri, experienced a drought in 1980. In January it received only .32 inches of rainfall, compared to the normal 2.66 inches. February, however, supplied 2.84 inches, more than the normally received 2.25 inches. March was another exception, providing 4.63 inches, whereas the normal March rainfall is only 4.24 inches. But in April the norm is 4.27 inches, and the county received only 2.49 inches; and the May average is 3.97 inches but Texas County received only 2.56 inches. The trend continued in June: Texas County registered only 2.05 inches of moisture, as opposed to the normal 4.58 inches. And again in July: only .68 inches for Texas Countians, compared to the usual 4.14 inches. August and September continued the trend--1.12 and 2.10 inches, respectively, instead of the normal 3.68 and 4.16. In October, however, the county received more rainfall than usual: 3.98 inches rather than 2.74 inches. But November and December reversed that short-lived trend, providing only 1.92 and .64 inches in lieu of the normal 2.53 and 2.25 inches, respectively. Thus the county suffered one of the worst dry spells in its history, receiving a total of 25.33 inches of rainfall, 16.14 inches short of the normal 41.47 inches.

● 3. Draw an organization chart depicting the following information: Southwest Missouri State University is under the general control and management of its Board of Regents. The President is the chief executive of the University, responsible to the Board of Regents. The Dean of Faculties, the major academic officer of the University, serves under the president; and five deans are responsible to him--the Dean of Arts and Humanities, the Dean of Business, the Dean of Education and Psychology, the Dean of Science and Technology, and the Dean of the Graduate School. Department heads are responsible to the deans; for example, the Head of the English Department is responsible to the Dean of Arts and Humanities--and then the English Department faculty are responsible to the department head.

● 4. Construct a line graph that presents the following information: Our university has grown from 400 students in 1909 to 14,350 students in 1979. This is how the growth pattern can be traced: 500 students were here in 1919, 1048 students were here in 1929, and 1615 students were here in 1939. In 1949 the headcount was 1877, in 1959 it was 2711, and in 1969 it was 8192.

● 5. Fifty people took Technical Writing last semester. Of these, 10 received A's, 20 received B's, 15 received C's, and 5 received D's. Draw a circle graph showing the percentage of students receiving each grade. Then draw a divided bar chart depicting the same information.

GRAPHIC COMMUNICATION: A SELECTED BIBLIOGRAPHY

Enrick, Norbert Lloyd. Effective Graphic Communication. Princeton: Auerbach, 1972.
Thorough, non-technical discussion of how to create and use many types of charts and tables.

Magnan, George A. Using Technical Art: An Industry Guide. New York: Wiley-Interscience, 1970.
An overview of graphics in American industry that explains when, why, and how to use them. Discusses drawings, diagrams, charts, graphs, photographs, slides, posters, filmstrips, and transparencies; and includes a list of advantages and disadvantages for each.

Murgio, Matthew P. Communications Graphics. New York: Van Nostrand Reinhold, 1969.
Chapters on types of charts and graphs and how to draw them, using color in graphic aids, and planning and making presentations with graphic aids (including a chapter on presentations using projected material).

Pocket Pal: A Graphic Arts Digest. 12th ed. New York: International Paper Company, 1979.
Graphic arts handbook that discusses printing: history, typefaces, composition, paper, inks, plate making. Has one chapter on graphic arts photography and a glossary of graphic arts terms.

Turnbull, Arthur T., and Russell N. Baird. The Graphics of Communication: Typography, Layout, Design. 3rd ed. New York: Holt, Rinehart and Winston, 1975.
Basic introduction to graphics and communication theory. Chapters on graphic illustration (photography and charts), typography, printing processes, and aspects of layout and design (contrast, balance, proportion, rhythm, grouping).

(Also, most technical communication textbooks contain useful chapters on the use of graphic aids.)

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A GRAPHICS PRIMER FOR ENGLISH TEACHERS

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SUMMARY

Technical writing, when taught in engineering curricula, is taught primarily by English teachers. While English teachers readily adapt methods of teaching general composition to technical writing formats, the acquisition of skills necessary for teaching graphics presents some difficulty. English teachers rarely have a background in drafting or even analytical techniques applicable to graphics. This paper presents a simple, step-by-step method of teaching students how to draw different types of graphs. Each step is illustrated by a drawing. Some audience analysis for the determination of appropriateness of the use of different types of graphs is included.

INTRODUCTION

Technical writing, when included in engineering curricula, is taught primarily by English teachers. These teachers rarely possess advanced degrees in technical communications, but generally have an academic background in literature or composition. The transition from composition to technical writing requires a change in the teaching of written material and also an understanding of graphical material. The second is particularly important, because engineering reports rely heavily on graphics. Reports may use up to 80% of space for figures with written material only acting to introduce or comment on figures.

If a comprehensive course in technical writing is to be offered, graphics must be taught as an essential component. Since English teachers rarely possess extensive drafting skills or sophisticated math backgrounds, the tendency is to avoid graphics or rely on student or engineering faculty expertise. This is unnecessary if teachers accept two basic ideas:

1. They are the audience, hence, graphics used by students are good if the teacher understands them.

2. Graphics are very similar to paragraph construction.

Use of graphics is covered by one and only one criterion: they should be used if they are more effective and efficient than words. It must be emphasized that both the effectiveness and efficiency are governed by audience. If they do not meet both criteria, graphics becomes analogous to "empty words", best deleted or replaced. To be effective and efficient, graphics must tell their story more rapidly, completely and clearly than an equivalent space of words alone could. Graphics, as used by engineers, fall into five categories:

1. "Draftings"

2. Drawings

3. Photographs

4. Computer Output

5. Graphs

"Draftings" may be defined as a drawing using stylized engineering symbols. These range from electrical circuit schematics, to computer flow diagrams, to assembly drawings. They are meant for technical audiences and, unless fully understood by the instructor, are best left out of a technical writing course. Engineering students, most of whom have taken a course including drafting, are easily able to add more sophisticated types of drawings. The addition of these drawings implies an audience narrowed to that of the highly "technically literate." The emphasis in a technical writing course needs to be on the harder task of conveying technical information to the general public. In fact, even for writing within the engineering community, more sophisticated material should be placed in appendices, since reports are also read by upper management who have neither the time or expertise for detail.

Drawings, for the purposes of this paper, are defined as non-stylized illustrations. In engineering reports, they are used to show designs not yet executed or are used in place of photographs when photography is unfeasible, impossible or too costly.

Commercial photography is a highly specialized field, with technical products as one of its branches. Criteria for acceptability are functional rather than aesthetic.

Computer printouts, unless meant for circulation among computer experts, need editing and extensive formating to be worthy of inclusion in the body of the report.

Graphs used by engineers fall into four categories:

1. Line graphs, cartesian coordinates

2. Line graphs, special coordinates

3. Bar graphs

4. Pie charts

Bar graphs and pie charts, frequently used in newspapers and magazines, are appropriate for any audience. Line graphs require a modicum of mathematical literacy, while specialized line graphs are best left for a scientific audience.

This paper deals specifically with a prescriptive method of drawing graphs. In addition, techniques for using graphs effectively in the body of a report are also discussed.

PROCEDURE

The statement of the problem in graphics is simply:

GIVEN: Data

FIND: Graphical representation

The method is outlined below, with illustrated explanations for each step on the following pages.

METHOD:

1. Choose appropriate paper.
2. Choose and draw axes leaving correct margins (1½" on left, 1" on top, bottom and right, after all lettering).
3. Choose scales on axes. A maximum portion of paper remaining after margins should be used. Scales should conform to graph paper lines.
4. Show scale captions.
5. Title axes with variable name, symbol and units.
6. Plot data.
7. Connect data points.
8. Title graph.
9. Show key.

Steps 1-5 and 8-9 are common to all types of graphs, while 6 and 7 are dependent on the type of graph. Each step will now be discussed and illustrated.

1. Choose appropriate paper.

I. Choose appropriate type of paper.

a. Linear paper - used for representation of general information particularly to a non-technical audience.

b. Logarithmic paper - scales graduated in logarithmic divisions. Used for presentation of data ranging from very small to very large.

c. Semi-logarithmic paper. The vertical scale (usually) is logarithmic while the horizontal scale is arithmetic. Used for determining relative changes or patterns in data.

d. Bar graphs. Used for easy interpretation by general public.

e. Pie charts. Used to present percentage relationships in a population.

II. Choose appropriate grid size.

a. Linear paper is available in various numbers of lines per unit length, i.e., 2 lines per cm., 10 lines per cm. Choose the appropriate number of lines per unit length for the required graph. The data should be plotted using as much of the paper as possible (maximum resolution). Paper should also be chosen so that convenient intervals (multiples of 2, 5, 10) occur on major lines (every inch or cm.).

b./c. Logarithmic and semi-logarithmic paper is available in varying numbers of cycles per page, i.e., 3 cycle semi-log. Each cycle represents a power of 10, i.e., one cycle runs from 1000 to 10,000. The appropriate paper to represent given data must be chosen.

d. Bar graphs are easily drawn on linear graph paper. The relative width and height governs paper choice. Bar graphs can also be drawn on plain white paper.

e. Either polar coordinate or percentage paper may be used for pie charts. Polar paper necessitates conversion of percentages to degrees, but has the advantage of easy variability of pie size. Percentage paper saves one step, but does prescribe pie size. Again, plain white paper may be used.

2. Choose and draw axes leaving correct margins (1½" on left and 1" on top, bottom and right, after all lettering).

   The margins indicated are appropriate for a full page graph. These margins conform to those required of a manuscript. If the graph is to fit in a smaller space, margins are chosen to set the graph off from the text. Since reducing copiers are readily available, it is suggested that the graph be drawn to approximately double size for better resolution and then reduced to conform to spacial allocation.

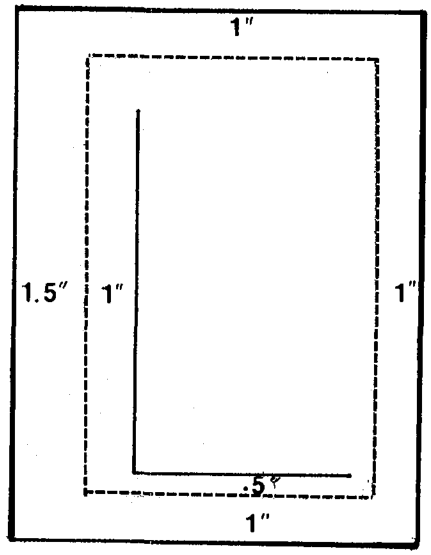

FIG. (1)

3. Choose scales on axes. A maximum portion of paper remaining after margins should be used. Scales should conform to graph paper lines.

   The horizontal axis should be used for the independent variable (the one you control or vary during an experiment) and the vertical should be used for the dependent variable. Data presentation can be manipulated by axis choice. A long vertical axis can make small variations seem exaggerated, while a compressed axis supresses data variation.

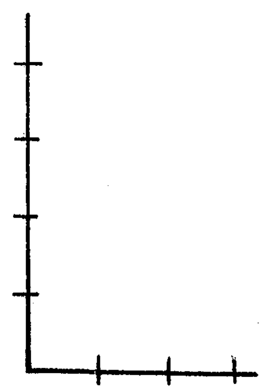

FIG. (2)

4. Show scale caption.

   Tick marks should be used for all major intervals. Not all ticks need to be labeled. Labeling should be sufficient to allow for easy identification of coordinates of points on the curve.

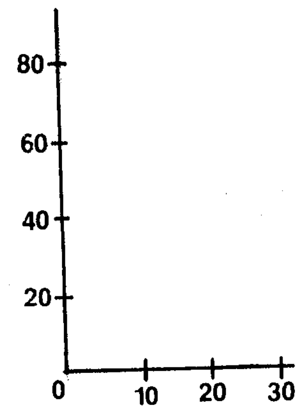

FIG. (3)

5. Title axis with variable name, symbol and units.

   The axis title should use a standard term for the variable. The symbol is used if the variable is referred to by the symbol in the text or if the symbol adds information. Units should always appear on the axis.

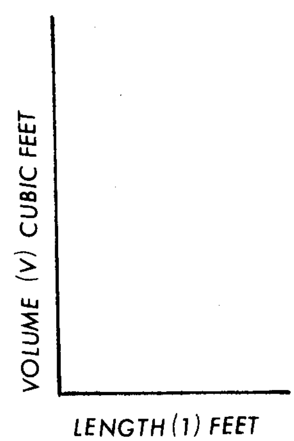

FIG. (4)

For line graphs (Arithmetic, Semi-log or Log-log):

6. Plot data using symbols such as circles, squares or triangles to indicate data points.

   The symbols perform two functions; they indicate at which point data was taken and they serve as a guide for drawing the curve. The symbols may also be used to indicate uncertainty in data. If more than one curve is drawn, different symbols should be used for each curve.

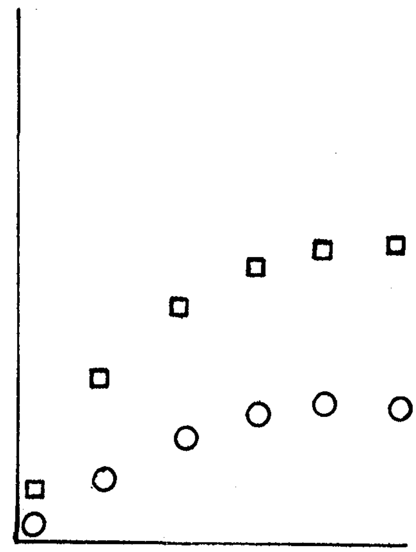

FIG. (5)

7. Draw the curve through all points. If the data is discrete, where one point is not related to the others (example: cost of car insurance as a function of the age of the car) points are connected by straight lines. If the data is continuous, a curve should be used. The curve should not obliterate data points plotted.

   A dense line should be drawn through the data. If more than one curve is drawn per graph, different line symbols should be used for each curve.

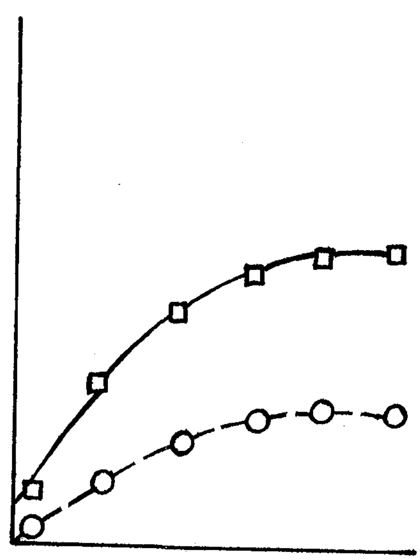

FIG. (6)

For <u>bar graphs</u>:

Steps 1-5 are followed as for line graphs.

6a. Construct bars.

Spaces can be left between bars if discrete information is to be indicated. Alternately, related bars can be grouped, (see Fig. 14) or all bars can be drawn adjacent to each other to better indicate a trend.

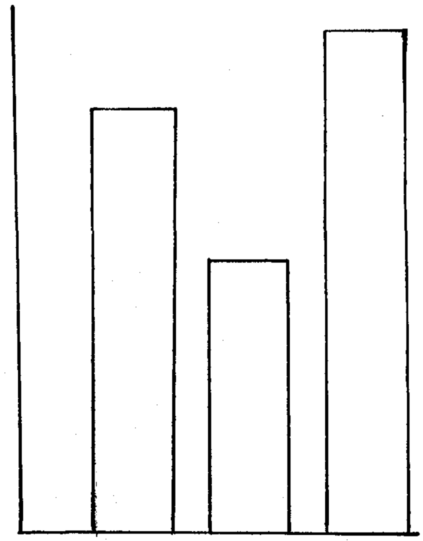

FIG. (7)

6b. Draw in horizontal grid. The horizontal grid should not pass through the bars.

The horizontal grid helps in determining the value of each bar. If the grid is omitted, the value associated with each bar can be added inside the bar or directly above the bar as shown in Fig. (8).

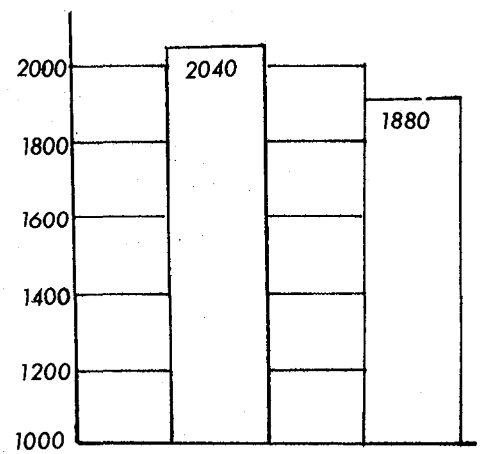

FIG. (8)

7. Cross-hatch or darken bars.

If more than one set of information is shown on a bar graph, a variety of shading techniques with a key should be indicated. This is shown in Fig. (14). The cross-hatching can be effectively done using dry-transfer shading. Alternately, it can be inked or, if equipment is available, computer generated.

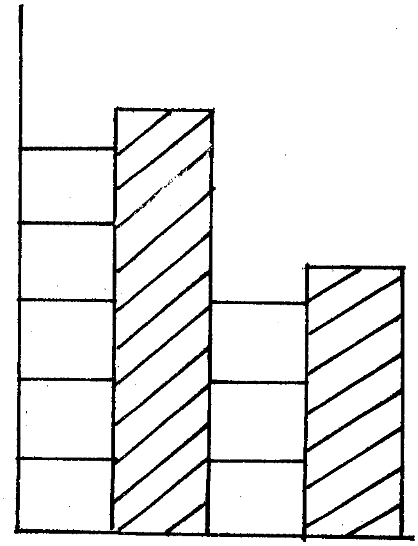

FIG. (9)

For a Pie Chart:

Steps 1-5 are followed as for line graphs.

6a. Calculate data into percentages.

Calculate degrees needed for each portion of data (note circle = 360°).

Field	Number of Students	Percentage	Degrees
Licensed Practical Nursing	210	21	76
Registered Nursing	430	43	155
Respitory Care	75	8	29
X-Ray Technology	60	6	22
Dental Technology	130	13	47
Medical Records	52	5	18
Dental Assisting	37	4	14
	994	100	361*

*Round off error causes the one degree deviation from 360 degrees.

7a. Draw circle.

If percentage is used, the circle is predrawn. On polar paper, the size is chosen. The circle's size is governed by the amount of information to be conveyed.

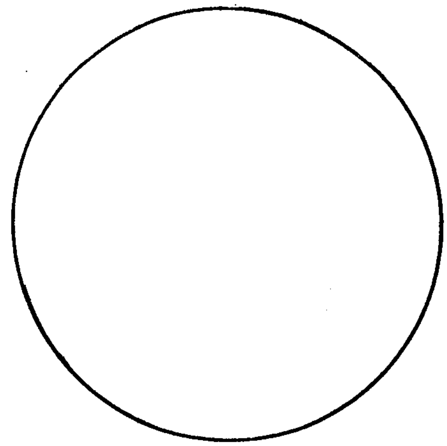

FIG. (10)

7b. Divide circle into parts calculated in part 6a.

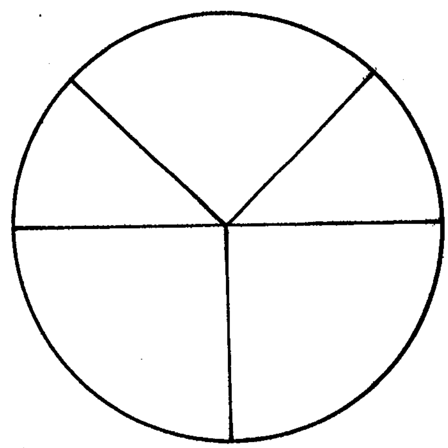

FIG. (11)

7c. Label all sectors. Small sectors should be labeled outside. Label should include the name of the variable and percentage, and/or actual number represented.

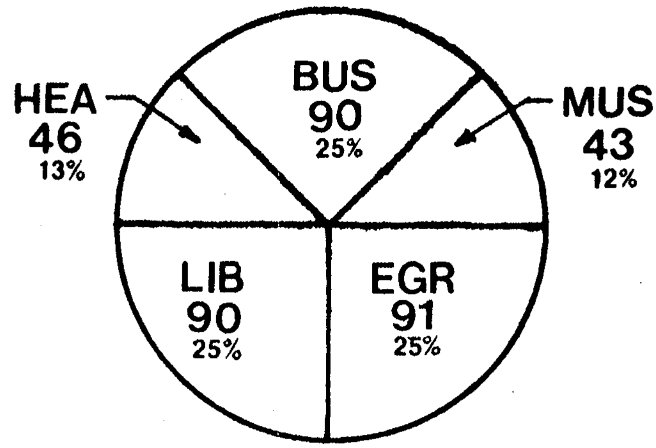

FIG. (12)

8. Title graph.

The title of the graph should be self-explanatory. If the title is to be included in a list of figures, it should be more comprehensive.

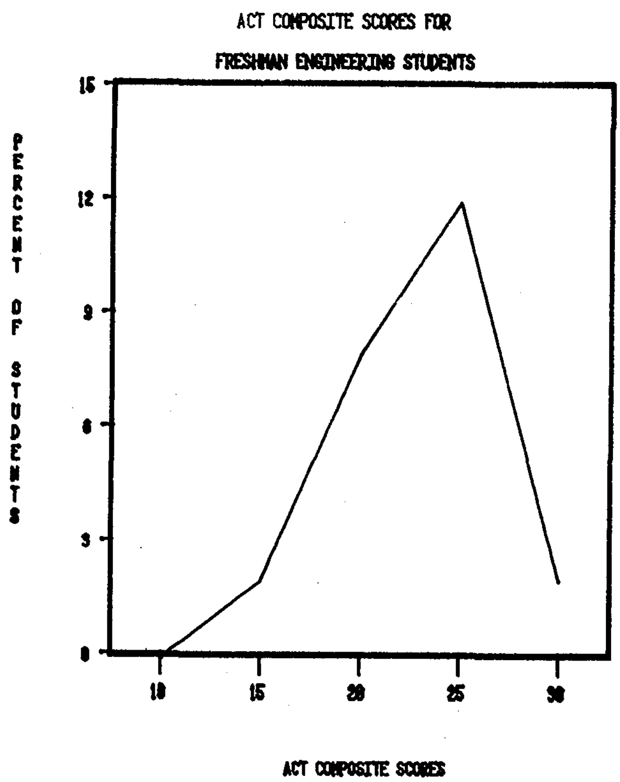

FIG. (13)

9. Show key.

The key is used to reference either the symbols for data points, the lines for graphs or the shading for bars.

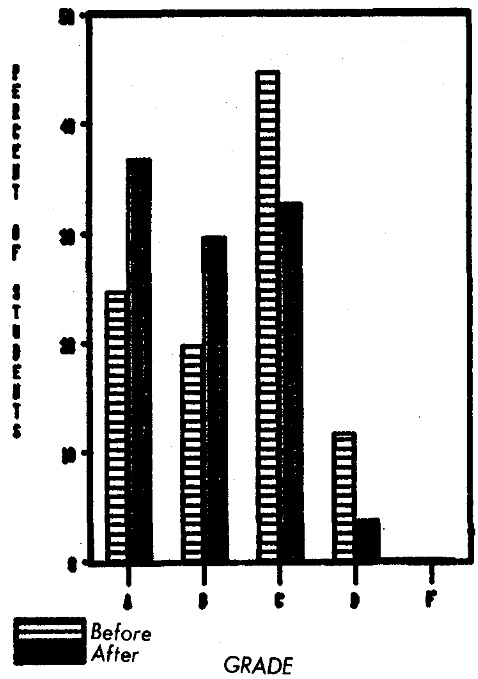

FIG. (14)

CONCLUSIONS

The mode of representation of data has been shown to be a function of the data itself and of the audience. Thus, bar graphs and pie charts in the forms shown or in more cartoon-like forms seem to be immune to math anxiety, and hence, appropriate for all audiences. A fat person helping himself to a piece of pie labeled "defense" and a small, skinny soul helping himself to one labeled "education" shows the budget picture efficiently and effectively to anyone. Similarly, a line graph showing horsepower versus r.p.m., tells an engineer an engine's characteristics.

A graph by itself may or may not be a good paragraph. The title acts as a topic sentence. The graph itself is the body and optimum points or trends should act as conclusion. Not all graphs are sufficiently self-explanatory or perform the function of total paragraph. Graphs then, can be relegated to the role of body of a paragraph. Introductory sentences are then needed. The topic of the graph and conditions under which data for the graphs were gathered, are generally sufficient. After the graph is shown, highlights of it can then be discussed. This discussion becomes the concluding portion of the paragraph.

The criterion of "Do I understand this?" must be definitive of judgement of the value of a graph rather than a judgement of the teacher's lack of expertise. An engineering student's technical communication skills are definitely enhanced by dealing with a teacher/audience who clearly establishes limits of technical literacy.

Biography

Dr. Brillhart received her B.M.E. at the Cooper Union in 1960 and her M.S. (1964) and Ph.D. (1967) at the Illinois Institute of Technology. She is a member of the Society for Experimental Stress Analysis, the American Society for Engineering Education, American Society of Mechanical Engineers, Society of Women Engineers and the Society of Technical Writers and Sigma Xi. Her publications are in the areas of experimental mechanics, engineering education technical writing, and women's equity. Her present areas of research interests are CAI, team teaching, video education and learning styles.

Ms. Debs received her bachelor's and master's degrees in English from Rosary College and is presently pursuing a doctorate at R.P.I. She is a member of the American Society for Engineering Education, Society of Technical Writers and numerous English associations. She has taught at Triton College and R.P.I. and has published extensively in the area of technical communications.

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Applied Tagmemics: A heuristic approach to the use of graphic aids in technical writing

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Mary K. Kirtz
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When we first became interested in the teaching of technical writing, we brought to this interest only our experience in teaching traditional composition courses, an experience that included a solid background in the different heuristic approaches to teaching writing. All such approaches, of course, are intended to help writers tackle their subject from various, yet systematic, points of view. As an aid to invention for the writer of traditional rhetoric, they are invaluable tools for adding needed depth and dimension to the student's examination of a subject. As we prepared for our new teaching assignment, we came across familiar complaints about technical writing and technical writers, complaints that the writers often did not seem to know what data to leave in and what should be discarded, that they seemed hesitant to draw forceful conclusions and make clear cut recommendations, hedging these most interpretive sections of their report with a plethora of data, both verbal and graphic. In other words, the problems seemed to lie, not in the writers' grasp of their technical problems and solutions, but in their methods of communicating these to others. As we analyzed these complaints, it became increasingly clear that the problem was two-fold: it was first a problem of invention -- what kind of material should be included and, second, it was a problem of arrangement -- how the material should be presented. These questions depended, in turn, upon knowing who read the report and how these readers would use the information.

From our work in the traditional composition field, we knew that a consistent heuristic approach to a subject enabled students to view their topic both objectively and analytically, since heuristics necessarily force them to look at the framework within which both topic and response to that topic exist. What we hoped to do was to find a heuristic method which would be flexible enough in its approach to enable students of technical writing -- whose topics are invariably of the problem-solving variety -- to examine their technical material in terms of the framework within which it is used, namely, the purposes to which it will be put by the readers.

The choice of a particular heuristic suitable to technical writing and to visual rhetoric in particular was our next step. We needed a heuristic, we felt, that fit the criteria set by Janice Lauer, in her description of a metaheuristic; the heuristic should be:

- transcendent, non-data conditioned, transferable
- have a flexible order yet be sensitive to cues from the material to which it is applied
- highly generative, allowing the thinker fluidity and flexibility.1

The tagmemic heuristic developed by Pike, Becker, and Young and presented in their volume, Rhetoric, Discovery, and Change, proved to be just such a heuristic. The tagmemic heuristic, having its source in the sciences, was a problem-oriented heuristic, one generated to deal with data as a problem to be analyzed and solved. It was a heuristic that readily transferred to the data-oriented area of technical writing, a heuristic that could be manipulated to generate an infinite amount and variety of material if handled correctly. In addition, we found the heuristic to be exceptional in its capability for handling data from a variety of perspectives. The heuristic generates information based on the concept of commonality or, as Becker, Pike and Young state:

> "The motive for communication arises from an awareness of difference and a desire to eliminate it or at least to modify it. But there can be no interaction between writer and reader, and no changes in their thinking, unless they hold certain things in common, such as shared experiences, shared knowledge, shared beliefs, values and attitudes, shared language." 2

The temptation in technical writing is to let the facts speak for themselves, to ignore the necessary human organization that must surround fact to make it useful to the corporation, to ignore the "shared" element that use of the tagmemic heuristic promotes. Giving in to such temptation, the technical writer can then subject his report to the familiar complaint: lack of organization, lack of focus, inclusion of irrelevant data.

The problem for the technical writer, then, is primarily a problem of figuring out how to get his material across clearly and quickly to his audience. Basically, it is a problem of translating the data into a common context. We define translation as a method of establishing mutual understanding between reader and writer. The tagmemic heuristic assists this translation process in that it enables this type of understanding. This is achieved because the heuristic examines material in a variety of ways and perspectives:

- as a particle, it examines the facts and data at hand
- as a wave, it examines the acts or the sets of operations involved
- as a field, it examines the systems and the sets of relationships in which the data is involved

Because of its versatility, thoroughness, and wide applicability, we believe the tagmemic heuristic can be applied to virtually all the rhetorical questions a writer must ask as he or she starts to organize and translate his or her technical data into a readable and useable report format. It is as systematic and consistent as any of the scientific methods which students use in dealing with their technical tasks.

Since graphics are one variation of reporting information in a technical report, the tagmemic method can also be used to show students how they can best understand graphics and their function within a report format. In applying the heuristic to graphics we made the following assumptions:

1) The primary objective of a graphic is to attract the reader's immediate attention through its visual presentation -- it is an appeal to the reader's sensory response to the message before the reader considers the message intellectually.
2) Graphics increase a reader's intellectual understanding through a multi-dimensional presentation, allowing the reader a second perspective on information which he or she has already received verbally.

Graphics should be studied as a rhetorical form and, as a rhetorical form, they can be studied in and of themselves and then contextualized by being positioned accurately within their appropriate format.

The main strength of the tagmemic method of inquiry is that it deals with three basic perspectives: it examines an item as a static entity -- what it is; it examines an item as a dynamic process -- what it does; it examines an item as a system -- how it works within a structure. Given this approach, the writer readily develops an understanding both of the nature of the graphic and its effect upon the reader.

We now ask you to examine both the questions presented by Becker, Pike and Young in their text Rhetoric, Discovery, and Change and our rather brief analysis of the use of bar graphs and line graphs using their method.

127   THE HEURISTIC PROCEDURE

	Contrast	Variation	Distribution
PARTICLE	1) View the unit as an isolated, static entity. What are its contrastive features, i.e., the features that differentiate it from similar things and serve to identify it?	4) View the unit as a specific variant form of the concept, i.e. as one among a group of instances that illustrate the concept. What is the range of physical varition of the concept, i.e., how can instances vary without becoming something else?	7) View the unit as part of a larger context. How is it appropriately or typically classified? What is its typical position in a temporal sequence? In space, i.e., in a scene or geographical array. In a system of classes?
WAVE	2) View the unit as a dynamic object or event. What physical features distinguish it from similar objects or events? In particular, what is its nucleus?	5) View the unit as a dynamic process. How is it changing?	8) View the unit as a part of a larger, dynamic context. How does it interact with and merge into its environment? Are its borders clear-cut or indeterminate?
FIELD	3) View the unit as an abstract, multi-dimensional system. How are the components organized in relation to one another? More specifically, how are they related by class, in class systems, in temporal sequence, and in space?	6) View the unit as a multidimensional physical system. How do particular instances of the system vary?	9) View the unit as an abstract system within a larger system. What is its position in the larger system? What systemic features and components make it a part of the larger system?

	Bar Graph	Line Graph
Block I Particle/Contrast	- is positioned on a matrix - has an X-Y axis - individual bars, either horizontal or vertical, are positioned on matrix	- is positioned on a matrix - has an X-Y axis - dots along axix connected linearly
Block II Wave/Contrast	- use of bars to indicate dimension, proportion among parts of whole	- use of linearly connected dots to show increase/decrease in dimension, amount, proportion
Block III Field/Contrast	- all parts in a bar graph work to show the precise proportions between at least two items for purposes of comparison - can be temporal, but spatial is best represented by the bar graph	- parts here stress variation in dimension between at least two points - emphasis is on temporal and sequential
Block IV Part/Variation	- can have limitless number of bars, differentiated by use of color or pattern - X-Y axis not an absolute necessity except for precision - can have multiple-bar graphs, negative bar graphs (to the left of the axis)	- can have limitless number of linearly connected dots, differentiated by color or line variation (broken line, dotted line, etc.)
Block V Wave/Variation	- significance of information changes according to type of bar graph used - change in axis value also possible	- Axis can stand for any numerical value, time, space or sequence
Block VI Wave/Field	- multiple bar graph (parts within the graph are highlighted - 100% bar graph (stress is parts-to-whole - sliding bar graph (stress is on negative as well as positive)	- temporal (stress in on trends over period of time) - sequential (stress is on cause/effect)

	Bar Graph	Line Graph
Block VII Part/Distribution	- shows comparisons, proportion between parts of a whole, between different wholes - emphasis is on static presentation of data	- shows companrisons of sequences - emphasis is on dynamic presentation of data
Block VIII Wave/Distribution	- focus on static comparison divided into appropriate proportions	- focus on a dynamic comparison - emphasis is on movement of data
Block IX Field/Distribution	- good for showing dimensions, proportions of data for comparison purposes - emphasis is on stasis - focus is on the data itself, on the parts themselves	- good for showing movement, trend of data for comparison purposes - emphasis is on dynamics, change, flow of data rather than on dimensions of each part per se

By examining the graphs in this manner, it should be clear that the focus has consistently moved from seeing the graph as a type of pictorial description of data, to a type which emphasizes a specific element of that data, namely, the relations of parts to the whole. When a writer uses this analysis with a specific piece of data, this outward movement is more clearly discerned than in our brief presentation here. Obviously, if the emphasis the writer finds does not serve the purpose of the writer or the needs of the audience, it should be discarded in favor of some other method of illustration.

The main virtue of this analysis is that it allows the writer to see the nature of the graphic aid as more than just a visual rendition of data; it allows him or her to see how the graphic translates the data for the reader making the relation between content and its context clear and explicit. Thus, it allows the writer to see that establishing a relation between data and graphic alone is not enough; the writer must see which graphic best informs the reader in terms of the purpose to which the report's information will be put, and this relationship between the message, the audience, and the purpose is the singular, most important context of the technical report.

In technical report writing, two needs which writers must meet if their reports are to be useable by an audience are the language needs and the technical needs of that particular audience. A heuristic analysis helps writers to decide the most suitable format for their information; that is, they must decide whether the information should be presented verbally or visually. Verbal choices lead to finding a suitable language level for their audience; visual choices lead to decisions about finding suitable graphic types for their audiences. Thus a heuristic approach helps writers to move away from focusing merely on their data, directing them outward towards an examination of that data within its functional context. The report writing process, then, is not seen as the unwieldy sum of disparate parts, but as an organic whole which can be divided and subdivided according to the writer's purpose, but which always functions as a totality. The tagmemic heuristic, because it itself follows a process of deconstructing and reconstructing information, lends itself to being a useful approach to the teaching of technical writing. By applying the abstract questions this heuristic asks to specific parts of the writer's report, the writer can analyse the language and technical needs of the audience, examing the viability of the solution within the givens of the corporate structure, and decide which graphic or verbal format will best suit the writer's purpose. By following such a method, the writer can arrive at answers which are both specific and thorough in their range of application.

End Notes

1. From lecture notes at the University of Detroit Seminar on Rhetoric, June, 1979.

2. Richard E. Young, Alton L. Becker, and Kenneth L. Pike, Rhetoric, Discovery, and Change (New York: Harcourt, Brace & World, 1970), p. 172

3. ibid., p. 127

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Panel B-14

Expanding the Role of Technical Writing in the 1980s

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A CATHOLIC VISION OF TECHNICAL WRITING

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Although one of the obvious characteristics of technical writing is its technical subject matter, it would be very difficult to say precisely what a technical subject is. For our purposes, however, it will be sufficient to say merely that a technical subject is one that falls within a general field of science and engineering.[1]

Mills and Walter, Technical Writing

Any attempt . . . to define technical writing is complicated by the recognition that exposition is often creative. Because technical writing often employs some of the devices of imaginative writing, a broad definition is necessary. Defined broadly, technical writing is that writing which deals with subject matter in science, engineering, and business.[2]

Blickle and Passe, Readings For Technical Writers

I should like to propose that the primary, certainly not the soul, characteristic of technical writing lies in the effort of the author to convey one meaning and only one meaning in what he says. That one meaning must be sharp, clear, precise. And the reader must be given no choice of meanings; he must not be allowed to interpret a passage in any way but that intended by the writer.[3]

W. Earl Britton, "What Is Technical Writing?"

These three definitions have one common theme -- the recognition that technical writing is extremely difficult to define. This recognition may someday prove embarrassing to academicians and frustrating to practicing technical writers. What technical writing teacher, for example, can defend to his or her students the statement: "Technical writing" involves "technical subject matter"?

Practitioners, in turn, will encounter a different problem. The continuing trend toward specialization can only mean a continued growth of technical terminology -- even clerics now talk of financial management, not collection plates. This increasing specialization will draw more non-technical people into technical areas. As a result, a number of writers previously outside the domain of technical writing will begin to label themselves as -- or, as the case may be, avoid the label of -- technical writers.

Let this analogy clarify the issue. Personnel outside of industry often assume electrical and chemical engineers have similar jobs -- both are, often all, engineers. Industrial personnel, however, never make such a naive mistake. In the same vein, personnel outside of academics and industry often assume technical writers and composition instructors have similar jobs -- both deal, after all, with writing.

But here the analogy falls apart. For this assumption is not only made from outside but also from within -- by professionals within industry and academics. Why? One reason is technical communicators have provided stylistically attractive, window-dressed definitions of their profession, definitions with ornament but no substance -- e.g., "Technical writing is good writing." These definitions have failed to establish meaningful standards by which a piece of writing can be labeled as technical or non-technical.

The point is obvious. A measurable definition of technical writing is needed. This definition should set demonstrable standards by which a written message can be classified as technical or non-technical. The purpose of this article is to set forth standards for beginning these classifications. These standards are by no means all inclusive, but they do provide a start, a base that others can be added to.

These standards are:

1. Point of View

2. Focus Models

Point of View

One common characteristic of a technical piece is its proportionally higher use of impersonal than of personal subjects. This tendency results partially from the presence of the passive voice but even more from the impersonal nature of the subject matter. Jane Walpole, for example, notes that "scientific prose may show far more passives than narrative prose . . .. The difference merely reflects the differing natures of content, purpose, and audience."[4]

Whatever the cause, this characteristic provides a quantitative standard for defining technical writing -- the ratio of impersonal to personal sentence subjects. For purposes of an initial definition, a written piece must have a two-to-one or higher ratio of impersonal to personal subjects in order to be labeled technical. A personal subject is any personal pronoun (I, you, we, etc.) or any personal name (John, Mary, etc.). Other proper nouns are counted as impersonal. Imperative sentences, having no written subject, are also counted as impersonal.

Table 1 demonstrates results obtained from a point-of-view analysis of written samples taken from six different fields. The analysis consisted of an examination of ten memos, reports, or letters randomly selected from each category.

TABLE 1: POINT-OF-VIEW RATIOS

	Percent Impersonal Subjects	Percent Personal Subjects
Internal Bank Memos	77.1	22.9
External Governmental Communiques	43.1	56.9
Internal Mid-Level Management Communiques	68.9	31.1
External Audit (10-K) Reports	77.6	22.4
Direct-Mail Sales Letters	58.9	41.1
Literary Articles	59.4	40.6

An interesting aspect of the point-of-view criterion is that it broadens the fields technical writing traditionally covers. Banking and accounting, for example, are two fields seldom looked into by technical consultants.[5] Likewise, management communiques are seldom thought of as technical documents. Perhaps some much needed technical writing training for mid-level managers may be in order.

The concept of point-of-view has a second interesting aspect as well -- it provides a clear distinction between business and technical communication. Business communicators make avid use of personal subjects; technical writers do not. Therefore, the point-of-view ratio provides an easy way to make a clear distinction between these two first-cousins of expository writing.[6]

By no means, however, should point-of-view provide the only measure of a communique's technical nature. The philosophic writings of Kafka, Camus, and Kierkegaard are certainly complex and difficult but few would defend them as technical in the modern sense of the term. For this reason at least one other standard needs to be established. One that provides a second useful distinction is the Focus model.

Focus Models

Most expository writing falls into one of two Focus models: 1) an Action/Decision model, 2) a Passive/Being model. For our purposes technical writing is always in the Action/Decision model; non-technical writing is always in the Passive/Being model. Let's briefly examine each of these focuses.

Action/Decision

Action/Decision models have an applied focus. The subject of the message at one time or another involves some sort of external action in a physical realm. This action may be expressed monetarily, geographically, structurally, or in some other external form. The point of action may take place in the past or be planned for the future. Look at the following Action/Decision letter.

Mr. Joe Jones
Head, Data Operations
XYZ, Incorporated
Opp, AL 35480

Dear Joe,

Enclosed are the results of the study just completed at XYZ, Incorporated. A section on the operation of the 1234 Retail Store System, itemized benefits and cost, and a financial analysis are enclosed.

This system should provide many benefits, as well as significant dollar savings. By creating magnetic tapes and scanning them at the point of scale with the 1234 terminal, you efficiently capture all the data necessary for inventory management, sales analysis, and check authorization. This can lead to a reduced dollar investment inventory, personnel productivity, better management of the retail operation, and significant dollar savings.

I definitely recommend the installation of the 1234 Retail Store System.

Sincerely,

Mary Smith
Data Analyzer

This writer obviously has some future action in mind for the reader -- installation of this system. Thus, the letter fits the Action/Decision description. But what if the last sentence of this letter is dropped? Suddenly, the letter looks like an FYI ("For Your Information") report. Does it still have an Action/Decision focus?

The answer is yes. The point of action shifts from the future to the past, with the emphasis on actions taken. But the overall model is still action-oriented. This emphasis on past action means a number of informational memos and process reports meet this second criterion. And rightfully so, for these communiques are often reports on previous external activity.

Passive/Being

No actions or decisions are involved in Passive/Being models. Agreement or disagreement is the main response. There is, of course, the action option of a written or oral rebuttal -- or the contention of an astounding revelation leading to a shift in life styles. But this is philosophical hair-splitting and its likelihood is remote. Look at the following example of a Passive/Being passage:

> The oral period is important in THE FREE-LANCE PALLBEARERS, too. Reed sees the United States as that monstrosity, a child empowered to carry out his fantasies of agression and destruction without the restraints of morality -- in short, an Oscar. Harry Sam has a personal home economist, Mlle Panda and a Personal Sister Lenore "who wears a nun's habit", to invent and serve "new exotic recipes" using children's flesh as the main ingredient."[7]

One may, of course, be appalled, elated, or disgruntled by this interpretation, but the only rational future action is mind-oriented. No external action -- except, again, a written rebuttal -- may occur. A focus analysis of the previously listed samples reveals the following classifications:

TABLE 2: FOCUS ANALYSIS

	Action/ Decision	Passive/ Being
Internal Bank Memos	100%	0%
External Governmental Communiques	100%	0%
Internal Mid-Level Management Communiques	90%	10%
External Audit (10-K) Reports	100%	0%
Direct-Mail Sales Letters	100%	0%
Literary Articles	0%	100%

Obviously, the majority of these memos have an action orientation.

If a written piece must meet both standards 1 and 2 to be classified as technical, then the following categorizations appear:

TABLE 3:: TECHNICAL/NON-TECHNICAL COMMUNIQUES

Technical	Non-Technical
Bank Memos	Governmental Communiques
Internal Management Memos	Direct-Mail Sales Letters
10-K Reports	PMLA Articles

As mentioned earlier, these two standards are not all inclusive. Others need to be added. Political tracts such as Common Sense certainly fall into the Action/Decision model. If they meet the point-of-view ratio should they therefore be categorized as technical?

Likewise, the two standards defined here need further modifications or additions. One deserving consideration, for example, is counting the imperative as personal rather than impersonal. When the imperative is counted as impersonal -- as this study does -- a number of detailed, step-by-step manual instructions meet the point-of-view criterion. At the same time, however, some direct-mail materials -- "Stop by today and buy your Sharpo sandwich maker" -- could likewise meet it. Is direct-mail technical writing?

Modifications and additions will come. The important point to realize for now is that a start at a specific definition has been made. Point-of-View and Focus Models provide ways to go beyond generalities and abstractions. They allow a kind of "hands-on look" at the machinery that makes technical writing work. And as every good mechanic knows, the more familiar one is with an engine the better he or she can make it work.

NOTES

[1]Gordon H. Mills and John A. Walter, Technical Writing, 4th ed. (New York: Holt, Rinehart and Winston, 1978), p. 3.

[2]Readings for Technical Writers, ed. Margaret D. Blickle and Martha E. Passe (New York, 1963), p. 3.

[3]W. Earl Britton, "What Is Technical Writing?" The Practical Craft: Readings For Business and Technical Writers, ed. W. Keats Sparrow and Donald H. Cunningham (Boston: Houghton Mifflin, 1978), p. 10.

[4]Jane Walpole, "Why Must the Passive Be Damned?" College Composition and Communication, 30, no. 3 (October, 1979), p. 251.

[5]Two useful texts on the topic of accounting writing are: Mary C. Bromage, Writing Audit Reports (New York: McGraw-Hill, 1979) and A. P. Richardson: The Ethics of a Humanist, ed. Michael T. O'Neill, (New York: Arno Press, 1980).

[6]The Practical Craft: Readings For Business and Technical Writers contains interesting discussions of this topic.

[7]Marian E. Musgrave, "Sexual Excess and Deviation," CLA Journal, 22, no. 3, (March, 1979), p. 234.

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Clinical Report Writing: Process and Perspective

by Helen Rothschild Ewald

In his article "Problems in Communicating Psychological Understanding," Fred Shectman, The Meninger Foundation, posits that failures to communicate often result from inadequate diagnostic assessment.[1] Significantly, much of what Shectman classifies as diagnostic assessment implicitly involves certain phases of the writing process. What are the similarities between clinical procedure and writing process procedure? And what is the importance of these similarities as they relate to written communication?

I came to these questions as a teacher of writing, not as a clinician. Yet, the more I taught Clinical Report Writing: 211, the more I realized the interconnections between clinical procedure and writing process. In this paper I will explore the "clinical connection" both as it contains insights into the composing process *per se* and as it offers a perspective on our professional opportunities as English teachers in the 1980s.

THE COURSE

First, a word about the course itself seems in order. Clinical Report Writing involves report writing in psychology and psychiatry. It thus attracts students somehow connected with clinical settings; these students can range from the Head Nurse of the psychiatric wing of a local hospital to a student working toward a two-year Associate Arts degree with a specialty in alcoholism counseling.

The course entails audience/use analysis and features the basic procedures of information gathering, diagnosis and prognosis. Commonly, the clinical report writer must consider a dual audience, consisting of primary readers who have a direct interest in the client's case and of secondary readers who may, for example, use the client's case-history as datum for separate research. The finished clinical report, therefore, stands as both a recommendation and a reference for its respective audiences.

The clinical report also represents the end product of a process "by which the behavior scientist /or prospective clinician/ proceeds from raw data to inference," a process through which new knowledge is created from information gathered.[2] (The report's data or information originates in "client" interviews.) Clinical report writing thus involves two interlinking processes: the process of creation and the process of communication.

As a communication process, it entails obvious similarities to the composing process of any writer. It involves working with audience, content, form, and style.

It is in the perception of clinical report writing as a creative process that interesting parallels develop between what the practicing or prospective clinician does as he/she deals with a client and what a writer does as he/she deals with a subject. Let's explore some of these parallels.

THE CLINICIAN'S AND THE WRITER'S GENERATIVE PROCEDURE

In describing the process by which clinicians generate new knowledge from raw data, Sarbin, Taft and Bailey write in Clinical Inference and Cognitive Theory of six overlapping stages of inference. These are: 1) possessing a postulate system, 2) constructing the major premise, 3) observing for occurrences, 4) instantiating (classifying) the occurrences, 5) reaching a referential product, and 6) predicting the significance of the inference, then making recommendations.

Of these six, the last five represent areas with clear parallels in generative writing procedure, namely: constructing a tentative controlling generalization, generating information, selecting that information which best supports the tentative generalization or discovering an alternative generalization from within the material, reaching a coherent relationship between the controlling generalization and the supportive information as expressed in a particular arrangement, and drawing up a conclusion.

The above point-for-point parallels in generative procedure suggest a common cognitive base, and support Frank D'Angelo's contention in A Conceptual Theory of Rhetoric that topics of invention reflect comparable conceptual operations, although D'Angelo's emphasis is on rhetorical patterns and not on generative strategies in general.

In any case, the first stage of inference in the clinician's generative procedure, that of possessing a postulate system, warrants further discussion before the overall significance of the similarities between the clinician's and the writer's generative procedures can be established.

The postulate system as a procedural base

When a clinician engages in generative procedure (sometimes termed diagnostic assessment), he or she implicitly invokes a personal postulate system (stage one) as a basis for inference making. This system, whether derived through inductive summation, deductive construction, analogical reasoning, or reference to authorities, forms the assumptive world which influences each of the subsequent five stages of inference mentioned earlier. It, for example, helps the clinician adopt a "focusing principle" which guides the search for relevant information.[3] Such focusing according to a personal postulate system involves asking questions such as: "What is the client in relationship to me?" (hostile, informative), "Who is the client in relationship to me?" (worker, child), "How well does he/she perform in relationship to my role expectations or valuational system?", and "Why does he/she perform as he or she does?"

The first two questions represent the types of questions writers ask in audience analysis; the second two represent those they might ask of their subjects: "How well does my topic reflect my social and/or ethical beliefs?" and "Why does the topic seem relevant to me?" What is interesting here is the essentially egocentric nature of the questioning. For the writer, the audience becomes important as it relates to the identity of the writer; similarly, the subject becomes important as it relates to his or her assumptive world. Both audience and subject are understood in terms of the writer's self. Thus, the questioning represents Kinneavy's triangle of self, subject, and audience with the self involved at all points. In so doing, it does not, at least in the traditional sense, feature the decentering thought so crucial by Piaget and others.

Such questioning forces the clinician or the writer to articulate his or her postulate system. In answering the question, "How well does the client or subject perform in relationship to my assumptions?", for example, both clinician and writer must explicitly formulate those assumptions so these may function as a concrete measure of the client and the subject, respectively.

It is possibly no surprise that clinicians undergo extensive self-analysis as part of their training. This analysis essentially defines for the clinician the set of assumptions which underpins subsequent inference making during diagnostic assessment. The self-analysis also eventually aids the clinician in evaluating his or her generative procedure after a "final" diagnosis has been reached. More on evaluation in a moment.

Writers, on the other hand, are not always forced to examine their assumptions before putting pen to paper. Their unarticulated assumptions therefore can emerge in their writing as unsupported broad generalizations, or as faulty causal relationships, or as the perception of the reader as the writer's clone, with identical understanding and experiences. The writer, however, needs to understand his assumptive world as being egocentric. The writer needs to realize that he or she does project a set of values on the audience and the subject. And the writer needs to evaluate these values, as well as the product informed by them.

These questions thus present themselves: Would student writers benefit from self-analysis before composing? Should writers be required to articulate their postulate system as a "pre-writing" strategy? Indeed, could these writers produce a clear picture of their assumptive world if asked to do so?

The overall procedural model

So far we have seen that each of the six stages of a clinician's generative procedure (including possessing a postulate system) offers comparisons to each of a writer's. If each of the six stages of clinical inference finds parallels in generative writing strategies, so too does the nature of the clinical procedure as a whole offer comparisons to generative writing procedure. Let's focus on two such comparisons.

First, Sarbin, Taft, and Bailey argue against an intuitive model of diagnostic assessment or inference. They maintain that just because certain clinical interpretations which seem to emerge "out of the blue" can later be confirmed does not mean that "labels which suggest a process akin to revelation or intuition" are appropriate.[4] Interpretive acts, they claim, have a natural history of pre-existing premises which, although implicit, strongly influence inference making. In other words, such premises, whether possessed as part of the clinician's initial postulate system or acquired as a "supplement" to that system during the client interview, _predict_ "discoveries" made during diagnostic assessment.

Can the same be said of those moments of inspiration or insight a writer may experience? Are discoveries in writing necessarily anticipated by a writer's assumptions or by pre-existing clues in the information gathered or in the drafts attempted or even in the writer's past composing experience?

Traditionally, educators in general and English teachers in particular have been associated with the intuitive rather than the empirical.[5] English teachers themselves are loathe to deny the intuitional in writing.[6] Yet, crosscurrents exist which would put insights in writing on more analytical ground.

In "The Psychology of Language and the Teaching of English," Robert de Beaugrande maintains that good writing is not so much inventive as _recombinational_.[7] Indeed, for good writers, these recombinations may seem spontaneous: "This paper just seemed to come alive and write itself." However, as Donald Murray suggests, perhaps good writers are constantly in a state of rehearsal. This rehearsal serves as a well-spring of creative clues or, to use a clinician's perspective, as a set of pre-existing premises, which quite naturally, even logically, elicits new combinations or discovery in writing.

What cognitive theorists state, in fact, is that inference itself is "the cognitive transformation of one set of events through another set of events which produces new knowledge about the first."[8] Their perception of inference here as involving a Hegelian thesis/antithesis/synthesis framework bears resemblance to Kenneth Burke's concept of _identification_ as "exploring the terminological limits of opposing positions and searching out the term at a higher level of abstraction which will allow opposing views to be reconciled."[9]

In any case, new knowledge or synthesis is achieved as a natural, rather than as an intuitive or mystical end to clinical and writing procedures. And, as such, the act of discovering this new knowledge can be seen as something which can be taught and/or learned.

Second, cognitive theorists note that variations or miscues in inferences as end products stem from various sources, including personal error, varying contexts, and differing interaction between clinicians and client. Whatever the cause of inferential error, clinicians discuss and evaluate inferential miscues by using each of the six stages of the inference process as "focal points."[10] In other words, to evaluate inferences as products, the clinician examines, step by step, the process which generated the inference.

Does such evaluation of the product in terms of the process have application in writing? Should a writer, or a teacher of writing for that matter, evaluate the final draft in terms of the procedure which produced it? To be sure, much has been made of the process/product distinction in writing. "Teach writing as process, not product" has become a bromide for composition teachers. Yet, the corollary "Evaluate writing as process, not product" is not commonly expressed. A notable exception to this dearth can be found in the work by Kroll and Shafer on error-analysis, a process-based approach to errors made by ESL students. Here, errors are seen as "windows into the mind" and as useful to both teacher and student.[11]

Admittedly, such a cognitively oriented perspective on error requires informed sensitivity. Indeed, how can the teacher gain access to the student's generative strategies, to the questions the student finds crucial while composing, to the process effecting the product? And how can the writer examine his or her product as process?

<u>Questions raised</u>

The above examination of clinical procedure has introduced three primary questions which should receive more attention from the composition teacher: Would students benefit from self-examination as a pre-writing strategy? Is discovery in composing a natural outgrowth of pre-existing contexts? And can a finished piece of writing be evaluated as process?

Let's assume, for the moment, that the answer to each of these questions is affirmative. What methodological implications ensue?

1. <u>Before beginning to write, a student should be asked to articulate, as best as he or she can, the assumptions which inform his or her world view.</u> At the beginning of the term, for example, a student could be asked to record statements which he or she believes are true. With each paper, the student could then be asked to relate one or more of these assumptions to the controlling generalization of each piece, and to note down any additions or revisions of these beliefs as they occur during the term. In so doing, the student would be working to understand his or her postulate system as it existed at any given moment.

2. <u>A student should be asked to enrich his or her contexts for writing</u>. Granted, it is not possible to tell a student, "Go out and live in the world a few more years and then come back to composing," or "Go out and read one-hundred books and write a dozen or so themes before returning to this class." It is possible, however, to construct occasions which encourage

discovery or synthesis. For instance, a student could be asked to pose both a tentative generalization and an alternative generalization governing a single topic. Then the student could be asked to reconcile the two generalizations with a final thesis which could be specifically supported. Christine Barabas' work with idea combining also has currency here.[12] In essence, the student here would be working to enrich his or her postulate system.

3. A student's final paper should be evaluated as process as well as product. A student, for example, could be asked to write down the questions which he or she found crucial in composing the paper, and to submit all such prep-work with the final draft. In addition, evaluative conferences could, in part, focus on the student's orally recalling how he or she reached the end product as submitted. In fact, recent literature on problem solving supports the idea that telling a person how people do do something is much less effective than telling that person how to do it.[13] In other words, telling a student how you have solved the problem in his or her text, or how peers may have solved a similar problem, is less effective than reviewing the process involved in reaching a particular solution or draft. If the student's product is flawed, the student's method for reaching that product should be examined. The student would thus be gaining insight into generative procedure as a whole.

The suggestions above are tentative. Certainly, additional research, into how the clinician proceeds while making and evaluating inferences for instance, may well generate further pedagogical approaches.

A CONSULTATIVE ALLIANCE

This paper has suggested how writers, and teachers of writing, might benefit from understanding clinical procedure. This significance of the "clinical connection" involves more than a one-way street, however. Clinicians themselves are expressing interest in the benefits that interdisciplinary study and cooperation can bring. Shectman's call for a "consultative alliance" that is "as essential for non-clinicians and their crucible of involvement as for diagnosticians and their patients"[14] embodies, I believe, a challenge to professionals to expand their "crucible of involvement" to include those insights into communication which various fields can provide.

Past work in educational psychology and recent work in such areas as the cognition of discovery or hemispheric brain functions show that the "clinical connection" has already been recognized by educators in general and English teachers in particular as one worth pursuing. Moreover, scientist Frederick Reif has just proposed intensive research into the domain of "human cognitive engineering" which would deal with prescriptive aspects of human information processing and would bridge the "gap" between the approaches of cognitive scientists and educators.[15]

At this point, I too would like to suggest briefly yet another area for potential collaboration: neurometrics.

"Many data show that brain electrical activity reflects subtle aspects of brain functions including information processing and cognition."[16] Neurometrics is a means of measuring that activity.

Neurometrics was originally used for diagnostic assessment of learning disabilities to determine whether the disability had a physical rather than an environmental or emotional base. More recently, it is being touted as a means of measuring intelligence, especially verbal intelligence.[17] In the future, I would submit, neurometrics could be used to measure the effects of certain materials or methodologies in teaching skills involved in information processing. As such, it could be a valuable tool for those of us teaching writing, a skill which surely entails information processing at core level.

The pedagogical applications of neurometrics are not yet known for a surety. It will take both the clinician and the educator working together to form a diagnostic assessment of neurometrics as a pedagogical aid.

NOTES

[1]Fred Shectman, "Problems in Communicating Psychological Understanding," American Psychologist, 34 (September 1979), 782.

[2]Theodore R. Sarbin, Ronald Taft, and Daniel Bailey, Clinical Inference and Cognitive Theory (New York: Holt, Rinehart and Winston, Inc., 1960), pp. 3, 44.

[3]Clinical Inference and Cognitive Theory, pp. 145 ff.

[4]Clinical Inference and Cognitive Theory, p. 81.

[5]Frederick Reif, "Theoretical and Educational Concerns with Problem Solving: Bridging the Gaps with Human Cognitive Engineering," Problem Solving and Education: Issues in Teaching and Research, eds. D. T. Tuma and R. Reif (Hillsdale, N.J.: Lawrence Erlbam Associates, 1980), p. 42.

[6]See Sabina Thorne Johnson's discussion in "The Ant and the Grasshopper: Some Reflections on Prewriting," College English, 43 (March 1981), 236 ff.

[7]Robert de Beaugrande, "The Psychology of Language and the Teaching of English," A paper presented at the Annual Meeting of the Conference on College Composition and Communication (Minneapolis, Minn., April 4-7, 1979).

[8]Clinical Inference and Cognitive Theory, p. 45.

[9]See Virginia Underwood, Unpublished Dissertation, Florida State University, 1980, p. 185.

[10]Clinical Inference and Cognitive Theory, p. 223.

[11]Barry M. Kroll and John C. Shafer, "Error-Analysis and the Teaching of Composition," College Composition and Communication, 29 (October 1978), 243 ff.

[12]Christine Barabas, "Idea Combining: Synthesizing Syntax and Meaning," A paper presented at the Annual Meeting of the Conference on College Composition and Communication (Washington, D.C., 1980).

[13]Michael Scriven, "Prescriptive and Descriptive Approaches to Problem Solving," Problem Solving and Education: Issues in Teaching and Research, eds. D. T. Tuma and F. Reif (Hillsdale, N.J.: Lawrence Erlbam Associates, 1980), pp. 135 ff.

[14]Shectman, p. 790.

[15]Reif, p. 42.

[16] E. Roy John, et. al. "Neurometrics," Science, 96 (24 June 1977), 1393.

[17] Berkeley Rice, "Brave New World of Intelligence Testing," Psychology Today, 13 (September 1979), 26-41.

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PREPARING FOR AN INFLUX OF FOREIGN STUDENTS IN TECHNICAL WRITING COURSES: UNDERSTANDING THEIR BACKGROUND

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One of the sureties facing technical writing and report writing teachers of the 1980s is that as enrollments of American students decline in our universities, the universities will enroll more and more foreign students, and these tend to congregate in technical and professional fields. In my own school, Syracuse University, nearly 20% of the 1100 engineering students are now foreign; in the fall of 1976, only 9% of the freshman engineering class was foreign. This represents a dramatic increase, and all signs indicate the percentage will rise still further. Our school is no exception. It's safe to say that all of us teachers of technical and report and professional writing will increasingly find ourselves with a new type of student body: foreign students who have mastered enough grammar to move out of basic grammatically focussed English as a Second Language courses, into regular courses often required by the student's professional field. Or the student may come on his own to take technical or business writing--to improve his written work so he can eventually communicate effectively with Americans and with American companies. The theory has in the past been that once these students pass the Michigan ESL exams, they have grammar reasonably in hand, and they can go into regular writing courses. In practice, things aren't so simple.

The technical writing field has so far done little to prepare its teachers for this phenomenon. The English as a Second Language Field too has on the whole been busy elsewhere: with the more severe problems of incoming students rather than the more subtle difficulties of the more advanced students. Even most of the specialized EST (English for Science and Technology) or ESP (English for Special Purposes) subgroups of ESL focus on the low-level problems of the students in vocabulary acquisition for scientific or technical or business writing and in grammatical control. Very little attention is given by the ESL field to the advanced foreign student whose problems are beyond the grammar and vocabulary level (though these difficulties never disappear as hindrances). The business communications field has been admirably active in researching and studying and teaching the special problems that arise in intercultural business interactions. But even here, questions of prose and writing tend to take second place to questions of behavior and attitude.

Thus most writing teachers will face this inevitable crop of foreign students with virtually no preparation for the special problems that arise. Since I myself have already been facing the situation, I feel that others can certainly benefit from my investigations to seek guidance in the literature to understand the particular problems of these students. Specifically, I would like today to examine the cultural and historical influences that students from foreign countries will bring with them to our technical and report writing classes, in particular those influences that would affect their receipt of instruction in American principles for written prose. I am on the whole not concerned with the level of grammar; that ground has been well covered. We are seeing students with reasonable grammatical control but with more sophisticated levels of difficulty and with more diverse needs in conforming to our writing precepts.

I am particularly interested in the larger aspects of prose, not the linguistic units in individual sentences, but in the grouping of sentences into idea units and into paragraphs, and the grouping of the paragraphs into whole structures. I am interested in the different cultures' different habits and norms for handling prose, and the dictates for style and structure and sufficiency and approach. This is an area that the technical writing field has paid no attention to, the business communications field has paid little attention to, and ESL researchers have seldom gone beyond sentence and paragraph-level investigations.

My work on this project has involved two stages. One is to examine modern technical and business reports written in the different cultures. This particular stage I do not yet consider complete. The other stage has been a search of scholarship in linguistics, ESL, communications, anthropology, sociology, psychology, psychiatry, literary criticism, and many other areas involving in-depth examination of a culture and its language, and the relation between the two. Thus I will today compile and interpret the observations and analyses and conclusions of the critics in these areas, and add some of my own. I would hope to interest more people to this area of study, to help understand and solve the writing adjustment difficulties of our foreign students.

Due to the constraints of time here, I will confine myself to students from two types of backgrounds that we are likely to see more of in future: (1) the middle eastern or Arab student, and (2) the far eastern or Japanese student. One of the foundations of intercultural communication study is Edward Hall's valuable cultural designation system, presented in his 1976 book <u>Beyond Culture</u>[1]. Here the Arab and Japanese cultures are termed high-context, low-logic cultures. Our American society, on the other hand, is a low-context, high-logic system. Hall's is an enormously valuable approach to understanding a culture and its communication tendencies.

For those unfamiliar with Hall's work, I'd like to look at this a little further. Our western culture is classified as low-context, meaning we are so mo ile and diverse in population that very little coded information is contained in the culture itself; each piece of writing must carry all of the needed codes and information within it. On the other hand, the middle eastern and far eastern cultures are much more uniform, characterized by greater similarities in background among those communicating with one another within the culture. Thus the writer in these cultures can assume much coded understanding in the reader, and the writing needn't stand on its own. In neither the mideastern or far eastern cultures is logic highly valued, as it is with us. Prose development in these cultures operates by other principles.

Hall's approach is thus useful for categorizing these extremes, but it has severe limitations in helping us to distinguish among the different codes and cultures at either of the extremes, and to account for the enormous differences we see in the writing of Arabs and Japanese, for instance--both high-context and low-logic.

What then are the differences in the writing of these cultures that another theory will have to account for? Let's look at the Arab student first. Where technical reporting is concerned, we're trying to see in these students a reverence for precision, accuracy, facts, ideas, and objective reality. Yet my research shows the Arab culture historically reveres emotional appeals and reveres words. This love of language rather than ideas and the Arabic dependence on emotional appeal and on rhythmic almost musical effects of language have rather pronounced consequences on the Arabic students' use of language. Raphael Patai, in a book entitled <u>The Arab Mind</u> points out that the Arabic noun balagha (eloquence) is derived from a variant of the verb which means to attain male maturity [2, p. 49]. States Patai, "eloquence is, thus, to the Arab an achievement akin to the attainment of masculinity." But note that "from the same verbal root is derived the noun mubalagha, which means verbal exaggeration or hyperbole. To the Arab mind, eloquence is related to exaggeration (p. 49)".

There's no doubt that our Arab writing students at SU have shown exactly these tendencies. Many overassert, overstate, overgeneralize, and often veer from objectivity. Their prose is frequently ornate and wordy; simplicity of diction and brevity do not come naturally to them. These students have met lower-class requirements before we see them, but the tendencies persist.

E. Shouby, a native Arabic-speaking psychologist with training in both clinical and social psychology, points out the persistent nature of the problem in a now classic 1951 article[3]. He points out that Arabs have in their culture been habituated and even forced to overassert and exaggerate in all types of communication if they wished to be sure of not being misunderstood. Terry Prothro, in a more careful and less biased study than Shouby's, tested and verified Shouby's observations[4]. He found that

Arab students had totally different reactions to and perceptions about the language used than did American students tested. Statements which seemed to the Americans strongly favorable or unfavorable seemed to the Arabs to be merely neutral. Statements that were taken by the Arabs as mere statements of fact were taken by the Americans to be extreme or violent assertions. Firm assertions to the Americans seemed weak and doubtful to the Arabs. Though Prothro's study dates to 1955, we are still at SU seeing many Arab students in technical or report writing classes with just these tendencies.

What does this style and cognition difference mean to us as technical and report writing teachers? If we are to have any hope of ourselves communicating with our Arab students and of teaching them to communicate in our culture, we at the least have to understand the problems the cultural background brings to their writing. We must understand that in the course of learning to speak, Arab children acquire not only the rich Arabic vocabulary and the grammar, but also the style, including specific devices such as exaggeration and overassertion. Use of these devices becomes, and remains, as natural to the Arab as his use of vocabulary and grammar. When a student uses exaggeration and overstatement, he is often not at all or only barely aware of employing these specific devices. We have to help him so that in his mind, exaggerated statements will register as such.

To move from style, what special problems does our Arab student bring to organizing or structuring units of information? Professor P. Cachia gives an analysis common in my examination of scholarship on the Arabic language and literature. Cachia writes that no literary form arose in Arabic literature demanding a sustained and unified development and inspiration[5, p. 346]. The reader and writer both approached literature and writing as a collection of fragments, rather than as a whole. Similarly, Arabic music and decorative art consist of repetition of one or more units, without the necessity for a definite feeling of a whole, for a recognizable beginning or ending. Professor Eli Salem echoes this[6]. He writes that Arabic prose is characterized by repetition and consists of isolated units with little or no transition or connection. (See the KORAN for a good example of this type of writing).

Jacques Bercque in his book Cultural Expressions in Arab Society Today [7] finds logic in the lack of logic of Arab writing, symbolic value in the fact that Arab writing often encompasses a series of apparently unconnected themes and parts. According to him, that's the way the Arabs perceived the world as being, and so in the jargon of structuralist criticism, the writing (the signifier) then becomes the signified. This is a quite different explanation of the phenomenon we observe than is Hall's high-context answer, but either explanation leaves our Arab students with the same heritage in prose cohesion, quite different from ours.

Bercque, writing in the 1970s, acknowledges that since 1950, contemporary

Arab writers have been reacting to the western discomfort with the lack of structure and logical continuity in Arab writing, and attempting to follow western precepts. Obviously we have to acknowledge that many Arabs have now successfully adopted western forms and western norms. But although the physiognomy of much Arab prose now looks more familiar to us, the conflicting tendencies are often still very strong. The tension in the cultural paradigms is still present in the background of many Arab students. At SU, we still see severe problems in connection and unity of prose of a quite different order than in American students. Also repetition for emphasis is commonly used far more by them than western codes find suitable. (Robert Kaplan from USC has also found significant differences in the prose movement within paragraphs between Arab students and American students [8]).

Another question of structure and expectation is what is felt necessary to cover for a specific type of writing assignment. In my own experience with students, I have found the Arab students to frequently include material that would not here be considered relevant for that writing task for that audience and purpose. The additional material is quite consistent in pattern, and, I find, consistent with the experience of others. Hall, creator of the logic and context classification of cultures already referred to, in another classic book on intercultural communication, The Silent Language, reinforces my observation: "The Arab looks back two to six thousand years for his own origins. History is used as the basis for almost any modern action. The chances are that an Arab won't start a talk or a speech or analyze a problem without first developing the historical aspects of his subject" [9, p. 147]. So, I will typically see first drafts of five-page papers on current progress with three pages devoted to a history of the problem or situation, all of which falls outside of the reporting period of the progress report. I find this happening not only in Arab student writing, but professionally, in progress reports of midest Nuclear Research Centers, for example.

What about the Japanese student? According to Hall's system, he too is from a high-context, low-logic culture, as is the Arab. And yet the Arab student's writing tendencies are entirely different from the writing adjustment difficulties we see in the Japanese student. Whereas the Arab culture puts a high value on language and on eloquence and on emotion, the Japanese student's heritage is just the opposite. A Japanese student's report is likely to be understated, rather ambiguous, and often extremely apologetic. We frequently can't quite make out if agreement or disagreement isbeing conveyed. The report may read much like a tight ambiguous haiku poem.

International communication specialists have oft commented on the ambiguity of the Japanese use of language. With an extraordinary degree of similarity in the background of its citizens, Japan has had a shared understanding that eliminated the need for precise wording to communicate meaning. Japan is such a crowded hierarchical society that the Japanese have developed as a virtue to live and let live, to reveal little in language, and thus to avoid offending anyone by a statement disagreeing with his own. The precision and clarity we revere are not at all desirable in Japan.

In fact, effective language use is not held in high esteem. Nor are the Japanese criteria for fulfilling communication purposes by prose development the same as ours. According to Eiichiro Ishida in Japanese Culture [10, p. 117], an orator seeking to appeal by persuasive logical argument or by eloquence is still considered contemptible in Japan. The response will be much better if both sides of the issue are presented and given due attention and credit. And Japanese organization patterns and paradigms differ from the western ones. in Ways of Thinking of Eastern Peoples, Hajime Nakamura notes that digressions are common in Japanese prose and the movement of the prose spirals, rather than heading in a straight, well defined direction [11, xii]. The Japanese students, as the Arabs, will come to us preferring a loose repetitive structure, but instead of overstatement or stylistic embellishment, they resort to suggestion and understatement. As Edwin Reischauer from Harvard puts it so aptly, "the Japanese do a great deal of beating around the verbal bush" [12, p. 386]. Their respect for the feelings of others and the resulting desire for social harmony I feel have led to a style of language use that constantly probes and hints, suggests by indirection and vague implication, but does not state positions sharply or move directly.

Much more can be said, but time is short. Let me conclude by pointing out that the existence of a meaningful correlation between culture and language was recognized as early as the 19th century by Von Humbolt and popularized in 1929 by Edward Sapir, the linguist. Despite objections that the cultural approaches deny the creative aspects of language use by focusing on the normative aspects, in general recent research in cultural anthropology, linguistic anthropology, sociolinguistics etc has been proving the validity of a close relationship between language use and culture. With our expected influx of foreign students, we as technical and report writing teachers should make ourselves more familiar with the work in these cultural-linguistic fields, to prepare ourselves for our changing student body. I hope more of us will apply ourselves to isolating and identifying the prose handling problems, and to finding ways to ease them for these students.

We should certainly seek the help of personnel trained in these areas at our universities, to develop special sections of technical or business writing, or at least to develop special components of regular sections to focus on cohesion, logic, context requirements, style etc for the needs of these special students. Students from cultures whose logic and context and thus prose heritages are so different from ours as are the Arab and Japanese heritages will need a great deal of attention to be able to produce prose competently according to our norms. But my research shows that even students at our end of the logic-context scale, such as French and German students, have significant difficulties in handling our prose and reporting demands. Their difficulties are not always as blatant, but nonetheless still troubling and extremely interesting. This is definitely an area that deserves much more attention.

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ENLIGHTENED USE OF THE PASSIVE VOICE IN TECHNICAL WRITING

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Pick up virtually any technical or scientific writing text published during the past ten years, check the index for "passive"or "voice," turn to the pages to which you are thereby referred, and what will you find? Sternness, censures, and caveats--all directed against the use of the passive voice. You will find qualifiers like "lifeless," "wordy," "unnatural," "indirect," "pompous," "impersonal," "unclear," and "inappropriate" applied to the passive. If you are a technical writing student, you will assume that the fewer passives you use, the better your chances for earning an "A" in the course. I feel these textbook jeremiads on the passive voice are misleading students.

To be fair, I must point out that the authors of some contemporary scientific writing texts admit the passive can "sometimes" be "useful."[1] John Brogan even feels that "the passive voice is indispensible for a flexible style."[2] But always the warning follows: "Use the passive, but use it sparingly."[3]

The technical text authors give the impression that, if the passive is necessary, it is a necessary evil. Normally, they treat the passive under a heading like "Common Technical Writing Errors," along with tense shifts and tautologies.[4] Sentences with passive verbs are denominated "problem sentences," and students are asked to provide "correct revisions" for the offending forms.[5] Under the heading "Active Verbs," one author even makes the suggestion that a passive sentence is one in which "the finite verb does not function properly."[6] Steven Pauley's instructions summarize the sentiments of most current technical text writers concerning the passive:

> Whenever possible, use the active verbs for descriptions of operations and for most other kinds of technical writing.[7]

Robert Day uses even stronger rhetoric in <u>How to Write and Publish a Scientific Paper</u>. Labeling the use of the passive in scientific writing a "bad habit," he appeals:

> I herewith ask all young scientists to renounce the false modesty of previous generations of scientists. Do not be afraid to name the agent of the action in a sentence, even when it is "I" or "we."[8]

Day's reference to "generations" of scientific-users is historically accurate. Generations--in fact, centuries--of technical writers have found that the passive voice was specially suitable for their subject matter and professional objectivity. Of course, they have not used the passive exclusively, but in ratios ranging between 1:5 and 1:3 (passive to active).[9] As early as the seventeenth century, Sir Frances Bacon (who might well be thought of as the father of English technical writing) used the passive without compunction. Of the 61 finite verbs in his "Essay 10, Of Love," for instance, 12 are passive and 49 active, roughly a 1:5 ratio.[10] As recently as 1966, Svartvik found a 1:3 passive-active ratio in a "scientific exposition" identified as typical of its genre in terms of voice distribution. This voice ratio contrasts sharply with those of two novel texts Svartvik examined, where passives averaged only 6% of the total finite verb count, yielding an active-passive ratio close to 1:17.[11]

Have stylists always complained about the scientific predilection for the passive? No. As a matter of fact, one author who decries the passive in his 1980 technical writing text wrote not a word on the subject in his 1958 text. But his practice belies his words in the 1980 text, where his examples and his own prose feature the passive prominently, in ratios as high as 2:1 (passive-active) on selected pages.[12]

During this century, the scholarly winds have shifted 180 degrees on the use of the passive in technical writing. T. A. Rickard used the passive freely in his 1931 text, Technical Writing. Although voice is nowhere discussed as such in the work, Rickard's corrections of "verbose and confused" passages show his own clear preference for the passive as the more direct and professional-sounding voice. Passive verbs he almost invariably leaves alone in his revisions, and active verbs he frequently converts to passive.[13] In 1962, David Comer and Ralph Spillman were still recommending the passive as a means of producing the "completely impersonal language style" most appropriate for technical writing.[14] Even in 1965, W. Paul Jones (then in the seventh edition of his Writing Scientific Papers and Reports) was maintaining that the third person passive was the preferable point of view for scientific writing, "mainly because it emphasizes the action and the thing done and minimizes the importance of the doer." But he apparently felt the winds shifting and so qualified his stand by commenting that the passive is "devoid of human interest and color" and that the third person active "may" be suitable for process descriptions.[15]

During the late 1960's, the academic weathercocks turned and the passive became unfashionable. The passive has always had its critics, of course, usually purists who have regarded it as abnormal. Many linguists objected to the introduction of the passive progressive in the eighteenth century, for instance. But their oratory was anachronistic. The populace had long since innovated, approved, and adopted the form into colloquial usage.[16] As Svartvik indicated in 1965, a dichotomy still exists between the passivists and the anti-passivists (the terms are mine), between those who see the passive as a significant and natural construction and those who feel "the only reason for keeping the category 'passive' is that it has come down to us as part of our classical grammatical heritage."[17] The most frequently quoted modern anti-passivists are Strunk and White in The Elements of Style (1959).[18] Their advice on the matter is simple and pungent: "Use the active voice."

However, current practice (not theory) in technical writing, together with a solid body of evidence and theory compiled by the most recent syntactical researchers, all urge that the passive is viable and suitable for this genre of writing. There is no indication that the passive will or should supplant the active in technical writing. But neither is there any evidence that the passive will or should be eradicated from the genre. The few reasons advanced in recent technical writing texts for banishing the passive are all essentially mythic and could, in many cases, be turned against the active as well as the passive. The bias of the textbook authors is nowhere clearer than in the examples they choose to demonstrate the impracticality of the form. It would be rather easy to come up with equally tendentious examples to prove another preposterous theory--that the active voice ought to be extirpated from technical literature.

Ironically, these very authors provide a convincing case in favor of preserving the passive voice, at least in technical writing. Why? Because they themselves use it repeatedly--not only in their texts proper but also (this is positively comic in some cases!) in their models. Joseph Williams regaled CCC readers just last month with selections from George Orwell and (more important for this study) from S. J. Reisman in A Style Manual for Technical Writers, violating their own dictums against the passive, and doing so "in the very act of criticising the passive."[19] The citation from Reisman is splendidly self-contradictory:

> Emphasis is often achieved by the use of verbs rather than nouns formed from them, and by the use of verbs in the active rather than in the passive voice.[20]

Other anti-passivists have slipped into the passive while proscribing it. Objecting to "could be heard," Strunk and White use "can be made":

> Many a tame sentence of description or exposition can be made lively and emphatic by substituting a transitive in the active voice for some such perfunctory expression as there is, or could be heard.[21]

Day, too, catches himself in his own trap:

> The passive voice could be avoided by saying "The authors found" instead of "it was found."[22]

Space simply will not permit me to rehearse all the passives that occur and recur in technical writing models constructed by the anti-passivists. However, the following instances are typical. In a 24-page model report entitled "The Feasibility of Removing Sediment and Muck from Wyoming Lake," Houp and Pearsall use the finite passive at least once on every page (except those pages with no finite verbs), in passive-active ratios ranging from 1:7 to 2:1. The average passive-active ratio in this 1980 model is a little better than 1:3, roughly the same ratio Svartvik found in a typical scientific text 16 years ago.[23] An even more startling passive-active ratio (7:12!) can be found in model sentences Day provides on the page just opposite his assertion that the passive is a "bad habit." Certainly the passive is a habit--one Day (to his credit) has not yet shed.[24]

Of the current myths concerning the passive, some are intertwined. Such is the case with these three erroneous notions: (1) that the passive utilizes an abnormal and artificial word order, (2) that the passive is lifeless, and (3) that the passive is indirect. Fear, for example, combines the three issues into a single line of argument. He asserts the passive "reverses the normal flow of a sentence" and is therefore "less direct than the active patterns it substitutes for." "Don't overdo the passive," he concludes, "or you'll risk sounding lifeless and stuffy."[25] Expanding on the passive's lifelessness, Pauley argues:

> When a sentence is in the active voice, the subject does something. If the sentence is in passive voice, the subject does nothing; instead of acting, the subject is acted on.[26]

Actually, the passive is a long-established, fully normal syntactic form. It is well represented even in the first systematic English grammars. John Fell's grammar of 1784 includes not only complete conjugations of all the passive tenses (except the progressive) but also the "Infinitive Mode" and participial passives.[27] And as early as 1731, in Duncan Daniel's _A New English Grammar_, an astounding thrust is made at defining the agentless or intransitive passive, a form not precisely identified until this century:

> Of Neuter Verbs, some are Neuter-Actives, and take the Verb _I have_ for their Auxiliary; as _I have dwelt_, _I have run_ &c. Some are _Neuter-Passives_; and these take the Verb _I am_ for their Auxiliary. Ex. _I am gone_; _He is ascended_.[28]

If the passive form needed further legitimizing, it was Chomsky who completed the process by establishing the essential equivalency of a transitive, active sentence with "its passive counterpart."[29] For Chomsky, the active-passive relationship epitomizes and provides the model for the transformational process which lies at the heart of his generative grammar. He demonstrates the following two sentences to be "cognitively synonymous," one being the natural by-product of the other:

> (i) I expected a specialist to examine John.
> (ii) I expected John to be examined by a specialist.

He then goes on to prove that, in terms of their "underlying deep structures," the two sentences are "essentially the same":

> (i) Noun Phrase -- Verb -- Sentence
> (I -- expected -- a specialist will examine John)
> (ii) Noun Phrase -- Verb -- Sentence
> (I -- expected -- a specialist will examine John)[30]

In terms of their "acceptability" (Chomsky's label for "utterances that are perfectly natural and immediately comprehensible"[31]), the two sentences are equivalent as well. To put it another way, the "passivization" of sentence (ii) in no way makes it less acceptable than (i), according to Chomsky's scheme.[32]

If the passive is a normal and acceptable form, why does it sound awkward and abnormal in some of the examples given in the anti-passivist texts? Because their authors have chosen contexts in which the passive is, for one reason or another, infeasible. Look, for instance, at an active sentence Strunk and White offer in their discussion of the passive:

I shall always remember my first visit to Boston.

Naturally, this sentence "is much better than" its horrendous passive conversions:

My first visit to Boston will always be remembered by me.

My first trip to Boston will always be remembered.[33]

Svartvik explains exactly why this sort of inversion fails:

> A general difficulty with using transformations of sentences in context is the imbalance that may result. It may be caused by discrepancies in the lengths of clause elements, such as personal pronouns and other short exponents occurring with long subject exponents. We have found that agents are generally heavier than subjects. Pronouns are very frequent as subjects but extremely rare as agents.[34]

In the first of Strunk's passive versions, he uses the "very rare" (and very awkward) pronoun agent Svartvik warns against. The second passive version, of course, is agentless in a context that simply demands definition of who did the remembering.

Svartvik uncovers other conditions within which the passive conversion is impracticable. What he calls "restrictions" on the passive forms of such verbs as "have, lack; contain, hold; become, fit, suit; mean, resemble; befall; cost, last, take, walk, weigh" keep them from making acceptable passives. "She has a fine job," for example, does not convert well into "A fine job is had by her." Nor does "Disaster befell the building project" translate well into "The building project was befallen by disaster." Also, Svartvik gives examples of some contexts within which "prepositional verbs" cannot convert into the passive. "The conclusion was arrived at" sounds fine; "The town was arrived at" does not.[34] Therefore, whenever an active sentence presents one of the conditions outlined above--(1) a short nominal or pronominal subject or (2) a verb with restrictions on its passive use--the passive version will be unattractive, if not incoherent. Obviously, textbook examples drawn from these categories are biased and cannot possibly show the potential of the passive.

Nearly all the anti-passivist texts perpetuate a myth that the passive is always wordy. Only in some cases is this true. One cannot argue with Day's observation that "*S. aureus* produced lactate" is shorter than "Lactate was produced by *S. aureus*."[35] Yet what if the agent "*S. aureus*" is unimportant? Or what if "*S. aureus*" has already been mentioned, or should not be mentioned yet? Then "Lactate was produced" will be briefer (Note that the passive's "was" is six letter spaces shorter than "*S. aureus*"). In their study of voice, Gordon Mills and John Walter offer another context in which the agentless passive is more economical and specific than its active counterparts:

> Discussion at the meeting of the Board of Directors clearly revealed the weakness of plan X. Plan Y was adopted.

They go on to comment:

The second of these two sentences is passive, yet it seems to do very well. You could write, "They adopted plan Y" but it's no shorter, and the referent of "they" is disturbingly vague. "The Board adopted plan Y" is still one word longer than the original and perhaps you will feel that the repetition of "the Board" is slightly unpleasant.[36]

The charge of wordiness can, thus, be turned against the active, for in cases where it is feasible to drop the agent, the passive is usually the more efficient construction. Further, elimination of the animate agent can often handily eliminate the difficult choices connected with generic pronoun use, now that exclusive use of "he" is considered sexist.

What about the myth that the passive presents tonal problems--that it is pulseless and impersonal because it can eliminate the actor/agent? Here the anti-passivists have confused matters by embroiling the passive in an unrelated debate over point of view in technical writing. The old guard feels the scientific point of view should be strictly impersonal and that the pronouns "I" and "you" should almost never be used. Reflecting this opinion, Comer and Spillman have these instructions for the technical writer:

> He has but to remember that he is talking <u>to</u> no one; that he is talking <u>about</u> a subject and the things that concern that subject; and that the talker himself never comes upon the stage.[37]

The newer (but not necessarily prevalent) trend in technical literature is toward a more personal style which features an onstage experimenter/technician (usually "I" or "we") as well as a reader who looks on from the wings (often as "you"). The passive voice was historically the standard vehicle by which the old guard eliminated the experimenter/technician from impersonal writing. "I dipped the litmus" normally became "The litmus was dipped." Unfortunately, however, the passive somehow became actually synonymous with impersonal writing, so far as the composition texts of the 1970's were concerned. In nearly all these books, the passive and the impersonal style are treated jointly or consecutively. But it is irrational and short-sighted to vilify the passive simply because of its long association with the impersonal style. Ironically, the new onstage experimenter/technician will be as dependent on the passive as his/her off-stage predecessor, if the "I/me" syndrome is to be avoided.

The remaining myths about use of the passive in technical writing amount to fears that the construction will somehow lead to other, graver errors--such as dangling modifiers and fogginess. Yet to maintain that one ought not to use the passive because the effort might result in a dangling modifier is like forbidding students to begin sentences with "because" for fear they might write a fragment. One of the texts seriously argues that "passive voice does, indeed, cause many dangling participles" and gives the following as a prime instance of the problem:

> While conducting these experiments, the chickens were seen to panic every time a hawk flew over.[38]

A writer who would construct such a sentence needs an emergency lesson in modifier placement, not a discussion on the passive voice.

The argument that the passive is ambiguous or vague is just as easily dispensed with. This criticism rests on two false assumptions: (1) that the passive will always be used without an agent, and (2) that the reader will always need to know who the agent is. An excerpt from the Council of Biology Editors Style Manual summarizes this line of reasoning:

> "I discovered" is shorter and less likely to be ambiguous than "it was discovered." When you write "Experiments were conducted," the reader cannot tell whether you or some other scientist conducted them.[39]

The editors underestimate the good sense of both writers and readers. No scientific writer would use the agentless passive in this instance without clarifying in advance just who the experimenter is, if that information is indeed important in the context. And no reader needs to be reminded in every single sentence who the experimenter is.

What is saliently missing in the treatment of voice by recent technical writing textbook authors is, first, a complete and realistic view of the passive's potential. Comments in these books are almost always limited to agentful passives with the "be" auxiliary alone and to finite verbs. But Svartvik's excellent study establishes that the term "passive" should be "used in a very wide sense" as "verb combinations of be (or auxiliaries commutable with be) and a past participle."[40] "Can," "may," "could," "have to," "should," and "get" are just a few of the commonly used passive auxiliaries that recent texts take little account of. Further, these books treat only the passive constructions listed in Svartvik's class A (clauses with animate agents) and class B (clauses with inanimate agents). Actually, 80% of the passive constructions normally used fall into Svartvik's class y (clauses without agents) and are virtually intransitive and equative in character.[42] In other words, the texts ignore all but the first one or two types in Svartvik's "passive scale," arranged below from agentful transitive to non-agentful intransitive types:

> The house was built by experts.
> The house was built of wood.
> His bills are paid.
> His bills are paid regularly every month.
> His bills are paid, so he owes nothing now.
> The snow was piled high by the wind.
> The snow was piled high by the door.
> The village was (appeared, lay, looked, seemed) quite deserted.
> He felt thoroughly disappointed.
> The door remained locked.[43]

Second, the anti-passivists fail to identify the special advantages the passive voice offers a writer, particularly a technical writer. For example, the passive is uniquely suitable to and frequently used with long nominal groupings at the end of a sentence. Where an actor or agent is, therefore, part of a bulky nominal grouping (as is often the case in technical writing), it is better placed at the end of the sentence than in the subject position.[45] That is why the passive version of the following idea sounds more efficient than the active:

The fabric was bleached with a pink, filmy liquid which the acid solution had produced.

The pink, filmy liquid which the acid solution had produced bleached the fabric.

Also, the passive can help the technical writer maintain proper FSP (functional sentence perspective) flow--that is, the logical progression from known to unknown.[46] The principle of FSP may even make the passive "obligatory" in a definition like this one:

Sediment will be defined in this study as residue of dirt or decayed organic matter resting on the ocean floor within 20 feet of the Nassau shore.

It goes almost without saying that the passive is obligatory where the agent is unknown or irrelevant, a circumstance quite common in scientific writing. In this sentence

Eight minutes later, the patient was exhausted.

the patient was undoubtedly exhausted by something, but the cause of exhaustion (if extraneous to the report or unknown) need not be considered if the passive is used.

This discussion would not be complete without reference to the usefulness of the participial and infinitive passives, both of which are liberally (and, I am sure, unwittingly) incorporated into current technical writing text models. In the following sentence from Houp and Pearsall's text, "needed" is a participial passive and "to be taken" and infinitive passive. Of course, the main verb ("must be considered") is also passive:

In establishing a method to remove the lake deposits, three factors must be considered: needed equipment, legal steps to be taken, and the disposition of the deposits.[47]

The phrase "needed equipment" is clearly some sort of elliptical construction signifying "The equipment is needed." Similarly, "legal steps to be taken" is a shorthand construction signifying "Some unidentified subject should take legal steps." These infinitive and participial genres of the passive, which have not been included in the verb counts used in this article, warrant further study. Even in non-technical writing, these forms are important shorthand by-products of the passive transformation.

The passive voice is not an anachronism. It is an essential and acceptable function of English syntax because it facilitates certain identifiable arrangements of information and coordinates well with a variety of tones and points of view. Under certain circumstances which arise frequently in technical writing, passive is actually preferable to active. When used properly and intelligently, it is a clear and economical form of expression fully appropriate in the technical context. The 1980's should signal a shift in the scholarly winds--and a full vindication of the passive in technical writing.

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Panel B-20

Writing Programs: Connections Between the Collegiate and Business Worlds

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TECHNICAL WRITING AND THE MARKETPLACE

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INTRODUCTION

There are many different kinds of job situations which students of technical writing may confront, but most of them fall into two major types which correspond to two major types of students who take technical writing courses. On the one hand is the specialist, the trained scientist, engineer, or technologist who will have learned to write unusually good correspondence, proposals, and reports on the job. On the other hand is the professional communicator, who may have only a general understanding of the sciences, but who can translate what he learns on the job into language and graphic forms that communicate effectively with anyone from production line workers through engineers to management.

As for the first type, the specialist, job opportunities will be determined primarily by the specialization, the current supply of and demand for geologists, electrical engineers, computer scientists, or whatever. Technical writing will give such graduates a decided edge in the market, and their communication skills will undoubtedly accelerate their advancement into managerial positions. But of greater interest to us here today are the opportunities for the second type, the professional communicator.

THE GROWING MARKET

Technical communications--as a profession rather than as an extra skill possessed by a professional at something else--is a rapidly expanding job area, the potential for which has only begun to be recognized. In some companies the profession is well established. Western Electric, for instance, employs over 1000 technical communicators in its publications center in Salem, North Carolina. Sundstrand, for another example, keeps a technical communications staff of over 150 at its home plant in Rockford, Illinois. Many other companies keep staffs of anywhere from one or two persons to several dozen. The greatest potential, however, lies in the uncounted number of companies that do not seem to fully understand what a technical communicator is. I shall speak more of it shortly, but this lack of understanding together with the lack of much in the way of market studies makes it difficult to assess how big the market really is. What does exist, however, shows great promise.

A few years ago Sundstrand sponsored a survey which found that from 1976 through 1981 just the industries in Rockford, Illinois would require

141 new technical communicators. In a more recent survey done closer to Bowling Green the results are even more encouraging. Thomas Buehrer, a master's student in our technical writing program, is currently completing a study of the job market for technical writers in Ohio and Southeastern Michigan. Over an eight-week period in 1980 (19 October-7 December) he checked the Sunday classified sections of eight major area newspapers, The Akron Beacon Journal, The Toledo Blade, The Cincinnati Enquirer, The Cleveland Plain Dealer, The Columbus Dispatch, The Dayton Daily News, The Detroit Free Press, and The Detroit News. After eliminating any repeated advertisements, he found 121 different employment opportunities for technical writers listed during that period. A more thorough analysis of the data is still in progress, including listings of companies, their locations, salary ranges, and the experience and education required, but if we may extrapolate, we can expect to find nearly 800 technical writing jobs listed in these eight newspapers over a year's time.

As encouraging as these preliminary results may sound, the true market picture for the technical communicator is probably more complex. Mr. Buehrer's completed study, I believe, will show that a great many of these jobs, probably many more than are necessary, specify highly specialized technical education and training. The reason for this is the lack of understanding in business and industry of what technical writers can do.

One indication of the continuing lack of awareness of the profession is the fact that the College Placement Annuals for both 1980 and 1981 list only 47 companies interested in "Writing and Editing--Technical"--they list even fewer, 12, under "Writing and Editing--General." Obviously such a list barely scratches the surface of the potential market. Why so few companies seem aware of the profession is indicated by a more concrete example.

A year ago last Spring an electrical parts manufacturer in Columbus advertised not for a technical writer, but for an engineer with five years of publications experience. One of our technical writing students--with a Bachelor of Liberal Studies degree and no science background beyond the basic science and mathematics group requirements for an Arts and Sciences degree--answered the ad. What the company needed, he found, was someone to write safety and operational manuals for their plant. He convinced them that they probably could not find the person their ad described, nor could they find an engineer willing to write such manuals. What they really needed was a technical writer. He got the job.

Aside from reinforcing the fact that there are more jobs out there than one would suppose, there are two important conclusions suggested by this incident:

- Many technical writing jobs require much less technical training than is usually supposed.

- Business and industry need to be educated to the way technical writers can serve them.

TECHNICAL WRITING AND TECHNICAL TRAINING

How much technical training a technical writer needs is a highly debatable issue. Certainly the more technical training he has the more marketable he is. But here are some more indications of how a well trained communicator can do the job with less technical training:

- A major Ford Motor Company executive tells us that Ford is beating the engineering shortage and saving money by hiring technical writers for many jobs they used to hire engineers for.
- NCR has hired some of our technical writing graduates with only two computer science courses for jobs they used to think they needed computer specialists for.
- Sundstrand is willing to hire our technical writers if they have just a couple of electronics courses.
- We have placed graduates with similarly minimal technological training with such companies as Bell Laboratories, Hewlitt Packard, and Norden Instruments, as well as with NCR.

These examples indicate that very often little beyond basic introductory knowledge of the technical field is required for a technical writer. If the writer needs more information, most major companies have excellent training programs that can efficiently provide what is needed, and if a real technical expert is needed, the knowledgeable writer can usually consult one. Moreover, as he works the writer becomes more expert, while the company is able to use the real expert's time more profitably. In short, well trained communicators who are familiar with the basic vocabulary of the technological area can do the job.

CONVINCING THE MARKET

As we have said, however, much of business and industry still needs to be convinced. Some of the ways this may be done are listed below, arranged roughly in the order in which they might be done, although the sequence is not of crucial importance.

Start by consulting with business and industry in your area. Ask them what kinds of writing skills are most needed in the jobs they do and most lacking in the people they hire. You will find many who feel strongly committed to writing. Invite them to speak to your writing classes.

Formalize this process of consulting by establishing, as Bowling Green has, something like our Alumni Advisory Council to the Technical Writing Program. This is made up of graduates with special interests in communications and with executive positions in such firms as Owens-Corning-Fiberglas, Batelle Memorial Institute, and Ford Motor Company. More recently we have added an alumnae from our technical writing program now with the Kettering Research Institute at the University of Dayton, and we have expanded membership to include people who are not alumni. Among those is Ted Brusaw of NCR, the coauthor of The Technical Writing Handbook, one of the best textbooks in the field.

Join and participate in your local chapter of the Society for Technical Communication. STC is an excellent professional organization made up of people who like their work and love to talk about it. Speak to members about their needs and your program. Bring your best students along to chapter meetings and introduce them around. We have placed several students in internships and jobs by way of STC meetings. We are also in process of establishing a student chapter of STC at Bowling Green.

Establish an internship program. The practical experience of a quarter or semester of full-time work as a technical writer is an essential part of a student's program, but internships are also an important way to sell the program. Many companies reluctant to hire a technical writer will take a chance on the short-term commitment of an internship, and if one student does the job for them, they will come looking for more. Moreover, internships offer the company an effective means of recruiting and learning far more about a job candidate than any number of interviews would do. Diebolt Corporation of Canton, Ohio interned three of our students so far this school year and subsequently offered jobs to all three. They are interning two more this Spring and are hungry for more.

Make use of your university placement office to meet company recruiters. William Coggin, the director of Bowling Green's technical writing program, has a standing invitation to lunch with any technical writing recruiters. More than that, he watches the placement interview lists for other likely prospects. Often companies asking for marketing or journalism majors really need technical writers and don't know it. Over lunch is an excellent context in which to sell the program, and Professor Coggin has used this means to set up internships and job interviews and most recently to recruit a new member of our advisory council, the senior software editor for Digital Equipment Corporation in Nashua, New Hampshire.

There are no doubt other ways to cultivate the market, and of course the ultimate success of any technical writing program is based on the quality of its product, the intelligent, capable, and well trained communicators turned out by the program. But the market is unquestionably there, large, growing, and able to take as many good people as we can turn out for some years to come.

Panel C-15

Teaching Technical Writing to Minority Students: Perspectives for the 1980s

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THE PROBLEMS INHERENT IN TEACHING TECHNICAL WRITING AND REPORT WRITING TO NATIVE AMERICANS

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SUMMARY

The Native American presents a unique problem to the college technical writing instructor for two reasons: English is likely to be the Native American's second language and mainstream American the second culture. The contrasts between native and acquired language and cultural systems result in a number of predictable difficulties. Error analysis indicates the same problems. Yet, the ideals of technical writing can be taught through compartmentalizing the task into minimal units and then teaching the related skills.

The Native American is a speaker of English as a second language, or the Native American is a speaker of English as a second dialect. In either case, the standard mainstream language is likely to have for the Native American at least some of the speaking and writing problems that any second language would have. For the Native American who is attempting to learn the particular skills of technical writing, the task is compounded. Because mainstream American culture is also a second, a learned, culture, the Native American's natural reactions to situations that require the specific skills that are related to a technical field are likely to bear cultural overtones of the first culture. As Paulston and Bruder have noted, (p. 58) although learning to speak a language is quite an accomplishment, "...it is easier to keep one's linguistic codes separate than one's social codes as one is often not aware of the social codes on a conscious level until they are violated. It is much easier to be bilingual than bicultural." The kind of judgment that technical writing requires is specialized; one does not learn it by becoming accustomed to the water.

That many (if not most) Native Americans are non-native speakers of English can be discerned in the five divisions of natural language: in phonological analysis we find that there are some sounds that are likely to be confused and that there is likely to be a variant of English that the tribe members share and that is recognized as a variety of the main language. In morphology we find that word choices are likely to be affected by age, first language, and experience. The English syntax of non-native English speaking Native Americans will probably show some aspects of the first language as manifested in word order, word form, tense, and world view. In the realm of meaning, we find evidence of a different world, different connotations about what seem to be common concepts. In the study of kinesics, we find an entirely different set of rules.

According to the theory of language-culture relativity as put forth by Benjamin Lee Whorf and Edward Sapir, language shapes the universe for its speakers, language determines Weltanschauung, that a person understands the world by selecting--in accordance with the cultural constraints of his or her language, those concepts that the language (i.e. the language community) has deemed relevant to human experience, and that only a small percentage of everything in any particular vista is relevant.

The concept is clear in an example: What is a river? To a boatman, it is a road. To a foot-traveler, it is a challenge to cross. To a hydrologist or a farmer, it is a source of water for different puroses. To a hydroelectrical engineer, it is a source of power. To a fish, it is home. Another example: What is the Painted Desert? To an artist, it is color, shapes, feelings. To a photographer it is light, reflections, and relationships as well. To a Navajo, it is grazing land. It is good to remember that the theory of language-culture relativity was formed after the studying of American Indian languages had begun, and that languages that manifested such great cultural differences had not been met and analyzed in such a great number before that time. The languages of Europe and Asia were relevant to different worlds; the differences were not likely to be so great, and the contrasts were not so remarkable as to cause anthropologists to take special note and make the inferences.

This special role of culture in the perceptions of non-native speakers of English brings to focus the entire tradition of composition teaching. The basis for compostition has long been a literature base: all the members of a class read a work of literature--something relevant to their age group and well written so that they have a common situation, a piece of human experience, to discuss. Then the teacher can use the literature to build a meaningful program, one that will exercise analytical skills and critical thought. It is true that there are some stories that will be appropriate for the mixed backgrounds of a second language class, even for the Native American class, but much more experience with European tradition is essential for European literature to be understood. Of course, technical writing has a different focus, perhaps one that is more important to the Native American; its involvement is not with interpretation at all, but with single purposeness. Perhaps technical writing is a more easily acquired skill, a more logical place to begin teaching second language learners to write in English.

When Merlin the Magician in T. H. White's book, The Once and Future King, helped young Arthur understand his universe, he changed him into a bird and a fish. Do we require Native Americans to turn into European Americans to understand some of the literature that is typically taught in freshman English courses? How much of what we are expecting these students to understand is really foreign to them? And how much of the logic in the development of the story is comprehensible? Even "creative" language, literature, has development patterns that probably do not match those of their first languages; and how much of what the words mean to them can we understand? For example, is there any way that we could read Shirley Jackson's The Lottery with the same cultural experience as a person from a high ritual society? Or, if we are looking at Hamlet through Yaqui, Laguna, or Pagago eyes, do we see the same drama? We must remember that in the late 1930's, German audiences cheered Kreon as a stong leader, one who put the disrespectful upstart Antigone in her place--hardly the interpretation that most English readers have ascribed to--and not what we think Sophocles meant (or did he?) It's how the reader looks at it and which cultural lenses are used.

Evidence shows that requiring language and cultural displacement before any composition can take place at least doubles the second language learner's task. Robert B. Kaplan, in his classic article on rhetorical patterns in other languages, (Language Learning, "Cultural Thought Patterns in Inter-Cultural Education," 1966, 16:1 & 2, pp. 1-20) presented convincing findings about the thought patterns of some other languages and opened the field of rhetorical pattern research. In the fifteen years since Kaplan's article, there has been corroborating evidence, but little if any counter-evidence.

For this writer, the understanding of what Kaplan was discussing came slowly. While in Turkey as a Peace Corps Volunteer, I had learned to speak Turkish fairly well although I could not seem to write successfully in Turkish. My tutor said that my writing was correct, cold, and lifeless. Simultaneously, I was grading the papers of my Turkish students as flowery, overstated, and pretentious. It took a while for the obvious to occur: that Turkish rhetoric required more embellishment than English, that the rhetorics of the two languages were quite different! Kaplan's extrapolations of thought patterns are idealized forms that reflect the logic systems of languages. Because Kaplan was able to see certain patterns emerging from the analysis of some six hundred students' papers, he was able to chart the results. He showed that Semitic language speakers tend to use parallel structures in coordinations, applying these structures in such a way as to appear as elements of equal value in English composition. Kaplan infers that the Semitic languages, therefore, contain a flexibility that can accomodate parallel constructions in a way that English does not. The use (overuse) of these parallelisms strikes the American English reader as strange and somewhat immature. To American English readers, the relationships of ideas are likely to come from the following set:

1) Chronological (narrative or process)
2) General idea to specific example
3) Result to reason for it
4) Thesis statement to definition of terms
5) Concept to description
6) Comparison of ideas
7) General whole to parts
8) Idea to its analysis

Furthermore, the American English reader will not tolerate another pattern, certainly not parallels. Conversely, a Semitic speaker finds the American idea of parallel constructions strange: parallel lines by definition can never meet; therefore, such ideas need careful and artful coordination to bring out the power in their similarities. (Personal communication with Hasan Ali Abbas, 1981)

English expository writing is ideally linear: the topic sentence + support. The highest marks are given to that piece of writing that most clearly sets forth the main idea, most crisply outlines the supporting information, and most succintly puts the whole thing together. In this way, if in no other, the cultural value of direct linear development is seen. Other cultural values, such as "getting to the point" and "not beating around the bush" are also obvious, even though they are exactly contrary to the rhetorical patterns of some other languages. Chinese, for example, tends to use a circular development, one which intentionally beats around the bush. To speakers of some Oriental languages, it is uncultured to go straight to the point--it is rather like telling the punch line of a joke first. The preferred pattern spirals inward as important notes are picked up along the way to the main idea. Each idea is related to the one before it and to the one after it. Each sentence adds a new piece of information that brings the topic and the topic sentence into the open.

Although the thought patterns of Romance languages are generally closer to that of English (is this perhaps why we think that it is easier for the Spanish speaker to learn English, or at least one of the reasons?), Romance languages allow much greater digression than does American English. French prose, for example, uses many flourishes of prose to give substance to the expression, and in Spain the "perfect" American English paragraph "has nothing interesting to keep the reader reading." (Personal communication, Jesus Carrera, 1981.)

Kaplan's research also uncovered some truths about Russian rhetoric; the patterns allow for many parenthetical amplifications that, when expressed in English, make for very complex structure.

In contrast, we have the basic agreement in American English that paragraphs ought to be straightforward and concise, that a paragraph ought to be a logical division of material and not simply a typographical one, and that deadwood and extraneous ideas should be cut out. By implication, we have a number of languages and therefore almost assuredly different basic organization principles--ones that are likely to be greatly different from American English, if we believe that language shapes one's view of the world. How then can we presume to teach the Native American to write in English; how can we teach composition with a literature base; and how can we teach technical writing?

The first task is to extrapolate the thought patterns of Native Americans. The task is great, but already there are clues. Mary Jane Cook (Turner, pp. 241-250, 1973) pointed out that at the sentence or T-unit levels, there is a commonality in the kind of errors that Southwestern Native Americans make, mistakes that show some but not definite language family lines. Cook's research suggests the appropriateness of an error analysis approach.

Hans Guillermo Bartelt (1980) uses this observation from Cook and the concept of interlanguage as defined by Selinker (1972) in his postulation that Navajo-English and Western Apache-English speakers tend to manipulate the tenses of English to express what would be the relevant modes and aspects of the mother tongues: the usitative and imperfective modes and the continuous aspect for the present tense in English, and the progressive, optative, and iterative modes and repetitive aspect as associated with the progressive aspect, and the perfective mode as associated with the past tense in English.

The problem of extracting the thought patterns and errors that are characteristic of Native Americans is compounded by the fact that all of the students are using an interlanguage and that they are <u>trying</u> to write using models--at the very least models through the directions of the teacher. Therefore, it is difficult to find many clear examples of thought patterns and to generalize from them. Yet, several patterns do appear when writing samples are analyzed, and from these general patterns, through extrapolations, conjectures, and speculations, some implications for teaching expository and technical writing can be made.

The methodology for determining an error in rhetoric, as the first step in remediation includes three processes of analysis: contrastive analysis of rhetoric (some things sound flowery in one language but not in another, what is good prose in one language is cold and lifeless in another), error analysis (the student is doing something wrong, what is it?), or the application of principles ("This is what a well-written English paragraph looks like: here are the principles--apply them and you'll learn to write well.") The composition teacher may use one, two, or all three processes in understanding the second language or second dialect speaker's writing problems; the next step is the development of corrective procedures.

Analysis of Native American writing shows a number of rhetorical problems and suggests some Kaplanesque patterns of thought organization. The major problems are logic of arrangement, selection of support, and time and space. Let us consider each of this matters.

<u>EXAMPLE</u>: Logic of Arrangement

The symbolic representation of one group of Southwestern Native American papers is a completed circle, starting at a logical point--such as the beginning of a day, and completing the whole day. Specific examples include a student's report on what it was like to go to a boarding school; the paper began with the sun rising in the morning and ended with nightfall. Another student described his sandals from the moment of purchase, through years of wear, to the need for a new pair. In this arrangement of ideas, the details and support statements are such that a whole is related to the audience by means of a person's reactions to it. A Navajo student described a rodeo in terms of his own personal reactions and experience with each aspect, thereby suggesting that once the circle is completed, like a bicycle wheel's spokes, the details and supports converge on the center, the writer. Another student reported on a movie in terms of what he had experienced; the chronology, therefore, was more of a descriptive sequence of emotions than a narrative.

In all the cases cited above (and in the other compositions that suggested this configuration) there was a focus and limitation problem for the American English audience because of the description of what seems to be a whole gestalt. (In other words, support was included that the native speaking reader found to be extraneous.) At the same time, it is difficult for the English-speaking mind to understand whether the focus is the rodeo or the cowboy's experience; so much is this a problem for the English-speaking writer that the two concepts (the story and the reaction) would most likely form separate paragraphs.

<u>EXAMPLE</u>: Selection of Support and Scope of Detail

Again the pictoral form seems to be that of a circle with the topic idea in the middle and lines from facts going in toward the center--although some of the spokes of the bicycle wheel appear broken off. One clear example is one in which the student wanted to write about the usefulness of the quarter horse to the cowboy. A native speaker of English would probably have analyzed the positive aspects of the quarter horse or compared and contrasted the aspects of the quarter horse with other horses. Instead, this Papago student discussed all horses, intertwining the concepts of quarter horse superiority in such a way that the audience never got the straight message that the best horse for a cowboy is a quarter horse. It was left to the audience to do the inferring. The selection of detail was so broad that the thesis was lost. Similar problems have been noted in many other papers; too often every detail (or so it seems to the English reader) is included.

EXAMPLE: Time and Space
The symbolic pattern suggested in the Native American problem with time and space is that of concentric circles. The most obvious example is the Hopi sense of time and space. The Hopi's concepts of time and space are radically different from the English speaker's; Hopi has no time and speed words as English does. In English, a person stands on a time line: I was there, now I am here, and that is where I am going. In Hopi, I am here in a time and space; all that was is part of this reality and the potential for all that will be is also here. Distance is time and space away from the center of my cognition, that which is me, here, now.

It is not surprising, therefore, to find that one common Hopi thought pattern is concentric circles, or telescoping. One short example that can be quoted here shows this pattern:

> People all over the word have individual lifestyles that are distinctive. Societies as well as individuals have their differences. The Hopi culture has a unique culture to which no other culture is similar to.

This same student did exactly the same thing in a much longer composition about the components of a culture--language, religion, and traditions.

What are the implications for expository and technical writing? The first imlication is that the concepts of the audience, the message, and purpose are all subject to cultural interpretation. Also, some specific problems are brought into focus.

1. The Concept of Promptness Native American time is flexible, natural.
2. The Contextualization of Purpose Expository writing in general and technical writing in particular are based on principles of persuasion and involvement of audience that are sometimes problems for Native Americans. The problem of ethics is a convincing example. The Native American asks whether it is ethical to try to persuade another, to change his mind when he has already decided for himself what he wants to do. Another example is whether a person can look into the future. How specific can one be in writing a grant proposal? How much must be planned? What information will the receiving agency see as relevant? Is that what the Native American will see as importatnt? Is justification for items in a proposal necessary? If so, how much?
3. Interpersonal Relationships Good technical writing (contrary to most other kinds of formal writing) involves "you." The Native American is often not very comfortable with this purposeful drawing in of another person.
4. Wordiness "Some English is good; more must be better." If an expression worked once, it must be good enough to use again and again. The repetition of certain transition forms, so typical of Southwestern Indian writing, suggests that coherence of argument in their native thought patterns might require such repeating of forms.

5. Mixture of Registers A typical problem of Native Americans' English is a combination of language tones that do not fit together. Usually because of a lack of experience with English, they have difficulty in "feeling" which word or phrase matches the needs of a formal or informal situation.
6. The Problem of Abstracting What is culturally defined as the "main" idea by the speaker of one language might not be the most important one to a person from another culture. In a similar way, what one person judges as relevant is determined by his or her culture. The topic or problem of the paper or other writing assignment might be defined differently although the same words are used (in English) to describe the task because the cultures from which the perceivers come will in a large part affect how the assignment is received.

For Native American students who are having writing and perception problems because of the kind of thinking/writing problems that are listed above, it might be necessary to use one or more of the following inductive procedures:

1. Topic choosing and limitation. It might be necessary to lead a student to awareness of appropriate topics and appropriate size of topic through exercises which require the student to estimate how much support would be appropriate for three to five topic statements (on the same subject). The students might also be asked to arrange a similar number of topics in order, most general to most specific. Next the student might be asked to double the scope of one subject and and then halve the same subject.

2. Support and detail relevance. Again, the teacher prepares a list of details to support the subject; one of the list is announced to be irrelevant. When the student gains facility in finding the non-related support ideas, the teacher contextualizes the "correct" support ideas and a few irrelevant ones by putting them in a paragraph and then by adding a completely unrelated paragraph to a well-written article for the student to sort out. By this stage, the student might be ready to select facts (from a list of related facts) to write an outline of ideas for a paper.

3. The contextualization process. Students often do not know all the information that they need to know in order to do an assignment; the inductive approach is to supply them with all the information that they need, the formula for putting it into an acceptable form, a model of a similar assignment, and (perhaps also) a list of how they can go wrong in completing the assignment.

4. Defining the purpose. To help students understand what the purpose of the writing assignment is, the teacher can provide the background, supply the rationale, and indicate the appropriate types of support. A teacher might give the students a list of audiences (and give each member of the class a different one) and a list of purposes (with each one in the class attempting a different one). Then the students' papers can

be analyzed as a class exercise, to determine what adjustments were necessary for the different purposes and audiences.

In other words, the methodologies for teaching technical writing are defined by compartmentalizing the skills in such a way as to reduce the components to minimal units. Thereby, the teacher provides a safe, controlled writing situation which will encourage rather than discourage Native Americans (and most other non-native speakers) to write clearly and concisely in the American English thought pattern.

Sheridan Baker in The Practical Stylist says, "If your writing falls apart, it probably has no primary idea to hold it together." Consider as a rebuttal that the falling apart is possibly in the eyes of the beholder, not the writer, because the primary idea is there--but not presented in a comprehensible way for the English speaker to understand more than the words.

SAMPLE EXERCISES
Memo Writing

[Note: This exercise focuses on evaluation of items, ordering, and appropriateness of language.]

What order is best for a memo? In the list below, there are all the necessary elements for a communication from an office manager to the staff members. The purpose for writing the memo is that there are a few problems that must be taken care of. You (as the office manager) also need to announce a meeting. First order the items by putting a number (1-8) in the blank that follows each concept. The write the memo in the space at the bottom of the page.

ADDRESSED TO ALL STAFF AT GOOD COUNSEL, UNLIMITED ________

THAT LIGHTS HAVE BEEN LEFT ON IN THE OFFICES ON THREE NIGHTS OUT OF THE PAST WEEK ________

TODAY'S DATE: June 30, 1981 ________

THAT NO ONE SIGNED OUT THREE BOOKS THAT ARE NOW BEING CONSIDERED STOLEN FROM THE LIBRARY ________

THAT COUNSELING ROOMS ARE NOT BEING KEPT AS ORDERLY AS MEMBERS HAD AGREED TO KEEP THEM ________

THAT SEVERAL MATTERS NEED TO BE BROUGHT TO THE ATTENTION OF ALL STAFF MEMBERS ________

THAT A STAFF MEETING WILL BE NECESSARY NEXT WEEK TO DISCUSS SOME BUILDING REPAIRS ________

THAT YOU ARE THE OFFICE MANAGER AND SIGN THE MEMO ________

THAT YOU NEED TO HAVE A PREFERRED DATE AND TIME FOR THE STAFF MEETING (Wed., 9:00am or Fri. 3:00pm) ________

Now write the memo.____

____

General to Specific

[Note: This exercises the students' abilities to select relevant support items, to find the most general and most specific items in a list, and to become more sensitive to the tone of the language.]

Which sentence is the most general? Would it be a good beginning sentence? If not, find the best general statement to introduce the topic.

Which sentence is the most important one? (Should you begin with this one? Why or why not?)

Which sentences do not contribute anything of value to the main idea?

Are any sentence irrelevant? Should they be left out?

* *

AWP-750 is more expensive than IBM's comparable model. ____________

AWP-750 sells for $11,999.46. ____________

AWP-750 is Acme's new word processor. ____________

AWP-750 comes in eight beautiful modern colors. ____________

AWP-750 can be installed in two hours. ____________

AWP-750 has many uses in the modern office. ____________

AWP-750 is available in desk and console models. ____________

AWP-750 is nearly as good as a computer. ____________

AWP-750 saves the work of four secretaries. ____________

AWP-750 is new on the market and has been tested for three months in busy offices. ____________

Your assignment is to write a sales description of the AWP-750. Do any of these ideas seem valuable to you? Are any of them worded badly for your purposes? How could the negatively stated ones be improved? What would you leave out? Now write the description:____________________________

Finding Relevant Support Ideas

[Note: This exercise focuses on whether ideas that are related to the general subject are relevant enough—or closely related enough—to a thesis statement to be used in a paragraph as support.]

Which of the ideas presented here are relevant to the topic? Check all the ideas that support the numbered sentence. Be sure that you know why they are and why the others are not important enough to be included in writing to support the thesis statement.

1. The AWP-750 is an essential tool for a busy office.

how much work it can do in one day........................ ________
how many pieces of information it can hold................ ________
how much space it takes up compared to how much work it does ________
that a person can play games on the AWP-750................ ________
that it does the work of five secretaries.................. ________
that a good typist can make efficient use of the AWP-750
after only four hours of training.......................... ________
that the AWP-750 comes in an attractive package............ ________

2. New Village needs a counseling program for many reasons.
The alcoholism rate is high. .... ________
There is no other counseling service in the village. ... ________
The other counseling services nearby are no good. ...... ________
New Village has a juvenile delinquency problem. .... ________
There is a good building for a counseling center in the
Park Community Center. .... ________
The village president's wife is an unemployed counselor. .. ________
The village has an unusally high divorce rate (35%). ... ________

Formula for a Letter

[Note: This exercise gives rigid requirements to the student writer so that no part of the letter can become inflated with other than essential information.]

Assignment: To write a letter in the following pattern for information regarding requests for proposals.

Paragraph 1	Introduction: Why are you writing to this office? (Maximum length, 5 lines)
Paragraph 2	Support, type A: What project are you thinking of? (Use 6-10 lines to validate your reason for writing for information.)
Paragraph 3	Support, type B: Who are you to ask for this information and to suggest this proposal? (Use 6-10 lines to summarize your position and reasons.)
Paragraph 4	Conclusion: What can you say in terms of summary and polite formulas to end the letter appropriately? (Maximum, 3 sentences)

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Panel C-20

Rhetorical Theory and Technical Communication: Some Inquiries

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A RHETORICIAN LOOKS AT TECHNICAL COMMUNICATION

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When I was first asked to teach technical writing, I experienced all the usual apprehensions of the typical English teacher. How could I get to know enough about a subject like nuclear physics to be able to make a judgment about the substance and the writing of a report on that subject? How could I learn all the special forms and formats of the kinds of writing done in technical fields? How could I sustain an interest in reading reports about subjects alien to my purview? Would all of my belletristic and humanistic instincts be anesthetized after a few weeks of immersion in pools of cold and colorless data? Would I be selling out to the "other culture" of the Two Cultures that C. P. Snow had once written about?

Like most English teachers who become teachers of technical writing, I soon learned that my apprehensions about these matters were unwarranted. The main problems that I and my students had were the same problems that attend any writing course: finding something to say and selecting, organizing, and verbalizing what the discovery process had yielded. I very soon learned that to be an effective teacher of technical writing, one had to become familiar with the kinds of writing demanded in various technical fields, to learn the conventional formats of that kind of writing, but above all, to acquire enough knowledge of the basic strategies of rhetoric to be able to guide students in composing not only the paper at hand but similar papers in the future. Although I am still very much of a neophyte at teaching technical writing, I want to talk about how a knowledge of traditional rhetoric has helped me cope with what has proven to be the most challenging and the most satisfying writing course that I have ever taught.

Of all the lessons that traditional rhetoric has to offer, the one that perhaps best orients the teacher to what Carolyn Miller has called "the community of technical writers" (ref. 1) is the lesson about the components of the communication process--the writer, the readers, the message, and the reality that the message is dealing with. Although many modern readers first encountered the so-called "communications triangle" in the work of such scholars as Roman Jakobson, M. H. Abrams, and James L. Kinneavy, the notion goes back as far as Chapter 3 of the First Book of the Rhetoric, where Aristotle said that a speech was the"joint result of three things--the speaker, his subject, and the person addressed."

What the teacher of technical writing needs to do is determine how this kind of writing relates to the communications triangle. James Kinneavy can be very helpful to the teacher on this score, for he not only makes the communications triangle the central paradigm for his A Theory of Discourse but discriminates the various aims of discourse according to which component in the triangle receives the predominant emphasis. Elizabeth Harris has shown how she used the notions set forth in Kinneavy's A Theory of Discourse to structure her course in technical writing (ref. 2). That kind of discourse in which the writer discusses the objective reality which exists outside the writer and the readers Kinneavy calls Reference Discourse and subdivides that into Scientific Discourse, Informative Discourse, and Exploratory Discourse.

The new teacher of technical writing soon learns that the students' reports deal exclusively with phenomena existing in the "world out there." Although there may be elements of Persuasive Discourse and Expressive Discourse in the technical report, most of the writing done in a technical-writing class can definitely be classified as Reference Discourse. At one point, Kinneavy gives a simple formula for discriminating the three sub-categories of Reference Discourse: "Exploratory discourse fundamentally asks a question. Informative discourse answers it. Scientific discourse proves it" (ref. 3). Although there are instances of Exploratory Discourse, especially in the proposal stage, most of the writing done in a technical-writing class could be classified, in Kinneavy's terms, as either Scientific Discourse or Informative Discourse.

The rhetorical system of the classical Greeks and Romans would seem, at first blush, not be be of much help for the teaching of the scientific and informative varieties of reference discourse. I must concede that if we are going to get any help from traditional rhetoric for that kind of writing, we have to go to the kinds of logic and rhetoric texts that developed during the eighteenth century under the inspiration of such seminal thinkers as René Descartes, Francis Bacon, and John Locke. And indeed when we investigate the rhetoric texts of such men as Adam Smith, Hugh Blair, George Campbell, and even the fervently Aristotelian Richard Whately, we find a rhetorical system that is congenial with the empirical spirit of modern technology.

For one thing, reading such rhetoricians as Blair, Campbell, and Whately would certainly weaken your faith--if you had any--in the usefulness of the topics as a device to aid technical writers in discovering material pertinent to the development of the kinds of subjects they typically write about. One of the most notable changes that has taken place in the heuristic procedures for scientific and informative discourse is the shift of reliance on what Aristotle called "artistic proofs" to the "inartistic proofs"--that is, to the kind of data that exist in resources outside the writer. Modern science and many of the professions rely heavily on data supplied either by direct observation or by expert testimony. Modern science still has to deal occasionally with what is only "probably true," but today that probable truth is more likely to be supported by some kind of empirical evidence than by some kind of deductive argument.

Students in a technical-writing class usually do not need the aid of a heuristic system like the topics, because often the material of their reports is supplied by their firsthand inductive study of some problem. They frequently have so much data available that they do not know what to do with their embarrassment of riches. Their problem is not, as it often is in a Freshman English class, the problem of finding something to say on their subject but rather the problem of selecting and organizing the abundance of material that is available to them. Their problem is one of selection rather than one of discovery.

I have learned, however, that if the topics are presented not as sources of material that can be used in the development of a subject but as modes of thinking, they can be helpful to students in technical-writing courses and especially helpful to them with their problems of selecting and organizing the hodgepodge of data available to them. The topic of comparison, for instance, might suggest to students that some of the material available to them could be used to set up an illuminating analogy between what they are writing about and something that is very familiar to the audience. Or the topic of cause-and-effect could suggest that some of the available material could be used to expose the reasons for the particular problem they are dealing with. A systematic run-through of the other topics could suggest other lines of development, could indicate which items in the available material could be pertinent to a particular line of development, and could even designate where in the report a particular line of development would best fit.

Some of the students' decisions about organizing their papers are taken care of by the conventions that prevail about the number and the order of the parts in a formal report. But students can sometimes be helped in organizing their papers by being introduced to a pattern as ancient and mechanical as the six-part Ciceronian structure of a classical oration. In an article in College Composition and Communication, Andrea Lunsford pointed out that her students were "quick to discover the relation of the classical pattern to their own problem-solving reports: the introduction, statement of the problem and purpose, report of the findings, and recommendations and conclusions correlate nicely with the classical pattern" of exordium, narrative, partition, confirmation, refutation, and peroration (ref. 4).

One of the biggest surprises for me has been the extent to which considerations of style figure in technical writing. Ultimately, the question of the appropriate style becomes the major problem for most students. That the problem of style loomed so prominently surprised me because I had been under the impression that the style in technical writing was supposed to be as inconspicuous as possible. It is true that in this kind of writing, the prose style should be kept as unobtrusive as possible. But therein lies the rub. How to make the style unobtrusive presents the major problem for many students. A prose style marked by a heavy use of jargon and by strings of five or six noun modifiers of the main noun is hardly an inconspicuous style.

It was the plain style that the Royal Society recommended for scientific discourse during the seventeenth century, and the plain style is almost universally recommended by textbooks of technical writing today. But it is easier to make that recommendation than to follow it. How to convey information to readers about the highly abstruse subjects dealt with in technical reports is a frustrating challenge even for accomplished writers, but for students who do not command a copious vocabulary and syntactical versatility, the challenge can be downright crushing.

Until I began teaching technical writing, I always believed what Hugh

Blair had said in his famous eighteenth-century rhetoric text: that obscurity of style was due mainly to the writer's insecure grasp of the subject (Lecture X). But I have since come to doubt Blair's view, because I have now had enough experience with very bright students who had a firm grasp of their subject but still had difficulty expressing themselves simply and clearly. Consequently, I am convinced now that most of the time obscurity of expression in technical writing can be attributed to one or the other or a combination of two situations: (1) some subjects--usually those with a mathematical base--are so inherently abstruse that they cannot be readily and precisely rendered in language that an ordinary educated person can understand; (2) the writer does not yet have enough mastery of vocabulary and syntax to be able to translate what he or she knows into language that an ordinary educated person can understand.

Likewise, I no longer preach that figurative language is wholly inappropriate in technical writing. Schemes and tropes may not figure as prominently in technical writing as in a ceremonial oration or a piece of literary prose, but they can be serviceable and even unavoidable in technical writing too. In fact, sometimes it is an apt metaphor that enables the writer to make a difficult concept clear to the reader, and parallelism--to mention only one of the many schemes--is the inevitable structure when one is enumerating a series of coordinate items. If you have any doubts about the serviceability of figurative language in technical writing, I would urge you to spend some time counting the figures of speech in your students' papers--but be sure to count all the submerged metaphors in the text too.

Problems of style are closely related to two other components in the communications triangle: the writer and the readers. A confirmed rhetorician can hardly refrain from talking about those two components, even though those two elements are supposed to be kept in low profile in technical writing. It is true that there will not be many, if any, explicit references to the readers of the report and probably no use of the pronoun you, but writers of technical reports invariably get into trouble when they lose sight of their audience. They usually enjoy an advantage over authors of other kinds of expository discourse: most of the time, they have a clear image before them of at least some of the people who will read their report. Accordingly, they should be able to adjust their strategies to fit that perceived or conceived audience.

The text that has made us most conscious of the multiple and varied audiences for a technical report is J. C. Mathes and Dwight W. Stevenson's Designing Technical Reports: Writing for Audiences in Organizations (Indianapolis: Bobbs-Merrill, 1976). In Chapter 2 especially, the authors give us a clear picture of the range and level of readers who are likely to read a report even in an in-house circulation. Most of the decisions that the author makes in the composition of the report have to be made in relation to the heterogeneous complex of people who will read the report in whole or in part. Far from being an insignificant element in technical writing, audience is probably more of a determining factor in this kind of writing than in the kind of writing directed, say, to the nameless, faceless audience of a daily newspaper. The principal consequence of the fact that the report must communicate with a wide range of readers is that the author must strive to achieve a common-denominator style, relegating the highly technical parts of the report to the Appendix, which the experts can consult if they need to check on the accuracy of the data or the soundness of the research procedures.

Another commonplace about the technical report is that the voice and the personality of the writer should be suppressed. Besides being clear and unadorned, the style is supposed to be impersonal and nondescript. The pronoun I will be conspicuously absent from the prose, and the passive voice of the verb will be noticeable for its frequency. Because the report is supposed to be objective in its tone, authors are encouraged not be interject their opinions or their feelings.

There are sound reasons for the traditional insistence that the writer of a technical report maintain a low profile, but it would be a mistake to conclude that the ethos of the writer does not play a crucial role in technical writing. In technical writing, writers must exert their ethos much more skillfully and subtly than writers of other kinds of prose do. The encoder of the technical report must strike a delicate balance between rigorous anonymity and obtrusive personality, for some measure of ethos must be present in the document. The subtlest way for the writer to elicit the trust and confidence of the readers is to create the impression of being unremittingly truthful, judicious, accurate, precise, and diligent. The writer cannot just claim those virtues; the writer must exhibit those virtues in the way that he or she presents data or makes assertions or draws inferences. Although an image of the writer must come through to the readers, the technical report is not the place for a "loud" personality. The personalities of Richard Seltzer and Carl Sagan are probably too obtrusive in their writings; the personalities of Lewis Thomas and Jeremy Bernstein seem to strike the appropriate balance.

I have presented a view of technical writing from the perspective of a rhetorician. I need a good deal more experience at teaching technical writing than I now have before I can confidently advise others about how to teach the course well. But I have remarked to myself on a number of occasions how much better I taught this course right from the beginning than I taught the freshman composition course at the beginning of my teaching career. When I began teaching Freshman English, I had had no formal training in rhetoric, but by the time I taught my first technical-writing class, I was thoroughly steeped in the tradition of rhetoric. And, oh, the difference that acquaintance with the art of rhetoric made in my performance. Maybe a long stint of doing technical writing in the business or the professional world would be a better preparation for teaching the course than the one I had. But if one does not have the opportunity to serve that kind of apprenticeship, I cannot recommend a better alternative preparation than an immersion in the long and glorious history of rhetoric.

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SYNTAX, COMPREHENSION, AND BELIEVABILITY:

IMPLICATIONS FOR TECHNICAL WRITERS

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As a part-time teacher of freshman composition during my first year in graduate school, I received a paper from a young engineering student which has profoundly influenced my professional career over the interveening years. The paper was written on the topic of retrofitting homes for solar energy production--a subject which holds some interest to me. The paper, regardless of the timeliness of its subject and my interest in it, was dull; not middle-of-the-road freshman mediocrity, but magnificent blandness. Since the hour at which I was reading was late, I--wishing to give the student the benefit of a doubt--went to bed, resolved to read the paper fresh the next morning. Nothing changed; the paper was incontrovertably soporific. Since we writing teachers have no corpus of knowledge to fall back on in situations such as these, I became inspired. In this moment of inspiration, I decided to count the number of sentences in the student's paper and then the number of words per sentence. I wanted to see if some pattern was recurring throughout the essay. The paper had thirty-eight sentences; of these, thirty-six had eighteen words apiece; one had nineteen words, and the other had seventeen words. I was incredulous, astounded--positive I had made an important linguistic discovery. Here, I thought to myself, was a young man who thought in eighteen-word segments. When I confronted him with his accomplishment and asked him if he indeed thought in eighteen-word segments, and when he responded rather nonchalantly that indeed he did think in eighteen-word segments, I was elated, certain in my naivete that I would be famous. He went on to tell me that when he was in the eighth grade he had had an English teacher who, along with the typical admonitions not to begin sentences with <u>but</u>, <u>and</u>, or <u>because</u>, casually remarked one day that the average American-English sentence contained eighteen words. Interpreting the teacher's words as a righteous path to perfection, my student had dedicated his writing life to producing eighteen-word sentences, and he was good at it. This event convinced me that to some extent form could be separated from content in writing for the purposes of study. What I want to address today is some of the ways this is being done and some of the implications it has for technical writing and writers.

The results of a recently completed pilot study suggest certain trends in the effects which syntax has on reader comprehension. A series of close-recall tests was used to discover these trends. For the tests, an original selection of writing was rewritten in six different structural styles: right-branching or cumulative; left-branching or periodic; mid-branching using centrally embedded modifiers; inverted; passive voice; and parallel structure. Test subjects, college student volunteers between the ages of eighteen and twenty-two, were allowed five minutes to read one of the stylistic versions of the original or, as a control, the original itself. Following the reading, the subjects were given five minutes to answer questions based on the style they had read. The results of the analyses of the tests suggest trends which, upon further, more detailed research, should prove useful to the educator and the communication researcher alike. As an example, the results for the most part replicated the conclusions reported by Fodor, Bever, Kintsch, Keenan, and others in earlier psycholinguistic research; in other words, passive constructions tended to be more difficult to comprehend than active constructions, negations more difficult than non-negated constructions. However, interesting and potentially important extensions of earlier research were also suggested: cumulative styles appeared more difficult to comprehend than teachers of writing have been led to believe, while centrally embedded styles, though laborious to process, seemed in some instances to promote reader comprehension. The possible reasons for and effects of these observations will be discussed later in this paper.

In addition to the tests, questionnaires were circulated to writing teachers at five separate colleges; these questionnaires were designed to complement the tests--though in a subjective and evaluative way. I intended to discover opinions and nuances which might lead to future research on comprehension and believability. Insofar as the questionnaires suggested that teachers of writing tended to believe formal style (which can be associated with bureaucratese) much more readily than informal style, they succeeded in identifying areas of much needed research.

TEST RESULTS

The following three bar graphs show, respectively, the percent of correct answers out of the total number of questions, the percent of correct answers out of the number of questions answered by the subjects, and the percent of questions answered out of the total number of questions.

Table 1.

Mean Values for Percent Correct of Total Number of Questions

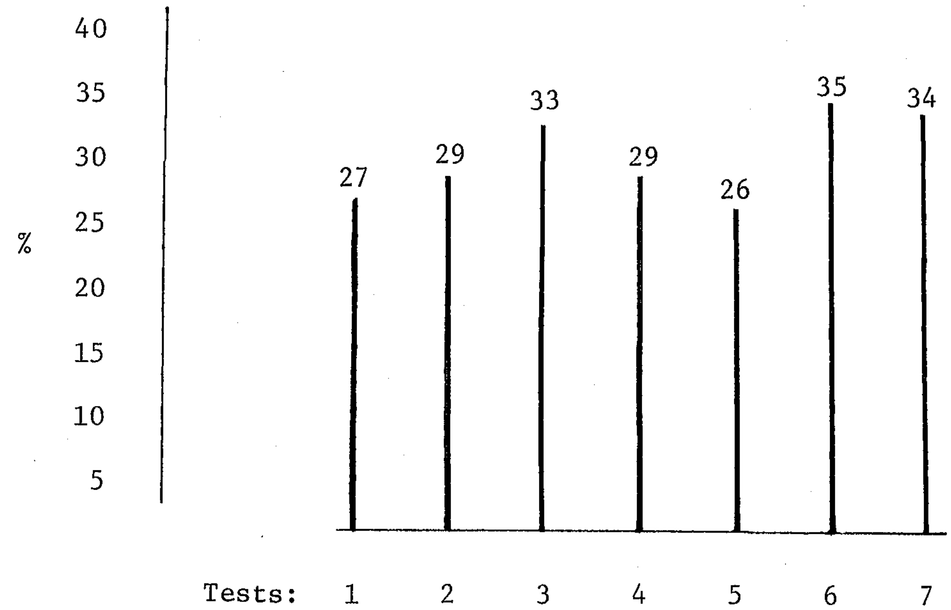


Table 2.

Mean Values for Percent Correct of Answered Questions

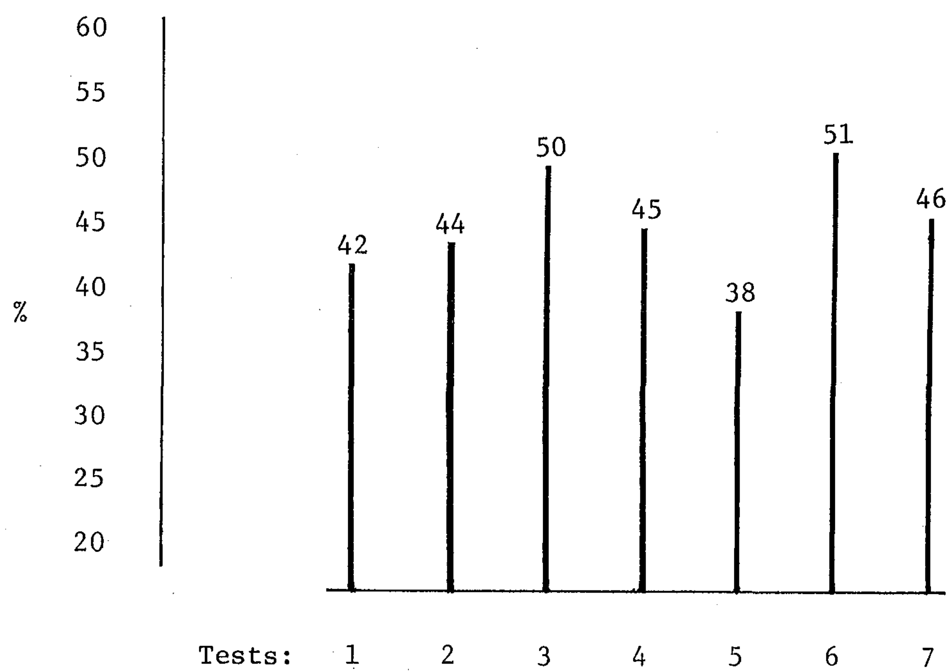
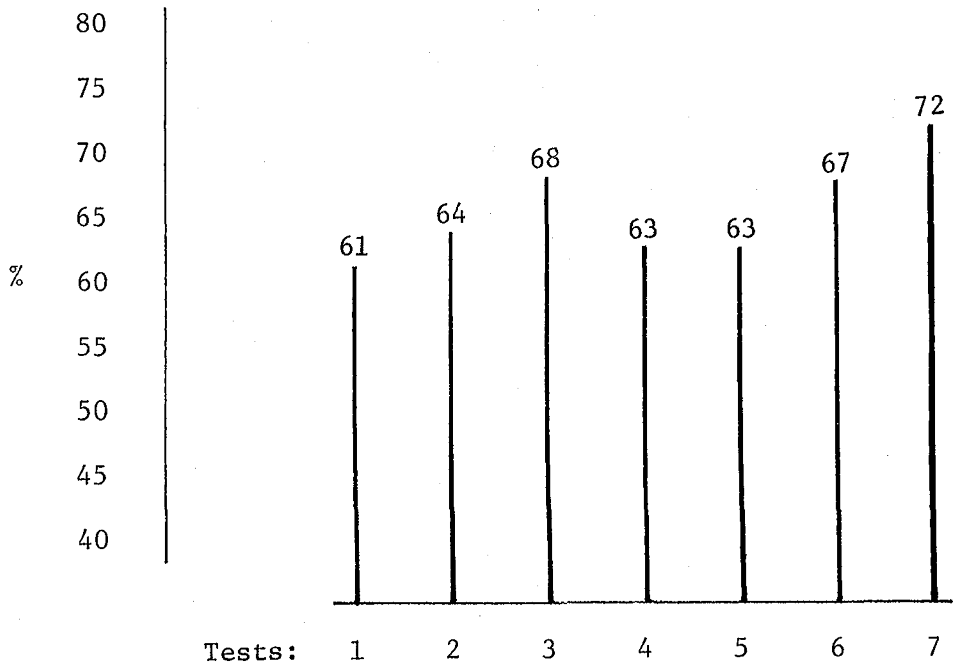


Table 3.

Mean Values for Percent Answered Out of Total Questions



In each of the tables, test 1 refers to right-branching style; test 2 to left-branching; test 3 to mid-branching; test 4 to passive voice; test 5 to inversions; test 6 to the original or the control; and test 7 to parallel structure. Two interesting results can be seen from the graphs. First, the version developed in a mid-branching, or centrally embedded, style proved to be surprisingly easy to comprehend--almost as easy as the control; whereas, all of the rest of the artificially developed styles were much more difficult to comprehend. This should come as a surprise to those of us who have been told that cumulative style, based on right-branching modifiers, is not only a clear and effective way to construct prose but also the American idiom. Since the testing procedure used for this research was not designed to determine the reasons for the results noted, we can only speculate until further study can be conducted to provide those answers. One possible reason that cumulative style did not enhance the comprehension of the test subjects is the fact that it is the American idiom; in other words, readers are so accustomed to this particular stylistic pattern that their attention to what they are reading is dulled. But why should a centrally embedded style, a style which is notably laborious to process, appear to enhance comprehension? One possible reason is that the style is not what the reader expects and, hence, the reader decreases his rate of processing the language and consequently his attention to what he is reading is increased. The second interesting result to be noted from this research is in Table 3, for test 7, parallel structure. More readers answered more questions for test 7 than for any other test. Interestingly, however, this increase in processing speed was not accompanied by an increase in the level of comprehension. One explanation for this could be that when reading a style which has been developed through the overuse of parallel structure, readers become stylistically conditioned to the syntactic structure of the discourse. Once a reader of parallel structure style becomes aware of the structure, he may be lulled into a lower attention to content. In other words, the rhythm of this particular style dulls a reader's senses. Future study may show that when a reader becomes conditioned to parallel structure, he may even tend to ignore the material placed in the latter positions within the structure--much as readers tend to ignore material placed within parentheses. At any rate, the research presented in this paper suggests that syntax does affect comprehension in complex ways. Specifying these effects will benefit composition and technical writing pedagogies.

QUESTIONNAIRE RESULTS

As I mentioned earlier, I intended, through the use of a questionnaire distributed to college teachers of writing, to discover writing biases--emotional and at times illogical responses which would shed some light on the state of writing education in our colleges. The results exceeded my hopes. Perhaps the best method of communicating the types of reactions to the various styles I used in the texts is to give an example of a particular style and some representative reactions to it.

Right-branching.

The search for intelligent life elsewhere in the universe is a timely and feasible undertaking with substantial potential secondary benefits which can be started now with only modest resources and can be expanded later to a much larger scale, if that turns out to be desirable and necessary.

Reactions.

"Unfortunately, this is believable because one expects scientific writing to look and sound like this."

"The writer seemed very objective because of his style."

The majority of the readers of this style felt that it was difficult, dull, and rambling; but they also admitted a tendency to believe what the writer had to say based on the style of the document.

Left-branching.

Needing only modest resources which can be expanded later to a much larger scale if that turns out to be desirable and necessary, the search for intelligent life elsewhere in the universe is a timely and feasible undertaking with substantial potential secondary benefits that can be started now.

Reactions.

"The writing sounds like the bureaucratese we expect in a scientific proposal. It avoids the suspicion of being trivial research by sounding like the typical, serious, and important research project."

One hundred percent of the respondents rated this style, which they classified as confusing and dull, as being moderately to strongly believable.

Mid-branching.

The search for intelligent life elsewhere in the universe is, with substantial potential secondary benefits that can be started now with only modest resources and can be expanded later to a much larger scale if that turns out to be desirable and necessary, a timely and feasible undertaking.

Reactions.

"The style gives the illusion of authority."

"The aggravation necessary to follow the train of thought greatly overwhelms the amount of information conveyed."

Not surprisingly, the respondents found this style to be difficult to process; they also had a tendency not to believe the author, one respondent going so far as to say that the writer seemed to be trying "to hide something."

Passive constructions.

The objective of the Science Workshops on Interstellar Communication are summarized by Morrison in his preface to the SETI report.

Reactions.

"The style is very formal, but for this topic it is suitable."

"The style is very convincing."

"The style sounds bureaucratic."

The respondents did not find a passive voice style as difficult to process as they did the three earlier styles; also there was some skepticism for believing the writer.

Inversions.

It is thought that the search for intelligent life elsewhere in the universe is a timely and feasible undertaking with substantial potential secondary benefits that can be started now with only modest resources and can be expanded later to a much larger scale if that turns out to be necessary and desirable.

Reactions.

"The style seemed proper."

"The writer uses the objective style of science and technical writing, but he does not achieve credibility."

"Though what the author has to say does not seem inane, the style he uses is a kind of scientific journalese: proper, measured, but without much vitality."

Inversions were disliked, but the style was not thought to be difficult to process. The respondents were much in the middle of the road as to whether they considered this style believable or not.

Parallel structure.

The search for intelligent life elsewhere in the universe is a timely and feasible undertaking with substantial potential secondary benefits. The search can be started now with only modest resources; it can be expanded later to a much larger scale if that turns out to be desirable and necessary.

Reactions.

"As a mover of jargon, the writer has skill and conviction."

"I like verve, grace, brevity, and forthrightness too much to read much of this sort of stuff--even for wages."

"Most scientists use this heavy, abstract, sometimes circuitous style in scientific discussion, which is why this writer seems authoritative."

"The phrasing seemed persuasive and sincere."

"Clear statements about potentially difficult issues."

To say that the style developed through an exaggerated use of parallel structure was more well received than any other style would be damning with faint praise. The respondents considered this version to be moderately easy to read and moderately clear. They suggested a strong sense of believability in the author.

GENERAL CONCLUSIONS

The respondents to the questionnaires point out an interesting paradox: the writing teachers tended to believe styles that they did not like and would not encourage their students to emulate as examples of good writing. With only a few exceptions, they did not point out the generally held conviction that bureaucratese can be and is being used to distort facts and withhold information. When we take these responses and compare them to the results of the tests, we see interesting and perplexing things. First, the tests suggested that a style which has been the vogue of writing education for some years may actually impede comprehension--for what reasons we cannot yet be sure. Second, many of the tested styles which appeared difficult to comprehend, and which the respondents concurred in the difficulty to process and understand them, the respondents nonetheless believed.

What implications do these results hold for us--teachers of technical communication? Their implications lie in their potential importance. If future research supports these findings, then we may have to reperceive our pedagogical stances on writing styles. Certain syntactic structures may prove to be advantageous vehicles for certain types of subject matter in particular writer/reader contexts, and the structures may not be what we have for years denoted as good writing.

TECHNICAL STYLE AND TECHNICAL WRITERS:

EXAMINING SOME ASSUMPTIONS

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The title of our session, "Rhetorical Theory and Technical Communication: Some Inquiries," indicates the trend toward re-integrating technical writing and other kinds of written communication. Teachers of technical writing must face the same kinds of problems all other teachers of writing face. Both Dr. Sides' paper, "Syntax to Comprehension: Implications for Technical Writing," and Dr. Corbett's paper, "A Rhetorician Looks at Technical Communication," address a central concern of instructors of technical writing: deciding what we should teach those writers who wish to communicate technical information in the most efficient and effective way. Each paper focuses on a different part of the communication process, but both work from the assumption that technical writing is one form of writing, not an entirely isolated kind of communication. Two basic questions come to mind after reading the papers. First, how do we as readers perceive and understand written technical communication? A consideration in answering this question is the relation of subject matter to style. Second, what kinds of information about writing should the beginning technical writer receive? Some determination about the most basic kinds of knowledge about the writing process needed by the writer should be made. A convenient way to discuss these questions is to re-view the reader-writer-subject triangle from a different perspective. Rather than concentrating solely on the reader (the most important consideration in this type of writing), we should consider some effects of the subject matter and the writer on the writing, effects that are not usually given enough emphasis in textbooks or classrooms.

In his paper, Dr. Sides presents the results of a study to determine if certain syntactical structures enhance comprehensibility. After rewriting a passage using various sentence constructions--right-, left-, and mid-branching--he attempted to discover which type promoted the highest degree of retention. His findings, admittedly a first attempt, should help us move beyond depending on simplistic readability formulas to consideration of the many elements that aid or hinder comprehension of material by readers. Along with this emphasis on the effects of syntax on understanding, we should also develop a sophisticated model for audience analysis, giving more specific consideration to the necessity of using technical language depending on the nature of the audience and the subject matter.

The basis for a sound audience analysis should begin with Mathes' and Stevenson's model for in- and out-group communications in Designing Technical

Reports. This model directs the writer to first consider his or her place in the organization and the function of the report in the organization. The writer then designs the report according to the effects desired. Thus, the subject matter seems to be only a mass of material ready to be shaped in whatever way the writer chooses. But Sides' paper seems to indicate that sentence syntax (and ultimately other elements of style) has a much greater effect on retention and comprehension than any technical writing textbook indicates. If syntax has such a large effect on readers, then we should be more discerning and careful about teaching style to our students. As writers, they should be aware of the impact that their style can have on their readers. And they should also be aware that subject matter can dictate something about the style of presentation.

Discussions of style have focused, as Dr. Corbett indicates, on attaining a "plain style" with an implicit author whose attributes are accuracy, precision, and diligence. The subject matter is rarely considered as a factor in determining an effective style. Dr. Corbett also refers to Kinneavy's model for "reference" discourse with its three sub-categories: exploratory, informative, and scientific. These categories indicate something of the diversity of purpose in technical writing--asking, answering questions, and proving answers. It is not logical that a plain, flat style will always work effectively in all three categories. Figurative language, extended comparisons, analogies, paradox, humor--all these techniques have a place in technical writing, as Elizabeth Harris points out in "Applications of Kinneavy's Theory of Discourse to Technical Writing" (College English, February 1979). Oversimplification of style could lead to an improper oversimplification of subject.

While exploring the question of technical styles, we might also consider the place of technical language in this type of writing. A commonplace in teaching style to beginning technical writers is to avoid the use of long, complicated phrases ("noun-stacking") and complex scientific or technical terminology when writing for a lay reader. Implicit in this instruction is the assumption that when writing for one's peer group or for more expert readers, the writer would automatically use more complicated language, examples, and organization. A more sensible approach would be to consider, in addition to the audience, how complex is the situation being described and then use appropriately simple or complex language. An adaptation of Thomas Kuhn's notions of "normal" science and paradigm shift could prove useful here. In The Structure of Scientific Revolutions, Kuhn traces the steps that occur when a major revision of science takes place; when, in other words, the fundamental assumptions and models that describe the world are changed--from Ptolemy to Galileo, Galileo to Newton, Newton to Einstein. Kuhn distinguishes between "normal" science, which is the kind of experimentation that proves the validity of these central assumptions (which he calls paradigms), and what we can call "investigatory" science, which attempts to explain anomalies in nature or to describe phenomena not covered by the current paradigms. When scientists are working with an accepted world-view, the language they use to report investigations and hypotheses is accepted and understood by other scientists because they all see the world and its phenomena in roughly the same way. There are no sharp differences in defining terms. When scientists move into areas of investigation not adequately described or considered by "normal" science, their writing becomes more figurative, imaginative, and "strange." Technical terms tend to disappear since they are not adequate to describe these new thoughts or relationships. Unusual new relations must have new terms, and they will often be described in striking, even disturbing ways. So could it be with "normal" and "abnormal" technical writing. By considering the relation of subject matter to the body of general knowledge in the area, as well as the nature of the audience we wish to communicate it to, we can discover and describe a more flexible and wide-ranging technical style.

Dr. Corbett's paper also calls our attention to the third part of the rhetorical triangle, the writer. After reading his paper, I began to think about what we assume that the beginning technical writer knows about writing. How much time should be given to introduction or review of the modes he mentions (definition, cause and effect, comparison and contrast) in a technical writing course? Are these "modes of thinking" actually the best models we can choose? We need to determine how much the students know about using these rhetorical modes. Obviously, the position of the technical course in the curriculum (sophomore or senior level) and the number of courses required or available will decide the question in many cases. Often the decision is to teach only the shorter forms. Other technical writing courses place most of their emphasis on the students' learning to design entire reports and their constituent parts. Depending on the students' backgrounds and plans of study, one of these courses could suffice. We return to the point that we are teaching technical writing. It seems very necessary for all writing instructors to communicate about what kinds of writing their students are doing so that they cover the most material most effectively. Some of the introductory work on the shorter modes could be covered in freshman classes, as is done in some technologically-oriented colleges now.

The question of teaching modes also brings us to the split between those who teach long report formats for the students to fit their work into and those who teach large rhetorical strategies (determining the report's audience and function) first. Perhaps the two methods are not so far apart, but are assuming that their students already know those subjects that they do not discuss or emphasize. If we begin by deciding on the function and audience of the report, could we not be assuming that the writer already knows the most effective mode of presentation and will naturally use it? And if we start by teaching various formats, are we not assuming that the function of the report is implicit in the well-designed format and that the writer already understands the functions? We should always be aware of the limitations of any approach and try to give our students as much useful information from every sound approach as possible. It seems likely that we can integrate several approaches into an effective program.

The proponents of both methods would, as both papers in this session do, agree that we are all teaching technical writing, and that we are all looking for more research and inquiries into how best to teach our students to be effective and flexible writers who can always get their message across in the most efficient manner.

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Panel D-10

New Directions in Technical Communication:

The Educators' View

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NEW DIRECTIONS IN TECHNICAL COMMUNICATION: THE EDUCATORS' VIEW

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ABSTRACT

The field of technical communication is changing rapidly. Each year the many new teachers who enter the field seek information on successful methods for developing and teaching technical writing courses, while experienced teachers seek information about designing advanced courses and developing technical communication programs. This panel focuses on new directions in technical communication and presents the educators' view on four key issues: (1) preparing to become an effective technical writing teacher; (2) teaching to have lasting impact on students' writing quality; (3) assessing what needs to be taught in the introductory technical writing course; and (4) developing advanced courses and degree programs in technical communication. The session is a corollary to the panel, "New Directions in Technical Communication: The View from Industry." Together the panels are intended to provide a forum for discussion of methods of structuring, developing, and teaching effective technical communication courses and programs to enable composition teachers to achieve the perspectives of the 1980s.

INTRODUCTION

Ours is a technological age--an information age. It is also an audiovisual age. Advances in computer technology and communications networks have resulted in audiovisual media and learning systems which will significantly affect the practice and teaching of technical communication: Word processing systems, computerized bibliographic retrieval systems, computer-aided instruction modules for teaching basics, videotaping, closed-circuit television programming, and remote learning centers are just some examples. Technological advances, the information explosion, the nationwide literacy crisis, and the emphasis on audiovisual communication together have brought to a focal point the need of professionals in academia, business, government, industry, and the sciences for training in written, oral, and graphic communication. In recent years there has been increasing demand for courses and programs in scientific and technical comcommunication.

Each year many new teachers enter the field of technical communication, and they seek information on successful methods of developing and teaching scientific and technical writing courses. At the same time, experienced teachers seek information about designing advanced courses and developing technical communication programs. It is the purpose of this panel to focus on new directions in technical communication and to present the educators' view on four key issues: (1) preparing to become an effective technical writing teacher; (2)

teaching to have lasting impact on students' writing quality; (3) assessing what needs to be taught in the introductory technical writing course; and (4) developing advanced courses and degree programs in technical communication. The underlying hypothesis is that teaching technical communication successfully depends upon the continuing cooperation of academia and industry--upon interaction and dialogue. Thus a corollary panel on New Directions in Technical Communication presents the view from industry. Together the panels are intended to provide a forum for discussion of methods of structuring, developing, and teaching effective technical communication courses and programs.

PREPARING TO BECOME AN EFFECTIVE TECHNICAL WRITING TEACHER

Technical and scientific writing is, as James W. Souther has said, "a discipline just as is creative writing and is journalistic writing," with a set of basic rules that separate it from related fields. Although technical writing shares with the other disciplines a common base in language and the ability to use it well, technical and scientific writing has a clearly developed set of basic principles, its own paradigms [1]. Technical writing is "objective; heavily involved with graphics, formats, and report design; action-oriented; practical; persuasive; situational; analytical; audience-oriented; highly rational and disciplined; *[and]* important," to use Thomas E. Pearsall's summary [2]. To teach technical writing well requires not only training in language, but also knowledge of the principles of the discipline, particularly of analytical thinking and problem solving. It also requires an understanding and acceptance of technology, science, and business, and a willingness to adapt to technological change [2,3].

What resources are available to the literature-trained Ph.D. preparing to teach technical writing? That is the question John A. Walter addresses in his paper, "The New Technical Writing Teacher." Professor Walter focuses on the means by which the new or inexperienced teacher of technical writing can prepare for effective teaching. Initially he considers the relationship of technical writing and traditional exposition to show how knowledge of the latter contributes to knowledge of the former. A number of resources are available to the new technical writing teacher [4,5], and in his paper, Professor Walter reviews useful texts, bibliographies, and journals. He lists important professional societies and organizations, and provides information about institutes and workshops on the teaching of technical writing. He discusses strategies that can be used in-house to develop expertise as well as means of interacting with industry to obtain first-hand knowledge of the field. His primary emphasis is on what the new or inexperienced teacher can do, largely on his or her own, through reading, interviews, conferences, and research to become an effective technical writing teacher.

TEACHING TO HAVE LASTING IMPACT ON STUDENTS' WRITING QUALITY

A second issue of concern to technical writing teachers is the quality of students' writing and the type of training needed to have lasting impact on that writing. James W. Souther addresses this topic in his paper, "Writing as Decision-Making." Professor Souther indicates that if we teachers wish to have a lasting impact on the writing quality of our students, we must focus on the elements that are essential and basic: an awareness of how the language functions and an understanding of the process we call writing.

As Professor Souther points out, "communication is not achieved just by writing; what we write must be delivered, read, comprehended, and used. More than one person is involved; writing in the world of work always has a purpose and a reader, and the situation always impacts the writer and the product." In a writing course, situational analysis and its relationship to writing decisions are what we have to teach.

Most writing courses concentrate on language awareness yet few really come face to face with the decision-making that is the heart of the writing process. In his paper, Professor Souther examines that decision-making to identify factors which influence it, and to suggest how we might go about teaching it.

ASSESSING WHAT NEEDS TO BE TAUGHT IN THE INTRODUCTORY COURSE

Introductory courses in technical writing are usually designed to prepare students majoring in the sciences, engineering, health care, and business for the writing they will do in their careers. A number of topics may be covered: Our introductory course at The University of Texas at Arlington, for example, includes basic techniques (definition, description, explanation of a process, instruction writing, classification, and analysis), technical style, audience analysis, correspondence (including the resume and cover letter), and the formal report. Recently we have added oral presentation. Other introductory courses may include memoranda, proposals, various types of nonformal reports, feasibility studies, and advertising among the topics covered.

A number of factors influence the choice of topics and the emphasis they receive in the introductory course: Among these are (1) tradition; (2) the instructor's area of expertise; (3) the mix of students in the course; and (4) the level at which the course is offered. Another set of factors includes (1) availability and access to audiovisual media, word processing systems, and computerized bibliographic retrieval systems; (2) reliance on research; (3) reliance on results of surveys; and (4) dialogue and interaction with industry.

What topics should be emphasized in the introductory course to prepare students for the kind of writing tasks they will do in industry? To answer this question, Paul V. Anderson has surveyed more than 800 graduates of seven departments at Miami University (Oxford, Ohio) that send students to introductory technical writing courses. He reports the results of that survey in his paper, "What Really Needs to Be Taught in Introductory Technical Writing Courses: A Survey of Graduates of Seven University Departments."

Much of the information previously available has been based on study of one homogeneous group of engineers [6]; Professor Anderson's survey includes data from six nonengineering departments (Chemistry, Home Economics, Office Administration, Pulp and Paper Science, Systems Analysis, and Zoology) as well as one engineering department (Engineering Technology).

In the survey, Professor Anderson asked graduates to indicate the amount of time they spend writing; the importance they attribute to writing; and the kinds of writing they do (advertising, articles for professional journals, formal reports, general instructions, letters, memoranda, minutes of meetings or conversations, preprinted forms to be filled out by the respondent, proposals for funding or approval of projects, scripts for speeches or presentations, and step-by-step instructions). He has used both descriptive and inferential statistics to analyze the results for the entire group, ad well as to determine whether the results obtained from each department differ significantly from the results obtained from the others. His analyses suggest that many technical writing teachers need to adjust the objectives and content of their courses to meet the needs of their students.

DEVELOPING ADVANCED COURSES AND DEGREE PROGRAMS IN TECHNICAL COMMUNICATION

As the demand for technical writers grows, there is a corresponding demand for curricula to prepare students for roles as professional communicators. It is this area that Thomas E. Pearsall covers in his paper, "Building a Technical Communication Program."

When the matter of going beyond the basic course in technical writing and developing a program in technical communication is considered, several questions arise, as Professor Pearsall has noted: What type of program? Is there a need for the program? What should be in the program? The technical communication program may be considered at several levels: (1) a course or two beyond the basic technical writing course, aimed primarily at technical students; (2) four or five courses beyond the basic course, again aimed primarily at the technical student, but with some students who may wish to become professional communicators; and (3) a full program where a major in technical communication is given [2].

Students from technical communication programs must have excellent written, verbal, and graphic communication skills; knowledge of analytical thinking and problem solving; technical knowledge and access to technical terminology; a willingness to accept technology, science, and business; and flexibility to adapt to technological innovation. "Technical writers are the great interpreters of our age," as Professor Pearsall states, and a program in technical communication cannot be based on writing alone. An undergraduate technical communication program must follow the dictates of the school concerning curricula while being an interdisciplinary program that produces people capable of working as professional technical communicators [2]. It must contain courses in communication as well as courses in the technical area in which the student wishes to specialize.

In his paper, Professor Pearsall describes the building of a technical communication major. Based on experience and research, he details the components needed in technical communication majors, such as technical writing and speech, technical graphics, interviewing, and communication theory. He discusses the environment the major needs to succeed and the job market for graduates. He recommends the development of an advisory group.

SUMMARY

Technical communication is a rapidly developing discipline. A number of resources exist to help the new teacher prepare to teaching technical writing effectively: texts, journals, professional societies, conferences, institutes and workshops, interviews, and internships in industry. To have impact on the quality of student writing, teachers must focus not only on language but also on situational analysis and writing as a decision-making process. To develop courses and programs teachers must assess objectives and be willing to adapt: to respond to trends and technological advances, to incorporate results of research and empirical studies into the design of introductory and advanced courses and degree programs, and to interact with industry to establish and maintain open channels of communication. With proper planning and selection of courses and the proper environment, technical communication programs can succeed and flourish.

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WRITING AS DECISION-MAKING

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If as teachers, we wish to have a lasting impact on the writing quality of students, we must teach those aspects of writing which are most significant, most common, and most constant in the writing experience. As I see it, two such basic aspects demand our attention: 1) an awareness of the language and the ability to use it effectively, and 2) an understanding of the writing process and those decisions which are fundamental to that process. Most writing courses concentrate on the first of these elements. Basic writing courses designed to increase the awareness of students and to help them develop their language skills are an essential to our writing programs. Such courses are common to all kinds of writing; language skills are just as basic to fiction as they are to journalism or to informational writing. Yet, as excellent as such courses are, they are only part of what the student needs. They are not the "end" of writing; they are the "platform" for the teaching of writing.

The realization that we cannot effectively teach professional and technical writing in a vacuum is a growing one. Today article after article and book after book express the need for bringing new dimensions into our writing classrooms. Tom Pearsall's Audience Analysis (Ref. 1), Mary Coney's comments on the "mock reader" (Ref. 2), Myron White's paper on "The Informational Requirements of Audiences" (Ref. 3), Don Cunningham and Tom Pearsall's view of the "communication triangle" (Ref. 4), and David Carson's "Plea for Greater Realism in Identifying the Fictive Reader" (Ref. 5) along with many other articles have made the reader an integral part of the writing formula. David Ewing in the Preface to the First Edition of Writing for Results (Ref. 6), states, "The approach to writing taken here is more situational; that is, it is based more on the facts of the reader/writer relationship in particular situations than on set rules and prescriptions." Here, Mr. Ewing suggests that there is more to the situation than just the reader. Mathes and Stevenson in the Preface to their book (Ref. 7) echo this same idea by stating, "This book focuses on the questions a writer must answer first: who is to read the report, what do they want to know, what does the writer want to accomplish, and how should the report be structured to meet these needs?....We begin, in short at the beginning."

Yes, these are the beginning questions, but more importantly, they flow through the whole of the writing process; they are not questions answered quickly and easily at the beginning of the process and then dropped as the writer moves on to other considerations. They do, in fact, become the guiding principles, the operational basis, for the decision-making of the writer throughout the writing process. David Ewing, in the Preface to his Second Edition (Ref. 8), states, "if there is one 'secret' of the good writer in business, government, science or the professions, it is--and always has been--an instinct for situational analysis."

Situational analysis and its relationship to writing decisions are what we have to teach. When I spoke as a member of that first MLA Technical Writing Panel, I spoke of the need for context for assignments in our writing courses (Ref.9). What I was referring to, of course, was providing full-bodied assignments that force students to be involved with situational analysis for each and every writing assignment. For it is the ability of our students to analyze a situation and to write responsively to it that becomes the most important principle in our teaching.

We need not get deeply involved in the philosophical question of whether we can really know our readers. Of course we cannot have complete information, but that does not stop us from acting or being as responsive as we can based on what we do know. When knowledge is insufficient, we must operate on the basis of assumption. Philosophically, our readers may be "fictive," but if we err in the writing we submit, there's a strong sense of realism about the supervisor who takes us to task for our mistakes.

Communication is not achieved just by writing; what we write must be delivered, read, comprehended and used. More than one person is involved; writing in the world of work always has a purpose and a reader, and the situation always impacts the writer and the product. In a writing course, then,we must begin with the situation, and we must provide this element for every assignment if our students are to learn to be situation reponsive.

Writing is a process of making decisions. As we reflect about our writing, we are constantly forced to make decisions: decisions concerning our objective, our purpose; decisions concerning the message and the reader; decisions on illustration and layout; decisions on tone and style. There are, of course, many other lower level decisions: How do I spell that word? What's the word I need here? Should I put the data here or place it in the Appendix?

Writing is difficult because thinking is difficult, because making decisions is difficult. Writers are most frequently frustrated because they have so little on which to base their writing decisions. Often it seems like a matter of personal preference, with no principles to be applied, with no basic rationale. The problem solving approach, the analytical approach, the design approach all emphasize asking the right questions. If our students can be taught to ask the right kinds of questions, then the answers they get to those questions will provide them with the basis for making writing decisions now and in the future as well.

But it is not enough that our students know what questions to ask, they must also know which writing decisions are impacted by those answers. What questions bear on what writing decisions? What impacts do the answers to those questions have, and where is that impact to be felt? To be effective teachers, we need to relate situational analysis to specific writing decisions. Our task as teachers is to bring situational analysis into our classrooms, not as a discussion topic but rather as the modus operandi of the course itself. We need to teach writing responsiveness.

HOW DO WE START?

Any new approach requires extra effort, and writing teachers always tend to be overloaded anyway. Let me assure you of two things: (1) it isn't nearly as difficult as it sounds, and (2) it will be the most exciting development in your classroom experience.

First, we must ourselves develop a sense of situational analysis. We must become aware of how people read, when they read, why they read, what kinds of questions they want answered, what they skip over, and how they make decisions. We must get answers to these kinds of questions for the various audience groups: expert, manager, general public, etc.

Second, we need to learn more about communication, especially in the world of work. We need to identify how information systems interact with other systems. We need to develop a feel for the reading habits and the informational needs of people in various roles. In short, we need to expand our exposure in real world communications. Spending two or three summers as a writer or editor in industry or government not only provides summer income but a wealth of insight and exposure to enrich the classroom.

But we need more than exposure to actual communication situations. Third, we need to relate specific situational elements to the individual writing decisions that must be made. What elements of the situation impact selection of content, organization, level of presentation or emphasis, for example. If situational analysis is to become an operational approach to writing decision making, we must clearly identify the nature and the points of their interaction.

WHAT DO WE DO?

First of all, we can't do everything at once. We eat an apple one bite at a time; we develop our course one step at a time.

1. Focus on two or three primary audiences. I suggest Tom Pearsall's "expert," "executive," and "layman" audiences. Read his *Audience Analysis* (Ref. 10) as a starter, then turn to other audience oriented materials. Avoid the combined audience at first, but read what Tom has to say about it in *Reporting Technical Information*, 4th edition (Ref. 11). If you can, read a good summary of the findings in communication research (Ref. 12).

2. Develop several writing assignments that have a specific purpose, and audience. Create the situation, the context for each, and hold the students responsible for writing that is responsive to each situation. Be prepared to discuss the situation over and over again, but make the student arrive at the writing judgments. See my MLA paper (Ref. 13) for suggestions, or write for copies of some of our assignments.

3. At the beginning, limit your discussions of situational analysis and apply it to your specific assignments. By doing this you develop an in-depth view of those specific situations without wandering off into less defined areas. As you gain experience and confidence, you broaden out your application of situational analysis.

4. Relate individual elements of the situation analysis to specific kinds of writing decisions.

The purpose of a piece of writing has direct impact on writing decisions such as the selection and organization of content and the need for emphasis. Questions of content relevancy, for example, usually come right back to purpose.

The use of documents varies. Some are read; some are not. Some serve as references; some as a basis for public discussion. Some are complete; some need updating. How we see a reader using our writing product influences decisions on layout, form, publication process, paper and binding, and often organization. In explaining the differences between the organization of a dictionary and a thesaurus, one is quickly reduced to a view of use.

The audience has a direct impact on decisions of level or presentation: i.e., special terms, mathematics, detail, evidence, data. But audience informational needs strike even closer to the heart of writing decisions. Myron White's article discusses this in detail and should give the guidance you need.(Ref. 14). Selection and organization of content often depends on how the writer views the informational needs of the reader. Reader interest, for example, is responsible for two different patterns frequently found in technical writing.

Experts, to use Tom's term, have a deep interest in how work is done, what data was gathered and what conclusions were drawn. They want to understand the work as well as the results. Is it any wonder then that most research writing has a "work-structured organization"? Almost all professional journal articles use this structure. The investigator of a number of alternative solutions to a problem might well focus on the following questions:

- what's the problem?
- what are the criteria for judging solutions?
- what are the alternative actions?
- how do they compare?
- what seems best?
- what should we do?

Managers, to use my own term, have a different interest pattern. Although they depend on their staff for evaluation and input, they must make the decision. This decision-making responsibility has its own set of questions, and its order and emphasis differs from that of the expert investigator just as their functions differ. The manager faced with making a decision might well ask the following questions:

- what's the problem?
- what should we do?
- why should we do that?
- what alternatives were considered?

Rather than try to ignore situational analysis, we should welcome the definition it brings to writing and the excitement it can bring to our classes. For situational analysis permeates the whole fabric of our writing; it underlies the whole range of our writing decisions. From selection and organization of content, through the use of illustration and layout, to matters of tone and style, situational analysis provides the insight for action and choice. Through it, we learn to write not only to our readers but for our readers. Situational analysis establishes the functionality of writing as its true test.

If we are to serve our students well, we must provide them with a knowledge of writing and language principles, but we must also provide them with a way of approaching future writing decisions. We must provide them

1. with a knowledge of the writing process,

2. with a knowledge of what questions to ask about each writing situation, and

3. with a knowledge of how specific writing decisions are impacted by the answers to those questions.

We shall succeed to the extent that we can relate our teaching to the specific writing decisions students will have to make, and to the extent that our assignments and courses match the real world. The more situational analysis becomes the working principle, the greater will be the challenge and the satisfaction for student and teacher alike.

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BUILDING A TECHNICAL COMMUNICATION PROGRAM

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Recent research by Dr. Earl McDowell of our Rhetoric Faculty and myself found 25 programs in the United States with something either called or resembling a technical communication program. By program, I mean a program that grants a degree ranging from an AA to a Ph.D. The titles of some of the degrees will indicate somewhat the range of these programs: BA in Industrial Media; BA in Industrial Communications Specialist; MS in Science Communication; BA in English, Writing-Editing Option; AS in Technical Writing; BS in Technical Writing and Editing. These programs range in size from 2 students to 270. The total number of students enrolled is over 1400. Of the 25 programs, 17 have come into existence since 1970. Obviously, in a small way, it's a bit of a growth industry. It even has its own organization, The Council for Programs in Scientific and Technical Communication, an organization that was founded in Minnesota in 1974.

I address myself briefly to answering two questions that would likely be in the mind of anyone considering increasing the number of programs from 25 to 26. First, what is the market for technical communicators? Second, how does one go about setting up a program?

According to the 1980/81 Occupational Outlook Handbook, 24,000 technical writers and editors were employed in 1978. For a comparison figure, the same source records 45,000 people working as newspaper reporters in 1978. In 1978, 240 journalism schools turned out over 6,000 graduates into that 45,000 person market. (1) Assuming that something over one-fourth of the 1400 technical communication students graduate every year, the comparable figure is 400 into a market of 24,000. The odds do seem better for the technical communication students and, in fact, they are. The programs we have checked indicate that their good students are snapped up immediately, and even the poorer ones usually land a job. In our midwestern school we have recruiters from both coasts after our students despite the fact that most of our students seem to prefer the Minnesota area and most, in fact, do find work there.

What are the pay scales? According to the Occupational Outlook Handbook again, starting salaries for technical writers range from $8,000 to $19,000 a year. I suspect that graduates of technical communication programs are mainly in the high range of that spread. In 1980, of our 18 graduates, the lowest reported salary was $14,040 and the highest $18,900. The average starting salary for all of our graduates reporting was $16,740. The first two students hired from our 1981 graduating class have both received over $21,000 per year.

What is the outlook for the future? According to the Occupational Outlook Handbook, "Employment of technical writers is expected to increase about as fast as the average for all occupations during the 1980's. ... graduates of technical writing programs should be in particular demand, especially those with backgrounds in areas of growing importance such as computer science, environmental science, and electronics."

Where is the market both by industry and by region? As the above quote indicates, computer science, environmental science, and electronics are where many jobs are. Defense industries, aerospace, energy, and the health sciences are also fertile fields. Government at local, state, and federal levels hires technical writers. In general, any field that has a high technology product and a low technology user needs technical writers. A computer industry furnishing computers to a bank to be used by high school graduate tellers and clerks is a perfect paradigm of what I mean.

Regionally, the hot spots for technical writers are the Northeast, Texas, and California; however, technical writers can be found in every urban area of the United States.

The second question: How does one go about setting up a program to educate technical communicators? Hidden away in that question is another one: Is your environment suited to a technical communication program?

The first step in answering both these questions is to find out what it is that technical communicators really do. First of all, what do they write? The Occupational Outlook Handbook tells us this:

> Manuals, reports, and proposals make up the bulk of technical writing today; however, the work may take other forms. Technical writers may write specifications; prepare speeches and news releases; edit and write technical books; prepare articles for popular magazines; develop advertising copy, promotional brochures, and texts for exhibits and displays; and handle technical documentation.

How do they go about this work? Technical writers are the great interpreters of our age. They begin by researching the technical knowledge they are to write about. Often, they start with the scientist or technician who possesses the needed knowledge. There is an interview often followed by much poring over documents, schematics, and cryptic notes furnished by the scientist or technician. Out of this welter of information, the writer has to fashion a document that satisfies the technical expert with its accuracy and that also teaches, informs, and sometimes persuades the intended audience, usually people with much less technical expertise than the scientist or technician. Usually the technical writer works with a technical illustrator, but the writer must have a grasp of what the illustrator can provide.

In some shops, the technical writer turns the draft over to an editor who sees it through publication. In others the writer carries out this stage as well. More and more the writer may also be required to compose on word processing equipment.

However, this bare recital is not enough for you to really know what it is that technical writers do. You have to be with them for a while or better still try your own hand at technical writing. Get to know technical writers. If you have a local chapter of the Society for Technical Communication nearby, join it. If, after all this, you still want to think about a program in technical communication, form an advisory committee of practicing technical writers. Such a committee has two great advantages: it keeps you in touch with the needs of practitioners and it is the start of a network of potential employers for your students. It has one disadvantage. Each member of the committee will want to train people for the precise needs of his or her shop. Such demands frequently are too narrowly vocational for a university setting or for a university philosophy. This can be a critical point. We are told that most of our graduates will go through one or more career changes in their lifetimes. Education that is too narrow may hinder the ability to change. Despite this disadvantage, an advisory committee is a necessary part of your program development.

Of course, you can also learn from existing programs. In 1979, we revised extensively our program in technical communication that we had begun in 1971. As part of the revision process, we queried three groups of people about our program: graduates of the program, members of the Society for Technical Communication (STC), and potential employers of our graduates. The complete findings are reported elsewhere. (2) However, I'll give you some of the key points here.

The participants in the survey were asked to rate the communication courses in our program on a scale of 1 (very unimportant) to 5 (very important). Obviously, this survey is biased to a degree by the courses we offer in the major. The STC members ranked the top eight courses in this manner:

1. Scientific and Technical Writing
2. Interviewing
3. Scientific and Technical Presentations (speech and graphics)
4. Writing for Publication
5. Scientific and Technical Graphics
6. Transfer of Technology
7. Professional Writing
8. Direction of Training in Business and Service Organizations

Potential employers ranked them this way:

1. Scientific and Technical Writing
2. Transfer of Technology
3. Scientific and Technical Presentations

4. Writing for Publication
5. Effective Listening
6. Scientific and Technical Graphics
7. Professional Writing
8. Interviewing

The graduates ranked them this way:

1. Scientific and Technical Writing
2. Scientific and Technical Presentations
3. Advanced Public Speaking
4. Scientific and Technical Graphics
5. Writing for Publication
6. Professional Writing
7. Interviewing
8. Studies in Organizational Communication, Conflict, and Change

Common to all three groups are these six courses:

- Scientific and Technical Writing
- Scientific and Technical Presentations
- Writing for Publication
- Interviewing
- Professional Writing
- Scientific and Technical Graphics

While writing is the skill most in demand, notice that all three groups expect the student to be educated to speak, interview, and understand graphic presentation. Our graduates also tell us we must stress report production and management more than we do.

In more recent research, McDowell and I classified technical communication competencies into six groups and asked existing programs if they had courses in the groups. Eighteen programs replied with these results:

Area	# Schools
Writing and Editing	16
Communication Theory	11
Organizational, Managerial, and Training Communication	10
Graphic Communication	9
Oral Communication	6
Media Communication	5

What about skills other than communication skills? If the program you envision is an undergraduate one, you must see to it that your students acquire certain knowledge necessary to their survival as practicing technical writers. In our program, for example, in addition to 70 quarter hours in a communication core, we require 4 hours of math, 4 hours of computer science, 18 hours of physical and biological science, and 20 hours of technical electives. In the latter, students take courses in areas in which they plan to work--computer science or biology, for example. We also require courses in the history of science. We encourage additional courses in computer science and in statistics.

Sixteen of the eighteen programs reporting require internships for their students. Here the student spends a term working in the field under the joint supervision of a practitioner and an academic instructor. Such experience is absolutely essential to students. It puts things together for them in a way that classroom work simply cannot do.

If the program you plan is a graduate one, you may be able to depend more on the scientific and technical knowledge your students bring with them. This allows you to concentrate more on the communication core. But I urge you not to allow students at any level to go out into the field naked of some knowledge of math, computers, and hard science.

After you learn what should go into a program, you must face squarely the question of whether you really have the proper environment for it. A proper environment means that you have people on your staff or in related departments who can teach such subjects as graphics, oral communication, interviewing, and communication theory. Course work in science and technology should be available. Your staff should be friendly to the idea of a program and honestly receptive to what it means in course work. If they merely see it as an occupational camouflage for teaching more literature, the program will founder.

Your community environment is also important. Not all existing programs are in urban areas or close to them, so I can't state categorically that such a location is necessary, but it certainly helps. In such a location, you will find practicing technical writers for your advisory committee. In such an area, you will find internships readily available. In such an area, your students may ultimately find employment.

To summarize. There is a good market for technical communicators that at least 25 schools are already supplying. The market seems large enough for more schools. But programs should be intelligently planned based upon a good deal of knowledge that already exists about what technical communicators need. They should not be a hastily put-together collection of writing and editing courses. And, finally, such programs need the proper environment to flourish.

<u>Schools and Departments Offering Technical Communication Degrees</u>

Boston University: Science Communication
Bowling Green State University: Technical Writing Programs
Carnegie-Mellon University: English Department
Clarkson College: Humanities Department
Colorado State University: Technical Journalism Department
Florida Institute of Technology: Humanities Department
Los Angeles Trade-Technical College: Art Department
Metropolitan State College: Industrial Communications Department

Miami University, Ohio: English Department
Michigan Technological University: Humanities Department
University of Michigan--Ann Arbor: Interdisciplinary Engineering Program
University of Minnesota: Rhetoric Department
New Mexico State University: English Department
North Carolina State University: English Department
Oklahoma State University: English Department
Oklahoma State University Technical Institute: Technical Writing Department
Oregon State University: Journalism Department
Pittsburg State University: English Department
Polytechnic Institute of New York: Humanities and Communications Department
Rensselaer Polytechnic Institute: Department of Language, Literature, and Communication
Rock Valley College: Communications Division
South Dakota State University: Department of Journalism and Mass Communication
University of South Dakota at Springfield: Technical Communications
University of Washington: Scientific and Technical Communication Program
University of Wisconsin--Stout: Technical Communications

NOTES

[1]Paul V. Peterson, "Enrollment Surge Again, Increases 7% to 70,601," Journalism Educator, 33, No. 4 (1979), 3-8.

[2]Earl E. McDowell, L. David Schuelke, and Chew Wah Chung, "Evaluation of a Bachelor's Program in Technical Communication," Journal of Technical Writing and Communication, 10 (1980), 195-200.

NEW DIRECTIONS IN TECHNICAL WRITING IN BRIEF

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This session provided suggestions on teaching technical writing to arm the new teacher and bring the veteran up to date. The suggestions concerned resources for research, methods for the classroom, content of such courses, and administration. John A. Walter opened with an overview of the course and comments about publications and persons to interview for current information. James W. Souther stressed the need to teach writing as a process and emphasized the element of decision-making in writing. Paul Anderson addressed the question of content: he emphasized the forms of writing graduates reported that they were required to produce on the job, particularly memos and fill-in forms. The traditional articles often stressed currently in technical writing classes were low on the list. Thomas Pearsall focused on administrative questions in writing programs that go beyond the one introductory class. Such programs may, as at the University of Minnesota, prepare professional technical writers. Or they may be directed at professionals who write--engineers and scientists, for example, who enroll in a joint major or minor in communication because they see reporting as something equally important as the technical work on which they report.

Discussion after the papers covered several topics. One concerned the difference in content between an introductory and an advanced technical writing course. Advanced courses may emphasize particular techniques, like editing technical material. Or they may concentrate on a particular form, for example, a course in dissertation-writing, or proposals, or journal articles, or writing for the public, or historical essays in science. Such courses tend to be conducted as seminars, with students spending much time reviewing each other's writing. Another question centered on the advantages of homogeneous (for example, all chemical engineering majors) as opposed to heterogeneous (students from several majors) groupings in classes. Homogeneous classes encourage team-writing projects and peer-review, since all the students are familiar with the same field--and often with one another. They also may ease the teacher's lot since he or she then only has to become familiar with one field. Such groupings, however, pose scheduling difficulties. Moreover, heterogeneous classes have the advantage of requiring students to abstain from their usual jargon to be clear to one another and provide a good simulation of the multiplicity of specialties represented on many technical teams in business and industry.

The proper home for instruction was also discussed. Commentators stressed the advantages of interdisciplinary approaches, whether the instruction centers in an English or a technical department. A program in an English department, for example, could profit from an advisory board composed of people from technical departments as well as local businesses. Informal collaboration with technical colleagues was encouraged; if possible, team-teaching can be effective. Some questions concerned the Anderson survey of graduates, particularly the differences in writing tasks between those in entry-level jobs and those more advanced in their careers. In general, the panel encouraged teachers to undertake more such surveys of document design in corporations, both for implications concerning necessary preparation in undergraduate courses and as evidence about the forms of information and reader needs in current practice.

Panel D-13

Oral Technical Communication:

Effective Models

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INTEGRATE ORAL COMMUNICATION WITH TECHNICAL WRITING: TOWARDS A RATIONALE

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Why teach oral communication in what is usually considered a "writing course"? Surely instructors have enough to do just to cover the principal strategies of technical writing within a single term. "Not only that," declares the beleaguered instructor, "but my forte is writing--specifically technical writing--not speech!" Such a position may be somewhat extreme, for many of us probably include an oral presentation as a component of the formal report assignment at the end of the term.

However, our proposal calls for us to integrate oral communication with technical writing. Although the word "integrate" has several meanings, the first one listed in our dictionary reads as follows: "To bring together into a whole; unify" (1, 338). Tacking an oral presentation onto the end of a technical writing course is not the same thing as integrating oral and written communication. Oral communication should represent a substantial portion of our instruction throughout the course. By integrating oral communication with writing, we offer what may be the only opportunity our students will have to learn and practice interpersonal skills. By linking oral communication to written communication, we acknowledge the importance of small-group interaction in developing ideas that are ultimately transferred into written discourse. We see three reasons for integrating oral and written communication:

- The technical professional's work day is largely comprised of oral interactions of various kinds.
- The role-taking skills required for effective oral communication can be applied to the process of audience analysis for job related writing tasks.
- Effective oral communication can help resolve conflicts between individuals and between groups.

Let's examine these reasons.

Workday Activities

A growing body of evidence suggests that technical professionals spend a great deal of their time on the job engaged in small-group conferences. Distinguishing large-group oratory from small-group interaction, R. John Brockmann points out how "statistics and interviews with professionals have demonstrated that it is small-group interaction--a qualitatively different sort of communication--that carries much more of the burden of communication in business and industry" (2, 285). Often important writing tasks are linked inextricably to on-going small-group exchanges. For example, in his argument for the use of the storyboard as a tool for preparing formal bid proposals, David Englebret describes the results of oral exchanges among members of the organization's proposal team: "Assembling the entire proposal team to preview the Storyboards promotes creative thought, fosters cross-fertilization of ideas, uncovers any loopholes in the message, and ensures consistency of approach. It tends to force the team to think in the customer's terms--what questions he may want answered, what concerns he may have" (3, 117).

Engelbret has described the value of dialogue to the process of rhetorical problem solving. Oral exchanges generate and shape the content of the message according to the needs of the audience. Joan Rymer Goldstein has found that the content of written reports is frequently "filtered" through such dialogue, but many entry-level technical employees are not prepared to translate informal oral exchanges into writing. They do not fully understand how oral interaction relates to writing (4, R-158).

Moreover, technical employees are often ill-prepared to represent their companies in public. This responsibility has been thrust upon technical personnel in recent years as companies discovered the importance of explaining their programs and policies to a public seeking greater accountability. According to John Burk of Westinghouse, the testimony before a legislative committee which fails because it was too technical for legislators to comprehend costs at least twice as much as effective testimony. The company must find additional opportunities to state its case clearly and convincingly if its goals are to be advanced (2, 2). Mr. Burk blames these problems on corporate representatives who fail to "consider the experiences, the biases and the level of understanding" of the very audience they want to reach, a failure due perhaps to a system of training that has taught them to "deal in complexities, minute details and elaborate cause-and-effect relationships" (5, 5). He advocates the inclusion of oral communication in the technical writing syllabus.

Applying Role-Taking Skills To The Writing Task

Another reason for integrating oral and written communication can be found in an emerging model derived from developmental psychology, linguistics, and related disciplines. The model rests on the assumption that the processes by which the adult learns to write are analogous to those by which children acquire language. According to Julia Falk, a proponent of this model, writing and speech are two different but "co-equal" ways to express language. Our understanding of how children learn to talk has implications for understanding how adults learn to write, for both processes are instances of language acquisition (6, 437).

A common element in this "parallel processes" theory is the concept of role-taking. Developed by John H. Flavell along the lines of Jean Piaget's theories of egocentrism in the speech of young children, the concept of role-taking describes a set of cognitive skills which enables the child to make inferences about the listener's needs, intentions, perceptions, opinions, beliefs, intellectual capacities, and so forth (7, 5). Note how Flavell's description of role-taking resembles John Burk's analysis of communication failure due the speaker's inability to, as Flavell might have put it, "take the role" of his listeners. Flavell calls these role-taking failures "intellectual egocentrism." It is, he says, "an inability, in our terms, to search out the role attributes of others, compare them with one's own, and make effective use of the comparison in any of a variety of adaptations" (7, 16-17).

Sarah Lundsteen uses Flavell's models of egocentric and non-egocentric communication in her work in listening theory. A non-egocentric communication consists of three stages:

1. The speaker apprehends events and codes them for himself or herself.

2. Before and during the speaker's communication to the listener, the speaker attempts to discriminate those attributes of his or her listener that appear to be pertinent to the listener's ability to decode the speaker's message about the events.

3. With this information in mind, the speaker recodes the events as a message he or she thinks is appropriate for the listener's needs. The speaker may have to actively suppress the tendency to allow his or her message to drift or regress to the egocentric error of coding just for himself or herself (8, 73).

An egocentric communication, then, lacks the discrimination of audience attributes which starts in stage two, and it lacks the recoding process of stage three. The audience receives the same message the speaker coded for himself or herself.

Professor Falk applies the theory of egocentrism to writing. Just as children's speech, according to Piaget, eventually becomes less egocentric as they mature, similarly novice writers learn to write according to the needs they have recognized in the reader (6, 442). She sees group interaction as a way to enhance the writer's sense of audience. Oral feedback on the effectiveness of the writer's draft enables the writer to adjust the message accordingly. Oral interaction of this kind becomes valuable for its immediacy.

However, Richard Gebhardt is quick to point out the difference between collaborative "evaluation" of a draft and truly collaborative writing (9, 69-74). The process, he contends, must start earlier. This kind of interaction begins with finding topics, defining audience, generating details, etc. Role-taking for the writing task can be augmented through role-playing. Students could play the role of the writer's audience, says Gebhardt, and offer constructive feedback.

Joan Goldstein also recommends collaborative activities early in the writing process; the oral interaction this method provides must be directed to a specific task and its completion (4, R-158). Collaboration becomes a problem solving act in the classroom just as it does in the work place. Note the collaborative process Engelbret described above and how oral interaction contributed to an improved sense of audience.

Oral Communication and Conflict Resolution

When the terms "oral interaction" and "oral communication" are used, one tends to think of the sender rather than the receiver. The importance of listening must not be overlooked. The so-called white collar worker spends at least 40 percent of the time at work listening (10, 564). Incalculable instances of faulty listening take their toll in conflicts between individuals and between groups. A course that integrates oral and written communication should address this problem. Indeed, courses requiring group writing projects could examine differences of opinion between group members by applying Rogerian strategies.

The question of how Rogerian strategies differ from traditional or Aristotelian argument has been discussed in depth elsewhere (11). It may be enough to look briefly at the benfits of introducing Rogerian rhetoric to our students. First, students learn that true listening is not passive. The Rogerian strategy can demonstrate the power of "active listening." Carl Rogers and Richard Farson use this term because active listening can change people. The active listener "tries to grasp the facts and the feelings in what he hears, and he tries, by his listening, to help the speaker work out his own problems" (12, 569). Conflicts between two people or groups of people are often dyadic. There is no third party to win to one's side and thereby win the case. The two persons, for example, may be organizational equals whose disagreement over procedures for solving a company problem delays action until circumstances or a third party settles the dispute for them. The hard feelings remain, however, making any further cooperative work between the two even more difficult to achieve.

Discussing Rogerian strategies can also help students better understand how writing and speaking differ. Although there have been discussions concerning the use of Rogerian strategies in written discourse, the approach did originate as a tool for use in dyadic oral situations. Part of its effectiveness is in a speaker's ability to use non-verbal messages in addition to active listening to reduce threat in the other party. Students could examine the advantages of resolving a problem through Rogerian means as opposed to writing a formal argumentative memorandum. What does the act of "putting it in writing" do to the situation?

Conclusion

Integrating oral communication with technical writing offers several advantages. First, such an arrangement helps to prepare our students for the variety of oral communication tasks they will face on a day-to-day basis, including those requiring them to transfer information from the oral mode to writing. Second, through oral communication instruction and practice, our students can develop the skills of role-taking and apply them to writing tasks by means of collaborative activities initiated early in the writing process. Improved role-taking skills can help make our students better public speakers when they represent their companies; they can also enhance our students' sense of audience when they write. Finally, an understanding of Rogerian strategies offers alternatives to damaging confrontations when conflicts occur in organizational life. The papers which follow demonstrate specific efforts to integrate oral communication with technical writing.

NOTES

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THE TECHNICAL TALK: MORE EFFECTIVE USE OF VISUAL AIDS

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ABSTRACT

While most technical writing teachers assign the oral report and insist on visuals, very few offer their students good classroom examples of technical report visual aids. However, a set of 35 mm slides on one teaching topic could be easily produced with neither expensive equipment nor much ability in graphic design.

INTRODUCTION

This past summer I attended a summer seminar for technical writing teachers at Rensselaer Polytechnic Institute. Most of the presentations were good, but one factor separated the good from the excellent speakers: the latter group had interesting visuals to accompany their talks. Not until that seminar did I realize my classroom failure to demonstrate this need to my students. I knew that the overhead projector and chalkboard that I commonly used had limitations, but I didn't have a background in graphics arts, nor did I want to spend a great deal of money on posters that would gather dust and scuff marks sitting in my office between semesters. On the other hand, my students would be joining business and industry as representatives of my university, and I was not providing them with even one good example of quality visual aids in an oral report.

Most textbooks offer information on oral reporting, but this advice is commonly limited to avoiding the dreaded schwa, or improving eye contact. Most of them also stress the importance of graphics, but seldom do they include information or examples of oral report visuals, and if they do, such samples, being confined to the printed page, do not easily lend themselves to a demonstration of use in an oral report.

The models of oral reporting available to students are the teachers' own presentations on the various aspects of technical writing. The visuals accompanying these talks are nearly always the blackboard and, occasionally, the overhead projector. Both of these are useful for communicating certain information--primarily listings; but they are static as well, for the visual impact of such devices is minimal. I cannot picture a professional giving a presentation before executives of a large corporation and relying on a blackboard. However, a teacher with interesting visual aids centered on one topic could demonstrate the effectiveness of a quality oral presentation.

One solution is a series of 35mm slides prepared on one aspect normally taught in the class, such as oral reports themselves, or the letter of application. The advantage of slides is that, unlike posters, they are easily stored in a small space on a bookshelf where they will not attract dust, and they offer large, colorful displays of visually-attractive information. They also allow a prepared sequence of material, and authentic, high-quality, professional samples.

Textbooks seldom discuss visual impact, and thus slides made from letters typed with different fonts should produce a useful discussion. After a few years of teaching, most instructors collect a supply of such sample communication. Some of these become ditto copies for the students, but such a method of reproduction does not do justice to a sparkling business letter. On slides, however, the letters will never crack or yellow with age, and the students will see the difference between a scribble, and a letter that demands the reader's attention

Virtually all schools offer slide projectors in the classroom if given 24 hour notice, and because slides enlarge on the screen, they can be seen by everyone. Some schools have staff who will make slides for faculty if the material is supplied; however, many teachers may find it easier to produce these on their own. Here is how:

MAKING SLIDES AS VISUAL AIDS

Obtaining Materials

Film catalogs contain stills from old movies to which the clever photographer may add comic dialogue or captions. Drawings from academic junk mail are also useful because publishers often ornament sale catalogs with little sketches. When these are photographed above typed lettering, they become title slides. For example, a picture of Falstaff pontificating in a Shakespearean setting may be matched with the caption "Giving the Oral Report." A Dickensian drawing of a Victorian sweat shop might be "Communication in Today's Business World."

Cartoons are always enjoyable for an audience, and many of them refer to job interviews, problems in communication, or work world situations the students will be confronting. Cartoons frequently will make a point that a teacher might strive for over several class periods.

Equipment Needed

* A single lens reflex camera

* Slide film (any speed will work). While Kodak offers special copy films, I recommend buying the cheapest. K-Mart's Focal Brand film works fine, or purchase Kodak's Kodachrome 64. High speed film is not necessary except for specialized work.
* A set of close-up lenses or extension tubes. If wealthy, buy a macro lens.
* Not completely necessary but useful is a tripod or a copypod (a tripod designed specifically for copying).
* If your camera does not have a timer, a cable release will be useful.
* Duct tape, available at any hardware store, will keep the material flat on the copying table; later it can be placed across those parts of the finished slide you don't want projected on the screen.

<u>Making the Slide</u>

1. Prepare your captions and visuals.
2. If possible, photograph on an overcast but bright day. Avoid any shadows crossing what you are photographing. If no clouds are available, indirect light is better than direct sunlight on the visual.
3. Set up your materials near a window and turn off electric lights. If you have a tripod or copy stand, attach the camera and place the visual material directly below the lens.
4. Use the necessary combination of close-up lenses or extension tubes until the camera focuses on only the material you want in the finished visual. Get as close as you can so the letters and figures will appear large in the finished product.
   a. Remember that most single lens reflex cameras show slightly LESS in the viewfinder than the film sees, so allow yourself some extra margin around the sides of the visual.
   b. Adjust the f stop (lens opening) and shutter speeds until the camera's light meter registers a slight UNDEREXPOSURE of one f stop or less. If your camera is automatic, set it to Manual and underexpose by one f stop.

   > Hints: Most lenses are uniformly sharpest at f 8, so try for this opening; and avoid shutter speeds slower than two seconds because this may cause a slight color change in the film.

   c. Use a cable release or the camera's timer to avoid vibration.

CONCLUSION

I have two sets of slides: one demonstrates the use of visuals, and the second, what makes a good letter of application. For some letters I have several slides, one showing the entire letter, to demonstrate the visual impact; another showing only the first paragraph, which is often the hardest to write. The slide materials came from old business reports and student-generated samples. My most successful visuals, however, are cartoons. They offer color and artistic interest that I could not provide.

Whenever I find potential slide material, I set it aside and wait until I have slide film with a few exposures remaining--a frequent occurrence after a vacation or family visit. Finally, I note this all on my income tax form because, of course, this is all deductible.

FROM PAPER TO PODIUM

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ABSTRACT

Four areas in the basic technical writing course lend themselves naturally to oral presentation.

1. Letters of application and resumes should be complemented with practice in interviewing.
2. Technical description and process analysis papers should be supplemented with an oral product demonstration.
3. Test and malfunction reports should be followed with oral proposal for change.
4. The more extensive research paper, proposal, or project report should be adapted into a more formal oral presentation.

As speakers, students are taught how to develop skills of audience analysis, simplification of technical material, repetition, illustration for clarification, and effective delivery. As members of the audience, students learn how to listen and to evaluate. In addition, students have an opportunity to acquire information on subjects that usually are not covered in any of their classes.

INTRODUCTION

In the past ten years, the major request from employers who hire our graduates has been to teach students to write coherent, precise reports, using well constructed grammatically correct sentences. In the last three years I have also begun to hear a concerted cry for improvement in oral communication. As one employer so succinctly said, "Now that you have taught your students to write clearly and concisely, when are you going to get them to stand up on their feet and speak intelligently and convincingly?"

This is a most legitimate request since it has been estimated that anywhere from twenty-five to fifty percent of a technician's time is spent in oral communication. Many graduates of technology schools begin their careers as field representatives; as such they are the company's liaison with the public, and, indeed, they must be able to explain the mechanical aspects of a situation or problem clearly and intelligibly.

Ideally every technical student should have a semester course in oral communication; however, since this is not required in most technology programs, the majority of students never take such a course. Therefore, I feel it essential to include as much practice in oral speaking as is possible in my basic Technical Communications Course.

As I see it, four areas in this course lend themselves to oral presentation. First, letters of application and resumes can and should be supplemented with actual practice in employment interviewing. Second, technical description and process analysis papers should be supplemented with an oral product demonstration. Next, test and malfunction reports should be followed by oral proposals for change. Finally, the more extensive research paper, proposal, or project report should be adapted into a more formal oral presentation. This paper deals with the actual construction of these four oral units. It does not dwell on the basic components of effective oral speaking such as audience analysis, and preparation and delivery of speech with which you are undoubtedly familiar.

INTERVIEW ROLE-PLAYING

I have always begun my Technical Communication Course with a unit on writing letters of application and resumes. We used to discuss interviewing techniques; now we actually role-play, one student taking the part of the employer--interviewer, and the other, the part of the prospective employee--interviewee.

First, I define the dynamic, dyadic process of interviewing, discuss the role of the interviewer and interviewee in the employment interview, show how these roles can change during the course of the interview, delineate the interviewer's responsibility for controlling and directing the questioning and the student's responsibility in responding. We discuss the preprogramming that both participants bring to the dialogue and the influence of societal roles and situational variables. We talk about voice range, enthusiasm, diction, eye contact, and body language.

Next, I provide students with lists of questions usually asked by prospective employers--for example, "Why do you want to come to work for our company? Where do you see yourself in ten years? Why should we hire you rather than all of the other applicants we have interviewed today?" A most difficult question to answer is the most general one, so often asked--"Tell me about yourself?" Perhaps as difficult and even more startling are the very unexpected specific content directives occasionally given by an employer in an initial screening interview such as "Describe a one shot multi-vibrator, or draw and explain the operation of a J-K Flip Flop." We practice answering many such general and specific questions.

Students work in teams. They decide who will be interviewer and who will be interviewee and what company they represent. The interviewer does not tell the interviewee what questions he or she will ask. By participating in such mock interviews and listening carefully to themselves and the comments made by their audience of peers, students become aware of their gestures, diction, voice control, and of their reasoning processes. They learn to think before they answer, be direct, emphasize their strengths, compensate for their weaknesses, talk work and not employee benefits, and move from one point to the next without getting "hung up." They begin to develop a sense of timing and to know when to stop talking.

After each pair of students completes its interview, the audience provides constructive comments. If the class is small and there is sufficient time, we tape the interviews and play them back. This, of course, provides an excellent opportunity for self-analysis. However, even in the larger classes where we cannot tape the interview, the student reaction is positive. The students feel that as a result of the practice interview and the constructive criticism, they develop an interview know-how and poise which is most valuable when the mock situation becomes a reality.

PRODUCT DEMONSTRATIONS

The second oral talk follows the unit of writing technical definitions, descriptions and analyses of process. These exercises give students experience in defining an object, describing its physical appearance and analyzing its functions. When they become industrial technologists, they should be able to write precise specifications, clear instructions, coherent reports of test analyses, and descriptive sales brochures. They should also be able to present oral product demonstrations when they represent their company at sales meetings and expositions. Therefore, in class, each student now has the opportunity to give an oral product demonstration which builds on the information in his or her technical description and process analysis.

Before the students structure these presentations, I emphasize the differences between a paper which is written for readers and a speech which is delivered to listeners. As Max Weber has stated, "Written language must ultimately be intelligible to the reader, but spoken language must be instantly intelligible to the listener." With this concept in mind, we stress the importance of accurate presentation and proper selection of facts, logical organization of material, and use of clear transitional phrases. We discuss proper use of note cards and visuals. We point out the advantage of the extemporaneous talk, spoken conversationally rather than the paper which is read mechanically or memorized and regurgitated in robot fashion.

This oral product demonstration very quickly convinces students of the need to identify the audience and adjust the technical complexity and density of information to that audience. They simplify the written material, adjust the pace, and slow the rate at which they unload highly technical facts. They use a multiplicity of visual aids--graphs, charts, schematics, actual objects to clarify. They adjust their tone from the totally objective to the more personal, informative voice, prepare their audience by telling them what to look for, repeating when necessary for emphasis, stressing advantages and disadvantages. The speakers enlighten the audience by using techniques of demonstration, logical analysis, and synthesis.

The subjects are, indeed, diverse and interesting to the audience of peers. Topics range from the description and operation of a Bi-Polar Transistor to the description of a dynamic microphone and how it records the snare drum, to the description of a multiplexer and how it fits into the computer system. The listeners become directly involved; they not only have the opportunity to question the speaker about how a particular mechanism or process works, but they must evaluate the content and delivery of each talk according to a detailed evaluation sheet.

PROPOSAL FOR CHANGE

The third area that lends itself naturally to oral communication is the trouble or malfunction report, also called problem notification. In industry, once a failure is identified and the cause or causes isolated, the next step is to determine the long and short range rectification, commonly termed proposal for change. The written paper and its three minute oral counterpart provide students with the opportunity to reason logically, write clearly, and speak persuasively. Both the oral and the written reports describe the problem or problems that have occurred, state the change or changes desired, detail the reasons for the changes, and specify the ways in which the alterations or modifications will affect procedures, costs, personnel, etc. The oral presentation proves to students that in order to be clear and convincing, not only must they thoroughly perceive every fact with all of the cause and effect ramifications, but they also must synthesize and simplify for their audience.

For this presentation, two techniques are used successfully; the choice is determined by the size of the class. In a small class, the oral presentation is given in the traditional manner; students have the opportunity to question the speaker after his or her presentations. In a large class, two people can take the podium at the same time, one plays the role of the proposer of change and the other, the role of the supervisor questioning the validity of the proposal. The proposer must be able to defend his proposal.. This interaction furthers the techniques practiced in the interview situation.

As with the product demonstrations, subjects are diverse, ranging from broken water mains in a college to faulty wiring in a machine shop to a bad thermocouple in a theater. And again, students evaluate their peers' presentations according to the detailed evaluation sheet.

FORMAL RESEARCH REPORT

The fourth, lengthiest, and most formal talk given by the students is the oral presentation of their technical research paper. The students give a seven to eight minute talk based on a ten to twelve page technical research paper. The oral report rarely follows the exact pattern of the paper; students must select the important concepts and eliminate the minute details which are not relevant to audience interest. Since these papers are highly technical, the oral presentation requires more skill than the earlier talks. The speakers must again, but even more assiduously, adjust the pace; simplify, clarify and amplify the highly complicated text; reduce statistics; and illustrate the main ideas with striking visuals.

The most difficult task for accomplished writers, let alone students, is to edit their work and eliminate some of the unnecessary words and concepts. But, in the words of Noel Perrin, we all must learn "to perform plastic surgery and when essential, even commit infanticide." And so the students learn for example, in a speech on operational amplifiers to eliminate the mathematical equations, use fewer schematics and less technical language than they did in the written version. Or in a talk on flat plate solar collectors, students analytically interpret rather than just technically present the data on theory of operation. They emphasize implementation and application rather than formulas and specifications.

This qualitative rather than quantitative approach enables all of the students to share in each other's research. They are exposed to a significant number of technical subjects, and they absorb a great deal of basic information without becoming bored or confused by excess detail.

CONCLUSION

Many students are initially intimidated by the prospect of oral communication, but I do force the issue after fully explaining my reasons for the torture. During the semester I repeatedly remind them that as they advance in industry, the ability to communicate clearly, concisely, and convincingly is increasingly important, and that every written report has its oral counterpart. I explain that my course objectives in the field of oral speaking are not just an academic exercise, but are directly responsive to the industrial demand.

For instance, in their professions, our graduates will constantly be making oral suggestions, explaining schedules, discussing policies, interpreting results of investigations, reporting on progress of projects, justifying departmental expenses, or making proposals. In short, in addition to having technological expertise, they must know how to listen, to think, to write, and to speak.

In an anonymous evaluation of the course last semester, only one of forty students claimed he gained nothing from the oral speaking experiences, thirty-nine stated that with each succeeding talk they gained more and more control and could see decided self-improvement. Admittedly, this is a time-consuming activity, but both students and faculty feel it is well worth the time and effort. And so, in English III, at Ward Technical College, University of Hartford, we continue to move from paper to podium.

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MAKING TEAM PROJECTS WORK IN A TECHNICAL COMMUNICATION COURSE

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INTRODUCTION

The use of team projects in technical communication courses is not new--in many courses oriented toward professional communication this kind of simulation of real-world activities is obviously attractive--but some discussion of their usefulness is called for. In this paper I offer my experience with team projects as an example, and on the basis of that experience I offer some general guidelines that might govern the use of team projects in the technical communication classroom.

Team projects may be large or small, may involve an entire semester's work on a large topic or a single class period on a limited exercise, but in general they have the same purposes. Having students perform in teams to produce presentations on subjects related to technical communication of course allows them to learn about communication. But in addition to the knowledge students gain of the individual subjects they investigate, they also acquire experience working in organizations, gathering information, writing and editing reports, and (in my course at least) giving oral presentations, all of which are necessary in the jobs students get when they graduate. In larger projects they also learn about scheduling, budgeting, working under deadline pressure, and coordination of effort. Furthermore, one of the chief benefits of this approach to the teaching of technical communication is the genuine enthusiasm and the high level of professionalism exhibited by the students. This positive attitude toward the projects spills over into their other work in the course and makes the entire learning experience much more profitable (and enjoyable) for them.

PROCEDURE: AN EXAMPLE

The team projects I have used are somewhere in between the semester-long project and the class-long exercise, and for that reason may provide an interesting point of departure for our discussion. I had my students investigate and present written and twenty-minute oral reports on topics central to technical communication (some sample topics were résumés, job interviewing, audience and purpose in reports, organizing reports, visual aids in oral and written reports, oral reports, editing, etc.). A vital part of each presentation was a self-contained transparency, slide or videotape show to accompany the oral and written reports. I took this approach for two reasons. First, my students come from a wide variety of technical fields and therefore share little in common other than their work in my course. Second, I needed additional visual aids materials to use in the classroom; by having my students prepare professional visual aids on the topic they were presenting, I encouraged them to learn how to make visual aids and I acquired a large library of useful materials.

I divided my students into groups of four and assigned specific topics for them to investigate. I chose the groups by lot to discourage cliques and to simulate real-world working conditions (employees do not always get to choose their co-workers). I left responsibility for group organization, scheduling, and method of presentation entirely to the students. Some devised rigid hierarchies and others operated more or less democratically. I gave each team about six weeks to complete their task. I obtained brief oral progress reports about halfway through the project, and spent some class time discussing the obstacles faced by all teams, but in general this kind of assignment need not keep one from the other business of the course. I found that most of the discussion about this assignment took place out of class, and that one of the benefits of the projects was that I got to know my students much better. They also came to feel a sense of identity with the course because of their group efforts to meet shared goals.

MATERIALS AND FUNDING

Materials for the projects (transparency film and frames, slide film and developing, videotape, etc.) were paid for out of a small grant I obtained from North Carolina State.

EVALUATION

Team project reports were evaluated in several ways. I graded the written, oral, and visual aids components of the reports, of course, but I also asked the class as a whole to evaluate the reports of each team. In addition, I asked all members of each team to evaluate their own performances and those of their teammates. I felt peer evaluation was necessary to get an accurate picture of the success of the visual aids presentations (which after all were designed to be used to teach future students). In addition, the self-evaluation of the team members allowed them to discuss frankly the relative diligence of their fellow teammates. This last aspect of the evaluation process was particularly useful because of the team-oriented nature of the projects. To instill a sense of responsibility and cooperation in the teams, I announced at the beginning of the exercise that all members of a team would receive the same grade. As a consequence, when teams found some members were working harder than others, they had to decide as a group whether to cooperate, take over the job of a non-participating member, or suffer the consequences of a poor or uneven presentation. In this self-evaluation at the end of the projects, team members were encouraged to analyze the results of their efforts at interaction and to discuss any lessons they had learned from the process.

RESULTS

The results of these projects were excellent. I received some fine reports, and I still use the visual aids produced in these projects in my classes. Furthermore, my students, in their evaluations of the exercise itself, indicated an overwhelmingly favorable response to the experience. Almost all claimed to have gained both knowledge of some aspect of technical communications and understanding of the importance of group effort and cooperation (which is of course the foundation of most successful professional activities). Significantly, almost all students indicated that the 20 to 50 extra hours they had put into the projects had been worth it, and that they would recommend the repetition of these projects in future semesters.

Assigning team projects is not without its problems, of course. The logistics of administering money and materials is often time consuming, and the inevitable obstacles to group harmony and efficiency are often aggravating, but I strongly feel that these problems are just the sort of things that our students ought to have to encounter and overcome in their technical communication courses. We are not just in the business of teaching people how to write letters or reports, but how to communicate in the broadest sense. If we can make the reports our students present truly useful, truly instrumental, then we teach them why it is important to be able to communicate as well as how to do it.

GUIDELINES

On the basis of my experience with team projects, let me offer some brief guidelines that might govern their use in the technical communication classroom.

The size of team projects can vary. Anything from a single class period devoted to evaluating student reports to semester-long projects that encompass the entire course and all its assignments can be appropriate. I don't mention specific topics because teachers must evaluate individual circumstances and goals before they decide on topics, scope, and approaches. What is more important than the kind or scope of the topics, it seems to me, is the interaction, the dialogue between students and the "real world."

To that end, let me suggest that the crucial factor in assigning team projects is the encouragement of student responsibility. An assignment which gives students clear goals (in terms of products or results) and then "turns them loose" to achieve these goals in any way they see fit will (sometimes astonishingly) promote--and reward--student initiative, ingenuity, and professionalism. As they face the decision-making process, they are brought face to face also with the same kind of obstacles and rewards they encounter in their communication on the job. Students have the opportunity to succeed or to fail--and the results are entirely under their control. What students learn from this responsibility is often vital to their success as professionals.

As for the teacher's role in this process, let me suggest that helpful but unobtrusive guidance works best. Let students work out their own problems--within teams, or in relation to the topics themselves. Of course it is occasionally necessary to offer counsel, but by and large the problems your students encounter are just the things which will help them to learn. You must make sure that the assignment is sharply defined and that the topics are worthwhile, and you must allow your students enough time to complete the assignment, but beyond that, your students should run the show.

Finally, let me suggest that peer evaluation is crucial to the success of most team projects. If you want your students to act professionally, you must treat them as professionals. Their opinion of their classmates' success is valuable--and valid.

CONCLUSION

Team projects may not fit into every technical communication course, especially not on the level that I use them, but the effort required to devise, fund, and direct them is repaid many times over by the enthusiasm and learning of your students. As a means of simulating professional communication activity they are one of the most potent weapons in the technical communication teacher's arsenal.

Panel D-20

Research in Business and Technical Writing: Three Empirical Studies

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SHARED RESPONSIBILITY:

TEACHING TECHNICAL WRITING IN THE UNIVERSITY

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Writing teachers are throwing up the barricades. Behind piles of books hastily pulled off library shelves, one side shouts that English teachers can and must teach technical writing. (See "Notes from the Besieged, or Why English Teachers Should Teach Technical Writing" by Keith N. Hull, CE, 41 [April 1980].) Behind an opposing barrier, formed of computer printouts and blueprints, the engineering educators are marshalling arguments. (See "Technical Communication: The Engineering Educator's Responsibility" by J. C. Mathes, D. W. Stevenson, and Peter Klaver, Engineering Education, 69 [January 1979].) At stake is a considerable prize, one that might ensure a good living for teachers as the writing boom roars on--the training of technical writers. The last twenty years of this century and the foreseeable beginning of the next will produce a geometric expansion in the amount of writing generated by technology, research, and government. Never mind how it will be disseminated, by word-processor, interactive computers, and/or satellites. It all has to be written first and someone must train the writers.

Stepping between the barricades, I'd like to call a halt and suggest that before we fight, we'd better know what we're arguing about. At least let's stop long enough to examine the functions and genres of technical writing, define boundaries, and apportion spheres of influence. Combative energies might then be deflected into a cooperative assault on the real enemy, writing ill adapted to its readers' needs.

Both combatants and spectators are confused by the inexact terminology in the field. "Technical writing" has too many vague overlapping meanings, not only because definition is hard but also because the groups using the expression do not communicate easily or habitually. Communication requires more than a disciplinary overview--it requires those inside the academy to investigate how writing is used in situations they normally do not encounter. In my argument, I have subdivided technical writing according to purpose, audience, and essential features, trying to lay out territory where English teachers have a legitimate claim to expertise and where they should cooperate (even as junior partners) with educators from other disciplines. Taxonomy demonstrates that we don't have a simple case here. We can't categorically declare that the English department should teach technical writing, or that it shouldn't. It can teach technical writing most effectively where English teachers can act as a surrogate audience; where professionals in the discipline concerned form the intended audience, the English teacher's role is severely limited. We're talking about a compromise, cooperation instead of competition. Consequently, a well-designed technical writing program should have an interdepartmental base, for writing is everyone's responsibility and no one's exclusive domain.

I.

We may agree, I hope, on a fairly broad division of writing to begin with. Literary writing, belles-lettres, differs from practical writing mainly in social function, for all other definitions fail.[1] Practical writing earns its living, literature entertains. To appreciate the truth of this distinction, reflect that both reading and writing literature are personal choices, but you can't choose when faced with a memo, a report, a proposal. Practical writing is part of the job. So we can construct a table from this first dichotomy:

TABLE 1

PRACTICAL WRITING AND LITERARY WRITING

Practical writing	Belles-lettres
business writing, secretarial	novels
business writing, administrative	plays
student papers	poetry
technical writing:	literary essays (including scholarly articles)
technical writing as advertised	scripts for radio, TV, and movies
journal articles	
instructions	
formal documents	
writing for decisionmakers	
legal briefs, memos, and decisions	

In this table, I have deliberately not included journalism, advertising, and public relations. I have an easy cop-out--these types of writing are usually not taught by the English department, but are considered "communications," so they aren't in dispute here. But there is a more interesting reason. Journalism and its subgenres occupy a grey area between literature and practical writing. They have work to do, but can't do it without entertaining. They are part of a job, but the job is the writer's rather than the reader's. A reader can choose whether to read journalism (or advertising) despite its manipulative efforts to replace choice with compulsion.

I have grouped the subgenres of practical writing in order to reveal the attitudes which provoke disagreement. Business writing is divided into two kinds, so that we do not confuse secretarial conventions (letter form, etc.) with substance. This confusion underlies the contemptuous dismissal of business writing as unworthy of inclusion in a university curriculum. A businessman, however, must read and write memos, reports, proposals, letters where the content may be so delicate that the writing takes weeks of polishing and revision.

Student papers are clearly practical writing. They would have no existence apart from the jobs of learning and teaching. But they also permit an important distinction. Student papers transmit information from those who don't know (students) to those who do (professors and teachers). The writing doesn't add to the recipient's store of knowledge or increase his ability to perform his job. On the other hand, the writing grouped under "technical writing" provides information essential to the reader.

I'd like to postulate this as a definition of technical writing: it is the communication of information the recipient needs to perform a task. Such a definition should satisfy all contending parties, because it is at once narrow enough to focus on essential features and broad enough for there to be no question that English teachers can understand and teach its rhetoric. The definition centralizes purpose and audience rather than specific subject matter. Definitions of technical writing tend to focus on disciplines: e.g., "technical writing, that is, the transmission of specialized scientific and technological data to readers" (Siegfried Mandel, Writing for Science and Technology [New York: Dell, 1970]). Limiting it thus excludes material like the instructions for completing tax returns--surely technical writing. The definition does not specify forms, because reports, memos, proposals, "papers," articles, catalogs are not confined to any single genre of practical writing.

But the subgenres are a strange assortment. Journal articles in the same class as policy analysis and legal writing? I have grouped them thus to dramatize the confusion surrounding technical writing. Articles of all types listed have been shielded from my scrutiny with some version of this claim: "Ah, but this is technical writing--you wouldn't understand what I'm saying." At the same time, a person describing himself as a technical writer would expect to write "technical writing as advertised" and instructions. He would not think of himself as a legal writer or a writer of policy analysis, much less of articles in scholarly journals. What we have here is really a subset of practical writing more accurately called "task-oriented practical writing." Such a renaming would confine "technical writing" to its use as a job description.

The following taxonomy attempts to make some sense out of the confusion. By subdividing according to audience, parameter, and importance of rhetoric, the classification focuses on the function of each kind of writing within a context. It permits a clearer understanding of the comparative contributions a discipline instructor and an English teacher could make to the acquisition of skill in task-oriented writing.

In the table below, "parameter" (in its strict sense, not a synonym for "perimeter") means the essential core of the writing, its raison d'être to which all its features refer. "Audience" is self-explanatory. "Rhetoric" indicates the scope of choice in the writing. Can this information be transmitted in more than one way, or must it follow a strict formula? Finally, "motivation for polished writing" indicates how much regard the writer would be likely to receive for investing time in refining his prose.

The table schematizes three subclasses of technical writing, in order of the increasing ability of English teachers to teach them. I'll present the table first, and then discuss each subclass separately.

TABLE 2

THREE SUBCLASSES OF TECHNICAL WRITING

Subclass 1
Technical writing as advertised; journal articles

parameter: fidelity to described object or process
audience: peer users, customers, colleagues
rhetoric (i.e., scope of choice): absent--language a necessary nuisance
motivation for polished writing: absent

Subclass 2
Instructions; "how to" writing; formal documents

parameter: reader's ability to perform operation
audience: nonpeer users and customers
rhetoric (i.e., scope of choice): present to the degree it serves usability
motivation for polished writing: conditionally present

Subclass 3
Writing for decisionmakers; legal briefs, memos and decisions

parameter: reader's understanding of the problem, the solution (if any), the possibilities, the caveats
audience: decisionmakers, equal in education level, but not sharing specialty
rhetoric (scope of choice): omnipresent
motivation for polished writing: strong

SUBCLASS 1. TECHNICAL WRITING AS ADVERTISING; JOURNAL ARTICLES

I wish there were a term less unwieldy than "technical writing as advertised," but unfortunately all the precision is needed. This is the technical writing which I believe English teachers cannot teach unaided. It is the technical writing usually associated with the engineering department. It is what springs to mind when someone describes himself as a technical writer--a person who translates blueprints and specifications into words. Despite the fact that its name has become that of the whole category, this kind of technical writing is a single narrow subclass of information transmittal.

"As advertised" specifies that this is the technical writing commonly understood. Here are some advertisements for technical writing positions which appeared during August 1980 in the Los Angeles Times:

> Procedures Writer: Leading relay manufacturing company has challenging opportunity for an experienced Procedures Writer. Good writing skills needed to document various department procedures. Will have responsibility for company forms control.

> We're looking for several technical publications writers in command, control and communications systems. . . . Since we will be providing over 700 technical manuals at system, equipment and depot levels for prime and test equipment, we need to talk to you now. So if you have experience and expertise in technical manual preparation and related support functions and/or technical familiarity with electronic systems and support equipment send us your resume and salary history today. And remember, when you start on the ground floor of a new division, there's usually only one way you can go. Up.

> Tandon Magnetics of Chatsworth is seeking a Technical Writer who can extract and compile technical data and write/revise text for product and parts catalog, service manuals. Technical or trade school training desirable, plus a minimum of 2 years' experience in related fields.

> American Honda . . . specifically we're looking for an individual with 2 years of technical writing experience, including familiarity with layout concepts and publications production plus 2 years of college. Also, because much of our writing requires hands-on validation,practical experience with automobile, motorcycle or small engine repair--including understanding of motor vehicle electrical systems--would be a definite plus.

> RCA Avionics systems has an immediate need for an Engineering Writer. The individual we seek will prepare circuit descriptions as well as instructions for digital avionics equipment. Must be able to work directly from logic and schematic diagrams and from engineering test specifications.

If we English teachers claim that we train technical writers, then a student leaving our classes should be able to apply for such a job, on whatever level he or she graduates. But there is no way, unaided by technical personnel, that we could train such a person, because we have no criteria by which to judge writing in that context.

In the communicative ecosystem of technical writing as advertised, the first necessity is fidelity to the original facts, usually embodied in engineering diagrams, chemical formulae or similar technical specifications. There is no room for rhetorical organization of any sort, because the presentational order is dictated by the technical process. The steps must be written in a sequence which will allow the user immediate access to the object.

There is also no need to eschew jargon, if we understand the word to mean diction adapted to a particular field or subfield. The audience for this kind of writing understands the jargon and the acronyms. In fact, if the writer did not use them, readers would suspect that he didn't know what he was talking about. They would not trust his expertise. The readers are users of the object or process described. They share with the writer a common background and language. "Good writing" in this context means minimum obstruction between the reader and the described object. It is a window. Much of this writing is documentation--assembling information into a unified repository.

The information would be just as easily understood in the original drawings and specifications, but these are unwieldy, dispersed, and not easily reproduced.

As the advertisements show, a technical writer commonly works from specifications to prepare instruction manuals. Computer hardware manufacturers, for example, employ writers to document every detail of a machine (or its derivatives, since new ones evolve from old) so that users will be able to consult a manual for installation, service, and operation. But these are not the instructions of subclass 2. The users are trained comparably to the designers of the machine. They want to know which design options have been chosen, but do not need explanations.

What could an English teacher do alone to prepare such a writer? He could make sure a student has a sound grammatical grasp of the language, although elaborate syntax will not be needed. Mechanical perfection in the language is not to be despised, for the "good writing skills" mentioned in the advertisements mean spelling, sentence construction and punctuation. (Technicians have an exaggerated respect for anyone who, like Holden Caulfield, can put the commas in the right places.) He can sensitize technical writers to redundancy: "in the vicinity of" means "near," "it is supportive of" means "supports," and "adequate number of" means "enough." And so on. (Style manuals for specialized journals now list a thousand such phrases, which may have a dual origin, in the desire for inflated dignity and in students' resorting to formulas to fill up required pages.) A teacher can make technical writers aware of the metaphorical history of words like "glean" and the ever-present "focus." Such awareness contributes to the linguistic consciousness users of language need--a good workman understands his tools. And results from psycholinguistic research demonstrating the theme-rheme progression of English sentences can help writers to place their emphatic material where it will get most attention.

But for technical writing as advertised, English teachers really can't do much more. They can't teach paragraph structure, because paragraphs are mandated by the way the diagram breaks up into components. They can't reorganize a description which must follow a process in time. They can't replace jargon with synonyms. Above all, they can't judge whether the writing is correct, for logic alone is not an adequate tool for understanding. Without assistance from technical experts, an English teacher cannot judge the essence of technical writing as advertised--substantive accuracy.

The matters which the English teacher can work on are peripheral to that central purpose. A technical editor who took my editing class at UCLA told me he was glad that he has learned to use the Chicago Manual of Style and had enjoyed Strunk and White, but he wouldn't be able to use the information much in his work. If the material was accurate, he said, he was not authorized to change it no matter how miserable the expression. An editor at the American Chemical Society told me the organization does not employ writers as such: "It's much easier to train a chemist to write reasonably than it is to teach a writer enough chemistry to understand what he's writing about."

Fidelity to substantive accuracy leads me to designate journal articles as subclass 1 technical writing. Journal articles in all fields--it wouldn't be stretching things too much to include literary criticism--address a tiny specialized audience, which has specific needs and understands the jargon. In the case of physical and social science journals, the majority of articles report experimental research. Like the technical writing which interprets blueprints, these reports must reproduce a process clearly and unambiguously. They follow a rigid and nonrhetorical prescribed order: summary or abstract, introduction, method, results, discussion, appendices. The order is so nonfunctional in one sense that experienced readers of these journals read the abstract, skim the methods, and go directly to the discussion. But in another sense, the order serves an important purpose, not apparent to those outside experimental fields: peers can verify every step of a procedure if the process is thus laid out systematically. The rigidity of the order suppresses any possible distraction an artful presentation might entail. Rhetoric is not welcome here. An article must be accepted or rejected on the strength of the work reported. "Improving" the writing of a scientist whose reputation depends on frequent publication in such journals could handicap his career.

We cannot leave this description of subclass 1 writing without stressing again the narrowness of its focus. Few beyond the targeted audience will read it. As I mentioned before, this subclass is not confined to a discipline or a genre, despite its common association with engineering. A doctor writes subclass 1 technical writing when he communicates with his colleagues, discussing cases and therapy. To the patient he writes subclass 2 and subclass 3 to the hospital administrator or to a state legislator. A lawyer reporting to his firm's senior partner after researching cases writes subclass 1. So does an economist describing a new econometric equation. The English teacher's help can make such writing crisp, nonredundant, grammatically and syntactically accurate. Ideally, technological and scientific training would include at least one course in subclass 1 writing taught jointly by a subject instructor and an English teacher.

SUBCLASS 2. INSTRUCTIONS; "HOW TO" WRITING; FORMAL DOCUMENTS

Subclass 2 technical writing explains. Technical writing courses in English departments chiefly teach this kind of writing. It describes an object or process in terms which the nonexpert can understand. Thus it differs from subclass 1 writing, where both writer and reader shared expertise. The user (reader) must be able to follow the explanation for his own purposes. The reader's needs are paramount. The writing will be successful insofar as it accommodates them.

Good instructions--which we can generalize to usable information--are extremely difficult to write because they must be entirely nonambiguous. They require the writer to identify with the reader, assuming ignorance and anticipating all the comprehension problems a reader faces.

Instructions and information are also ubiquitous. They are supplied by the government--how to fill out forms, where to get what services; by the research community, when it devises evaluation instruments, for example, which will be used on the job by social workers or administrators; by industry, for installation and service of its products. (Some examples are very good. Even an unsophisticated mechanic can follow the instructions supplied in the Clymer series of handbooks for different makes of automobile.)

The writer of instructions or information must know his product or procedure as well as the technician. But he must also act as a bridge between that knowledge and the potential consumer. Rhetorical training provides the framework for the bridge. First of all, the audience for instructions usually needs more context than the expert would require. Before the explanation gets down to detail, there must be an initial high-level explanation to give the novice reasons for the required action, a context for it, and the constraints on it. This explanation would irritate the consumers of subclass 1 writing, who don't want any elementary scene-setting. The audience-sensitivity necessary in instruction writing would impede subclass 1 writing, where the relationship is primarily between written message and original artifact, not between material and reader. Second, good instructions should not use jargon. If they do, it should be jargon explained and consciously used as shorthand. Third, instructions need reliable terminology and repetition. The same object should always have the same name, no matter how many times it occurs in the same paragraph. Not only must identical terms be repeated, but repetition of whole phrases and sentences may be necessary. Such repetition assuages the insecurity of the nonspecialist user. Criteria for successful subclass 2 writing are its substantive accuracy (fidelity to the object) and the reader's ability to make use of the information, not merely to understand it. Rhetoric is essential, but unobtrusive. The writer must be conscious of manipulation, not the reader.

The English teacher has an obvious role as surrogate audience. He can monitor the reader's end of the process, although still trusting to technical experts for the accuracy of the front end. His task is also made easier in this kind of writing because students can easily check each other's efforts. If one student can accurately follow instructions written by another (especially in a different branch of technology or a different discipline), then the first student has performed well. But if he produces a raven instead of a writing desk, then the teacher doesn't have to justify a low grade.

SUBCLASS 3. WRITING FOR DECISIONMAKERS; LEGAL BRIEFS, MEMOS, AND OPINIONS

Writing for decisionmakers communicates specialized knowledge to administrators who need the information to make informed decisions. Like the readers and writers of subclass 1, specialist researchers and administrators are peers--but in educational level, not discipline. (Researchers are often told to write "to Ph.D.'s in another subject.") Like the readers of subclass 2 writing, the administrators need to use the information, although abstractly. They aren't making bicycles, but policy.

Here is where the rhetorically trained writing teacher can offer most assistance. He can teach the specialist how to organize so that his writing will communicate to the decisionmaker precisely the degree of confidence to be placed in the results. Very few research questions have simple answers.

Most problems have partial solutions, acceptable only under multiple conditions. A nonspecialist administrator risks oversimplifying a complicated answer to the problem; he may not understand the conditions where the partial solution applies. As the ideal surrogate reader, the nonspecialist writing teacher trains the expert to explain with fidelity to the research findings and to the reader's needs. Frequently, the results of analysis can be communicated thus: if you want result A, choose path A; if you want result B, choose path B. Neither A nor B may be what the administrator originally envisioned, but they may be the only feasible options. The researcher cannot recommend either A or B. He can only make clear how either could be accomplished and the probable consequences of choice.

In February last year, the Congressional Budget Office in Washington, D.C., was asked to analyze ways of reducing the Federal Budget. The resulting publication, Reducing the Federal Budget: Strategies and Examples (CBO Background Paper, February 1980, U.S. Government Printing Office, Washington, D.C., 20402), brilliantly exemplifies effective writing for decisionmakers. The audience for the paper, the legislators on Capitol Hill, lacks the technical economic information needed to understand the calculations involved in budget projection. On the other hand, the trained economists at CBO understand the means and the probable results, but cannot usurp the legislators' duty to choose a course of action. The publication therefore lays out first five possible strategies: management efficiencies, better targeting, shifting responsibility to state and local governments, shifting responsibility to the private sector, and revising judgment as to what can be afforded. Then it follows the exposition of each strategy with a series of examples--each displayed on a separate page--where the potential savings are set out in a table and then briefly discussed. Deliberately, the discussion includes the pros and cons of the strategy in this particular case. Here is an example (chosen partly for its brevity):

Elimination of Operating and Construction Subsidies for the Maritime Industry

Savings by Fiscal Year (in millions of dollars)					Cumulative Five-Year
1981	1982	1983	1984	1985	Savings
130	160	189	221	254	954

The Maritime Administration pays a construction cost differential subsidy to U.S. shipyards so that they can meet the competition of foreign shipbuilders. It also pays operating cost differential subsidies to U.S. shipping companies, again for the purpose of meeting competition from foreign countries. If the two subsidy programs were ended, the savings in the first five years would approach \$1 billion. Because the operating differential subsidy is a contractual obligation with respect to a particular ship, and typically for 20 years, it would take about that long to capture all the savings this option would generate.

The argument for such a step is that only three or four ships a year are built with the construction subsidy, so that the program has minimal effects in maintaining shipbuilding capacity.

If the subsidies were ended, there would be some loss of emergency naval shipbuilding capacity, some possible adverse effects on U.S. export and import prices, and some loss of employment in shipbuilding regions and in the industries that furnish shipbuilding materials.

A further chapter of the paper explains possible savings on the revenue side, by reducing tax subsidies and tightening up enforcement of existing laws. A summary table by budget function closes the volume.

A legislator can use this material. It was designed to make his decisionmaking well informed, if not easier. It presents the result of analysis with fidelity to the subject and its enormous complications, but without allowing these complications to make the communication itself inaccessible. Reducing the Federal Budget: Strategies and Examples resembles the top one-tenth of the iceberg, as good decisionmaking writing should. It rests on a solid substratum of intense analysis both by computer and by hand. But it does not thrust that analysis before the reader and confuse him.

When writing for decisionmakers, a researcher must reduce his specialized knowledge to a point where it can be judged by logic alone. Both highly intelligent and well educated, the reader and writer share an ability to reason, but not the capacity to understand multiple regression or the role of empirical Bayes estimators. Naturally, the necessity of explaining in logical terms alone strains the rhetorical skills of researchers. In graduate school, their models were journal articles. They are ex-subclass 1 writers, who must now expand their jargon, explain methods, and reorder their communications for a different audience. Credibility is a major issue in journal articles--hence the review of relevant research ritualistically included. But administrators and legislators wouldn't be impressed by the most extensive knowledge. They trust the experts because they are employed by the Congressional Budget Office, or the Office of Technology Assessment, or the Rand Corporation. Decisionmakers need the shortest possible explanation of research results, stripped of all except the essential qualifications. They need what they can use.

So do consumers of legal writing. Recent "plain English" statutes have reinforced a drive towards demystified legal writing begun by David Mellinkoff (The Language of the Law, 1963) and Richard C. Wydick (Plain English for Lawyers, 1979). Like researchers, lawyers are reluctant to recognize that they are writing for decisionmakers. One cannot really blame them. Trained to respect extensive documentation and to display their credentials for inclusion in an elite group, they find it difficult to write directly and--as they see it--reductively.

In addition, decisionmaker writing is difficult and time-consuming. Arnold J. Meltsner writes: "Analysts will have to improve their understanding of rhetoric and the psychology of communication. They will also have to accept the necessity of spending as much time on communication as they do on the analysis itself" (Pitfalls of Analysis, ed. Giandomenico Majone and Edward S. Quade, p. 136). In rhetoric and the psychology of communication, the English teacher is an expert.

II.

How can this taxonomy assist in curriculum design for technical writing (or, as I would prefer, task-oriented practical writing)? It guides the degree of cooperation between teachers of the discipline and teachers of writing. Applying the taxonomy, we can lay out some principles for comprehensive programs incorporating all three subclasses. What follows is not intended to be a practical, financed layout ready for the Schedule of Classes. You may reasonably object that it's a long way from even the proposal stage. But it provides some parameters for brainstorming.

Before principles, a stipulation and a consideration.

Let us stipulate that the writing courses we are discussing supplement, not replace, the regular English department composition course. English department instruction may have all the vices claimed against it by Mathes, Stevenson, and Klaver ("If engineering educators . . . send engineering students to English departments to learn technical communication, they risk having their students taught principles that are in conflict with engineering principles," p. 332), and all the virtues claimed for it by Keith Hull ("Ambiguity is bad in technical writing, yes, but a heightened awareness of the meanings of words, of the deep resources of the language, is the technical writer's surest guide to clarity and economy. Any writer trained only in language that can have but one meaning will be . . . totally inadequate to the range of writing challenges likely to be encountered in a professional career," p. 879). In this paper I have tried to dovetail these views, not exclude either one. For compromise here is what we're after--what the extradepartmental colleague can't teach, the English teacher can, and vice versa. But there's another reason for supplementing rather than replacing the freshman writing course: it provides many students their only experience of literary values and the literary essay. The ideal writing program for the technological and scientific major should include the English department's literature-based writing course and build from there.

And here's the important consideration: the students who most often need practical writing instruction will frequently need help with English as Second Language. (In fact, the U.S. is becoming so polyglot, especially in large urban centers, that ESL and composition teaching may become indistinguishable within the critical next twenty years.) So in our ideal program, we should anticipate the need for additional tutoring for some students, perhaps even complete sections taught by ESL specialists.

The program has to train at least two kinds of writers, and maybe more. It must train those who want to become technical writers and those who will primarily be technologists or scientists. Although what these specialists write will not be technical writing as advertised, they will spend much more of their careers writing than they think. In an article in <u>Engineering Education</u>, January 1979, M. E. Leesley and M. L. Williams write:

We tell freshmen that in their first few months of work they will spend about 30 percent of their time doing engineering and 70 percent of their time writing about it. Soon the ratio will be 20/80 and thereafter will slowly dwindle to 0/100, except in unusual circumstances. They don't believe us, of course, not at first anyway. (One student told of how he went home and, incredulously, repeated our words to his father. His father, a nationally known chemical engineer, said, reflectively, that it was true; furthermore, he said that the engineering content of what he wrote had also dwindled.) (pp. 338-39)

The amount of writing involved in a technical or scientific career shocks students who may have deliberately chosen the field because they preferred not to write. Surprisingly, despite pressure to publish, faculty sometimes reinforce the students' prejudice rather than breaking it down. I have heard psychology faculty members scorn the need for writing--"it's obsolete"--and engineering faculty relegate writing to the triviality of a frill.

From the need to provide a flexible program, then, arises our first principle: all three subclasses of practical writing should be taught at the undergraduate and graduate levels. Technical writers need a course taught jointly by discipline and writing instructors. The same kind of instructional pattern should underlie the writing of theses, dissertations, and journal articles. These are subclass 1 writing because they are essentially of the same genre as journal articles, addressed to a narrow audience of comparably trained peers. Thus an English teacher could routinely meet with dissertation students, not as a member of the committee but as part of a dissertation seminar. (The logistics of such an arrangement are no more forbidding than any interdisciplinary cooperation, since one English teacher could work with a number of dissertation students in several disciplines simultaneously.)

Subclass 2 and 3 writing can be taught by English instructors alone, although ideally subclass 2 writing would be taught as an adjunct, this time with the discipline instructor as junior partner. The difference between undergraduate and graduate instruction would depend on level of material and intended career. An undergraduate training for a technical writing career would need to know how to write instructions and how to write for administrators about products and services. A graduate contemplating a career in research must learn to write policy analysis.

Perhaps the idea of writing classes at the graduate level seems incongruous, even demeaning. However, we are not talking about remediation, but about training for kinds of writing formerly not acknowledged. Research institutions, as well as government departments and industry, try to meet the need by offering their employees in-house training. Law schools now have English departments. Despite instructors' expertise, such courses are patch-up jobs at best, for the university is the place where such skills should have been practiced.

So we have a program where at least six courses (or forms of instruction) are offered. We can arrange them on a spectrum: at one end, subclass 1 writing, the courses are primarily discipline-oriented, with writing instruction adjoined; at the other, subclass 3, they are writing-oriented. In the middle, subclass 2, the courses are writing-oriented, but need disciplinary monitoring, perhaps by the students themselves as they check each other's accuracy.

Now comes the second principle, an obvious corollary: practical writing instruction belongs in no single department. Behind the claims for expertise which began this paper may lie a fear of institutional complications--if instruction is located in a single department, things are much simpler. True interdisciplinary teaching requires an extradepartmental unit which will mediate academic credit, faculty assignments, and scheduling. At UCLA, such a unit has been established as UCLA Writing Programs, under the directorship of Professor Richard A. Lanham. Funded by Executive Vice-Chancellor William D. Schaefer, formerly Executive Director of the Modern Language Association, UCLA Writing Programs is an anomalous unit loosely connected to the English department but with its own staff, lecturers, and physical location. It responds to expressed needs for writing instruction of precisely the kind we are discussing--help at the graduate level with dissertations and policy analysis, at the undergraduate level with component and adjunct writing courses attached to courses scheduled in other departments. It suffers the problems of detachment from a regular academic department, for its teaching staff are hired annually and are neither faculty nor administrative personnel. Its financial status is not institutionalized. Thus, it exemplifies both the risk and the opportunity of an interdisciplinary solution to writing instruction in the university.

A final principle: practical writing instruction should be attached to central, basic courses in the discipline. Sticking a writing segment into a course entitled "The Engineer's Social Responsibility" (no course so far as I know has such a title, although there are similar offerings) confirms the students' belief that writing is not taken seriously by the faculty and need not preoccupy them. Enlightened departments will arrange for students to take at least one mainstream course a year which includes writing during their final three years. At a minimum, a student should emerge with experience in each of the three subclasses.

A program based on these principles would have the virtues of a good treaty. It would end hostilities, promote futurue cooperation, and allow all parties to feel victorious. There are no losers when everyone--students, teachers, future employers--stand to gain.

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TOWARD DEFINING "GOOD" WRITING: A RHETORICAL ANALYSIS OF THE WORDS, SENTENCES, AND PARAGRAPHS IN 16 INDUSTRIAL SCRIPTS

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INTRODUCTION

The report on research which follows addresses a significant problem of technical and scientific writing and, in particular, of recent theory and practice in writing across the curriculum programs.[1] These programs and the theory which informs them have proceeded as if teachers of English and technical writing and teachers of writing in all disciplines agreed on a definition of "good" writing. However, in workshops offered to interdisciplinary faculty groups at Michigan Technological University it became obvious that we could reach no satisfactory agreement on a definition of good writing. In addition, no systematic research or study has attempted to define the features of writing which would go to make such a definition. English departments, and universities in general, have shown little or no interest in such an investigation and have proceeded to teach technical writing as if such information had no bearing on pedagogy or on a student's efforts to learn to write well for industrial and business audiences. Joseph Williams, lamenting this situation, notes " . . . we know next to nothing about the way individuals judge the quality of writing in places like Sears and General Motors and Quaker Oats. What counts as good writing at Exxon? . . . It is the obligation of universities to support the research that would tell us, so that we would know what to teach . . . and yet virtually no such research exists."[2] Our intention in undertaking this research was to move toward forming such a definition.

We wanted to know, or at least to begin to answer, the following: What constitutes good writing in the real world? What kind of writing will students actually do after they leave the university? To what extent are the features of this real-world writing determined by aim, mode, and audience? Does the English teacher's definition of good writing, as indicated by textbook maxims, have any substantial connection to the writing students will be expected to produce in industry and business? Does current pedagogy actually prepare students to write as they will have to outside of the English class? In asking these questions we are aware of a number of problems associated with beginning such research. First, this research must initially identify a wide range of features from writing considered good by readers in industry and business. We begin then with an assumption that good writing is not exactly a product or object but, to some extent, a perception of a product. That is, readers define the quality or the success of a piece of writing. We embark, therefore, on research which initially derives from the observations of specific readers. While aware of the problems inherent in such research and particularly in the tentative kinds of conclusions which we can draw from it, we see no other way to start. The analysis of published writing in popular journals, e.g., Harper's, The Atlantic Monthly, The Saturday Review, has been extensively used by researchers like Kellogg Hunt and Richard Braddock, but for our purposes such sources are inappropriate. Analysis of student writing is not at all to the point, nor is analysis of process at this time. We have been concerned, in fact, that composition theory and pedagogy have shifted too much toward the composing process with a resultant neglect of the product. Knowledge of the process of writing will not, by itself, enable students to write better products since the process itself may be determined by the form the product must assume. This is especially true in industry and business where formats and textual features are often fairly rigid. In addition, most theories of process include among the stages of the process frequent stages of revision. When revising, a writer must make corrections or additions to his work. Whatever name we give to a writer's sense of completion we assume that the writer must know when he has arrived at some closure (even if only at a point where he wishes to submit the writing to another reader). This requires that the writer has the ability to read his work. Students must understand what constitutes a successful piece of work across a variety of disciplines, in business, and in the general world of work. The most economical way to do this is to examine what passes for good and successful writing in a field and then to go through the processes which produce similar writing. At every revision, however, the student must be able to read his own and his peers' work with a consciousness of the important features required.

Our concern is to begin to identify those features of technical/industrial writing which appear consistently across a variety of written modes and which professional writers use for a variety of purposes. The analysis of any single feature for statistical reliability and validity remains, we are aware, for future follow-up research.

The central purpose of our work is to develop a wide-ranging list of features. Our study depends on the analytic tools generally associated with literary research--close reading and careful textual analysis. Any such research suffers from certain subjective limitations. For example, reading a paragraph and deriving the topic sentence depends on what a reader considers to be the thesis of the paragraph and of the whole discourse. We usually agreed about such matters, but, on a significant number of occasions, we disagreed. Such disagreements had to be resolved through re-reading and discussion (future researchers might well wish to work with a number of trained readers, a luxury we could not afford). Indeed, once we were past the analysis of features which we could easily count or define (the limits of a sentence, subordinate clauses, T-units, passive or active voice) we found it much more difficult to come to exact agreements. This fact perhaps sheds some light on the subjective nature of the reading process, even of technical discourse. Certainly it explains the hesitancy of many empirically trained researchers to tackle the problem.

METHODOLOGY

Because we required writing identified as good by industry and business readers our first task was to collect samples from them. We requested samples from a variety of industrial sources, e.g., IBM, ALCOA, Exxon, Weyerhaeuser, Bell Labs, Underwriters Laboratories, Dow Chemical, U.S. Steel, Onan Corporation, and others. We tried to identify writers within the industry or business, that is, individuals specifically involved with producing or reviewing writing done in the work place. They ranged from members of technical writing departments to superintendents of divisions within corporations. We asked for writing which "would serve as a model for incoming or present employees--the kind of writing you want done in your office or corporation." We requested that the samples fall into two broad categories: writing which primarily informed and writing which primarily persuaded. Within those categories we requested writing directed at two audiences: a specialist audience and a lay audience. We received 57 pieces of writing from industrial/corporate sources. This paper reports on the analysis of 16 complete pieces of discourse--four samples from each possible category (a piece to inform a lay audience, a piece to inform a specialist audience, a piece to persuade a lay audience, a piece to persuade a specialist audience).

While we collected our samples, we designed analysis sheets for each of the five levels we intended to study: 1) word level 2) sentence level 3) paragraph level 4) discourse level 5) readability. At each level we had to decide what features we wanted to examine and whether or not each feature could be quantified. At the word level, for example, it was easy to establish percentages of monosyllabic and polysyllabic words; it was impossible, however, to count specialized words with absolute precision because of the subjectivity or relativity inherent in the concept "specialized." Similarly, at the paragraph level it was easy enough to count words and paragraphs per discourse, but it was much more difficult to tabulate methods of organization and development. In designing these analysis sheets, we also had to establish consistent procedures for examining each text since we would read the text separately. We had to decide how much of each sample actually to study and how to locate those passages within the overall discourse. These early decisions, along with some trial readings, resulted in a fairly tight and consistent analysis of scripts. For the present report we have completed analysis of the first three categories. This includes, at the word level, amount of syllabism, verb selection, nominalizations, and vocabulary choices. At the sentence level we counted T-units, measured sentence length, clause length, and degree of subordination, and determined syntactic order. On the paragraph level we examined patterns, methods of development, frequency and placement of topic sentence, propositional hierarchy, and the use of transitions.

WORD LEVEL

Considering the limitations set out above, we offer these conclusions and comments. Since the work of Herbert Spencer, handbooks and textbooks on composition have urged the use of the shortest possible words and sentences; such advice has taken a number of forms which correspond to this maxim--use concrete, specific terms, familiar to your readers. As interest in the readability of texts has increased, textbooks have begun to say the same thing to a slightly different purpose. For instance, Houp and Pearsall in their technical writing text Reporting Technical Information say " . . . the use of shorter words and shorter sentences correlates positively with ease in reading . . . "[3]

As Figure 1 (below) shows, the writers of our samples (and the readers who selected the samples) paid little attention to the maxim to use shorter words. Instead, the samples showed writers using familiar words or repeating words. The industrial writers we surveyed used polysyllabism or high density words twenty percent of the time.

Figure 1 WORD LEVEL

	Persuade Specialist	Inform Specialist	Persuade General/Lay	Inform General/Lay	Total
Total Words	1263	1221	1210	1222	4916
% Monosyl.	59.9	57.90	53.14	56.14	56.77
% Disyl.	22.25	23.26	24.88	20.87	22.82
% Polysyl.	17.81	18.84	21.90	22.99	20.39
Total Verbs	111	93	94	101	399
% To Be	18.01	25.81	30.85	9.90	21.14
% Active	57.66	54.84	48.94	69.31	57.69
% Passive	24.32	19.35	23.40	20.79	21.97

This is a higher percentage of polysyllabism than found in some critical, theoretical works, e.g., E. D. Hirsch's Philosophy of Composition, Francis Christensen's Notes Toward a New Rhetoric, and Richard Lanham's Style: An Anti-Textbook. The fact that technical writing contains more syllabism than theoretical material in composition might be explained by a need in technical discourse for specialized words or "high density" words. However, this idea is undercut by the level of polysyllabic usage in the specialist categories. Rather than using more specialized, high density words writers used less (17.8 and 18.8 percent vs. 21.9 and 22.9) when addressing a specialist audience. In part this may be explained by the tendency of the authors of the samples we analyzed to dispense with pronoun usage and rely instead on noun repetition. This tendency is particularly strong in writing for a specialized audience, e.g., service or operational manuals for engineers. In addition we should consider the advantages to readability of repetition since it increases the cohesion of the whole discourse and, in particular, raises the reader's level of expectation and confirmation--both essentials to reading ease.

Academics in scientific disciplines disagree with technical writers and textbook maxims on the question of passive voice. Academics in engineering and physical and social sciences strongly believe in the necessity and appropriateness of the passive voice in their writing. Technical writing texts increasingly decry usage of the passive and English teachers have long urged students to write, where possible, in the active voice. Our sample suggests that across all modes and for both lay and specialized audiences industrial writing abjures passive voice except in fairly obvious places (where the active voice would have required awkward rewriting). Passive constructions appeared 22% of the time across all modes and audiences. Writers used the active voice between 49%-69% of the time. These figures support the advice of textbooks and English teachers to avoid the passive voice wherever possible. These writers _did not_ use passive constructions 79% of the time. The use of "to be" forms as copula or state of being, of course, may often prove necessary. Students frequently confuse the passive with legitimate and requisite uses of "to be" and with use of first person--they often think that first person _per se_ is active voice. This appears especially true when science or engineering majors attempt to re-learn the use of active voice. It may, therefore, prove especially valuable to teach students how to change passive forms to active forms (see for reference Richard Lanham's _Revising Prose_ and _Revising Business Prose_, New York: Scribners, 1978, 1980 respectively).

SENTENCE LEVEL

Technical writing textbooks urge writers to maintain a simple, clear style. In order to accomplish this many texts urge writers to use shorter sentences. Houp and Pearsall, who may be taken as typical, argue that readability of a text is enhanced when sentences are kept short. In part, they base this dictum on Rudolph Flesch's work which suggests that readability relates positively to sentence length. Since Flesch first proposed his scale of readability a number of researchers have tried to more accurately define syntactic maturity. Kellogg Hunt, for instance, argues that sentence length is a poor indication of syntactic maturity because it fails to take into account the immature writer's use of series of coordinate clauses linked by coordinate conjunctions (most frequently the conjunction _and_). Hunt, in his article "A Synopsis of Clause-to-Sentence Length Factors," advances the thesis that mean clause length and mean T-unit length are the best of all indices of "grade level" (a T-unit is defined as a main clause and any subordinate clauses attached to the main clause).[4] In the same article Hunt revised La Brant's index for assessing amount of subordination. Hunt's method gives a simple ratio of subordinate clauses to main clauses and provides a researcher with a clear sense of a writer's use of subordination. Figure 2, on the following page, gives the results of our analysis of industrial writing at the sentence level.

Figure 2 SENTENCE LEVEL

	Persuade Specialist	Inform Specialist	Persuade General/ Lay	Inform General/ Lay	Total	Hunt's Superior Adult
Total Words	2506	3704	3342	3142	12694	
# of Sent.	136	167	133	165	601	
# of T-Units	149	178	172	180	679	
# of Clauses	196	274	263	249	982	
# of Main Cl.	148	183	172	177	680	
# of Sub. Cl.	48	89	91	72	300	
Avg. Word/ Sent.	18.25	22.27	25.09	18.99	21.15	24.7
Avg. Word/ T-Unit	16.74	20.82	19.45	17.42	18.61	20.3
Ratio T-Unit/ Sent.	1.09	1.07	1.29	1.09	1.14	1.24
Ratio Clauses/ Sent.	1.31	1.54	1.53	1.38	1.44	1.74
Avg. Word/ Clause	12.78	13.52	12.71	12.62	12.91	11.5
Sub. Clause Index	1.32	1.49	1.53	1.41	1.44	1.78

The writing we examined fell above Flesch's limits for readability at the "standard difficulty" level: 17-21 words per sentence (our sample showed a mean sentence length of 21.15). At the same time, our sample produced results considerably lower in both mean sentence length and mean T-unit length than Hunt's figures for "superior adults." Using these indices alone we might mistakenly conclude that industrial writers are less "mature" than the writers Hunt studied. However, Hunt examined samples which do not represent writing in the world of work--they differ widely in audience, purpose, and discourse mode from the samples we analyzed. We would expect these differences to affect the syntactic and semantic choices an author makes as he writes. In addition, the writers of our sample produced a higher mean clause length than did Hunt's "superior adults." Hunt established mean clause length as a significant measure of syntactic maturity. How may we explain these apparently contradictory results?

There are two factors to be considered in understanding the differences between our figures and those Hunt obtained. One, studies by Crowhurst and Piche (1977) and Rosen (1969) offer some evidence to suggest that differences in the aims, audiences, and modes of discourses will affect their syntax.[5] Two, we may expect the industrial authors whose writing we examined to make syntactical choices based on readability (even if intuitively). Research in psycholinguistics suggests that coordinated structures are more easily processed than subordinated ones.[6] E. D. Hirsch cites a number of studies showing that the clause represents the primary unit of semantic determinacy.[7] Clarity at the main clause level, Hirsch claims, is primary to understanding because deeper embeddings of information (e.g., subordination) are more difficult for readers to process. Where clarity is a significant factor in a discourse we may expect, therefore, a decrease in subordination. Certainly clarity was a major factor in the writing we examined. And, as might have been expected, the writers whose work we analyzed used significantly less subordination across all modes than did the authors Hunt examined (.44 to .78 subordinate clauses per main clause). Hunt points out that T-units, clause length, and subordination are interrelated so that T-unit length increases with larger main clauses and greater subordination. In this case, T-unit length decreases because the drop in subordination is great enough to offset an increase in clause length. The writers of our sample appear to achieve clarity in part by limiting subordination; indeed, they demonstrate considerable skill in producing clarity through word and phrase repetition and through coordination. Such a practice is clearly supported by psycholinguistic findings regarding clauses and subordination. Our own research suggests that further comparative studies need to be carried out to determine the effects of audience and discourse modes on the syntactic forms found in mature writing which serves widely varied purposes. Such study would have special significance for teachers who must move among a variety of composition courses and might lend support to case study pedagogy in particular. As we moved from the word and sentence level to the paragraph level we saw the tendency for carefully controlled subordination reinforced through headings and by means of coordinated paragraph development.

PARAGRAPH LEVEL

Here we asked five basic questions: How frequently were topic sentences used? Where in the paragraph were they located? How were the paragraphs organized? What methods of development were employed? What cohesion strategies were most prevalent?

At this level we quickly discovered that we were dealing with a much more complex and ambiguous unit of discourse. With the word and sentence levels we had been able to divide the scripts between us; after reading only one sample at the paragraph level, we realized we would both have to read each text, then compare/contrast our conclusions. If there was disagreement, we had to talk until we resolved the problem. Part of our difficulty was perceptual. One of us would see a topic sentence; the other wouldn't. One of us would see a set of hierarchical relationships among sentences; the other would perceive an alternate set. Another problem was the difficulty of content. Many of the samples contained highly technical language, and our attempts to analyze were often complicated by our attempts to understand. And of course because reading is an individual act and because readers bring different sets of personal experience and expectations to a text, each of us at times "interpreted" paragraphs differently. A third problem was created by our methodology. We had decided to select paragraphs from three locations in each text, these three passages amounting to about 1,000 words. We were not, therefore, reading the entire discourse, but rather excerpts from it. Thus we were reading paragraphs out of context of the whole discourse. Paragraphs operate within a rhetorical field, and our approach neglected this field. Consequently, the logic of a paragraph which a writer had established earlier in the discourse sometimes remained unclear.

Previous studies of the paragraph generally suffer from two deficiencies. First, they usually do not classify their samples by audience and discourse mode in order to see how these two main variables affect paragraphing. Second, they draw their samples either from student writing or from The New Yorker, Harper's, or The Atlantic Monthly, ignoring the fact that few of our students will be writing for such audiences and implying that the textual demands of these publications apply equally well to writing in the world of work. We designed our project to remove both of these deficiencies.

Our first concern was the frequency with which industrial writers used topic sentences. Since Alexander Bain in the late nineteenth century, traditional writing texts have advised students to begin each body paragraph with a controlling generalization. Little actual research confirmed this advice until the mid-1960's when Francis Christensen's analysis of a number of paragraphs written mainly by professional writers concluded that most paragraphs have topic sentences and these most frequently come first.[8] But in 1974 Richard Braddock found in his study of 889 paragraphs by professional writers in major popular magazines that "considerably fewer than half of all the paragraphs in the essays have even explicit topic sentences, to say nothing of simple topic sentences."[9] Given these contradictory findings, what are we to tell our students? Furthermore, since both studies rely on a type of discourse which our students will normally not be required to produce, are they of any relevance at all to teachers who must prepare students for more practical writing tasks? It was our conviction from the outset that if we must be prescriptive, we should be so on the basis of a relevant sample; that is, we should find out what paragraphing expectations students will have to fulfill when they write on the job.

Since we have looked at only 16 texts, any conclusions we draw must be tentative and suggestive at this point. The 16 scripts, covering our four categories and encompassing a fairly broad range of discourse types, yielded 180 paragraphs. Of these, 29 contained only one sentence. In looking at these paragraphs, we wanted to find out how many of them contained explicit or implied topic sentences and how many had no topic sentence. By "explicit" we mean a single sentence which clearly serves to unify the remaining sentences in the paragraph. We were very cautious about identifying implicit topic sentences because of the inherent subjectivity of such a process. Therefore, we granted the "implicit" status only when we could quickly agree on what the sentence would say had it been stated. Figure 3 shows the results of our analysis of topic sentence frequency.

Figure 3 TOPIC SENTENCE FREQUENCY: N = 151 PARAGRAPHS

	Persuade Specialist	Inform Specialist	Persuade General/ Lay	Inform General/ Lay	Total	%
PARAG	28	48	36	39	151	-
EX TS	16	26	21	20	83	55
IMPL TS	1	2	2	2	7	5
NO TS	11	20	13	17	61	40

Our results come closer to supporting Braddock's findings than those of Christensen. That is, topic sentences do not control paragraphs nearly as often as Christensen and textbooks would have us believe. We found explicit topic sentences only 55% of the time in paragraphs longer than one sentence. Forty percent of our sample had no topic sentence. If we add back the one-sentence paragraphs and tabulate percentages for all paragraphs, we find that 50% have some kind of controlling topic sentence (explicit or implied); only 46% have an explicit topic sentence, a figure which compares favorably to Braddock's 45% explicit for all paragraphs. Although we do not yet have adequate numbers for our individual audience and function categories, one interesting trend does appear. The informative function has a clear edge over the persuasive, 55% to 45%, in the use of explicit topic sentences. The two main audience categories divide the explicit topic sentences almost equally.

Our second concern was the location of topic sentences. Traditionally, textbooks and some readability studies have favored the first sentence of a paragraph as the best location for the topic sentence. Christensen agreed. Braddock, however, found otherwise, concluding that only 13% of the expository paragraphs in his sample opened with a topic sentence.[10] Figure 4 shows the breakdown for the 83 paragraphs in our study which had explicit topic sentences:

Figure 4 TOPIC SENTENCE LOCATION:
N = 83 PARAGRAPHS WITH EXPLICIT TOPIC SENTENCE

	Persuade Specialist	Inform Specialist	Persuade General/ Lay	Inform General/ Lay	Total	%
TS First	13	24	18	19	74	89
TS Mid	1	1	1	1	4	5
TS Last	2	1	2	0	5	6

Our sample suggests that if writers used an explicit topic sentence, they put it in the initial position 89% of the time. For all paragraphs longer than one sentence, the figure drops to 49%. For all paragraphs in our sample, 41% of them open with a topic sentence. Again, function seemed to influence topic sentence location. The informative mode used the initial position 58% of the time; the persuasive mode, 42%. Audience seemed to play little role. Clearly, writing in industry depends more heavily on the topic sentence in the initial position than does writing intended for popular magazines. Yet such topic sentences play less of a role than textbooks generally suggest. Nevertheless, the advice remains sound, for we found that other strategies such as sub-headings and layout often contributed to the top down arrangement which the initial position topic sentence effects. These supplementary strategies relieved the opening sentences of paragraphs from some of the responsibility for the deductive pattern. Students must be able to handle this top down pattern, but they should be able to effect it through ways other than just initial topic sentences.

Our third concern was paragraph organization. Most texts describe such patterns as the "general-to-particular" and "particular-to-general," often with variations such as "general-particular-general." The general-to-particular pattern is the basic model offered to student writers. Christensen, in his work on paragraphs, speaks of pattern in terms of "direction of movement" or "levels of generality," and we found these concepts useful in attempting our own classification of paragraphs.[11] As we read each paragraph, we looked for the superordinate generalization, then tried to determine what hierarchical relationship the remaining sentences bore to it. We were interested in where the superordinate generalization came in the sequence; in other words, did the paragraph move away from or toward this key sentence? If the former, we used Christensen's term "cumulative"; if the latter, we called it "periodic." Those were our only two classes at the outset, but it did not take long for us to discover a third type, what we came to call the "coordinate sequence." We were aware of Christensen's use of that label to describe one of the most basic paragraph types--a topic sentence followed by a series of subordinate sentences which were coordinate to each other. We use the term to describe a paragraph which has no single superordinate sentence. A paragraph, to earn this label, had to have two or more top-level sentences of equal rank. Each of those top-level sentences might have sentences subordinate to it, but there had to be at least two of these top-level sentences parallel to one another. Figure 5 summarizes our findings.

Figure 5 PARAGRAPH ORGANIZATION: N = 180 PARAGRAPHS

	Persuade Specialist	Inform Specialist	Persuade General/ Lay	Inform General/ Lay	Total	%
Cumulative	15	25	21	21	82	46
Periodic	2	3	2	0	7	4
Coordinate	3	18	8	9	38	21
One-Sen. Parag.	10	5	6	8	29	16
Others	--	--	--	--	24	13

Our study suggests that the general-to-particular pattern is far less dominant than texts and teachers lead students to believe. Only 46% of our paragraphs were organized this way. The periodic paragraph appears to be of minimal value to writers in industry, only 4% reflecting this pattern. Most interesting, we feel, is the fact that 50% of our paragraphs were what we called "atypical." The coordinate sequence appeared most frequently in this atypical category, showing up 21% of the time. One-sentence paragraphs (16%) occurred consistently in our sample. The "Others" category (13%) consisted of transitional paragraphs and several other fairly rare patterns which did not fit the three primary groups. All of these figures clearly undercut traditional dictums about paragraph pattern.

Our fourth concern, paragraph development, was informed by this question: Does instruction in the traditional methods of paragraph development have any value? Most of the traditional methods derive from the rhetorical modes--description, narration, classification/division, comparison/contrast, cause-effect, and so on. Other methods which texts frequently cite are reasons, examples, enumeration, and question-answer. We wanted to know how much good writing in industry relied on these traditional methods of development. In 1970 Richard Meade and Geiger Ellis reported the results of their research on paragraph development in three sources: The Saturday Review, English Journal, and a morning daily newspaper, the Richmond Times-Dispatch.[12] They found that traditional textbook methods were used less than half the time in the 300 paragraphs they studied. In 56% of the paragraphs no textbook method was employed.

The Meade-Ellis study is interesting, but how relevant is it to writing in industry? Looking for an answer to this question, we studied the 180 paragraphs in our sample to see if any particular methods of development dominated. Rather quickly we dropped the idea of finding one central method in each paragraph, for it was clear that many of the paragraphs in our sample relied on a combination of methods, traditional and atypical. (Meade and Ellis found this combination tactic in nearly 21% of their sample. So we altered our approach, deciding to count each occurrence of a method. Figure 6 contains the results.

Figure 6 PARAGRAPH DEVELOPMENT (201 Occurrences)

Method	Persuade Specialist	Inform Specialist	Persuade General/ Lay	Inform General/ Lay	Total	%
Traditional:						
Reasons	4	2	7	4	17	9
Example	0	6	2	2	10	5
Analogy	0	0	0	0	0	0
Contrast	1	9	5	3	18	9
Cause-Effect	2	9	4	6	21	11
Classif.	2	1	0	1	4	2
Chron.	1	0	6	11	18	9
Enumer.	6	2	9	6	23	11
Descrip.	4	0	0	1	5	2
Ques.-Answ.	0	0	0	0	0	0
Atypical:						
Elabora.	8	14	17	11	50	25
Logical Chain	1	2	3	1	7	3
Process	1	9	0	9	19	10
Analysis	1	2	0	0	3	1
Definition	0	1	1	0	2	1
Tech. Desc.	0	2	0	0	2	1
Prob/Solut.	2	0	0	0	2	1

Most interesting is the finding that roughly 58% of the identified methods of development fell into the traditional category, reasons, contrast, cause-effect, chronology, and enumeration being the most frequently employed. Nearly as interesting was the emergence of a method which did not match up adequately with textbook descriptions, a method which cut across function and audience categories and which we labelled "elaborative." Paragraphs employing this method begin with a superordinate generalization, then the remainder of the paragraph fleshes out this generalization at lower levels of abstraction. The subordinate sentences do not constitute examples; they provide texture for the initial abstraction. Once we saw this method and labelled it, we began to see it often. How much this was a matter of making paragraphs fit our newly created expectation is difficult to say. Nevertheless, we found this method occurring 25% of the time, and our results parallel to some extent those of Meade and Ellis, who identified a non-traditional method which they called "additional comment" and which showed up in 19% of their paragraphs.

These findings, when added to those pertaining to paragraph organization, suggest that traditional methods of development should be taught, that writers in industry use the methods and the thinking implicit in them frequently. However, greater attention in our classes should be paid to the combining of methods within paragraphs and to thinking and writing strategies which encourage students to manipulate levels of abstracting and hierarchical relationships. So dominant was the presence of this skill at the paragraph and discourse levels that we believe it should be a central objective of all expository writing courses.

At this stage we can offer only impressions regarding our final paragraph concern, cohesion. We are still working on our methodology, which has been influenced by Halliday and Hasan's Cohesion in English. Basically, we examined each paragraph for those primary lexical and grammatical features which bound the sentences together into a coherent unit. Our checklist contained the following techniques, most of which are found in textbook discussions of coherence: pattern, sentence pattern repetition, consistent person and subject, pronoun reference, word and phrase repetition, and transitional words and phrases. Rather than attempting to qualify each of these, we elected to estimate the degree to which each of these functioned in the paragraphs.

We can offer these tentative conclusions about our sample: 1) Pronoun reference played less of a role than we had expected. Writers in industry appear to prefer repeating a key word rather than substituting a pronoun for it, choosing to risk monotony over ambiguity; 2) Repetition--of sentence patterns as well as words and phrases--proved to be a very strong device for achieving coherence; 3) Transitional words and phrases proved to be less prevalent than we had expected, playing a negligible role in at least 25% of our paragraphs; 4) Writers generally failed to keep a grammatical subject consistent throughout a paragraph. They kept the general topic consistent, but opted for "grammatical chaining" i.e., converting a grammatical element from the preceding sentence into the subject of the succeeding sentence so that a chaining effect occurs throughout the paragraph; 5) Graphic and typographic features of a text play an important role in coherence at both the discourse and paragraph levels. These visual components of texts should, therefore, be explored more fully in writing classes.

NOTES

[1]For background on the concept of writing-across-the-curriculum see James Britton, The Development of Writing Abilities (11-18), London: Macmillan Education Press, 1975; Randall R. Freisinger, "Cross-Disciplinary Writing Workshops: Theory and Practice," College English, 42 (October, 1980), 154-166; Randall Freisinger and Bruce Petersen, "Writing Across the Curriculum: A Theoretical Background," Fforum, II (Winter, 1981), 65-67, 92; Toby Fulwiler, "Showing, Not Telling, at a Faculty Workshop," College English, 43 (January, 1981), 55-63.

[2]Joseph Williams, "Linguistic Responsibility," College English, 39 (September, 1977), 13.

[3]Kenneth W. Houp and Thomas Pearsall, Reporting Technical Information, 4th ed., Beverly Hills, Calif.: Glencoe Press, 1980.

[4]Kellogg Hunt, "A Synopsis of Clause-to-Sentence Length Factors," English Journal, 54 (April 1965), 308.

[5]Marion Crowhurst and Gene L. Piche, "Audience and Mode of Discourse Effects on Syntactic Complexity in Writing at Two Grade Levels," Research in the Teaching of English, 13 (May, 1979), 107-109, and Harold Rosen, An investigation of the effects of differentiated writing assignments on the performance in English composition of a selected group of 15/16 year old pupils, unpublished doctoral dissertation, University of London, 1969.

[6]Walter Kintsch and J. Keenan, "Reading Rate and Retention as a Function of the Number of Propositions in the Base Structure of Sentences," Cognitive Psychology 5 (1973), 257-74.

[7]E. D. Hirsch, Jr., The Philosophy of Composition, Chicago: University of Chicago Press, 1977, p. 109.

[8]Francis Christensen, "A Generative Rhetoric of the Paragraph," CCC, 16 (October, 1965), 144-156.

[9]Richard Braddock, "The Frequency and Placement of Topic Sentences in Expository Prose," RTE, 8 (1974), 299.

[10]Ibid, p. 301.

[11]Christensen, p. 21.

[12]Richard Meade and Geiger Ellis, "Paragraph Development in the Modern Age," English Journal, 59 (February, 1970), 219-226.

RESEARCH IN THE COMPREHENSION OF ENGINEERING LECTURES BY NON-NATIVE SPEAKERS

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PROBLEM

Lectures are a critical mode of instruction in American universities, yet many non-native speakers of English (foreign students) have severe problems understanding even well-structured and well-presented lectures. In many science and engineering courses where the lectures often do not repeat the text, non-native speakers having trouble with lectures simply miss important course material; there is no text which extra effort will master, a fact too frequently noted by professors and documented by Holes, Morrison, James, and Wijasuriya. This problem affects us as technical writing teachers since many of us are faced with non-native speakers in our courses or are called in by technical departments to help train the non-native student to be more effective.

The number of times this occurs will vary, but we might note that foreign student enrollments in the United States as reported by The Institute of International Education have risen from 203,070 in 1976-77 to 286,340 in 1979-80, and this rise is expected to continue. Further, we should note that approximately 70% of all foreign students are studying science and technology, and that in some fields their concentration is remarkable. For instance, foreign students account for over 50% of the graduate enrollment in some departments at the University of Michigan College of Engineering.

What can we do to help reduce the lecture comprehension problems encountered by numbers of our foreign students, especially incoming students? To answer this question, a study was commissioned by the University of Michigan Graduate School to determine the cause(s) of problems in lecture comprehension especially amoung science and engineering students. This paper presents the results of that study.

BACKGROUND

The hypothesis traditionally offered for foreign students is that such problems with lecture comprehension derive solely or principally from linguistic shortcomings, that is, from difficulties with pronunciation, vocabulary, and accents compounded by fast speech phenomena. On the surface there seems to be some merit in such a hypothesis. However, our research and that by several British applied linguists suggests that while linguistic shortcomings may contribute to incomprehension, they are certainly not the only impediments or even perhaps the most serious ones. Holes attributes much of the problem to the students' lack of culture-bound knowledge and their inability to interpret speaker's intentions; Wijasuriya and Morrison stress the students' inability to perceive discourse markers and logical relationships and connectives; and in addition to stressing these points, Candlin and Murphy also stress problems in speech perception and problems in identifying the role of cohesion, coherence, intonation, and movement (or kinesics).

SUMMARY

All of the problems listed above surely contribute to incomprehension, especially for students with quite low-level skills in English. However, after some weeks of accommodating to varying speaking styles, slightly more advanced students can often handle pronunciation, vocabulary, accents, local discourse markers, and connectives even though they still can't comprehend lectures.

Our research suggests that one main problem for such students is that they fail to perceive the rhetorical structure or overall organization of a lecture and are thus unable to integrate the individual bits of information they do hear into any meaningful context. (This result is quite consistent with the research literature in psychologistics and cognitive psychology.) Equally seriously, students often fail to perceive the organizing role of theory in structuring activities in their field. In particular, engineering students failed to identify the role of theory in the problem-solving process that underlies engineering itself; they frequently did not see engineering as a series of on-going problems where each stage of solution exposed new problems to be solved.

These results have significant implications for course planners and material designers; instruction on lecture comprehension for non-native speakers (and interestingly enough for some native speakers) might focus significantly on discourse-level structures and the cues native speakers use to expose those structures. These cues have been described by Candlin and Murphy in some detail.

METHODOLOGY

Our methodology involved selecting stimulus materials, exposing both native and non-native subjects to these materials, and then analyzing protocols the subjects provided for completeness and accuracy of comprehension. The materials, subjects and procedure are described in more detail below.

Materials: To provide a sample lecture for our subjects, we choose a 16-minute videotaped lecture segment on fracture mechanics from a first year graduate course in Mechanical Engineering. It met the criteria we had established for such a sample lecture: it was authentic (was a real class lecture), had a level of subject matter understandable to non-majors in its field, was comprehensible as an isolated segment independent of context, and was well-organized, clear, and coherent in itself.

As the appended material illustrates, the lecture segment describes how a crack moves through a substance and how such crack movement (or crack propagation) can be stopped. The content of the lecture has been clearly understood by freshmen and non-engineers in a variety of fields such as political science and banking, linguistics and education. A transcript of the first ten minutes of the segment appears in Appendix A; a tree-diagram of the entire lecture appears in Appendix B.

Subjects: The subjects for this study were fourteen non-native speakers of English and six native speakers. The non-native speakers included ten graduate students and four undergraduates from nine different countries and eight different fields of engineering, plus physics. The native speakers (all Americans) included three undergraduates in engineering and three post-graduates without engineering backgrounds.

Procedure: All subjects were instructed to listen or watch for "main ideas" and to take notes as they would in a regular lecture situation. They were then asked to explain what the lecturer had said as if they were telling a friend who had missed the lecture but who needed the lecture material to prepare for a test. In this task, they were allowed to use their notes and to take as much time as they needed. Thus, all of the subjects produced immediate-recall protocols from notes, and several subjects also participated in follow-up interviews. The protocols were tape-recorded, transcribed, and analyzed for completeness and accuracy. A "successful" protocol was defined as one which identified the problem-solution structure of the lecture, which identified the relation of theory to tests of theory, and which captured the mechanisms and data points presented in the lecture.

RESULTS

The results of this study were somewhat surprising. Among the non-native speakers, three failed probably due to inadequate English (they produced protocols averaging only 82 words long). Six failed despite adequate English; they produced relatively coherent protocols averaging 349 words long, and they felt that they had understood the lecture segment. Four probably succeeded, and one definitely succeeded as illustrated in the protocol in Appendix C. Among the native speakers, three failed (including two engineering undergraduates) and three succeeded (including two non-engineers).

INTERPRETATION OF RESULTS

The traditional hypothesis attributes failure to linguistic shortcomings in pronunciation, vocabulary, and accents. However, this hypothesis does not account for our results. Six non-native speakers failed despite adequate English and their sense that they understood, but more confusingly, three native speakers failed whose English was perfectly adequate to the task. All of these subjects understood most of the details of the lecture; they had copious notes and produced long protocols. However, they didn't see how things fit together.

Thus, other factors than pronunciation and accent seem to be at work here. All of the failures missed the overall rhetorical structure of problem-solution and the organizing role of theory in the particular problem-solving process illustrated. Both the structure and role of theory are prominently cued, as indicated by the transcript in Appendix A, and both were stressed by gesture and intonation in the videotaped version of the lecture. In spite of the problem-solution cues, seven of the nine who failed were seemingly misled by narrative or chronological cues in the lecture: "Now, in the ... early 1960's ... then ... then ... " The remaining two failures focussed heavily on practical application, not on theory, even though much of the lecture dealt overtly with theory.

Why should these types of failure occur? Typically, science and engineering students take notes by copying what is written on the blackboard; they often minimize the role of introductory remarks, audio-visual materials, etc. Unfortunately, these minimized sections are exactly the parts of the lecture in which structure is outlined and main points emphasized. The student who merely copies off the board catches some individual points but often does not see how they fit together. To further complicate this issue, many non-native speakers are used to having professors in their home countries write the main points and the rhetorical structure in one corner of the board, each new point being added as it appears in the lecture. This is the equivalent of hearing "Now here comes the next main section of this lecture and it explains why the Cook-Gordon mechanism provided one type of solution to our problem of catastrophic crack propagation." Unfortunately for the non-native speakers, few American professors have such obvious signposts for their lectures, even though the lectures may be well organized and carefully delivered.

Our contention that missing the rhetorical structure of the discourse should create comprehension problems is quite consistent with the research findings in cognitive psychology and psycholinguistics. For instance, Meyer has argued from experimental results that items are better remembered and more easily processed if they are attached to an idea high in the organizational hierarchy of a text. Cirilo and Foss, Tenenbaum, Kieras, and Huckin have made similar arguments, Kieras and Huckin in particular for the function of topic sentences in technical texts. Kieras's arguments are based on experimental research and Huckin's on a wide survey of the research literature in cognitive psychology and psycholinguistics. Such insights have been incorporated into a seminal model of text comprehension and production by Kintsch and van Dijk.

One final point should be noted about this particular lecture type. Science and engineering are problem-solving professions, and science and engineering lectures often reflect this orientation. However, science and engineering students frequently do not see their fields as a series of on-going and inter-related problems to be solved, since much of their course material consists of isolated, pre-formed, and pre-digested "problems." The student has only to figure out which formula should be used to process the data given in the problem. He or she rarely has to eliminate irrelevant data, find missing data, or reformulate a poorly formed or misleading problem statement. Although these are important skills in the field, they are not skills demanded often enough of students and students often fail to have or perceive them. Thus, a kind of cultural conditioning tied to methods of science and engineering instruction seems to be largely responsible for the failure of our engineering subjects to "understand" this engineering lecture. If we are to teach students to understand and communicate more effectively, we may need to point out the organization of their fields as well as the organization of their discourse.

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Appendix A

Prof. Caddell on Fracture Mechanics

I indicated, I think, in early comments I made about Chapter 9, that probably the biggest single failure in the early days of composite work was the fact that if a crack started propagating it generally went catastrophically. For two reasons, really: One, although it's fundamental can be overcome, and that is that many of the matrix-fiber combinations were made of materials themselves that were fairly brittle--their strain-to-fracture, regardless of whether they were fiber or matrix, was low. But that has been overcome, and we'll talk about it in a qualitative way in just a second. The real problem is that there was no way to stop the crack from propagating because the fracture toughness of the material--that composite itself--was just too low. Now, in Figure 9-10, this is meant to illustrate--we used to run a little experiment in one of our courses where we took a single fiber of boron in an epoxy matrix and tried to get as good a bond along this interface as we possible could, hopefully making that as strong as possible. And inevitably, when those composites were loaded and they broke, usually the fiber cracked first--because its strain-to-fracture was smaller--That immediately tended to reduce, to some extent, the load carrying capacity (because now you've lost some of the stronger material as far as your cross-sectional area goes) and the crack would just catastrophically propagate: we couldn't stop it at all. That's all I'm implying here, that although in general--because of its larger sizes--I don't mean that the crack here has come about due to loading. If it were just pure loading, very often the first thing the crack is going to be a fiber because its fracture strain is lower than a matrix. But if a crack exists in a composite, it's more likely, on the average, to exist in the matrix because it's got a much greater area in which initial cracks could exist. So I'm just indicating here, suppose we did have a crack here, if this is a material of very low fracture toughness, the crack starts to propagate, we're almost getting back, you might say, to a Griffith-type situation, where the stress is maintained, as the crack length increases the stress required to cause continuing propagation really decreases, if you don't start dropping the loads off it's going to go catastrophically. And that is what happened with many many composites where the major factor was to try to make them as strong as they possible could, and people began to realize, well, we've got to do something to improve the fracture toughness.

Now, in the--I think it was the early 1960's, these two men named Cook and Gordon--uh, this book by Gordon, by the way, if you ever want to read a technical book that almost reads like a novel, I would highly recommend it, it's, uh--I always hate to push stuff like this, because you might think I have an interest in this book company, but it's a British company, it's called The New Science of Strong Materials, or Why You Don't Fall Through the Floor. So I think you can even tell from the title, it's kind of--it's a terrific book, really, I think you'd very much enjoy reading it. Paperback. But in this, uh, he talks about the use of different type materials, and one chapter on composites he goes into this discussion--

which I better draw a sketch here, because it really isn't completely shown in figure 9.11--is what I'm gonna refer to.

But suppose we had a crack in part, and over here we have a fiber. And we're loading it on this end. Now it turns out--and I can't prove this to you in two minutes here, you'd almost have to read the original paper--but making a stress analysis, Cook, I believe, probably did the analysis, found that ahead of this crack and at right angles to the applied load there actually is a tensile stress that's set up at this interface. In other words, even though the tensile effect is this way, there is a tensile result that occurs at right angles to the applied load.

Now you'd almost have to read the original paper to see why. The whole idea here when they theorize this, and uh on the basis of analysis at least, said that well you know if this crack starts to propagate in this manner, as it gets closer and closer to this fiber, if this--the tensile stress that's set up in this direction under this applied loading--if it exceeds what they refer to as the adhesive strength, that is, the strength normal to the fiber at this interface, if this stress gets large enough it may start to open up a crack along the fiber, uh, it will debond, in other words. Then, as this advancing crack comes into this region, finally--and I'm gonna highly exaggerate this--this type of argument indicated that two things could happen. One is that the debonding along here would open up new crack surface area; that requires energy (the energy that's stored in the body), so if you're gonna, if you can use some of this excess strain energy to cause debonding along the interface--where this crack is parallel to the applied load and that's not gonna be as dangerous to us as if it was at right angles to the load--that it is conceivable that all the excess strain energy could be used up to do this instead of having the crack continue across the section. Secondly, when the advancing crack runs into this region it sort of blunts it: it causes the entire crack shape to change, and a crack with that kind of configuration would be far less serious in general than one with a very sharp notch.

Now this was a theory that was proposed, and it turned out that experiments did tend to support it (and I'll indicate one in just a minute). But the key thing is, in this Cook and Gordon theory, it says that the debonding between the matrix and the fiber occurs before the crack reaches the fiber. So keep that in mind.

That was the proposed mechanism. It turns out it does not work for every combination of fiber-matrix materials. It's not a universal--Uh, the tensile stresses conceivably occur. But even under tensile stresses here, depending upon...

APPENDIX B

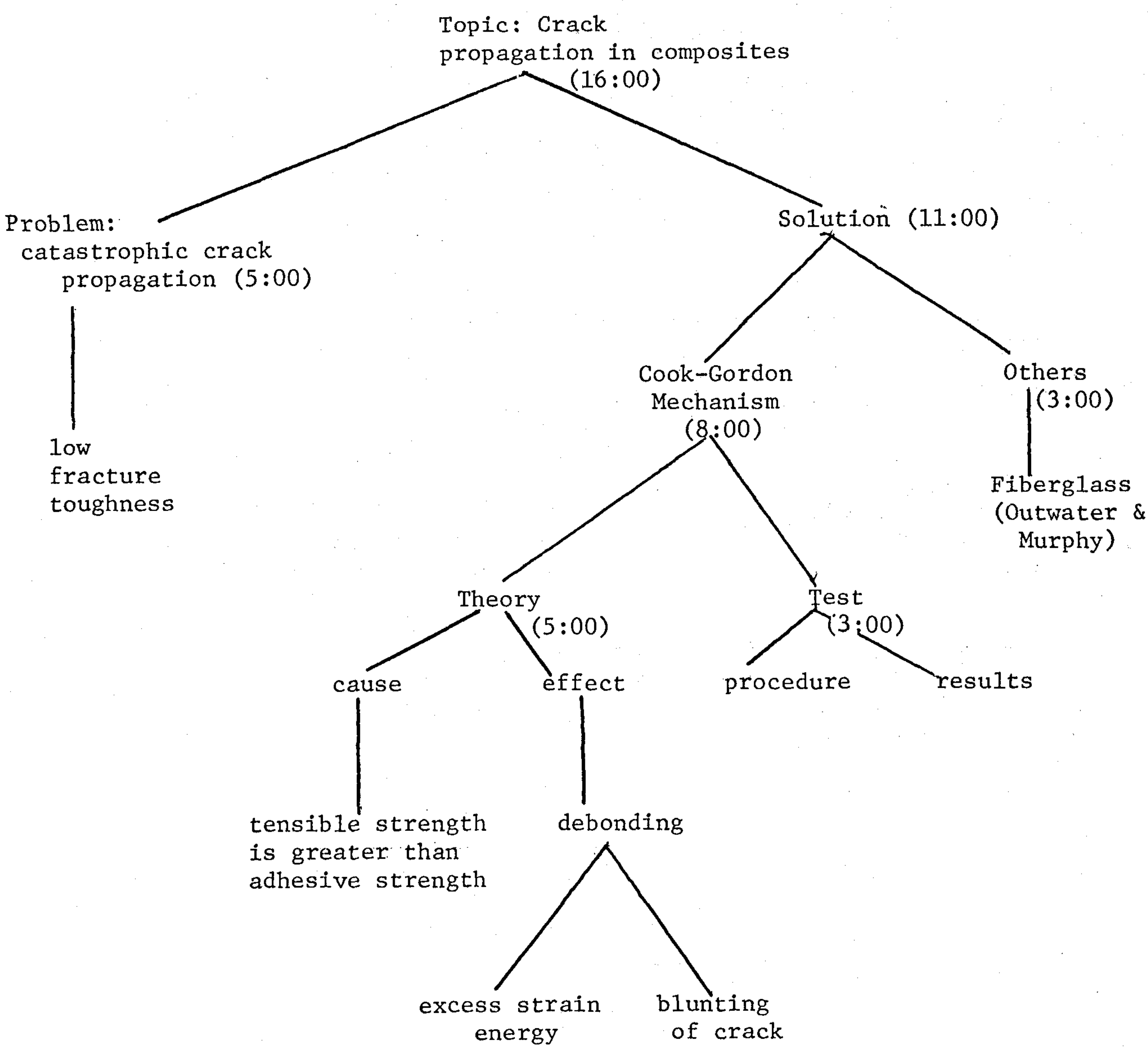

Figure 1. Overall structure of Caddell lecture, with time breakdown

Appendix C

Example of successful comprehension, from 21-year old Chinese student (H.K.) in Computer Engineering, who studied English for 14 years in his home country but has been in the U.S. only three months:

This naturally is about mechanical engineering and the major emphasis is on cracking in fracture and and ah...for a composite material which is made of matrix and fiber cracking always occur and cracking occurs it will propagate along the... sorry, I mean propagate perpendicular to the matrix and fiber. This crackeling crackeling occurs and the strength and strength of the fiber-matrix decrease and also the fracture of toughness decrease. Crackeling is propagating along-- sorry, I mean cracking is propagated perpendicular to the mat-- of matrix and fracture matrix and fiber.

I -- the technical book called <u>The New Science of Material</u> ehm, it can be -- theory is being present. Consider, consider fiber, consider...material composite of fiber-matrix and-- part of this material tensile stress increases and cracking occurs perpendicular to the direction of app--...no... When strength of fiber increases, debonding is occurred along---perpendicular to the fiber and strain energy is increased in other areas of the material; therefore, the crack, the crack is not propagated in a perp-- in strictly perpendicular direction, we have to note. In fact, there is some ... occurs in the crackin process. Some cracking occurs along the direction of the ... while some of them occur perpendicular to the direction of note. Before the crack, before the cracks reach the fibers, bonding between fiber and matrix occur in the direction perpendicular which is in the direction parallel to the direction of note. When cracking occur there is a trade-off between strength and toughness: as strength is increased, toughness is decreased and vice versa. This process is called "Cook-Gordon mechanism" and it increased at least and this mechanism at least doubles the toughness of the composite materials. But the combination is so complex that there is no-- so that there is no single theory or equation that enable us to calculate, to calculate the cracking of the composite material. Sometimes there is no debonding and sometimes...it doesn't and sometimes it does occur. When there is no debonding, the crack propagate directly perpendi...through the fibers and the fibers is not affected. There are so many variables in this kind of problem such as debonding and ... strengthen. To this day there is no single equation or theory that enables, that enables us to ... all possible situation eh that's all.

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16. Abstract

The 32nd annual meeting of the Conference on College Composition and Communication had 20 sessions with over 75 papers relating to various aspects of technical communication. The rhetoric and ethics of technical communication, recent developments in technical communication, pedagogical techniques, empirical research, courses and curricula, and business writing are the important subject areas represented.

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