SCIENTIFIC DISCOURSE, SOCIOLOGICAL THEORY,

AND THE STRUCTURE OF RHETORIC

by

James H. Collier

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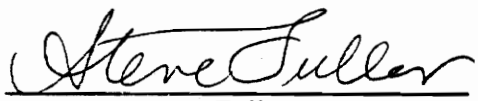

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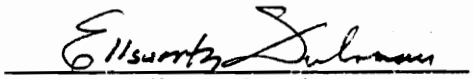

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Scientific Discourse, Sociological Theory,

and the Structure of Rhetoric

James H. Collier

Graduate Program in Science and Technology Studies

Chair: Joseph C. Pitt

(ABSTRACT)

This thesis examines the rhetorical, analytical and critical efficacy of reflexivity and sociological theory as means for reconciling the normative and descriptive functions of the rhetoric of science. In attempting to define a separate research domain within Science Studies, rhetoric of science has borrowed Strong Program and constructivist principles and descriptions of scientific practice from the Sociology of Scientific Knowledge (SSK) as a basis for analyzing scientific discourse. While epistemological claims in the social sciences have been considered inherently self-referential and subject to reflexive analysis and critique, rhetoricians have generally taken these claims on face value and applied them to a treatment of scientific practice. Accordingly, rhetoricians have maintained a natural ontological attitude to sociological theories and descriptions supporting an understanding of scientific discourse as implicitly rhetorical. Recently, however, the concept of "rhetoric" in rhetoric of science has come under scrutiny. This thesis will connect arguments involving the relation of the "irreducibly social" nature of science, to a concept of scientific discourse as rhetorical "without remainder," to the philosophical commitments of reflexive analysis. Stipulations as to the universal presence and influence of social and rhetorical forces in science substitute, I argue, for a conception of the scientific rhetor as a social type. Although I do not mystify either scientific discourse or practice, I wish to provide grounds for determining whether, given claims about the nature and relation of scientific discourse and practice, rhetorical

analyses can be considered either trivial or substantive, descriptive or normative, or even rhetorical or social.

Acknowledgments

Great patience has been exhibited by both the members of my thesis committee and the Steering Committee during the months of fitful production of this thesis. Initially, I thank Professor Robert Paterson and Professor Richard Burian for providing an institutional setting both diverse and flexible enough to lend the inspiration and time needed to complete this work. To the members of my committee I thank: Professor Skip Fuhrman for lending context to my sociological passions, for unflagging personal support, and for his matter-of-fact way of getting to what matters in an intellectual debate; Professor Steve Fuller for unmatched skill and help in weaving together divergent perspectives on science into whole cloth, for needed transfers of energy, for being a true believer in STS, and for providing me with numerous, extraordinary opportunities; and Professor Joseph Pitt for demonstrating an analytic philosopher's irony in having unremitting faith that the seeds he planted twelve-odd years ago would, evidence to the contrary, finally show growth.

Many of the ideas in this thesis were either directly or indirectly entertained in several courses I have taken at the Center. I thank Professor Marjorie Grene for her interest, support and insistence on clarity despite my muddle-headed pursuits, and the participants in her course on J.J. Gibson' psychology of perception; Professor Henry Bauer for his insightful interchange in his course on scientific method; and Professor Gary Downey for his truly helpful comments on a draft of Chapter 2, and the members of his postmodernism course.

I take this thesis as the first payment on a debt I owe to students and colleagues in the English department, colleagues at Price House, friends and family. Specifically, I thank the students in my English 3764 classes at Tech from 1989-91 for constantly challenging me to refine my ideas about the relation between theory and practice in

scientific communication. As well, I thank the English department for the opportunity to interact and learn from some of the best instructors at this, or any, university. To my student colleagues past and present in Price House who help me to go on through their scholarly example and personal concern; I thank Bill Lynch, Sujatha Raman, Ranjan Chaudhuri, Garrit Curfs, Teresa Castelão and Nancy Mannikko. To my friends in Washington and Richmond who hold the safety net, I will always support their changes as they have mine. I celebrate my companions in Blacksburg – Mary, John, Jane, Gary, Grace, Phred, Diane, Chris – for their humor, individual counsel, deep friendship and commitment to being there. Special thanks to "my friend and co-author" Dave Toomey – I look forward to the 21st century. To my parents, especially my mother, and family who exasperatedly ask when it will all be over, but who never waver in sponsoring the journey. Finally, to Elena wherever she may roam.

Table of Contents

Chapter One

Approaching Scientific Communication: On the Culture of Rhetoric and the Practice of Composition

1. INTRODUCTION

Arising out of the anarchy characterizing the study and teaching of English composition and rhetoric in the 1960s and early 1970s[1] were a number of theories recasting the static components of discourse as part of a continuous, recursive process of knowing and communicating.[2] Composition theorists applied the lessons learned from philosophical, sociological, psychological and literary challenges to traditional frameworks of linguistic meaning and reference to the teaching of writing and textual criticism.[3] Moreover, causal theories of reference, in conjunction with the revolution in cognitive science, opened the way for constructivist theorists, in composition and rhetoric as well as philosophy and sociology, to focus on the constitutive function of discursive practices of individuals and communities.[4]

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[1] James Kinneavy, *A Theory of Discourse* (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1971).

[2] See, for example, James Britton, *Language and Learning* (London: Penguin Books, 1970); James Moffett, *Teaching the Universe of Discourse* (Boston: Houghton Mifflin, 1968); Richard E. Young, Alton L. Becker, and Kenneth L. Pike, *Rhetoric: Discovery and Change* (New York: Harcourt, Brace & World, Inc., 1970); Frank J. D'Angelo, *Process in Thought and Composition* (Cambridge, MA: Winthrop Publishers, Inc., 1975); Janet Emig, *The Composing Process of Twelfth Graders* (Urbana, IL: National Council of Teachers of English, NCTE Research Report No. 13, 1971); Linda Flower and John Hays, "Problem-Solving Strategies and the Writing Process, " *College English*, 39 (December, 1977) 449-61. For a concise overview see David Foster, *A Primer for Writing Teachers* (Upper Montclair, NJ: Boynton/Cook, 1983).

[3] Nelson Goodman, *Fact, Fiction and Forecast*, 4th ed. (Cambridge, MA: Harvard University Press, 1979); Saul Kripke, "Identity and Necessity," *Naming, Necessity and Natural Kinds* Stephen P. Swartz (ed.) (Ithaca, NJ: Cornell University Press, 1977); Noam Chomsky, *Aspects of the Theory of Syntax* (Cambridge, MA: MIT Press, 1965); and Peter L. Berger and Thomas Luckmann, *The Social Construction of Reality* (Garden City, NY: Doubleday, 1966).

[4] Nelson Goodman in *Of Mind and Other Matters* (Cambridge, MA: Harvard University Press, 1984) and *Ways of Worldmaking* (Hassocks, Sussex: Harvester Press, 1978)

Sociologists of science, following the lead of David Bloor (1976),[5] began to treat science as a socially embedded phenomenon and scientific knowledge as product of social negotiation. Other researchers began to turn inward; becoming interested in how communication could be embodied and legitimated within the boundaries of academic disciplines.[6] Subsequently, the purpose and rational aims of technical and scientific communication were scrutinized; seen both as the last vestiges of positivist influence and as a means for rhetorically maintaining scientific autonomy and influence.

In this chapter I will discuss a number of recent theories, developed by composition theorists and rhetoricians of science, concerning the nature of scientific discourse and leading to the formation of various pedagogical practices. Forays by Sociologists of Scientific Knowledge (SSK) and Science and Technology Studies (STS) practitioners into the field of scientific and technical communication generally, and discourse analysis and rhetoric of science specifically, have largely ignored the theories and practices of composition, rhetoric and technical writing researchers while favoring literary and postmodern criticism. The emphasis on poststructuralist and deconstructionist interpretive strategies, in SSK for example, has paid only lip service to deep criticism and practical intervention (at the level of the practice and teaching of scientific and technical communication [7]) in the process of scientific discourse.[8] Research

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argues for a "mental constructivist" theory of creating the world out of the interplay among minds and symbol systems. Goodman's view derives, in part, from his solution to Hume's problem of induction. Social constructivists such as Steve Woolgar, Harry Collins, Karin Knorr-Cetina and Nigel Gilbert, while possibly agreeing with Goodman's stipulation of a previously constructed world denying bedrock reality, certainly see the source of construction as society, rather than individual cognition.

[5] David Bloor, *Knowledge and Social Imagery* (London: Routledge & Kegen Paul, 1979).

[6] See, for example, Stephen Toulmin, *Human Understanding* (Princeton, NJ: Princeton University Press, 1972), and Steve Fuller, *Philosophy, Rhetoric and the End of Knowledge* (Madison: University of Wisconsin Press, forthcoming).

[7] I use the phrase "scientific and technical communication" instead of the more common expression "technical writing" to bring attention to the other types of communication, aside

in SSK and STS fails to fully recognize the disciplinary, pedagogical and ideological orientations of the concepts of text, encoding, authorship, audience and communicative action on which their critiques of technical discourse are based. Additionally, given the recent resuscitation of rhetoric through its application to science, a gap in the literature exists. In order to provide a broader context for the study and practice of technical communication, a link needs to be established among the images of science and technology adopted and applied by rhetoricians of science, the normative, thematic and theoretical structures to which they appeal, and the practice of social and communicative action resulting from the reciprocal influences of composition, rhetoric, SSK and STS.

In this chapter I will show how the analyses of the processes of scientific and technical communication have been developed by composition theorists and rhetoricians

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from writing, used by technologists and scientists. Scientific and technical communication may be defined as: a process by which ideas and information are transmitted, and a process which is inevitably shaped by its contexts, and which is improved when it recognizes its contexts.

[8] I contend that the descriptive basis of scientific discourse leading to certain pedagogical practices, by rhetoricians and composition theorists, partially derives from modernist conceptions of audience, author, text, act, scene and agency (to borrow from Burke's pentad). While these traditional concepts are currently being challenged by literary theorists, theorists in SSK have failed to recognize that their own postmodern, scientific iconoclasm derives from modernist context. The first edition of Bruno Latour and Steve Woolgar's *Laboratory Life: The Social Construction of Scientific Facts* (London and Beverly Hills, CA: Sage, 1979) serves as an example. Initially posed as a fiction (see the postscript to the second edition, 1986) *Laboratory Life* buys into the humanist proclivity for posing story telling as a means – in itself – for cultural and institutional change and communicative action. The concepts of cultural iconography on which this idea is based, however, derive from the same foundational assumptions concerning audience, author, text, act, scene and agency which Latour and Woolgar reject. As a result, *Laboratory Life* fails, reflexively, to show how ethnographic fiction can be valued as a means for subverting the cultural ideals involving natural science. *Laboratory Life* also suffers from several postmodern paradoxes which involve deconstructing, balancing and trading off on foundations for humanist and scientific discourse and serves neither as good fiction nor a means for reform. Latour (1988), in fact, levels a similar charge at reflexive theorists whom, he argues, fear being "contaminated" by empiricism, yet use it as a tool when so inclined. Fear of empiricist influence has inspired SSK theorists such as Latour to rush headlong into humanist camps. While fearing the contamination and complicity of humanists theorists in SSK seem unaware how their research is shaped by the decline of humanist influence and the possibilities for true reform of scientific discourse.

and applied in the rhetoric of science. My review will provide a basis for a critique of, and answer to, reflexivist textual practices in the Sociology of Scientific Knowledge (SSK) in Chapter Two. Subsequently, in Chapter Three, I will look at the current status of the rhetoric of science as a "stalled" research project, and attempts to recontextualize rhetorical analyses of science in terms of the reflexive project in SSK. I will argue that because of ambiguities surrounding the ontological status of rhetoric,[9] and, in some instances, due to the misapprehension of sociological categories, rhetorical analyses of scientific discourse fail to offer any deep sense of explanation of scientific practice and would serve best as normative guidelines for communication between scientists and lay persons.

1.1 *Ideology and Governance*

Technical communication has been characterized as a field "hampered by its own strengths."[10] An insistence on disciplinary autonomy, practicality and objectivity has encouraged critics to speculate on technical communication's moral purpose in relation to societal concerns about science and technology. For this reason, technical communication, in league with composition and rhetoric, has been earned the reputation of being a mercenary discipline in which ideological commitments depend on whose

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[9] In using the phrase "ontological status of rhetoric" I wish to bring into question the status of the existence and causal effect of "rhetorical phenomena" (e.g. assent or dissent to an argumentative claim) in science resulting from the use of persuasion. Many rhetoricians have simply asserted that rhetoric acts as a constant social and linguistic force (in varying degrees) in the construction of scientific facts and in conceptual change. However, the constructivist ontology rhetoricians take as given with respect to scientific theory and practice does not seem to reflexively apply to their own practice. What is taken to be a "real" rhetorical cause or effect could also be seen as constructed and explained as the result of some other social or linguistic force. Rhetoricians, as I will argue later, need to legitimate their accounts of science on other than constructivist grounds.

[10] Russell Rutter "History, Rhetoric, and Humanism: Toward a More Comprehensive Definition of Technical Communication" *Journal of Technical Writing and Communication* Vol. 21, No. 2 (1991), 133-53.

interests are currently being served. Specifically, an emphasis on rhetorical rather than literary theory by technical writers supposedly bolsters a set of ideological assumptions supporting a program of social domination. The ideology of technical writing has been cast as:

> ... explicitly assent(ing) to its instrumental subordination to capital; the aim of the discipline as a whole is to become a more responsive tool. Many technical writing teachers see themselves as academic counterparts to the corporate communications officer. Nor is this identification wholly disinterested. Long excluded from lucrative industrial consulting jobs, English teachers can finally hope to share this wealth by developing an expertise in technical or professional communication. Unlike, say, an ordinary language philosopher, a technical writer would not be shaken by a critique that his or her work served domination. A discipline founded on the principle of service is not ashamed to be of use.[11]

When one simply dismisses rational discourse as completely subordinate to the aims of a user or discourse community one buys into the critical gloss given to "technocratic" disciplines by many contemporary critical theorists. This critical perspective trades on, at least, three disingenuous assumptions:

> (1) Methodological and behavioral norms exist in science and technology which can be transferred to accompanying "service" disciplines;
>
> (2) Representational discourse in science and technology has no constitutive or rhetorical function and succeeds in establishing an unambiguous correspondence between word and object;
>
> (3) Scientific discourse, by nature, denies a necessary reflexive consciousness on which moral foundations can be built.

The first assumption allows the critic to simply shift focus from criticisms of science and technology to technical communication, in so doing conflating the prescriptive elements of each of these fields. Thus all prescriptive actions and recommendations are seen as naive by neglecting the complexity of a discursive situation. Discourse analysts, with which critical theorists hold much in common, argue

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[11] Susan Wells "Jurgen Habermas, Communicative Competence and the Teaching of Technical Discourse" *Theory in the Classroom* Cary Nelson (ed.) (Urbana and Chicago: University of Illinois Press, 1986).

that discourse is "too open textured to be classified in a straightforward way, let alone controlled ... However, the discourse analyst's charge has force only if it is assumed that prescriptions should not be made unless they are likely (or maybe even guaranteed) to bring about the prescribed outcome."[12] Besides, such a criticism relies on an acontextual understanding of the function of prescription. That is, even if Popperian norms, for example, did govern scientific practices they could not be readily translated into prescriptions for scientific discourse. Critical theorists and discourse analysts wish to have it both ways. Scientists, technologists and technical communicators can be held similarly accountable for formulating a totalizing discourse without regard to its context or purpose, even though the meaning of given a utterance rests with a set of utterances of which it is a part.

The second assumption makes available ideological critiques of composition, rhetoric and technical writing as service disciplines. Since the stated goal of scientific discourse, in most instances, is to establish a principle correspondence between words and their referents in nature, technical writers in principle must provide the clear representational language. Such language, as Wells (1986) in the quote beginning on page 4 argues, may be subordinated to the ideological will of the institution being served. This argument trades on an ambiguity about the function of discourse. Again, critical theorists want to have it both ways. On the one hand, technical writers and composition theorists can be attacked for supplying scientists and technologists with what they want, a prescriptive, representational discourse. On the other hand, critical theorists argue that the functions of discourse cannot be separated from one another. Technical communicators then are characterized as being unaware that scientific discourse always

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[12] Steve Fuller "Book Review -- Shaping Written Knowledge: The Genre and Activity of the Experimental Article Science" *Science Technology & Human Values* Vol. 16, No. 1 (Winter 1991) 122-25, p. 124.

carries rhetorical and constitutive elements. Further, critical theorists suggest belief in strict representational discourse, because it is impossible, lends scientists and technologists a false consciousness about the relationship of their theories, practices and language to the world.

The third assumption, given scientists' false consciousness, makes available arguments for the necessity of interpretive conceptual apparatuses supplied by poststructuralists and deconstructionists, and the possibilities for institutional intervention. Since composition, rhetoric and technical writing have, in selected ways, been characterized as mainstream service disciplines available to the highest bidders, like science and technology, they have also been tagged as missing a reflexive consciousness. Left to their own devices, those serving in the interests of science and technology seemingly are unable to tap into the cultural ethos codified in literature. The job of discerning social values from the cultural icons of novelists and poets has historically been left to humanist critics, a job beyond the reach of technical writers. A similar assumption, for instance, provides the thesis for C. P. Snow's famous Rede lecture.[13] Snow suggests knowledge of the humanities by scientists and technologists would provide a moral awareness and context for their work. The mutual fear and contempt held by the members of the "two cultures" would be resolved by the benign moral presence of humanists tempered by the real-world perspectives of scientists. Critical theorists have turned ideological governance into a cottage industry; existing as interpretive advisors to those in a technocratic and industrial society who suffer from false consciousness.[14]

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[13] C.P. Snow *The Two Cultures and the Scientific Revolution* (New York: Cambridge University Press, 1959).

[14] Alvin Gouldner *The Future of Intellectuals and the Rise of the New Class* (New York: Seabury Press, 1979), p. 1-8, argues for the emergence of a "New Class" out of the socio-economic order of the twentieth century. The New Class is composed of "intellectuals and technical intelligentsia" (p. 1) who will compete on the world stage with businessmen and

These three assumptions have been used to reposition critical theorists and discourse analysts as defenders of the spirit of open inquiry in the face of increasing technocratic domination. In accepting relegation to the margins of society, and of academia, critical theorists have appropriated the rhetoric of difference and oppression. Other "marginal" disciplines, such as SSK, have been quick to take up this rhetorical cue and adopt similar textual strategies. Thus in order to avoid the univocalism of structuralists, critical theorists have developed reflexive deconstructive strategies and "New Literary Forms" which invite reader participation. These assumptions and textual strategies have been bred a paradox of prescribing Byzantine reflexive and deconstructive *forms* to provide the reader an "open" text.

1.2 *Crisis and Reform*

Confronted with the task of linking their metatheoretical perspectives with a theory of social action, reflexive theorists in SSK have fashioned a rhetorical theme – crisis and reform [15] – as a basis for amending scientific discourse. In sociology generally,

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party leaders to control social resources. However, the New Class will be remain divided due, in part, to the loss of the "exclusiveness and privileged market position" (p. 4) of humanist intellectuals and prominence of technical intelligentsia. Gouldner sees the New Class as "elitist and self-seeking ... to advance its own interests and power" but perhaps "the best card that history has presently given to play." (p. 8) The New Class is also "morally ambiguous" while holding "a mortgage on at least *one* historical future. (p. 8) The differentiation among humanist intellectuals and technical intelligentsia has been played out in how academic disciplines are conceived and how reforms would be instituted.

[15] Jurgen Habermas *The Theory of Communicative Action: Reason and Rationalization in Society* Vol. 1 Thomas McCarthy (trans.) (Boston: Beacon Press, 1981) sees the theme of crisis and reform as an organizing principle in sociology: "... sociology originated as a discipline responsible for the problems that politics and economics pushed to one side on their way to becoming specialized sciences. Its theme was the changes in social integration brought about within the structure of old-European societies by the rise of the modern system of national states and by the differentiation of a market regulated economy. Sociology became the science of crisis par excellence; it concerned itself above all with the anomic aspects of the dissolution of traditional social systems and the development of modern ones."(p. 4) With respect to scientific and technical discourse, both reflexive and normative theorists in SSK evoke the same themes to promote different responses. Reflexive theorists cite the dissolution of traditional concepts of autonomous science (crisis) in the face of the development of a postmodern society. A shift in emphasis from the representational to the constitutive functions

this theme gained currency in a lengthy postscript to *The Coming Crisis in Western Sociology* (1970) by Alvin Gouldner. Gouldner argued that sociologists needed to begin looking inward to provide a moral context for their research and their responsibility to the culture. Ignoring Gouldner's moral concerns, present-day reflexive theorists have pressed for radical internal methodological reform. The absence of a normative context, however, has rendered reflexive proposals impotent. For example, reflexive theorists point out, from a series of case and "laboratory life" studies, that traditional formulations of the structure of science cannot explain actual practice.[16] While some scientists know of Popperian norms governing practice, for instance, they admit these norms are seldom followed.[17] The conceptual basis for experimental procedure and what counts as a "good result" are subject to continuous negotiation; a process completely excised from papers appearing in journals. Countering claims for institutional norms as an explanation of scientific and technological success, SSK theorists have presumably shown that scientific facts and technological artifacts are socially constructed. If successful in this effort, SSK theorists would then be in a position to possibly micro-manage these social processes. However, these theorists have be hobbled by internal methodological crises on two fronts; both owing to

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of language (reform) would provide the expression and integration of the needs of scientists and society. Normative theorists cite the pressing need to establish relations among science, knowledge policy and social action (crisis) in the face of the omnipresence of science and technology in public life. A shift in emphasis from scientistic to public discourse (reform) would change practices and lend a new basis for communication and policy.

[16] Harry Collins work is the most prominent in this area. See, for example Harry Collins "The Seven Sexes: A Study in the Sociology of a Phenomenon or the Replication of Experiments of Physics" *Sociology* Vol. 9 (1975), 205-24, "Son of Seven Sexes: The Social Destruction of a Physical Phenomenon" *Social Studies of Science* Vol. 11 (1981), 33-62, and Harry Collins and R. Harrison "Building a TEA Laser: The Caprices of Communication" *Social Studies of Science* Vol. 5 (1975), 441-50.

[17] See Michael Mulkay and G. Nigel Gilbert, "Putting Philosophy to Work: Karl Popper's Influence on Scientific Practice" *Philosophy of the Social Sciences,* 11 (1981), 389-407.

constructivist/relativist theoretical orientations.[18]

On one front, while maintaining the realism and the reproducibility of their own empirical claims, certain researchers deploy constructivist arguments against other forms of empiricism.[19] The SSK community has been split over the place of a realist epistemology in their work. While one camp holds that a researcher can be a realist about personal methodology without being a scientific realist, the other camp sees this positions as inconsistent and a fundamental betrayal of the tenet of the Strong Program.

On the other front, reflexive theorists have focused the nihilism of post-modern literary theory in coming to question the rhetorical assumptions of scientists and the epistemological assumptions of ethnographers of science which led to an advocacy of "New Literary Forms," [20] " the idea that the format of the standard empiricist research report inhibits the development of any serious and sustainable reflexive practice, and

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[18] Thomas Gieryn's, "Relativist/Constructivist Programmes in the Sociology of Science: Redundance and Retreat" *Social Studies of Science*, 12 (1982) 279-97, offers an objection to the need of sociologists of science to adopt a relativist/constructivist orientation in examining scientists accounts. Gieryn claims that sociologists practicing discourse analysis routinely overlook the influence institutional networks of power play in elevating certain scientific accounts over others.

[19] During the November, 1991 4S meeting in Cambridge, Massachusetts Harry Collins was asked to explain his selective use of relativism/constructivism with respect to his work in *Artificial Experts: Social knowledge and Intelligent Machines* (Cambridge, MA: MIT Press, 1990). Collins' answer echoed a retort found in Malcolm Ashmore's *The Reflexive Thesis: Wrighting the Sociology of Scientific Knowledge* (Chicago: University of Chicago Press, 1989): "My advice to scientists, for instance is 'for Christ's sake, don't take relativism seriously. You'll never do another piece of decent work in your life.'" (p. 23) Additionally, Collins is quoted as saying: "I can't see what difference it's (reflexivity) is supposed to make to *my* practice. Just as I don't expect my studies to make any different to them, to the *scientists'* practice. I'm not trying to change physics..." (p. 23) (Ashmore's emphasis).

[20] See, for example, Michael Mulkay "The Scientist Talks Back: A One-Act Play, With a Moral, About Replication in Science and Reflexivity in Sociology" *Social Studies of Science* Vol. 14 (1984), 265-82, Michael Mulkay *The Word and the World: Explorations in the Form of Sociological Analysis* (London: George Allen and Unwin, 1985) and Steve Woolgar "Laboratory Studies: A Comment on the State of the Art" *Social Studies of Science* Vol. 12 (1982), 481-98.

that therefore other alternative formats are to be preferred." [21] Void of any pretense of scientism, reflexive theorists maintain that New Literary Forms, and the subsequent disjunction of fact and fiction, more clearly (and honestly) represent the constructivist position.

Within STS, issues involving scientific and technical communication have generally been ceded to Strong Program sociologists, with the following debilitating consequences:

> (1) The ideological dismissal of rational-purposive discourse as *simply* a tool of dominance to be used by scientists and technologists;
>
> (2) The perceived need for *only* literary-interpretive approaches and reforms of scientific discourse leading to the advocacy of New Literary Forms;
>
> (3) The inability to provide a basis for pedagogical reform in composition and technical writing;
>
> (4) The inability to connect public and scientific and technical discourse to concepts of audience, author, text act scene and agency;
>
> (5) The lack of a moral context connecting public and scientific and technical discourse;
>
> (6) The occlusion of a truly reflexive discourse in which pragmatic and theoretical aims are brought within an interdisciplinary context.

The belief in the dogma of crisis and reform has also predominated a "normative response" in the sociology of knowledge. Normative theorists have argued that scientists and technologists, who already possess great power in society, should not be depended on to proffer social policy. A central criticism of scientific and technical discourse, for example, has been that by failing to recognize the inherent social and rhetorical qualities of language, a blind eye has been turned to the linguistic, philosophic, social and historical contexts in which words shape, and are shaped by the objects to which they refer. Ironically, critics of the reflexive blindness of natural science discourse largely

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[21] Ashmore, *The Reflexive Thesis*, p. 66.

remain ignorant of the conventions, traditions, influences, research and practices in the fields of composition and rhetoric.

1.3 *Interdisciplinary Intervention*

While debates among literary critics, sociologists and philosophers over whether social, cognitive and/or linguistic elements control the writing process and textual criticism are ongoing and influential,[22] the possibility of developing an interdisciplinary consciousness which redefines the traditional function of scientific and technical communication remains unexplored. Much of the literature on scientific and technical discourse fails to draw connections among the theories and practices of composition specialists, technical writers, natural and social scientists and policy makers. The recent explosion of work by discourse analysts in SSK and the resuscitation of classical rhetoric serves as an example. Due to a lack of consensus and mutual intellectual suspicion, the dialogue among European discourse analysts, and rhetoricians of inquiry and composition theorists in the United States, has been truncated, producing strategies of writing, interpreting, reading and revising scientific and technical texts which talk past one another and hold little pedagogical consequence.

Although STS has developed on many fronts, its unique interdisciplinary mission holds for the possibility of a shared normative perspective necessary for the development of communicative strategies which bring together the needs and concerns of both scientists and laypersons.[23] Rustum Roy and others[24] have been instrumental in

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[22] See J. Hillis Miller *Versions of Pygmalion* (Cambridge, MA: Harvard University Press, 1991).

[23] Steve Fuller and Sujatha Raman (eds.) *Teaching Science and Technology Studies: A Guide for Curricular Planners* (Wesleyan University, CT: NEH Summer Seminar "Science as Cultural Practice," 1991) note two general tendencies in the development of STS. The first, a response to Thomas Kuhn's *The Structure of Scientific Revolutions*, which sees STS as "... either as the site where several already existing disciplines collaborate on specific projects or as an emerging discipline in its own right that may ultimately displace other disciplines." (p. 1) The second "... is toward building institutions for democratic participation on scientific decision-

bringing science studies to the classroom. I propose, at the university level, to position science studies practitioners, or, at least, critical rhetorical principles taken from science studies, in composition and technical communication classrooms to revise the teaching and subsequent practice of scientific and technical discourse. To that end, the techniques of composition theory and pedagogy, need to be wedded to available communication strategies[25] in the rhetoric of science. However, instead of solely maintaining a critical literary stance, as have continental discourse analysts, science studies practitioners must get their hands dirty by engaging student scientists and non-scientists in dialogue. Composition and technical communication classrooms are places to construct a way for students to talk with one another in a meaningful way, and to begin to sort out legitimation criteria and norms for substantive changes in scientific and technical communication praxis. Discourse analysts have been reticent to integrate their interests with the rhetoric of science, or composition theory, because rhetoricians tend to separate and study elements of communication discourse analysts wish to deconstruct, such as the author. My thesis, in arguing to provide a range of practices for scientific and technical discourse, will give positive application to critical rhetorical principles available from a science studies perspective. I take exception to discourse analysts who

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making." (p. 1). These two-wings have also been referred to as the "High Church" (theory-oriented) and the "Low Church" (practice-oriented) of STS. See Steve Fuller *Philosophy, Rhetoric and the End of Knowledge* (Madison: University of Wisconsin Press, forthcoming).

[24] Rustum Roy in "The Relationship of Technology To Science and the Teaching of Technology" *Journal of Technology Education*, Vol. 1, No. 2 (1991), 5-17 proposes the insertion of STS issues within the curricula of schools in grades 6-12 to enthuse and reorient students toward the influence of science and technology apart from strict disciplinary presentations. In universities, Roy sees STS as an "intellectual core" uniting concerns of science and technology with the humanities.

[25] I find it necessary to refer generally to communication practices, not simply to written texts. Deconstructionist critics, in undermining the privilege given to the spoken word (by Plato, for example), have considered written texts prior to other acts of communication. Scientific discourse analysts have routinely made the same assumption.

seem content to write for one another in drawing attention to the "new forms" of their texts (certainly not subject to interpretive flexibility), while giving the technical communicator little of use in their own textual strategies.

2. THE PLACE OF COMPOSITION

Composition theorists and rhetoricians have occupied uneasy places in the academy. The decline of traditional rhetoric as a discipline and antipathy toward the teaching of writing has led a bewildering array of critical and pedagogical strategies visited upon composition students. Additionally, composition and technical communication courses have been parsed out to other academic departments. The growing caste of instructors and graduate students hired to staff composition courses, and the absence of qualified composition specialists in the classroom reinforces the notion that one need not possess any special qualifications to teach writing. Disputes over the ideological content of canonical texts, political correctness, respect for cultural identity displayed in differing norms of grammatical usage and the need for writing across the curriculum have further relegated writing classes to the role of service courses. A great deal of what passes for composition theory has simply reified the instructor as a "make do" theorist; one who, in touch with the needs of the class, sifts through options for writing instruction and textual interpretation and makes the right decision for the group and the individual.

Despite the disparity of approaches to composition theory and practice, there are "winds of change," the formation of a paradigm for teaching writing.[26] The "writing

[26] Maxine Hairston, "The Winds of Change: Thomas Kuhn and the Revolution in the Teaching of Writing," *College Composition and Communication*, Vol. 33 (February 1982), pp. 76-88. Hairston lists twelve "principle features" of the new paradigm which mark a transition from "product" to "process" oriented approaches to composition. While the appropriation of narrative elements from Kuhn's *The Structure of Scientific Revolutions* serves as a general, rhetorical means for disciplinary legitimation, Hairston also finds a sympathetic association between Kuhn's (from Piaget and Bruner) model of cognitive development and the process model of composition. The serendipity between the narrative framework of *Structure*, and the theories

as process" model entails a rhetorically based, non-linear activity developing out of both the rational and non-rational faculties of writers. This model has also been incorporated into the teaching of technical communication and into critical theories for analyzing discourse. In order to see how practicing scientists and engineers are initially trained to communicate[27] in the academy, one needs to see how conceptions of rhetoric have been presented at the level of composition courses.

2.1 *Developments in Composition and Rhetoric*

My overview of the changes in the field of composition and rhetoric will use the Woods Hole Conference, sponsored by the National Academy of Sciences in 1960, as a point of departure. Although the conference was convened to discuss science teaching in the schools, the final report included a number of suggestions for literature instruction.[28] The findings of the conference were included in Jerome Bruner's book *Process of Education* (1960) which was cited as an influence by the U.S. Office of Education in funding research projects in English during the 1960s.[29] A number of Bruner's other works, among others, *On Knowing: Essays for the Left Hand* (1963) and *Toward a Theory of Instruction* (1966), would bring the influence of Jean Piaget to bear on student instruction in composition and rhetoric. Applying Piaget's model of cognitive development, Bruner emphasized the role personal discovery played generally in the learning process, and

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and practices of scientific discourse proposed by rhetoricians and composition theorists will be discussed in greater detail in Chapter Three.

[27] The emphasis by composition teachers, and discourse analysts as well, has been on the writing process. But with renewed interest in the rhetoric of science and technical communication, and the common computer networks to which writers have access, alternative forms of discourse are being developed out of process-oriented theories.

[28] See chapters six and seven of James Berlin's *Rhetoric and Reality* (Carbondale, IL: Southern Illinois University Press, 1987) for a more detailed discussion of the emergence of writing instruction from 1960 to 1985.

[29] Ibid., p. 122.

specifically in the writing process. Bruner urged abandoning the teaching of writing by mimicking the styles of selected writers and rhetoricians. Each student was asked to find their own writing process; to pursue the types of invention and textual strategies suited to the individual writer.[30] Teachers were to act as facilitators to the writing process by providing students with a universe of options from which to choose. Students would come to an awareness of how communities, disciplines and social resources shaped their composing from a sense of the self as locus, out of which the writing process took place.

Keeping with the spirit of Bruner's influence, Albert Kitzhaber called for revival of rhetoric, or New Rhetoric, to augment the contemporaneous New Criticism and New Grammar of the 1960s. Kitzhaber's concern with rhetoric led him to part with Bruner on essential points. While he agreed college composition courses should be a service courses which aided in facilitating the student's writing, Kitzhaber found value in knowing the history and disciplinary nature of rhetoric to lend depth to the composing process. Traditionally, students had been taught the superficial necessities of grammar, correct sentence structure and modes of discourse. Kitzhaber wanted composition courses to have greater substance in concert with further autonomy of rhetoric and composition as a discipline.[31] One of Kitzhaber's supporters, Wayne C. Booth, saw the revival of rhetoric not simply as a call for introducing students to Aristotle and Quintilian, but to reveal the practice of persuasion already at work in forming university disciplines. Booth, Kitzhaber and Erwin Steinberg stressed the need for empirical research and

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[30] Jerome Bruner, *The Process of Education* (Cambridge MA: Harvard University Press, 1960).

[31] Albert Kitzahaber was one of the most vocal advocates of the New Rhetoric during the 1960s. See, for example, *Themes, Theories, and Therapy: Teaching of Writing in College* (New York: McGraw, , 1963); and "New Perspectives on Teaching Composition." *College English* Vol. 23 (1962) 440-44.

methodological rigor to legitimate the authority of composition and rhetoric as field of "scientific" inquiry." [32]

3. THE RHETORICAL TURN

Rhetoric had long been held in disfavor by academics. Rhetoric has been equated with Sophistry, or the unwitting persuasion of an audience by an unscrupulous orator who, trained in the art of verbal deception, would substitute false promises and empty verbiage for the true desires of rational listeners. If the rhetorician was skillful, the free thoughts of the audience could be coopted for any number of arbitrary reasons. Persuasion, one of the clear purposes of rhetoric, has been branded a contemptible goal, for the rhetorician has not allowed the audience to come to know their own mind and make a reasoned decision based on a considered reflection of personal preference and social responsibility. In 1936, at Bryn Mawr College, I.A. Richards lectured on the deplorable condition of the state and perception of rhetoric.[33] Richard's refrain was akin to that of professors of composition and rhetoric in the 1960s and 1970s:

> We have instead to consider much more closely how words work in discourse ... Whatever we may be studying we do so only through the growth of our meanings. To realize this turns some parts of growth and

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[32] The formation of disciplinary boundaries as a way for practitioners to gain epistemic privilege is a common theme within the sciences and social sciences. Composition and rhetoric theorists have solidified their boundaries with mixed success. The rift between theory and practice in composition has resulted in individual classroom practitioners becoming the initiators of research innovations. Stephen M. North in *The Making of Knowledge in Composition* (Upper Montclair, NJ: Boynton/Cook Publishers, 1987) likens the "nature of practitioner knowledge" to folk lore (see chapter 2). In one instance North states: "... Composition's lore is a body of knowledge very much like those accumulated among practitioners of other arts - art here being broadly conceived - like painting or parenting , to offer an unlikely pair " (p. 23). North, however, defends the reflex of researchers to denigrate the authority of individual practitioners. Further, he finds practitioners more "methodologically self-conscious than any of the other communities " (p. 55). The cognitive authority of composition practitioners has been assumed by practitioners of discourse analysis and reflected in the "new forms" available from reflexive analysis (e.g. Ashmore 1989).

[33] I.A. Richards *The Philosophy of Rhetoric* (New York: Oxford University Press, 1965).

> interaction between meanings, which might otherwise seem a niggling philosophical juggle with distinctions, into a business of great practice importance. For this study is theoretical only that it may become practical.[34]

At the heart of Richards' remarks on rhetoric was the contention that the meaning of words and, hence, language was ambiguous and determined by context. The "old rhetoric" found ambiguity to be a problem which should be confined or eliminated; the quest for the source of meanings has proved to be a maddening task. Language, and our understanding of the world, is a series of conventions with which we live. Yet, Richards was convinced, in his discussion of metaphor, vehicle and tenor for example, control of language and rhetoric, based on our discerning daily misunderstandings and "local errors," would unveil the way our personalities develop and minds work. Here, Richards called for the remediation of rhetoric as a prescriptive orientation. Proper use of rhetoric, illustrated in the command of metaphor, can be apprehended by looking at the relations in which utterances tell us something. Using the pathology of transference as an example, Richards underscored the importance of coming to an interpretation of a text through mutual interaction and purpose, not through a borrowed attitude, fixation or rhetorical coercion. Rhetoric may be inherently persuasive, Richards held, but it should give way to the correction of problems in conveying ideas.[35]

While at Cambridge, Richards presented his students with unidentified poems and asked for their anonymous responses over a week. In *Practical Criticism* (1929),

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[34] Ibid., pgs. 5 and 19.

[35] Richards closes his lecture on "The Command of Metaphor" with a quote from Plato's *Timaeus* (47c) in which Socrates compares speech and hearing to virtues of sight: "... as meant to correct any discord which may have arisen in the courses of the soul ..." However, Plato's distaste for rhetoric has been often cited in Phadrus and Gorgias. Socrates conflates flattery and persuasion in his argument (in Gorgias) on the dangerous nature of rhetoric. Ironically, Socrates own rhetorical authority is wrested from the silenced Callicles by a singular interpretation of Homer's telling of the Greek myths. The interlocutors, from Richards' perspective, have forgotten the purpose of rhetoric.

Richards published the findings of his experiment. Students had fundamentally misread the poems, unable to read the texts in order to derive any meaning. Given the quality of the students, Richards found it absurd that they had no instruction in how to interpret a text. Interpretation itself could be taught; students could be instructed on how to derive the meanings of texts, and then learn to make meaning in the process of interpretation. In turn, Richards later took up the task of instructing students how to perform detailed readings of texts, responding, for example to Mortimer Adler's *How to Read a Book* with *How to Read a Page* (1942). The interaction between the reader and the symbol in making meaning demonstrates what Ann Berthoff labels "an absolutely central principle of Richards' philosophy of rhetoric ... we think not just about concepts but with them." [36] Richards' influence, through the principles of close reading, made apparent the need to pursue not only how meaning is constructed in writing texts, but the means by which meaning is constructed in the act of reading.[37]

3.1 *Kenneth Burke's Dramatism*

In as much as I.A. Richards prefaced the "rhetorical turn" in the social and natural sciences, the dramaturgy of Kenneth Burke has forged a link between critical literary theory and the sociology of science.[38] Out of Burke's pentad[39] comes a

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[36] Ann E. Berthoff "I.A. Richards" *Traditions of Inquiry* John Brereton (ed.) (New York: Oxford University Press, 1985).

[37] Peter Rabinowitz in *The Chronicle of Higher Education* (April 3, 1988) argues that the principles of close reading may be "the nearest thing literary scholars have to a shared critical principle." Yet, he argues, the hegemony close reading enjoys leads to: (1) implicit favor of the figurative over the literal, (2) petrification of the literary canon, (3) concentrating heavily on authorial intent, (4) extracting discussion over specific historical and social events by making them figurative, and (5) allowing only the reading (due to time) of a few selected texts. Rabinowitz wants to give students " ... practice in various types of reading" with a number of different texts to examine the variety of circumstances under which texts are written and read.

[38] Joseph Gusfield "The Bridge Over Separated Lands" *The Legacy of Kenneth Burke* Herbert W. Simons and Trevor Melia (eds.) (Madison: University of Wisconsin Press, 1989). Although Burke is not directly cited by, among others, Bruno Latour, the elements of Burke's

treatment of the motives and symbols which promote human action. Put simply, Burke's method is to manipulate the permutations of the pentad and apply them to an explanation of the action of a humanistic endeavor. As Burke explains in the introduction to *A Grammar of Motives*:

> And so with our five terms (act, scene, agent, agency, purpose): certain formal relationships prevail among these terms, by reason of their role as attributes of a common ground or substance. Their participation in a common ground makes for transformability. At every point where the field is covered by one of these terms overlaps upon the field covered by any other, there is an alchemic opportunity, whereby we can put philosophy or doctrine of motivation into the alembic, make the appropriate passes and take out another.[40]

Clearly Burke wished to increase the number of interpretive possibilities to be generated out of an explanatory framework, whether literary, sociological, psychological or biological. When the concepts of academic disciplines overlap, for example, one series of attributes may be shared with another. The occurring rupture calls into question the linguistic and epistemological assumptions of the discipline or an individual rhetor. However, Burke holds that the formal relationships existing between the terms of the pentad (and their subdivisions) do not lead to a dialectic, rather, "Our work must be synoptic in a different sense: in the sense that it offers a system of placement, and should enable us, by the systematic manipulation of the terms (in the pentad), to "generate," or "anticipate" the various classes of motivational theory." [41]

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pentad - act, scene, agent, agency and purpose - appear directly in the social constructivist literature and are conceived of in similar ways. Burke's undermining of distinctions separating literary and sociological analysis has paved the way for a robust conception of the presence of rhetoric in scientific accounts.

[39] Kenneth Burke *A Grammar of Motives* (Berkeley and Los Angeles: Prentice-Hall, Inc. 1945).

[40] Ibid., pg. xix.

[41] Ibid., pgs. xxii - xxiii. Note, for example, how Burke's "system of placement" can be seen to underwrite the symmetry thesis of the Strong Programme. The movement between attributions of "science" and "society, " or scientific "genius" and scientific "anomalies" can be generated when terms such and act and agent are used within disciplinary or descriptive

Burke's dramatism, then, leads to psychological and sociological analyses (among others) of how an agent uses, or is represented by, symbols and rhetoric within a scene. Accordingly, this cross-fertilization of disciplinary perspectives on the practice of science has been promoted within disciplines prompting Burke to chastise the social sciences for focusing on one of the elements of the pentad, and excluding others, while embracing the rhetoric of science in offering "statistical rationalizations" for their work.[42] Lending privilege to the agent, in psychology, and the scene, in sociology, has meant only a partial rendering of a narrative or text. The split over whether to study the cognitive or the social in scientific practice has followed disciplinary preferences as Burke had suggested. Scientific discourse analysts and the rhetoricians of inquiry have committed many of the same sins by converting the elements of the pentad into familiar categories and disciplinary attitudes.[43] Whereas Burke recognized that a socially generated symbol system necessarily defines our expression, he attributed narrative and poetic detail and innovation to the author. It is the denial of the tension between authorial voice and pre-

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frameworks. Again, Bruno Latour's *Science in Action* (Cambridge MA: Harvard University Press, 1987); can be seen to thoroughly adopt Burke's dramaturgy by examining science as it happens, not after the performance has already been rendered in a journal article or textbook. The elements of the pentad, placed in "unfinished" science, produce rival, equally valid, accounts of the conduct of science.

[42] Donald McCloskey's *The Rhetoric of Economics* (Madison: University of Wisconsin Press, 1986) documents the over-mathmatization of economics as a rhetorical ploy providing the veneer of scientism. See also, Trevor Melia "Scientism and Dramaticism" *The Legacy of Kenneth Burke*, Herbert W Simons and Trevor Melia (eds.) (Madison: University of Wisconsin Press, 1989); and John S. Nelson, Alan Megill and Donald McCloskey (eds.) *The Rhetoric of the Human Sciences* (Madison: University of Wisconsin Press, 1987).

[43] Much of the ambiguity of discourse analysis rests with where to locate the elements of Burke's pentad. A unique move by the strong program in sociology and reflexive theorists in the sociology of scientific knowledge has been to reconfigure the elements of discourse by explaining both sides of a dichotomy (truth and falsity, for example), or causes other than social (idiosyncrasies by an author), in their own accounts. See Bloor, *Knowledge and Social Imagery* (1976).

existing symbols and forms of expression[44] (by deconstructionists, for example) which has led to the lack of full interdisciplinary exchange between composition theorists, rhetoricians and discourse analysts in sociology. The critical dismissal of authorial voice and the role of the author in scientific discourse, by both critical theorists and scientists (writing conceived as transcribing the voice of nature), has supported the myth of scientific autonomy; at least with respect to the codification of information in discourse. What has been lost in relegating the place of the author (agent) to the margins is a connection between the act and agency of teaching writing to scientists and engineers in universities, the purpose of understanding dramatism in scientific rhetoric, and how the scene internal to the text relates to context in which the text is produced. If, as Charles Bazerman[45] suggests, scientific writing can be explicated in the same way as literature, then the function of the authorial idiosyncrasies (or logological anomalies[46]) as individual expression, and social manifestation, must be seen in the process of writing a

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[44] See Carol Gilligan *In A Different Voice* (Cambridge, MA: Harvard University Press, 1982) and Louise Wetherbee Phelps *Composition as a Human Science* (New York: Oxford University Press, 1988) for a discussion of how writers attempt to locate themselves within a text.

[45] Charles Bazerman *Shaping Written Knowledge: The Genre and Activity of the Experimental Articles in Science* (Madison: University of Wisconsin Press, 1988).

[46] Burke's examination of the function of religious symbolism in *The Rhetoric of Religion: Studies in Logology* (Boston: Beacon Press, 1961) led him to re-examine the work of Coleridge, among others. Coleridge's passing remark that "language itself does as it were think for us" led Burke to claim that "if a new distinction becomes generally established, in effect the corresponding words think for us, we are at the very center of logological inquiry." (See also "Theology and Logology" *Kenyon Review*, n.s., 1 (Winter 1979), 151-85. However, Burke attributed these new distinctions, or logological anomalies to authors' private experiences. Both Marxist literary critics and deconstructionists have attacked this position for its ahistoricism and departing from the text. Trevor Melia in "Scientism and Dramaticism" *The Legacy of Kenneth Burke*, Herbert W. Simons and Trevor Melia (eds.) (Madison: University of Wisconsin Press, 1989) develops the argument more thoroughly. I contend that authorship must be viewed as a locus for the expression and development of normative choices explained in the teaching of composition, rhetoric and technical communication to scientists and engineers.

scientific text. Kenneth Burke's dramatism dovetails the authorial voice and the social voice implied in the use of rhetoric to the practice of scientific discourse.

3.2 *Toward a Theory of Discourse*

Appearing in 1971, James Kinneavy's *A Theory of Discourse* was one of the most thorough and sustained attempts to bring composition theory in league with contemporary advances in rhetoric, linguistics and literary criticism. The foundation of Kinneavy's taxonomy of discourse is based on his communication triangle (taken form Roman Jakobson). Similar in function to Burke's pentad, and Richards' modification of Peirce's theory of signs, Kinneavy plotted the interrelationship between "expressor, receptor, and language signs referring to reality." [47] The virtue of Kinneavy's triangle was in bringing together the dynamics among reader, writer, text and reality in a necessarily reciprocal way; each point of the triangle was seen as effecting the other points through changes in linguistic signs. Kinneavy also defined his task by tracing the aims of discourse to the history of a particular form, referential, persuasive, literary and expressive, and the stress thinkers would put on chosen features of language. For example, in discussing reference, or scientific[48], discourse, Kinneavy bemoans the lack of a "corresponding analytical tradition for the organization of scientific and informative discourse paralleling the 'arrangement' (dispositio) tradition in rhetoric" [49] while later

[47] See chapter one of James Kinneavy's *A Theory of Discourse* (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1971). Kinneavy has mapped out several subdivisions of the triangle with respect to "syntactics, semantics, and pragmatics " (pgs 20-40). For purposes of my summary the importance of reciprocal relationship among encoder (rhetor), decoder (audience), reality and signal (language) will be tied to the teaching of writing as process (Donald M. Murray, "Teach Writing as a Process not a Product" *The Leaflet* (November 1972), 11-14 to scientists and engineers and Charles Bazerman's *Shaping Written Knowledge* (1988) p. 24, footnote 4 modification of Kinneavy's triangle.

[48] Kinneavy divides reference discourse into three styles, scientific, informative and exploratory. I will only look at scientific discourse.

[49] James Kinneavy *A Theory of Discourse* (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1971), p. 151.

tracing the "media of scientific discourse" from Lucretius to Max Planck. In setting out the organization of scientific discourse, Kinneavy reflects on the modes of it and their arrangements. Although, I will not examine Kinneavy's notions of scientific discourse in detail, I do want to begin to show how his notions about the nature of science[50] and the style of referential discourse are seen through the communication triangle.

Breaking down various styles, referential, persuasive, literary, expressive, into the matrix of the communication triangle, Kinneavy separates styles having to do with aim (purpose), from styles evolving from components in the arts. In drawing this distinction, Kinneavy seem to be saying less about the epistemic privilege of referential discourse, and more about the goals of writers. The stylistic conventions used by a novelist or a scientist come from the language being used in tandem with the narrative the author presents to the reader. The language of science, or of a novel, is embedded within "semantic components," terms derived from the peculiarities of the discourse group, or the idiosyncrasies of the author. Style is also derivative of how terms refer; literally (neutrally, referentially), nonliterally (exaggeratedly, metaphorically) and qualitatively (clearly, ambiguously). Grammatical choices and norms, practiced in discourse communities, are also elements which determine style with respect to syntax, morphemes, phonemes and graphemes. Governing organizations of academic disciplines set guidelines tailored to the types of information conveyed by researchers.[51]

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[50] Kinneavy may have been the first composition theorist to flesh out how the developments in the history and philosophy of science (Kuhn, Duhem, Quine and Popper, among others, make appearances throughout the text) were incorporated into scientific and technical communication. In fact, Kinneavy begins the section "The Style of Reference Discourse" by stating: "Possibly the most important remark to make at the outset of a discussion of the style of reference discourse is that there is no systematic coverage of the topic, either historically, critically, descriptively or comparatively - as far as the author is aware. This is true of scientific discourse ... " (p. 166).

[51] Conventions such as footnote and bibliography style, grammatical usage, mathematical notation, and technical terminology are sponsored by academic organizations and journals at a macro-level, and instituted and practiced at a micro-level by writing

Historically, the predominate style of scientific discourse has been tied to reporting, or the objective rendering of observations within a plain prose style. As Kinneavy points out,[52] it would be foolish to hold that there is one scientific style, or that there ought to be. In rehearsing a brief history of scientific discourse, Kinneavy looks to Bacon as the writer who exercised a profound influence on what we consider modern scientific and technical writing. Bacon's partial rejection of the rhetorical art of discourse, found in the digressions and verbal posturing of scholars, led him to support a pure and unadorned style for the members of the Royal Society. An emphasis was placed on scientific discourse as finished, or as product oriented as possible. The exploratory style of works in progress was seen as sloppy and taxing on audiences. Echoes of Bacon's prescriptions can be found in Puritan conceptions of good style in America. Cotton Mather, for example, extolled the virtues of simplicity and naturalness in communicating ideas, while shunning academic rhetoric. Thomas Foxcroft's *A Practical Discourse Relating to the Gospel-Ministry* (1718) expounded on the necessity for words to exhibit clarity, truth and good reasoning, without the opaqueness of scholasticism. Blatant appeals to emotionalism were thought contemptible and, thus, condemned.[53]

The attempt to erase the of presence of the rhetor and audience in scientific discourse was a means to allow the given information to "speak for itself." Word choice, style and arrangement of information in contemporary scientific and technical

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instructors and students. The elements of the debate over the norms of usage, in non-natives speakers for example, has not been lost at the level of practitioners of specific academic disciplines. Initiation into a discipline requires mastery of the approved forms of communication, eventually determining who gets a voice within a disciplinary context. Questions over the place and purpose of forms, conventions, expressive styles and reforms in regard to the production, distribution and accessibility of texts have been the basis for ongoing disciplinary turf wars.

[52] James Kinneavy *A Theory of Discourse* (1971), p. 168.

[53] See chapter twenty-seven of Perry Miller's *The New England Mind: From Colony to Province* (Cambridge, MA: Harvard University Press, 1953, 1981).

communication were approached with the assumption that the audience, upon reading a document, or listening to a description of an experiment would want to act; either to replicate the experiment or build a better mousetrap. Instruction in technical communication is geared toward this "cookbook" mindset. The quest for "useability" by scientific and technical writers has led to a number of stylistic conventions: substituting third person pronouns for first-person pronouns, use of passive voice, use of denotative terms, dependence on multiple modifiers, preference for literal terms,[54] use of jargon and the adaptation of new meanings to familiar terms. Rather than achieving clarity, most writers within highly specialized disciplines have succeeded only in defining discourse communities through a shared technical vocabulary. Kinneavy suggests the use of jargon comes of the author's good intention, a precise reference, and not out of a desire for obscurantism. Rhetorically, the author is positioned as the possessor of a unique knowledge or practices to be shared with other members of the discourse community who will use the information; much as in following a set of instructions. Kinneavy notes the tension in the purpose of reference discourse between the *ethos* of discovery and reader application.

The *ethos* of scientific discourse, as described by Kinneavy, appears bounded by his own aims at establishing an empirical study of the composing process. Kinneavy has been criticized for his overly positivistic attitudes toward the aims of discourse,[55] and

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[54] As Kinneavy -- *A Theory of Discourse* (1971) -- points out on page 177, the use of models and analogies in technical communication has become a standard practice. Feminist critiques of "androcentric" science stand as one example of the lack of literalness in technical communication. For audiences lacking the same degree of technical expertise as a writer, for example, the use of simile, metaphor and analogy is encouraged by a number of technical writing textbooks in order to relate sophisticated concepts to the general experience of the layperson.

[55] Kinneavy defines aim in discourse as that "aim which is embodied in the text itself - given the qualifications of situation and culture" (p. 49). Thus the "totality of the effect" of a text -- authorial intent, reader response, organization, style -- must be studied as contained in the aim (or purpose) of the text which determines the four other elements of discourse -- sender, receiver, the reality being presented or the text.

his reduction of speaking and writing to one activity, "encoding." [56] By extending the communication triangle to fit all forms of discourse, Kinneavy has also been accused of forcing examples to fit his theory and being overly ambitious in constructing a complete taxonomy of discourse. Yet, his attention to the aim and purpose[57] of scientific discourse within the elements of the communication triangle revealed the complexity in the structure of scientific texts and approaches for unpacking their elements.

4. CONTEMPORARY COMPOSITION THEORY

Composition theories representing a variety of epistemological assumptions began to take root in the 1970's. James Berlin[58] tags three rhetorical classes, objective, subjective and transactional, which roughly fall into the philosophical/psychological schools of positivism/behaviorism (Zoellner 1968, Bloom and Bloom, 1967), idealism/constructivism (Coles 1978, 1988, Macrorie, 1964, Bruffee) and dualism/cognitivism (Emig 1971, Bruner 1960, 1962, 1966, Young, Becker and Pike 1970, see Odell and Cooper 1978 [59]). However, in dealing with the onslaught of

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[56] See Paul Hunter's " 'that we have divided/In three our kingdom': The Communication Triangle and *A Theory of Discourse*" *College English*, Vol. 48, No. 3 (March 1986), 132-43.

[57] One of the problems Kinneavy faces in tracing a taxonomy accounting for the aims, purposes and norms of discourse is the artificial separation of rhetorical modes of discourse which overlap. Kinneavy argues, however, one mode remains dominant and can be analyzed accordingly. "To achieve a specific purpose a specific aim of language must be used. Persuasion is bad science, but good rhetoric; and science may be good reference discourse but bad literature (p. 66)." Texts succeed in communicating to the reader a hierarchy of aims in which certain aims, persuasion in technical communication for example, are subsumed to the primary aim. More recent critics of scientific discourse -- e.g. Lawrence J. Prelli *A Rhetoric of Science: Inventing Scientific Discourse* (Columbia: University of South Carolina Press, 1989) -- have raised the embedded elements of scientific texts to the surface to survey the invention process of rhetors.

[58] James Berlin *Rhetoric and Reality* (Carbondale: Southern Illinois University Press, 1987).

[59] Lee Odell and Charles R. Cooper (eds.) *Research on Composing: Points of Departure* (Urbana, IL: National Council of Teachers of English, 1978).

poststructuralist theory, Marxist critical theory, and the advent of social and cultural identification, rhetoric, by locating language at the center of these concerns, was seen as central to the process of formulating knowledge, and hailed as epistemic. The way in which language shapes, or is shaped by societies and/or individuals continues to be the central issue informing current rhetorical practices. Roughly, concentration on the social or private versions of knowledge and accompanying forms of language use have broadly divided schools of rhetoric into two camps: mental constructivism and social constructivism. Mental constructivists (L.S. Vygotsky, A. R. Luria, Nelson Goodman, Jerome Bruner, Ernst Cassirer, E.H. Gombrich) denied the existence of a "real world" preexisting prior to our use of symbol systems. In essence, the human mind creates the world through the use of symbols - whether language, art, or mathematics. As "world makers" [60] we apply individual mental categories, assumptions, knowledge of symbol systems, predicates and other ideas we take as given to an understanding of the world. Expressionistic rhetoric (Kenneth Dowst, Donald Murray, David Bartholomae) casts the writer as primarily involved in inventing the self within an assumed discourse community. Composing is seen in personal terms: the writer struggling to establish their voice in negotiating with an audience and a world in which they must function. Since individual minds are trained to process symbols in particular ways which are assumed, the communicator must some to grips with their own knowledge of a symbol system contrasted with the needs of an audience.

Social constructivists emphasize the collaborative nature of composing in tandem with the social nature of language and rhetoric. Since languages are created by societies and groups, the process of discovery, invention and communication is, inherently, a

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[60] Nelson Goodman *Ways of Worldmaking* (Indianapolis: Hackett Publishing Company, 1978).

social one. Discourse occurs primarily within groups, and through public interaction. If symbol systems stand as the locus from which all expression derived, then the concepts on which discourse is based are socially constructed. The role of disciplines, professional organizations and institutions in sponsoring norms for communication has been inculcated into writing across the curriculum (and disciplines) programs,[61] and inspired research into the ideological implications of the use of rhetoric.

An interesting shift in pedagogy, based on a recognizing the social nature of writing, has been proposed by Kenneth Bruffee. Classroom procedures in English centered (and in many instances still do) on the individual student and the teacher. Students implicitly assume the job of anticipating the teacher's need within a given rhetorical context. Bruffee's "collaborative learning" scheme was an attempt to "de-center" the classroom by dividing the students into small groups and having them write for one another. The teacher would arrange the classroom conditions in order to provide a social network for students to write for other students. Writing was conceived to be primarily a social act and a writer's language "... originates with the community to which he or she belongs. We use language primarily to join communities we do not yet belong to and to cement our membership in communities we already belong to." [62] In Bruffee, and in some aspects of Young, Becker and Pike (1970) the purpose of the new rhetoric was

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[61] Michael Foucault's *The Order of Things: An Archaeology of the Human Sciences* (New York: Vintage Books, 1970) insistence that "the historical analysis of scientific discourse should, in the last resort, be subject not to a theory of the knowing subject, but rather to a theory of discursive practice" (p. xiv) has underscored the social, rhetorical and ideological nature of knowledge. This theme has also been developed by Kuhn (1970) and been can be seen in the work of Donald McCloskey, Carolyn Miller, Lawrence Prelli, Greg Myers and Charles Bazerman who directly map out the social influences manifest in scientific writing.

[62] Kenneth A. Bruffee. "Collaborative Learning and ' The Conversation of Mankind' " *College English* Vol. 46 (1984), 635-52. See also Bruffee's review of social constructionism and its possible application to the teaching of English composition in "Social Construction, Language, and the Authority of Knowledge: A Bibliographical Essay" *College English*, Vol. 48, No. 8 (December 1986), 773-90.

to prepare students, based on a conception of knowledge as socially constructed, to participate in public debate through an understanding of the interplay among language, communities and individual cognition.

The influx of disciplinary perspectives on communication, the entrenched favor of literary studies and the continual squabbles over the status of theory and practice has left composition theorists groping for a professional identity and place to hang their hats. This comes at a time when disciplinary boundaries within the academy are being reshuffled, and the teaching of communication practices are being addressed by a growing number of non-specialists. As composition theorists have called for a divorce from literary studies and, in some cases, English departments,[63] theories about the process of writing are germinating from the points of view of the social science and legal studies, and other disciplines in the humanities. Additionally, the insistence on teaching students how to write across the curriculum and the adaptation of "writing intensive" courses outside of the English discipline have farmed out responsibility for teaching students of science and engineering how to communicate. Although the future autonomy of composition remains in doubt, the continued debate over the social and cognitive content of rhetoric and communication is certain.

5. THE RHETORIC OF SCIENCE

Rhetoric of science is a relatively young field which attempts to bridge the sociological and psychological aspects of scientific discourse while analyzing the use, by the rhetor, and effect, on the audience, of persuasion. To position science and rhetoric together seems to be quite odd. At first glance, one field has absolutely nothing to do with the other, looking at the Sophistic origins of rhetoric and the positivist trappings of

[63] See, for example, Chapters 11 and 12 in Stephen M. North *The Making of Knowledge in Composition: Portrait of an Emerging Field* (Upper Montclair, NJ: Boynton/Cook Publishers, 1987).

science we must surely be comparing cabbages and kings. But the rhetoric of science has gained a foothold in the terrain abandoned by philosophers which Richard Rorty has attempted to recover, and it has found allies in sociological and psychological studies of scientific practice. The blending of disciplinary borders in studying science and technology has also been grist for the rhetoricians mill; scientific texts are no longer seen solely as true, impartial renderings of observables by scientists and explicated by philosophers of science. Perhaps the principle difficulty of composing a rhetoric of science lies in the "loose ends" [64] which fail to demarcate the theories and practices of either field.

Rhetoric has been taken to be a vast toolkit of communicative heuristics, many times extracted from composition and literary theory, and employed randomly in producing and analyzing scientific discourse. As one might expect, there is little common understanding about the use, function and significance of rhetoric in light of technical communication, thereby reinforcing its second-class citizenship and denying an advisory role for rhetoricians in fashioning technical discourse.[65] Somewhat paradoxically, the lack of a disciplinary anchor for rhetoric has made way for a study of how knowledge has been embodied, practiced and communicated within academic disciplines by historians and sociologists. In looking at the canonical histories of the sciences, for example, one can trace how research agendas are set and perpetuated through rhetoric and other communicative techniques. Practiced reflexively, rhetorical analyses can lead

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[64] R Allen Harris "Rhetoric of Science" *College English* Vol. 53, No. 3 (March 1991), 282-307.

[65] Harris – "Rhetoric of Science" (1991) – claims that rhetoric parallels philosophy as a advisor, rather than an arbitrator, of claims aspiring to truth on our culture. Rhetoric's advisory position is seemingly mitigated by how well it is used and understood in determining the purpose of communicative praxis in natural science, and by the epistemic authority culturally granted to rhetoric. The association of rhetoric with hucksterism and the piecemeal deployment of rhetoric by social scientists (even reflexively) has done little to elevate the advisory, and hence normative, function of the rhetoric of science.

communicators to discover how their voices are determined and fit within an intellectual tradition. And yet, while scientists and non-scientists may admit to the "rhetorical nature" of their discourse, the significance of that description has, ironically, little rhetorical force.

The techniques of rhetorical analysis can be wielded, with relative success, by anyone in any discipline looking to subvert or authorize targeted discursive practices. The seeming accessibility and wide distribution of composition, rhetoric and literary theory turns researchers, writers and speakers, in any discipline, into instant critics. Scientists and non-scientists alike find no particular expertise necessary to label something "rhetoric" and vilify speaker, author or text. Further, writers and speakers are loath to surrender the authority of their accounts by trumpeting their rhetorical nature. Setting norms for proper communication have passed out of the hands of rhetoricians and grammarians and have been left up to participants of a communicative event to discover later. Scientists, consequently, have no problem in a summary dismissal of rhetoricians, and no problem applying rhetorical principles as they see fit.

The proliferation of subdisciplines in the sciences, accompanied by specialized jargon and ready-made audiences, supports scientists' high-handed attitude toward rhetoricians. However, the science community knows it must entice a new generation of students into becoming practitioners; it must provide a more detailed and accessible public accounting of its proposals and practices, and must appeal to a new generation of politicians who may be even less scientifically and technically literate than those who currently hold office. The arbitration of scientific and public interests, both internal and external to the institution of science will be mediated (or vitiated) by the use rhetoric. What rhetoric will have to offer to science will be a means to inform and persuade audiences with a greater range of impressions and knowledge about the role of science in society and the cost/benefit of technological and scientific projects. Accordingly, science

studies practitioners will be in the unique position of molding the rhetorical techniques of the history, sociology and philosophy of science to the needs of scientists and the public. As the disciplinary boundaries separating social science and humanistic inquires about science begin to recede, a new set of rhetorical principles will become available and applied through interdisciplinary research.[66]

Rhetorical analyses of scientific texts comes out of many traditions from the Sophists, Plato, Aristotle, Quintilian, Augustine and Bacon to contemporary theorists such as Burke and Kinneavy to scholars primarily associated with other fields like Polanyi, Kuhn and Feyerabend. At the same time, the jumble found in composition theory seems to be associated with the many approaches plied by rhetoricians of science.

Rhetoric of science papers tend either to "star" texts through empirical case studies (e.g. Finocchiaro, 1980, Gross, 1984, Dear 1985) or offer more a more theoretical analysis (e.g. Nelson and McGill 1986, Prelli, 1989, Zappen, 1983). Although a taxonomy of rhetorical approaches to science is both artificial (suggesting an

[66]Alan G. Gross in Chapter 1 of *The Rhetoric of Science* (Cambridge, MA: Harvard University Press, 1990) asks if what scholars such as Ian Hacking, Arthur Fine, Evelyn Fox Keller and Steve Woolgar do does not amount to the literary and rhetorical criticism of texts, indistinct from doing sociology, psychology or intellectual history. Rhetoricians of science (e.g. Prelli (1989) and Harris (1991)) have reappraised the disciplinary tasks of scholars, as rhetorical analysis, to "register a claim already staked and mined ... to make available to all a coherent tradition, a set of well-used intellectual tools (p. 5). Charles Bazerman *Shaping Written Knowledge* (1988) makes a related point in prefacing the need for increased interdisciplinary exchange: "Scientists, however, are unlikely to recognize difficulties in framing successful investigations and claims as rhetorical, unlikely even to be aware of rhetoric as a relevant field. Even if they are aware that their claim making can be fruitfully conceived in rhetorical terms, they may have little idea of what the relevant branches of rhetoric are, what books to read or whom to talk to. Finally, even if they find a willing rhetorician to talk to, very few of those rhetoricians have had any experience in talking to scientists and applying rhetorical knowledge to problems of scientific communication (p. 332). My response to Bazerman's view (which I will develop in chapter 3) is two-fold: (1) to codify new rhetorical strategies arising out the integration of disciplines studying science (i.e. science and technology studies), and (2) to teach student scientists and engineers, in composition and technical communication courses, the rhetorical skills sufficient to deal with a wide range of audiences with diverse intellectual profiles.

organization which may not exist) and difficult to construe,[67] there are a family of common themes and approaches adopted by critics of scientific texts which fall along pragmatic and theoretical lines in dealing with the composition, interpretation and adaptation of persuasive techniques in scientific texts. Divisions exist, however, as to how the relationship among rhetoric and science is to be characterized. On one end of the spectrum, as Myers points out in a review of Prelli, (1989), rhetoric has been seen as "a branch of cognitive science" [68] (see Chapter 3) in which the systematicity of rhetorical invention and scientific practice are seen as complimentary. This branch of rhetoric has been tagged by other researchers as "epistemic rhetoric." On the other end of the spectrum lie constructivist/relativist philosophical orientations, the ground assumed by discourse analysts and reflexive theorists (which I will address in Chapter 2). The middle ground in this debate has been staked out by Charles Bazerman whose conception of rhetorical prescription is less naive than that epistemic rhetoricians, but

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[67] Again, R. Allen Harris -- "Rhetoric of Science" (1991) -- serves as a guide and a caution. He has developed "six fuzzy but identifiable categories" (p. 296) in which to place the work done in the rhetoric of science and technology. While helpful, the taxonomy suffers in trying to reflect the fading border between composition studies, science and technology policy, technical writing and communication studies. Harris' strives, by virtue of his taxonomy, to show a clear demarcation between the goals of rhetoric of science and the philosophy of science. What Harris -- and many rhetoricians of science -- are at pains to avoid is the hegemony of philosophy's judgment about knowledge claims; and the relativism inherent in rhetoric of science insures this goal. My explicit connection between rhetoric of science and composition studies (under which I include the field of technical communication) seeks to inspect the norms of communicative practice which are taught to student scientists and engineers. Here, a philosophy of social science is necessary. The critical interpretive mechanisms brought to a study of scientific texts can also be made available to the study and practice of technical communication. Harris' argument for a descriptive, rather than evaluative, rhetoric of science, reinforces the distinction between theory and practice and allows little hope for constructive change or criticism of scientific practice. Steve Fuller *Philosophy, Rhetoric and the End of Knowledge* (forthcoming) in fostering his own brand of knowledge policy sees rhetoric as stemming "the tide of disciplinary fragmentation" by integrating the theory and practice of rhetorical discourse.

[68] Greg Myers "Sociology of Science Without the Sociology" *Social Studies of Science* Vol. 20 (1990), 559-63, p. 563.

who offers nothing more than a "Polanyiesque" view of disciplinary communication.[69]

5.1 *Epistemic Rhetoric*

In addressing traditional philosophical problems within the framework of rhetoric, Richard Cherwitz and James Hikins (1986) have been the most recent advocates of an epistemic rhetoric. Central to the claims arising out of their model is the assumption that "reality including perceptions, attitudes, beliefs and values exists wholly independent of us and is knowable." [70] As all knowing can be considered to be inherently rhetorical, Cherwitz and Hikins are prepared to assign the dual function of discovering and propagating truth to rhetoric. Through the dialectical process of persuasion and argumentation, the rhetorician and the audience appraise various knowledge claims and may begin a working debate, or forge a consensus, which permits rhetorical investigations to move forward. The aim of the dialectical process of rhetorical communication and argument, for Cherwitz and Hikins, is to discover the independent objects of reality. For example, in considering scientific rhetoric as a form of epistemic rhetoric, one goal of the discourse community would be to compare and assess

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[69] Steve Fuller ("Review of Bazerman" 1988, see note 10) makes the same point in his review of Bazerman. He argues that discourse analysts attitude toward "the prescriptivist turn of mind" (see also "'Rhetoric of Science': A Doubly Vexed Expression" *Southern Communication Journal*, forthcoming)has been motivated by " The pathological fear of error that Richard Bernstein (1983, chap. 1) aptly termed the 'Cartesian Anxiety.' It is an epistemological strategy that forbids one from making any claims unless one can guarantee their truth. However, sane prescriptivists like Bazerman realize that their advice could well be wrong in a good number of cases, but the prospect of failure does not undercut the importance of giving such advice." Fuller disagrees with Bazerman's conception of disciplines as institutions fostering a sense of shared understanding in which a rhetor can assume an audience's implicit compliance and understanding of a rhetorical claim. Bazerman's assumption of the stability of institutional and communicative structure belies an attitude demonstrated in technical writing textbooks which rely on the formulaic presentation (e.g., proposal and report formats) of scientific and technical knowledge.

[70] Richard A Cherwitz and James W. Hikins *Communication and Knowledge: An Investigation in Rhetorical Epistemology* (Columbia: University of South Carolina Press, 1986), p. 12.

competing descriptions and perspectives of discrete entities and facts. Through a process of revision, the community would pare down the elements of the description to lend a more accurate representation of reality. By linking rhetoric and epistemology, Cherwitz and Hikins seek to describe how the study of modes of discourse and concerns about the nature of knowledge, found both in rhetoric and philosophy, cut across disciplinary concerns and may lead to the amelioration of problems in common topics of inquiry; in, for example, the sciences.

Three definitions are central to the project of rhetorical epistemology. Cherwitz and Hikins define rhetoric as *the description of reality through language*. Subsequently, knowledge is defined as *justified true belief*. The definition of rhetorical epistemology, which owes much to Robert L. Scott is *the investigation of how through communication we come to know*.

These definitions have been sufficiently vague to invite a great deal of criticism from both philosophers and rhetoricians. In a 1988 review of Cherwitz and Hikins' *Communication and Knowledge*, Steve Fuller in *Philosophy and Rhetoric*, remarks their definition of rhetoric, "... as a definition of anything ... leaves much to be desired, since it suggests that the rage for breadth has driven our authors to the brink of tautology. As a definition of rhetoric, however, the definition is even worse, since Cherwitz and Hikins have identified precisely that function of language - describing - which philosophers from Aristotle to Ayer have touted as 'cognitive' and therefore susceptible to a nonrhetorical treatment." [71] Following Fuller's criticism, one can see Cherwitz and Hikins' limited definition of rhetoric leaves little room for practicing rhetoricians to ply their trade, except as "wanna be" epistemologists. Further, the acceptance of the

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[71] Steve Fuller "Book Review -- Communication and Knowledge: An Investigation in Rhetorical Epistemology" *Philosophy and Rhetoric* Vol. 21, No. 3 (1988), 234-237, p. 234.

definition of knowledge as justified true belief does not address why, since we have almost nothing satisfying that condition, we still proclaim to have knowledge.

In the following issue of *Philosophy and Rhetoric*, Stanley Cunningham cites the "provocative" nature of Cherwitz and Hikins' definition in comprising claims about reality which normally are not considered the purview of rhetoric. However, in attending to the relationship between philosophy and rhetoric, the authors take as given the potential for descriptions of reality to persuade an audience. Cunningham attempts to amend this problem by rewriting Cherwitz and Hikins' definition of rhetoric to state; "rhetoric is the art of uttering language - mediated, potentially persuasive descriptions of reality." [72] From both Fuller and Cunningham's viewpoints, Cherwitz and Hikins have made an ironic error. The philosophical constraints of epistemic rhetoric have hamstrung rhetoricians. A common function of rhetoric, persuasion, is noted as a latent possibility in any exchange, but is not made explicit in Cherwitz and Hikins definition. Any impact in proclaiming "all knowing (as) ... inherently rhetorical," and therefore persuasive, has been forsaken for a weaker conception of rhetoric in deference to a stronger view of classic epistemology.

The conundrum surrounding rhetorical epistemology resurfaced two years ago in a forum in the *Quarterly Journal of Speech*.[73] In the exchange, Barry Brummett writes the eulogy for epistemic rhetoric, Cherwitz and Hikins retort by "burying the undertaker" and Thomas Farrell waxes poetic in documenting life, death and rebirth along the

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[72] Stanley B. Cunningham "Rhetor Redux: A Rejoinder to the Cherwitz/Hikins Definition of Rhetoric" *Philosophy and Rhetoric* Vol. 21, No. 4 (1988), 290-93, p. 291.

[73] The articles published in this form in *Quarterly Journal of Speech* Vol. 76, No. 1, (1990), were Barry Brummett "A Eulogy for Epistemic Rhetoric" 69-72, Richard Cherwitz and James Hikins "Burying the Undertaker: A Eulogy for Eulogists of Rhetorical Epistemology" 73-77 and Thomas B. Ferrall "From the Parthenon to the Bassinet: Along the Epistemic Trail" 78-84.

epistemic trail. Further rejoinders in the debate by Robert Scott and Alan Gross admonish Barry Brummett for following the siren song of the relativists.

Brummett's claim is that the research once sparked by epistemic rhetoric has died out because the theoretical principles have not been applied to actual discourse. Brummett echoes other critics of epistemic rhetoric who feel rhetoricians are not served by ignoring active controversies in philosophy; in uncritically taking philosophical concepts and using them in an internal analysis of rhetorical practice. Cherwitz and Hikins respond to Brummett's assertions in holding that rhetoric consists of an analysis of what symbols do, and therefore, is inherently epistemological. In the role of arbitrator, Thomas Farrell tries to clarify the boundaries of the dispute over epistemic rhetoric, but succeeds in only adding fuel to the fire. Farrell circumscribes the debate by returning to original question: What is a rhetoric? On one hand, both Brummett and Cherwitz and Hikins agree to marginalize one idea of rhetoric, as the art of speech making, the aim of which is the pernicious influence of an audience through the clever use of rhetorical tropes. On the other hand, Brummett and Cherwitz and Hikins cannot agree on the first task of rhetoric; practice, disciplinary introspection, or a marriage of both.

The brand of realism supported by Cherwitz and Hikins (1986, 1990) is identified as perspective realism: the resulting rhetorical theory supported by this brand of realism is known as rhetorical perspectivism. Simply stated, perspective realism may be seen as a form of minimal realism. At the heart of rhetorical perspectivism lies a theory of relationality which asserts "there is no ontological distinction among the entities populating the universe" because everything in the world stands in relation to everything else in the world. Observers are presented with the world largely as it is in itself, but are never presented with all of reality at once. Individual observers, then, view aspects of objects in the world. The aspects of the objects to which the observer attends may be a by-product of cultural orientation, needs, physical position, personal

expertise, or a combination of factors. Through communicative praxis, the perspective of one observer is made salient to another observer. Here, rhetoricians would be able to reconstruct the subjective judgments of an observer as an ultimate effect of an accessible reality. A discourse community would function to exchange and provide context to rhetorical claims in view of largely successful perceptual strategies. Although agreement about knowledge claims may not be gained, the implication of a rhetoric situated epistemologically is that rhetorical discourse, as a process, needs to remain open and continue to refine claims in reference to commonsense reality.

In order for rhetoric to be seen as epistemic, Cherwitz and Hikins list five conditions which, if taken hierarchically, enable one to judge if rhetorical claims can be elevated to the level of knowledge. I summarize these conditions as follows: An epistemologically productive rhetoric must: (1) differentiate between the rhetor, the audience and extralinguistic phenomena (the world), (2) be able to reclaim all possible descriptions of reality deriving from first-person epistemic judgments to the source (3) survive in the marketplace by withstanding argumentative analysis, (4) adapting, changing and surviving a dialectic process, and (5) must make clear the relationship between the knower and the limited aspect of reality being observed.

5.1.1 Assessing Epistemic Rhetoric

I agree with promoting the study of science and rhetoric within a realist framework, but not at the expense of an understanding of the representational and persuasive elements in language. A classic epistemology need not be the goal of a realist based rhetoric. A review of the arguments against epistemic rhetoric suggests that rhetoric defined as "the description of reality through language" is simply bad. Assuming the latent function of persuasion circumvents a number of ontological and normative arguments and lightly treats serious questions posed by relativists. Further, a steady diet of theory void of practice has weakened the research agenda of epistemic rhetoricians.

The conception of rhetoric sponsored by constructivists/discourse analysts is based in urging the practitioner to action and then having philosophical notions refined through use. Realists, in coming to terms with rhetoric, seem mired in dissecting philosophical arguments, and by additionally assuming a common sense access to reality, miss the opportunity to take prescriptive action. One of the flaws in epistemic rhetoric comes, in part, from a strict emphasis on the referential aspects of scientific discourse related to the assumption that the primary goal of scientific discourse is the description. Scientific discourse can, of course, take a number of forms which may have little to do with the sharpening of descriptive references. Cherwitz and Hikins, seemingly take a step in the right direction in stating: " ... only an incomplete, if not misleading analysis could come from criticism done solely in reference to the author's intent or the audience's reaction or any other singular dimension. Insofar as a complete understanding of a *literary work* could be attained, it must come from reconciling conclusions from all possibly relevant perspectives." (my emphasis)[74] The reference to a literary work is helpful in that it reveals the ontological positioning and argumentative counter-punching informing realist (epistemic) and constructivist (discourse analysis) interpretations of texts.

Realists point to phenomena beyond the text, to which the text refers. The realists' cognitive authority comes from a more accurate depiction of a real "state of affairs" which is being conveyed to the audience. Constructivists counter that the functions of the writer, the audience, and the text can been seen as embedded in a social context, from which the realist writer cannot escape. Of course, the writer, the audience and the text exist, are real, and do refer to objects in the world about which we have some degree of certainty. Yet, from the constructivist position an understanding of the

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[74] Cherwitz and Hikins, Communication and Knowledge, (1986), p. 170.

references of writers, audiences and texts is, in fundamental ways, limited to the experiences of individuals or groups of writer and readers, and is transmitted through a socially constructed medium.

Realists can try to show that the constructivist must refer, at some point, to the reality beyond the phenomena. In turn, constructivists can oppose realists by showing how their motives are grounded in a socially defined notion of realism, or empirical adequacy. A realist can show that the constructivist is committed to an objective notion of the social; which may entail a deeper commitment to an independent physical reality. For a constructivist to make intelligible rhetorical claims about the social, they must ground their ideas in the "fact of the matter;" namely that societies exist, objectively. Again, the constructivist may counter that the idea of objective reality only makes sense relative to individuals whose cognitive powers may be limited, or constrained.

5.2 *How Scientific Rhetoric is Composed*

Charles Bazerman's series of papers on scientific persuasion, genre and context, many of which have been collected in his book *Shaping Written Knowledge* (1988), trace the development, emergence, distribution and diffusion of the scientific article. Bazerman's work is thoroughly interdisciplinary; attending to the critical perspectives of the writer and the audience enmeshed in the linguistic, social, historical and cultural frameworks of science. From a description and criticism of the genre of scientific writing, Bazerman also offers pedagogical insights into how texts in the natural and social sciences and the humanities are designed, assuming reception in either "stable" or "unstable" rhetorical universes. In comparing "three examples of academic discourse," [75] Watson and Crick's "A Structure for Deoxyribose Nucleic Acid," Robert Merton's "The Ambivalence of Scientists" and Geoffrey Hartman's "Blessing the Torrent: On

[75] See Chapter 2 of Bazerman's *Shaping Written Knowledge* (1988).

Wordsworth's Later Style", Bazerman pieces together the puzzle writers and readers in each discipline must face at a given intellectual moment.[76] Bazerman's thesis, that the rhetorical game played by natural scientists (Watson and Crick) is more clearly governed than the rhetorical game(s) played in the social sciences (Merton) and the humanities (Hartman), shows how ideological moves by readers and writers are bracketed and constant in the natural sciences, and open-ended and fluid, in the humanities. The critic Hartman must work more diligently at establishing his authority, credibility, and connection with the audience. In so doing, Hartman's prose tends to be longer and more complicated; Watson and Crick can rely on shared universe of meaning and the authority granted in being exegetes of the book of nature.

As the density of Bazerman's prose indicates, there is a difficult step from case studies validating the construction of science knowledge (favored by social constructivists) to a repertoire of accessible trade secrets for technical communicators. The final chapter of *Shaping Written Knowledge* attempts to integrate Bazerman's most radical thesis, that one can explain scientific writing in terms of communication structures rather than subject matter, with ideas for better scientific writing. Certainly the thesis that all the scientific writer had to worry about was clarity of presentation has been defeated, but the simultaneous fragmentation and borrowing among scientific subdisciplines has made the scientific writers' task more complex. In the absence of simple formulae for technical communication, Bazerman returns to his modification of Kinneavy's elements of discourse and lends advice for a rhetorically more sophisticated process of scientific writing. Scientists need not become rhetoricians, but do need to

[76] David Bartholomae's "Inventing the University" *When a Writer Can't Write* Mike Rose (ed.) (New York: Guilford Press, 1985) documents a similar problem faced by freshman writers in the university who must quickly learn the discourse of the university and of specific disciplines, while establishing a personal voice in deference to the purposes and idiosyncrasies of the instructor. Writers coming into, and publishing out of, humanities departments face a daunting task in establishing a rhetorical niche.

become aware of how "the underlying epistemology, history, and theory of a field cannot be separated from its rhetoric." [77]

On the surface, Bazerman's claim proves inoffensive. Once unpacked, however, both scientists and discourse analysts in SSK find a great deal which is objectionable. Clearly, associating the unsavory discipline of rhetoric with science, could only diminish the authority scientific texts have traditionally held. Couched within a rhetoric of science is, of course, an image of science scientists find objectionable; a science in which practitioners can be persuaded by the artful use of language of what is true. The autonomy of science, portrayed as a body of researchers able to filter out the coarse elements of social influence and persuasion through repeatable experiments and objective discourse, is dealt a serious blow by the admission and awareness of rhetorical practices. Additionally, the closed rhetorical universe on which the scientist could depend becomes increasingly problematic. Bazerman answers scientists' concerns by outlining how knowledge of institutional structures, in concert with "rhetorical self-awareness" would benefit the production of scientific knowledge. In the concluding section of the book, Bazerman exhorts research into "the historical and current rhetoric within the sciences and other knowledge-generating communities ..." [78] If rhetoricians could present an overall picture, at local and disciplinary levels, of the interaction between the social and cognitive processes of communication in science in constructing knowledge claims, then a (stronger) case could be built for the necessity of learning rhetoric. But Bazerman seems content to show scientific discourse as cleaved off from ordinary language; conveying a sense that scientific cognition (and language) is somehow apart from society and penetrating it from the outside moving in. Other rhetoricians of science and discourse analysts contend that social discourse (ordinary language) allows

[77] Chapter 12, p. 323 of *Shaping Written Knowledge*.

[78] Ibid., p. 332.

scientists to see how assumed linguistic communality can gloss over disciplinary and cognitive differences. Bazerman's case studies indicate scientists can rely on the stability of symbolic practices, at which point he offers no room for the reinvention of rhetorical categories. Informing Bazerman's work is the assumption that the success of science, for the purpose of deriving other rhetorical practices, follows from a series of social and historical moves codifying scientific cognition and practice into a consensus notion of meaning. In turn, much of the success of science translates to a successful theory of rhetoric.

6. CONCLUSION

In fitting constructivist (neo-Kantian) developmental psychology to writing as process models, composition theorists have opened a place for rhetoricians to reconceive scientific discourse. While the constructivist ontology of process models has been modified to account for the social and cognitive factors influencing discourse, debate continues as to how, or if, either of these models helps students become better writers. And yet process models have been adopted to the teaching and practice of scientific and technical communication, along with a constructivist ontology. Scientific and technical discourse began to be seen as a medium for the social construction of facts and artifacts, a medium possessing the persuasive elements of rhetoric. However, the roles of composition, rhetoric, and technical writing as service disciplines for, in this instance, science and technology, has given rise to criticism and confusion over the prescriptive function of rhetoric in science. The basis of this criticism, provided by discourse analysts and reflexive theorists in SSK, has been born out of sociological *ethos* wedded to postmodern literary theory. From this perspective, discourse analysts have tailored the interpretive methods and anti-elitist rhetoric of literary theorists to constructivist/relativist arguments against rhetorical prescription.

Rhetoricians of science, while promoting the constructive aspects of persuasion in the production of scientific and technical knowledge, have based their prescriptions on the assumed stability of the social structure of science. This has been illustrated most clearly in the use of classic epistemological categories in epistemic rhetoric. Although Bazerman offers more help for science studies practitioners, his concentration on case studies neglects larger philosophical and sociological issues; hence Bazerman's inference that the social stability of science has led, with respect to the natural sciences, to rhetorical consensus.

The underlying differences embedded in given types of scientific and technical discourse can neither be neglected for the sake of prescription, nor exploited for the sake of interpretive gymnastics. Science studies practitioners are in a unique position to formulate a practice of scientific and technical communication which can bring together constructivist theory and prescriptivist practice. Bazerman's insistence on disciplines as relatively homogeneous discursive settings, for example, could be revised rhetorically to include categories and themes showing the reciprocal effect of public concern, disciplinary proclivities, and individual professional action. Rhetorical categories developed in a science studies context would serve the needs of scientists, technologists and the lay public.

In the following chapter, I will look in greater detail at an alternative communicative practices (new Literary Forms) by reflexive theorists in SSK. In a critical review of Malcolm Ashmore's *The Reflexive Thesis*, I examine the programmatic and rhetorical character of the reflexive textual practices. This chapter, in part, will serve to frame two aspects of the constructivist approaches to scientific discourse, and the application meta-theoretical concerns, from the perspectives of reflexive theorists and rhetoricians of science. Whereas reflexive theorists consistently maintain a relativist/constructivist position with respect to their own methodology and account,

rhetoricians have come to question how the concept of rhetoric functions as an ingredient in scientific knowledge, and as a basis for interpreting scientific texts. In Chapter 2, I will look at reflexive textual practices as applied to sociological practice and interpretation of scientific discourse. I have taken Ashmore's text as a case study acting as a critical backdrop against which to current developments of the rhetoric of science can be measured, and which prefigures constructivist intervention in scientific communication and the production of scientific knowledge.

Chapter Two

Reflections On Reflexive Wrighting: *The Reflexive Thesis: Wrighting Sociology of Scientific Knowledge*

> *... Think of you? To think of whirlwind, though 'twere in a whirlwind, were a case of more steady contemplation – a very tranquility of mind and mansion ... There is no point of the compass to which they cannot turn, and by which they are not turned; and by one as well as another. For motion, not method, is their occupation.* (William Congreve, *The Way of the World* [1])

> *The significance of the argument, the significance of the form, the significance of the text; for social scientists wary of self-reference, for philosophers bored with foundations and prescriptions, for avant garde artists and post-everything textualists – can all be summed up in just one word:* ***wrighting****. But I wouldn't advise it.* (Malcolm Ashmore, 1989)

1. INTRODUCTION

In this chapter I will explore the structure of, and argue against rhetorical appeals to, the fundamental character (*ethos*) of the Sociology of Scientific Knowledge (SSK) enabling reflexive textual practices (e.g., Woolgar 1988, Ashmore 1989). The appeal to *ethos* by reflexive theorists in SSK emerges from an attempt to reconcile the social character of reflexive knowledge and relativist methodology with postmodern textual practices. In failing to reformulate the modernist philosophical categories and debates from which they borrow, reflexive theorists have succeeded in reproducing and reifying local communicative norms. These communicative norms have gained currency in the areas of rhetoric, philosophy and sociology of science by heralding an epistemological "crisis" stemming from the antifoundationalism present in the

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[1] William Congreve *The Way of the World* in *Six Restoration Plays*, John Harold Wilson (ed.) (Boston: Houghton Mifflin, 1959), p. 345. An example of the height of Restoration comedy, *The Way of the World* examined, in part, aristocratic assumptions about the nature of eminence. Eminence was derived from the possession of wit, literacy and worldly grace, and subject only to the fierce requirements of honor. Congreve's characters are rewarded or praised for their prowess at linguistic play; personified by the battle between the Truewits and the Witwouds -- those who are able to manipulate language to their advantage, and those who are not.

postmodern condition. Although antifoundationalism serves primarily as an implicit backdrop against which reflexive textual practices are posed, its rhetorical adoption by reflexive theorists leads to a narrow conception of social and communicative action in science. However, as I will argue, the necessity for a "reflexive turn" in scientific communication depends, in part, on foundational arguments derived from internal disciplinary debates. For example, the demand for a reflexive consistency within SSK runs counter to the argument for a plurality of methodological practices. Further, in being composed of locally recycled cultural signs, reflexive textual practices replace the totality of scientism by a corresponding emphasis on the totality of particulars.

The social character of reflexive knowledge consists in both a rhetorical foundation derived from, and a reply to, Robert Merton's conception of a "community of assumptions" [2] making scientific knowledge possible. While Merton's formulation of these assumptions has been subjected to criticism because no evidence exists of conscious commitment to its elements, scientific discourse maintains the appearance of universality because of its emphasis on form. In order to counteract the discursive function of Mertonian norms, reflexive practitioners in SSK have, I claim, proposed a set of counternorms.[3] These counternorms are posed as textual practices extending from David Bloor's (1976) fourth tenant of the Strong Programme – reflexivity.

Bloor's dual concern with the possibility of SSK being at once "a standing refutation of its own theories" (p. 5) and explanatorily trivial commits him to two forms

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[2] See Robert K. Merton, *The Sociology of Science: Theoretical and Empirical Investigations.* (Chicago: University of Chicago Press, 1973).

[3] Counternorm is a term coined by Robert Merton to suggest that the four norms of modern science: universalism, "communism," disinterestedness and organized skepticism are balanced by counternorms such as strong particularism, secrecy and strong commitment. Ian Mitroff's *The Subjective Side of Science* (New York: Elsevier, 1974), lengthy case study of scientists studying rock samples from the moon provides empirical evidence supporting the presence and effect of counternorms on these experiments.

of relativism; "sophisticated" – or methodological – and "vulgar" – or evaluative (1982, p. 369, also see Ashmore 1989, pgs. 38-40). In essence, Bloor defends a discipline-based reflexive examination of methodology, while dismissing the necessity for personal reflexivity. As a result, SSK researchers have remained agnostic about reflexively applying relativism to their own selected methods. In promoting a "truly" reflexive SSK, reflexive theorists have argued that a researcher cannot take their own methodology for granted and must, for the sake of consistency, be self-reflexive. Reflexive textual practices then, are an effort to incorporate counternorms into sociological discourse which deconstruct the methodological privilege of the researcher. I will argue that these counternorms originate in a Puritan stance against scientism and undermine the concepts of knowledge and communicative action they seek to support. Reflexive theorists hold that the form and content of scientific discourse should reflect the lack of institutional, moral and individual consensus about the nature of scientific knowledge. This argument is based upon the rhetorical assumption that by drawing attention to the expression of self-applicable "patterns of explanation" the social elements of science are revealed which – in turn – *entails* new discursive practices. I counter that reflexivist counternorms and textual practices by their philosophical nature can serve only to reproduce the social structures and communicative patterns specifically belonging to reflexive theorists rather than promote the opening of scientific texts to new audiences.[4]

[4] Reflexive theorists appear to hold that disciplinary and personal reflexivity is immediately efficacious in practice. While I do not doubt the emancipatory intent of reflexive textual practices, reflexive theorists' arguments does not seem to square theory with outcomes outside SSK. This seems to be a matter of implication following from the reflexive application of Bloor's symmetry tenet (see Ashmore p. 217). As Ashmore ironically illustrates, the reception of his thesis by a fictional examining committee results in their retrenchment into a traditional expressions of internal and external disciplinary concerns. (Chapter 7). The relation between reflexivity, its deconstructive affect, and a subsequent change in practice is an empirical question which must lie, in part, outside of discourse analysis workshops.

Reflexive textual practices are characterized by the use and mention of self-referring narrative forms, devices and literary styles. By self-consciously undermining the authority of assumptions held by writers and readers about the representational function of language, reflexive practitioners invite the active participation of readers in constructing the meaning of texts. The meaning of a scientific text, for example, would not rest primarily with the author's ability to match transparent linguistic referents with observable phenomena, but would be related to disciplinary dialects, previous literature on the subject and discussions among members of a given discourse community. Reflexive theorists hold a robust conception of language as constitutive of reality. Writing science is not just simply to record natural facts.[5] Writing science, rather, involves the creation of facts through social and rhetorical contexts. Consequently, traditional – often static – roles among reader, writer, text and real-world referents in scientific texts have been redefined according to constructivist orthodoxy. Reflexive textual practices are intended to show scientific knowledge as *nothing more than* a by-product of social negotiation. Declaring their works "fictions" (Latour and Woolgar 1979, Ashmore 1989), reflexive theorists invite readers to employ the same interpretive devices to scientific texts as they would to literature.

Generally reflexive theorists portray science as an entrenched, omnipresent social order maintaining its unity through a process of self-reproduction and repression. The purpose of this caricature is to position reflexive writers as opponents to, and reformers of, the monolithic totality of science and as proponents of democratic pluralism – illustrated by equating the "meaning" of a text to an available readers' interpretation. Rhetorical appeals to democratic pluralism and egalitarianism also serve as a warrant for revising the discursive practices of science. These appeals refer to a more general

[5] Charles Bazerman, *Shaping Written Knowledge: The Genre and Activity of the Experimental Article in Science* (Madison: University of Wisconsin Press, 1988).

argument that "making science better" entails public participation. Shapin and Schaffer (1985, Chapter 8), for instance, have suggested how Boyle's triumphant conception of the *polis* gave rise to the experimental form of life. However, Boyle's public sphere was bound by the nascent laboratory which engendered a specialist form of witnessing an experiment. The practices of reflexive theorists, on the surface,[6] seem to echo Hobbes' sense of the public as anyone concerned; not simply as specified interest groups or as given professionals. But given the images of science produced by micro-sociological studies in SSK, the rhetorical position of reflexive writers is both disingenuous and reflexively unsophisticated. That is, reflexivist theorists fail to acknowledge how scientism (attributed broadly in science studies by sociologists to philosophers) lends the impetus for their practices. Accordingly, if SSK research has produced a more accurate or detailed portrait of science, reflexivist rhetoric has not been revised to reflect it. As I will argue, reflexive textual practices ignore explanations of what constitutes an egalitarian exchange of ideas about science, how power plays a role in that exchange, and how (or if) revised textual practices would transform a scientific discourse community and the writer herself.

1.1 *The Argument*

Self-reference has been of particular concern in the social sciences. The affect between analysts and objects of study has proven methodologically intractable; preventing the social sciences from – as some desire – emulating Popperian norms.[7]

[6] Although I am not prepared to give a detailed argument at this point, I suggest reflexive textual practices, given their complexity, postmodern obscurity and local flavor are more closely tied to Boyle's rather than Hobbes's conception of public.

[7] Mulkay and Gilbert in "Putting Philosophy to Work: Karl Popper's Influence on Scientific Practice" *Philosophy of Social Science* Vol. 11 (1981), 389-407, p. 393 interviewed thirty-four scientists to track the influence of Popper on actual scientific practice. Only a small number of scientists had read Popper in any detail, and many interviewees doubted the influence philosophy of science had on laboratory practice. Mulkay and Gilbert determined the reasoning of scientists "... depends on highly personal judgments ... (and) each individual

However, the model of the natural sciences initially adopted by social scientists (Manicas 1987) was called into question (as a partial result of Kuhn's (1962) work) as philosophically naïve and historically inaccurate. Bloor's (1976, pages 70-73) formulation of the Strong Programme in the Sociology of Knowledge was, in part, a response to Kuhn. Recently, reflexive theorists in SSK have stressed the anti-scientistic aspects of the Strong Programme. Any pretension of the social sciences to imitate the natural sciences has been countered by reference to the "reflexive problem" inherent in social science research. Thus reflexivity has been characterized either as debilitating by, for example, Bloor and Collins, or liberating by Woolgar and Ashmore. Since the social sciences will not "grow up" to be the natural sciences, reflexive theorists have turned to postmodern literary theory to critique scientific narratives and to ground their practices. The *ethos* of SSK, couched as legitimation for the reflexive turn, is illustrated in Ashmore's (1989) ethnography. Evolving from the central tenets of the Strong Programme, the *ethos* of SSK is claimed to be anti-scientistic, original, fictional, ironic, anti-elitist, pluralistic, and emancipatory. Given the kinship between SSK and rhetoric of science (which I develop in the next chapter), mapping how disciplinary *ethos* derives from, or leads to studies of science becomes necessary for deriving alternative sets of textual norms and practices benefitting both scientists and the the lay public.

Specifically I will argue that:

(1) Reflexive forms of communication presuppose their own validity and beg the question as to how scientific or reflexive knowledge can be considered in any sense

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scientist continually disagrees with his colleagues Popperian interpretations" (p. 404). Quoting from the 1958 preface to *The Logic of Scientific Discovery*, Mulkay and Gilbert state that the norms Popper spells out derive from purely logical analysis, and not the norms of practice. Popperian logical norms have been loosely interpreted by scientists to fit certain practices. Therefore, Mulkay and Gilbert conclude, rules, in this instance, are open-ended and do not entirely determine actions, If philosophers (or scientists) seek more effective rule use, the rules must be seen as inculcated in social practice. As an example, Mulkay and Gilbert note how the rules of scientific publication lead to a relatively uniform product (p. 407).

privileged or authentic. Reflexive textual practices are open to the same charges of special competence and prescription brought against natural scientific discourse.

(2) Reflexive textual practices fail to meet self-espoused relativist, constructivist principles by positing and building on a reified notion of SSK *ethos*. The *ethos* of SSK can be seen in the proposal of communicative counternorms to displace the rhetorical effect of Merton's positing of behavioral norms followed by successful scientists. Moreover as the *ethos* of SSK can be attributed to a specific response about postmodern discourse pertaining to science, I will show that reflexive theorists give insufficient consideration to the modernist concepts, interpretive techniques and political assumptions on which their textual practices depend and which many scientists (unreflexivly) have adopted. By assuming the fragmentation of the modernist project, reflexive theorists do not develop a rhetorical framework to support their practices, and to support their use by other scientists.

(3) Reflexive theory betrays the very *ethos* to which it subscribes by assuming the universal character of scientific knowledge as socially constructed – illustrated by a programmatic call for sociological researchers to be consistently reflexive on both disciplinary and personal levels. The relativist/constructivist emphasis on the special occurrences and local nature of scientific discourse has been substituted for a universal scientific language. And yet, the wholesale endorsement of relativist/constructivist methodology supplies just as one-sided a characterization of scientific discourse (anti-scientistic) as any based on Popperian norms (scientistic). Additionally, reflexive theorists give no account as to how local networks, social relations, audiences and reflexive relations are generally understood, related to and adopted by scientists into communicative practices.

My argument will be presented by way of a critical analysis of Malcolm Ashmore's book *The Reflexive Thesis: Wrighting Sociology of Scientific Knowledge.* Ashmore's book is important for four reasons:

(1) it stands as the most comprehensive overview of SSK research to date (1989),

(2) it provides the first sustained (book-length) development of reflexive textual practices for an academic audience,

(3) it offers strategies for the continued development of SSK from postmodern principles and,

(4) it lends necessary insight into the process of appropriating, transferring, retooling and implementing narrative frameworks, historical perspectives, methods and practices from academic disciplines to interdisciplinary fields of study.

As a result of my analysis, I conclude that reflexive textual practices lead to an impoverished sense of the social in science. Unable to accept or generate principles of scientific discourse on other than on a locally bounded level (e.g., discourse analysis workshops), reflexive theorists depend on tortured attempts to recuperate their own disciplinary language in order to make a case for the fragmentation of other scientific discourses. However, the recovery and extension of disciplinary discourse (with specific respect to SSK) remains antithetical to postmodern efforts to deconstruct traditional disciplinary boundaries and foci. For this reason, the reflexive theorist finds her practices only minimally able to address issues involving social relations, power and moral action outside her discipline. Questions remain as to how (or if) reflexive theorists can derive a positive notion of freedom to foster the egalitarian participation which they advertise among scientists, "non-elitist" humanists and lay people in the construction of scientific texts. Consequently, any discussion of instituting reflexive textual practices at a "Low Church," pragmatic, level is absent.

2. BEGIN THE BEGIN

Generally provided in an opening paragraph, the introduction to a book review turns on a variation of the following structural theme: a catchy first sentence or "hook," a second sentence evaluating the book on a continuum between ringing endorsement (as original, remarkable, well-researched) and flat rejection (as hackneyed, run of the mill, uninformed), third and fourth sentences setting the intellectual stage on which the text may be viewed, and fifth and sixth sentences stating the general thesis or focus of the book – inevitably bearing on the reviewers' own ideological axe grinding. An introduction to a book review rarely gives a reader pause. When, however, a writer refers to the structural and stylistic qualities of a text, paragraph, or sentence, to their membership in a group supporting those structures and styles, and to the events influencing their composing processes, an awkward moment arises. Readers find themselves within a self-referential loop. They must unpack the "message" of the text amid the use and mention of self-replicating, self-parodying textual devices. If, for example, a reader agrees in principle to the template fashioned in the first sentence of this review, which has not, to this point, been followed, they are asked to consider the following questions: When is an introduction truly an introduction, or a metaintroduction? Does writing of writing itself lead to "pathological navel-gazing" (p. xxvi, from Gouldner)? Do self-referencing textual techniques threaten to overtake 'substantive' intellectual space? Do rhetorical conventions serve as a useful shorthand between writers and their audiences? How and why do academic disciplines develop or adopt the rhetorical conventions and narratives of other disciplines? Do textual forms position unwary writers and audiences to accept, by bracketing critical discourse, epistemological presuppositions? How are social codes translated into disciplinary practices? But rather than soliciting the reader's participation in a critical examination of textual and disciplinary practices, one suspects that "... the use of 'tricks' in these

unconventional texts to draw attention to their own textuality is at best trivial and at worst distracting. After all, one wants to get on to the 'news' in a paper without having to keep pausing to admire the latest New Literary circus act" (Pinch 1988, p. 179). Nevertheless, if the reader wishes to witness a highly skilled and ingeniously reflexive 'circus act' evolving out of an ethnography of the Sociology of Scientific Knowledge (SSK), one need go no further than Malcolm Ashmore's *The Reflexive Thesis: Wrighting Sociology of Scientific Knowledge.*

The foreword to Ashmore's book, presented as a letter from Steve Woolgar to Doug Mitchell at the University of Chicago Press, describes the manuscript as: "...one of the most impressive ... I have read in a long time: carefully researched and documented, highly unusual in format, an important and serious contribution to a key topic, yet witty and clever throughout" (p. xvii). Taken literally, Woolgar is right. Ashmore's book abounds with nimble textual free play involving: the need for disciplinary introspection and change, the process of constructing reflexive ethnographic accounts of scientific practices using "New Literary Forms," [8] the placement and value of traditional research and reference found in a thesis/book, and the critical irony and variability of replication claims. Of course, the reader would be forsaking her reflexive duty to countenance any literal or representational function of language; even in the foreword. Tongue-in-cheek self-promotion (see Woolgar and Ashmore 1988 p. 10-11) is but one of many rhetorical ploys used by reflexivists.

Turning to Ashmore's self-referring "Encyclopedia of Reflexivity and Knowledge" (Chapter 2), one finds – as expected – a variety of definitions for reflexivity. Ashmore's

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[8] Ashmore employs a number of literary and textual devices in order to '... do scholarly work by nonscholarly means' (p. 29). Examples of these devices and forms are, but not limited to, dialogue, multi-voiced narration, transposition of quoted text, correspondence and conversation (pastiche), "double texts" – in which the second text comments on the variability of 'first text' analyses -- fiction, and parody.

discussion of the etymology and multiple uses of reflexivity mirrors the postmodern move to suspend the closure associated with single definitions. Reflexivity *does* lie within the domains of: "self-reference, self-awareness, and the constitutive circularity of accounts" (p. 32) – the last phrase indicating the reciprocal relationship in ethnography between interpretations and the events to which they refer. In one instance, reflexivity can be seen as a type of recursion, in which "... the mind or a computer program loops back on the output of a output of a prior computation and treats it as a given that can be the input for the next operation" (Bruner 1986, p. 97). In another instance – more congenial to Ashmore's purposes – reflexivity can be seen as a process of "... destabilizing any presumptions the reader might have about how scientific knowledge is constructed. The 'New Literary Forms' that Woolgar (1988) and his colleagues in discourse analysis have pursued in recent years are Borges-inspired attempts to ensure that the reader's ruminations never reach a resting point" (Fuller, 1991, p. 7). Reflexivists claim to avoid the trap of narrative omniscience by granting invitations for reader response ("The text is now yours." p. xxvi), and textual "throat-clearing" (see p. 209) warning neophytes of impending literary devices. In order not to coerce readers into any single reading (see p. 204), Ashmore acts as rhetorical gatekeeper; barring any presumptive or normative explanation for the use of textual devices. Yet the space reserved for reader participation is occluded by reflexivist hucksterism, constructivist jargon, gendered concepts (see Latour 1987) and textual irony. Ashmore makes the text all the more baffling by his hide-and-seek attitude toward the secondary audience *outside* SSK. Again as Woolgar points out in the foreword: "The interesting paradox, of course, is that you need to make clear that what you publish as a book is in fact a thesis, even though it *appears* to be a book. Perhaps you could get this point across by including some kind of spoof foreword?" (p. xix). Ironic confusion aside, Ashmore's book unveils a glimpse into a postmodern SSK.

Reflexivity is an interdisciplinary issue shared in mathematics, cognitive psychology, computer science, philosophy and literary theory. Popular presentations of reflexivity have been made by Douglas Hofstadter in *Godel, Escher, Bach: an Eternal Golden Braid* (1979), *The Mind's I: Fantasies and Reflections on Self and Soul* (with Dan Dennett, 1981) and *Metamagical Themas: Questing for the Essence of Mind and Pattern* (1985). A unifying thread in all these works is the recognition of structures and patterns common to the 'organizing principles' (p. xxv, 1985) the mind exploits to make sense of the world. Ashmore has put these 'organizing principles' into a social context. For example, the way in which we organize knowledge and study and write about nature, society, or the self has largely been a matter of social contrivance. To see organizing principles as socially contrived (or constructed) opens natural science, for example, to inquiry about institutional procedures for sanctitioning research agendas and candidates for explanation. Reflexive theorists work to show how organizing principles become 'naturalized' by a culture. Accordingly, they argue that left unattended, organizing principles can assume the authority of naturalized edicts and turn pernicious. The formation and propagation of a literary canon serves as an example. Nevertheless, Ashmore does not merely settle for socially contextualizing inquiry, he disrupts it. SSK has retrieved the social in scientific language and acted as a gadfly, prodding scientists to continually rethink their organizing principles and resulting practices. Lest SSK practitioners become too intoxicated with their success, reflexivists are the gadflies of the gadflies, prodding sociologists to rethink their assumptions as well.

A guiding principle in Ashmore's work is to turn the practices of SSK upon itself, simultaneously deconstructing and revealing the foundations of – and opportunities for – sociological inquiry. "The problem" encountered by relativist, constructivist social studies of science has been "... what grounds provide the warrant for the relationship between the objects of study and statements made about those objects?" (Woolgar 1983,

p. 240, Ashmore p. 32). Although, as Woolgar indicates, "the problem" has no resolution, research practitioners in sociology continue to provide explanations and interpretations. Simply stated, "the problem" centers on how researchers, in the natural and social sciences conceive of reality, and how discourses, methods and practices correspond to that idea. Typically, SSK researchers show how the reality to which natural scientists appeal is mediated by social contingencies. Ashmore goes one step further and shows how the social contingencies to which SSK practitioners appeal are further mediated by social contingencies. The irony, of course, comes in gauging the shifting rhetorical sands on which relativist, constructivist accounts in SSK are based. Do SSK practitioners adopt a realist stance with respect to their own methodology while maintaining a relativist stance toward natural science explanations? Should SSK practitioners be principled relativists (another irony?) with respect to all natural and social scientific explanations? How do SSK practitioners, from an ironic standpoint, claim authority or insight? How do, or should, SSK practitioners avoid infinite regress? Ashmore joyfully embraces these questions which have many answers. Instead of infinite regress – against which Ashmore legislates to avoid duplicity with philosophers – he finds "infinite progress" by doing reflexive analyses despite caterwauling against relativism (e.g., Laudan 1981). The regress of the reflexive turn is apparently mitigated by Ashmore's positioning as methodological therapist – reminding sociologists of the self-same social contexts governing their analyses. Such a move smacks of self-referential closure. If a sociologist, for example, takes the reflexive line seriously, then she would initially become bogged down in a regress of offering explanations of explanations. Ashmore, however, would be a position to step in and negotiate the proper philosophical or literary attitude (such as "infinite progress" or irony) to put an end to these ruminations. The deleteriousness of reflexivity, then, lies in the ceaseless commentary of the text on itself until an arbitrary endpoint – a length requirement for

example (see Ashmore's thesis abstract, p.*xxiii*) – is provided. Reflexive theorists seem content to endlessly blend literary forms, applaud their originality and then trump one another with increasingly clever references. The reflexive thesis does not lead to an infinite regress because of its vicious circularity.

The warrant for Ashmore's work, also ironically, is parasitic on the constructivist, relativist methodology of SSK and the reflexivity tenet of the Strong Programme in the sociology of knowledge. Therefore, while some SSK practitioners may be obliged to legitimate their interpretations to outside observers, Ashmore, in theory, need offer no such legitimation. Still as Ashmore's self-exemplifying treatment points out, the reflexive textual practices resulting from deconstructing traditional scientific hierarchies and binary oppositions appear destined to become entrenched as rules of sociological metatheory – which is, perhaps, the ultimate irony of the reflexive thesis. Consequently, Ashmore's book reads as a portrait of a comedy of manners among European sociological wits: a cacophonous exchange of voices in which the rules of engagement are esoteric and the repartee edifying only to the participants.

A battle of wits derives, in part, from a thorough knowledge of the actors, tempered by a wry sense of humor. Ashmore exhibits an extensive and playful understanding of sociology generally, and SSK specifically. Although reflexivist styles can be difficult to manage (e.g., reading double texts, Chapter 6), Ashmore's persona makes the task more tolerable. Ashmore's participant/observation study of SSK illustrates how disciplinary practices and behavioral regulations are imparted to graduate students. Chapter 1, for example, provides an accessible overview of SSK and serves as a intriguing introduction to the debates, ideological commitments and personalities comprising SSK. Quotes, bits of dialogue, personal asides, literary devices and empirical research are juxtaposed within a variety of contexts supplied by numerous sources. Like audio and video "sampling," the reflexivist style can be seen as

analogous to the multiple layering of inter-related refrains, or the rapid jump-cut editing made popular in music videos. Out of these techniques, Ashmore parodies academic boiler plate in which the topics and elements of papers are endlessly shuffled and combined to produce the next paper. Further irony is heaped upon the "felt importance" of SSK from its periodic emphases on "knowledge," "scientific" and "sociology" as a way to support its claims of distinctiveness and originality (see pages 6-25).

2.1 *Contextualizing Reflexivity*

Ostensibly, Ashmore aims for a wide audience as sanctioned by constructivist sociology's "tendency toward anti-elitist humanism" (Woolgar 1983, p.256). The brand of humanism referred to by Woolgar, and forwarded in Ashmore's ethnography, reflects, I suggest, a failed synthesis of postmodern political goals with SSK research. Science, for rhetorical purposes, has been cast by Ashmore as a cultural monolith perpetuating itself through the use of instrumental reason. The claim about the influence of instrumental reason is supported by an appeal to the homogenization of scientific language through communicative norms. Reflexive textual practices overtly appeal to postmodernism's goal of empowering suppressed voices through alternative forms of expression. The interruptions occurring in a reflexive text, for example, are a means for subverting the authority of the author. By prompting active reader participation, a scientific text, presumably, can be read as a "coerced statement", owing its content to an extended and repressive form of reason, to be deconstructed.

Although Ashmore assumes the moral high ground by posing as liberator of the oppressed, his caricature of science, an acting warrant for reflexive textual practices, is a cynical rhetorical prop. SSK research has shown in a number of instances (e.g., Latour and Woolgar 1979; Mulkay and Gilbert 1981; Collins and Pinch 1982) how forms of life and categories corresponding to social action or disciplinary practice are locally

constructed. Yet reflexive textual practices do not reflect the local character of scientific practices. It remains to be seen how reflexive practice would lead to local changes in scientific and technical communication. The subversive political and epistemological consequences of Ashmore's critical stance only go so far. Fuller argues:

> ... SSK practitioners employ discourse-analytic techniques to reveal the various voices in a language game played by a community of scientists, but they do not use such techniques to engage in an ideology critique of science that appeals to the factors that sustain the game but which transcend the scientists' control or awareness. This stunted sense of critique has been a constant source of frustration for Marxist and Feminist science critics, whose relations with SSK have been chilly, to say the least. [9]

Similarly, Ashmore's ideological critique of science remains embedded in SSK research. While he does state; "More generally, we can simply argue that self-reflexivity is an abstract Good." (p. 92) with respect to new historiography, Ashmore shies away from explicating and applying a deep critical perspective. Reflexive practices, seemingly, carry with them implied normative and ideological aspects and accompanying critiques, but Ashmore's reticence in fleshing out these ideas gives the impression that reflexivity is simply about style, not substance. Consequently, Ashmore leaves a number of questions unanswered. For instance, would reflexive textual practices intended to undermine the authority of an author (or institution) actually do so? How would one know? Would New Literary Forms transform the landscapes of an academic discipline? Would, as Pinch alludes (page 2), a reader skip the "circus act" to get to the substance of the paper? What postmodern concepts of audience motivate reflexive practices?

Ashmore's rhetoric reproduces the pessimistic judgment on modernity cast by members of the Frankfurt school. The "... complexity of modernism" – argues John McGowan (1991, p. 7) – "stems from its containing both the spiritualistic, religious

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[9] Steve Fuller, "Being There With Thomas Kuhn: A Parable for Postmodern Times'" *History and Theory* Vol. 31, No. 3 (1992), p. 258.

impulses of high romanticism and the scientific, rationalistic impulses of realism while at the same time bringing to center stage the issue of art's autonomy." One of the great follies of the modernist project, argue postmodernists, was in creating the dominant culture of capitalism as an unintended consequence of attacks on religious foundations. This folly was compounded by the belief that individual autonomy could be achieved by willfully excluding oneself from commercial culture. In *Dialectic of Enlightenment* (1972), Horkheimer and Adorno argue that reason, embodied in capitalism and science, succeeded in asserting commercial domination of nature and in destroying the conception of rational being it seeks to preserve:

> Man's domination over himself, which grounds his selfhood, is almost always the destruction of the subject in whose service it is undertaken; for the substance which is dominated, suppressed and dissolved through self-preservation is none other than that very life as a function of which the achievements of self-preservation are defined; it is, in fact, what is to be preserved (p. 54).

Horkheimer and Adorno are moved to conclude, "The identically persistent self which arises in the abrogation of sacrifice immediately becomes an unyielding, rigidified sacrificial ritual that man celebrates upon himself by opposing his consciousness to the natural context" (p. 54). The conscious vehicle for opposing the 'natural context' has been the concept of disengaged reason. In appropriating the discourse of disengaged reason, modern science sought a foundation for its language, concepts and practices. What Horkheimer and Adorno wanted to show is that "... the process of enlightenment is the result of a drive to self-preservation that mutilates reason, because it lays claim to it only in the form of a purposive-rational mastery of nature and instinct – precisely as instrumental reason" (Habermas 1987, p.111). The function of instrumental reason, then suggested by Horkheimer and Adorno (and earlier by Nietzsche) was to protect the myth of "purposive rationality" (p. 114) in science as something other than the objectification and manipulation of nature. By institutionalizing the exercise of

enlightenment, modern science has succeeded only in preserving its rational perspective, not understanding the phenomena being studied.

Repudiating disengaged reason as the arbiter of scientific knowledge and practice, reflexivists have substituted the unconstrained freedom and flux of producing signs. Ashmore's ethnography acts as an ideological critique of science and SSK; exposing the practices used to preserve remnants of positivistic discourse. Abrogating the purposive-rational discourse of sociology has opened Ashmore of charges of "sociological nihilism" (Rose 1979) resulting from "hyper-reflexivity": [10]

> The various perpetrators or "victims" of hyper-reflexivity for comment (by Rose 1979, Rose and Rose 1979) include not only Robert Young ... but also Theodor Adorno, Paul Feyerabend ... Barry Barnes, Luke Hodgkin and Alfred Sohn-Rethel. Their critics object to games playing, to hipness and coolness, to the new authenticity, and to interpersonal subjectivism. The left critique of science is present as having been corrupted by the philosophical relativism of the new sociology of knowledge ... But of course one can choose instead to notice the deep affinities between the form and content of the Roses' attack on hyper-reflexivity, and those critiques levelled at the same or similar "victims" – Feyerabend, Garfinkel, Mannheim, Marcuse, Habermas, Nietzsche, Levi-Strauss, Derrida, Kuhn, SSK, etcetera, etcetera – which emanate from such impeccably radical sources as Popper, Gellner, Trigg, Hollis, and Flew (pgs 56-57).

Dismissing the presumed turf war between leftist critics and reflexivists, Ashmore finds the removal of the pretense of instrumental reason in science as emancipatory. But the old saw presented by Rose and Rose (1979) still has teeth. For example, Ashmore employs subjective freedom and imagination as a means for reforming social scientific narratives, but in the guise of 'new literary forms' these concepts could resonate with either paradigmatic or narrative discourse.[11]

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[10] Ashmore quotes Rose (1979, p. 287) and Rose and Rose (1979, p. 328) at the beginning of his dictionary entry on the notion of hyper-reflexivity: 'For the new sociological relativism the metaphor must be that of the onion. First reflexivity usefully peels the skin away, then hyper-reflexivity takes over and strips away the remaining layers until nothing -- for an onion has no kernel -- remains (p. 55).

[11] Jerome Bruner (1986) argues that the "paradigmatic/logico-scientific" mode of thought and discourse is a naturally different kind than the "narrative" mode of discourse found in literature. Bruner suggests the paradigmatic mode "... deals in general causes, and in

In theory, reflexivists would have no problems utilizing any form of discourse and challenging readers with ambiguous conceptual referents. In practice, however, objectivist and realist modes of communication are clearly objectionable:

> So the idea is simply to accept the criticality of one's discourse and to avoid programmatic claims for its neutrality? Perhaps; but then what would be the implications of doing so for my disagreement with Barnes's endorsement of the use of the realist mode of speech to analyse itself? After all, if analysis *is* critical, then analysing the realist mode of speech *is* criticising the realist mode of speech, which I gather, is what I want to do. Yes, but if one is using the mode for purposes of critising the use of the mode, then how authentic can such a critical exercise be? It would be, rather, a celebration of the ever greater powers of the realist mode: look, it can even be used to critise itself (pgs.178-179)!

In a manner antithetical to the spirit of Ashmore's work, the same lack of authenticity can be cited in reflexivist analyses of reflexive discourse. On the one hand, Ashmore rightly objects to the invocation of steely-eyed clarity and moderate strain in most realist discourse. On the other hand, Ashmore poses no "social correlatives" or historical origins for the removal, transfer and 'successful' use of narrative forms and interpretive devices from one mode of inquiry to the other. For example, postmodern critiques of the modernist project, including concepts of subjective freedom and imagination, turn on a

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their establishment, and makes use of procedures to assure verifiable reference and to test for empirical truth. "The narrative mode ".. deals in human or human-like intention and action and the vicissitudes and consequences that mark their course. It strives to put its timeless miracles into the particulars of experience, and to locate the experience in time and place" (p. 13). Bruner's Popperian insights to the contrary, the reflexivists do not detail the function of imagination in either mode of thought, or within a postmodern context. Bruner lends an example: "The term *then* functions differently in the logical proposition "if x, then y' and in the narrative *recit* 'The king died and then the queen died.' One leads to a search for universal truth conditions, the other for likely particular connection between two events -- mortal grief, suicide, foul play ' (p. 12). Since, on the one hand, reflexivists are intent on blurring, or deconstructing the differences between these two discourses, one may assume social scientific imagination does not assume the purpose of '... lead(ing) to tight analysis, logical proof, sound argument, and empirical discovery guided by reason hypothesis" (p. 13). On the other had, one may also assume social scientific imagination does not entail modernist, humanist virtues. Yet Ashmore leaves unanswered the status of imagination within postmodern SSK. Is, for example, imagination a socially constructed resource to be accessed, in some manner, in telling stories about science? Does Ashmore conceive of the imagination of scientists (social scientists included) differently, or the same as the imagination of the novelist? How do disciplinary modes of discourse shape imagination?

particular reading of Nietzsche. Yet Nietzsche levels modernist notions of self-knowledge and reason by engaging in the same totalizing discourse to which he objects. Additionally, as Habermas argues (1987), Nietzsche transposes aesthetic criteria and judgment on science. Nietzcshe later struggled with rectifying his presentation of science in the context of art, while pursuing his own reflexive project. Similarly, Ashmore seeks to occupy the space provided in the science by a totalizing critique – available from radical relativism – of instrumental reason. Since scientific discourse has been rendered as the extension of the unauthentic prescription of enlightenment, reflexivists are ready to proclaim the authenticity of their own texts:

> The historical accident of the existence and success of the science project, fuelled, as it were, by an instrumental interest in prediction and control (Habermas 1971, 1972; Barnes 1977) has mutually constituted Man and World in a nondialectical opposition to each other. The World as Object is the *result of not the warrant for* Science. If this piece of speculative history seems to portray science more as a constructive enterprise than a deconstructive one, I would argue that successful constructions are simultaneously deconstructions, and vice versa ... The phrase "science deconstucts the acting, participatory World" and science constructs the objective World" describe the same process.
> ... (metascience; SSK) deconstructs ... (science) and resurrects (the World). Here then, is the scandalous speculation I promised. Nothing less than the Mission of the Millennium is entrusted to our intrepid little band of science deconstructors: the resurrection of the acting, participatory World (pgs. 103-104)!

Not to be swept away by the charming irony of Ashmore's delusions of grandeur, the force of the reflexivist project does appear to emanate, in part, from this final, ironically totalizing proclamation.

The emergence of reflexivist beliefs, dogmas and emerging practices in SSK – supplied by a radically relativist microsociolgy – signals both the possibility of a change in the production and expression of scientific knowledge and the rise of reflexive "Puritanism" (Latour 1998, p.172). So the reflexive turn lends another answer to the "What Next?" question for constructivist sociology of science posed by Woolgar (1983,

p.239).[12] What is next for Ashmore – as well as other reflexivists and discourse analysts – appears to be the task of assembling a series of isolated narratives out of the highly contextual confessions offered by scientists – all the while pursuing nonprivileged discourse and ironic ambivalence. What Ashmore also strives for – and largely obtains – is a sophisticated narrative in which SSK practitioners can trace the impact of social structures on their beliefs and practices.[13] In contrast, the reflexive turns leads to an obsession with enforcing postmodernism prescriptions:

> The reflexivists spend an enormous amount of energy on the side of the knowing, and almost none on the side of the known. They think that any attempt to get at things in themselves is proof of naive empiricism. Even those from Yorkshire who claim to use literary tools to pursue social science (Ashmore 1985, Mulkay 1985) do so only to expose reflexive claims, never to talk about something. Talking about something is anathema to every one of them. This horror, the fear of contamination with empiricism is amusing, because it is exactly the counter-part of the empiricist position. They think that objects, things-in-themselves, are somehow out of reach. As if access to the world was for ever in the hands of the empiricist programme. As if the world in which we live was the property of scientistic accounts of science. Reflexivists fully endorse the scientistic agenda when they believe there is no other way out of empiricism than language, words and self-reference (Latour 1988, p 173).

Contra Woolgar, reflexivists do not uphold the spirit of "anti-elitist humanism" of the social constructivists. Reflexivists replace the dogma of institutionalized postmodernism for the dogma of empiricism. The aversion of reflexivists to getting their conceptual hands dirty by talking about "something" does, indeed, keep them above the scientistic fray. But such a move is both cynical and disingenuous. Assuming, if true, readers rush to make a connection between a text and a real-world referent in scientific discourse, the

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[12] See also R. Collins and S. Restivo, "Development, Diversity, and Conflict in the Sociology of Science" *The Sociological Quarterly*, Vol. 24 (1983), 185-200. E. Fuhrman and K. Oehler "Discourse Analysis and Reflexivity" *Social Studies of Science* Vol 16 (1986), 293-307.

[13] Ashmore's book can be seen as answering criticisms raised about the direction of discourse analysis project, and the subsequent need to go beyond scientists' discourse as an end in itself (refer to op. cit. note 3). See, for example, M. Mulkay, J. Potter and S. Yearly "Why an Analysis of Scientific Discourse is Needed" K. Knorr-Cetina and M. Mulkay (eds.) *Science Observed* (London and Beverly Hills, CA.: Sage, 1982), 83-113.

reflexivists move to block or diffuse this connection seems at best an underestimation of the intent and cognitive prowess of many readers and, at worst, paternalistic. Ashmore gives no detail as to how multiple readings of a text are to be achieved through the use of new literary forms, except to provoke conscious challenges to "taken for granted" (p. 209) speech acts.[14] In all fairness, however, such a task is daunting, but does seem to turn on much the same reasoning as attacking the "myth of the given" in philosophy. Ashmore does provide profiles of *fictional* reflexive readers (see Chapters 1 and 7), but they never rise above a parody of one-dimensional Socratic interlocutors; unless, ironically, one knows the real-world personalities. The personalities appearing in Ashmore's text, both real and fictional, have all their ironic cues in order. Disruptions occur at fairly regular intervals and readers can anticipate that when the text becomes univocal, the arrival of familiar dissenter (the co-author of the paper, the thesis advisor, the split personality). By disrupting the text, reflexive writers try to elicit the reader's surprise. If a reader feels surprised, the writer has violated certain textual presuppositions. As a result the reader may turn reflexive, to see how their expectancy was violated. Given the relative homogeneity, size and Ashmore's familiarity with his primary audience – SSK researchers and reflexivist theorists – one can see why the text rarely challenges reader expectancy. Textual disruptions, of themselves, can be self-defeating, if the content of a text does not violate reader expectancy. In disclosing reluctant reception to his thesis proposal, Ashmore quotes Pickering: "You 're going to find everybody you interview is going to say, 'Yes, we are reflexive,' and they're all going

[14] Bans on cognitive psychology aside (Latour 1987, Woolgar 1989), Ashmore does raise a number of interesting questions about the psychology and sociology of reading literature. Many of these questions are also raised initially by Richards (1935), and taken up by Barthes (1974), Goodman (1976, 1978) and Bruner (1986) among numerous other scholars. Just how texts and genre trigger multiple readings, how (or if) reading groups arrive at consensus and disciplinary canonization, how individuals are taught to read through group interaction and how cursory and/or 'close' readings lead to multiple readings is not altogether known -- and may be a question left for psychologists.

to ask you where it's going to get you. I can't imagine how you can write a very **interesting** (original emphasis) thesis on it" (p. 21). While Ashmore text fails to surprise, Latour's (1988) does. The simple proclamation: "Let us go back to the world, still unknown and despised" (p. 173) prompts the "sneer" of constructivists as Latour anticipates, but induces the reader to reflect the rhetorical weight Latour's text carries, and why he would make such a statement. Perhaps in this case, Latour's lack of consistency gives reflexivity the saliency lost on true believers.

The reflexivist process of writing (or wrighting) rests largely on the articulation of a "... modernist-postmodernist dispute that cuts across all the human sciences today" (Shadish et al. forthcoming). Ashmore embraces the totality of freedom and apparent egalitarian exchange characteristic of postmodernism. The historical narrative of SSK informing the reflexivist project also includes homage to the postmodern condition by embodying the *ethos* of subversion, revolution, democratization and distinctiveness through self-effacing hyperbole. As such, the reflexivist project can be seen as a reaction against sociological 'schools of thought' (e.g., Parsons) and the "... 'the experience of modernity' shared by such otherwise disparate figures as Marx, Weber and Durkheim" (Fuller, forthcoming). Adopting a coy stance as populist outsiders, reflexivists promote themselves as catalysts for change in science. Ashmore presents his text as an example of "wrighting" defined loosely as "... a concentration on textuality ... including the use of new literary forms ... devices allow(ing) the reader to *participate* in the construction of the text" (pgs. 110, 209). Assuming a liberating posture, Ashmore calls for texts to reflect the immediacy of social influences on scientific expression – through new literary forms. If practiced, texts in the sociology of science would displace the rhetoric of disengaged reason supplied largely by philosophers and borrowed from the natural sciences. A space would then be created for readers to engage in constructing the text by substituting "... a philosophy... negating subjectivity, self-possession, and full presence and which see

thought as perpetually dispersed and 'deferred' in a field of infinite substitutions also exalt(ing) the indefinite freedom of play..." (Taylor 1989, p. 590, note 90).

The *ethos* of SSK belongs to a larger narrative framework; it is a mesh of the methodology of the Strong Programme in the sociology of knowledge, relativist, constructivist discourse, and postmodern literary criticism. While I agree with Latour that:

> Since no amount of reflexivity, methodology, deconstruction, seriousness or statistics will turn our stories into non-stories, there is no reason for our field to imitate those few genres that have gained hegemony in recent time. To the few wooden tongues developed in academic journals, we should add the many genres and styles of narration invented by novelists, journalists, artists, cartoonists, scientists and philosophers,. The reflexive character of our domain will be recognized in the future by the multiplicity of genres, not the tedious presence of 'reflexive loops' (1988 p. 173).

I do not agree a that "multiplicity of genres" of itself is a virtue. Ashmore cites the universal presence of the reflexive "problem" in all forms of discourse. The explicit inclusion of reflexivity in the tenets of the Strong Programme, however, lends greater epistemic value, rhetorical purchase and disciplinary attention to the reflexive character of SSK discourse. By disarming structuralist concerns out of hand, Ashmore deflects part of the discussion about the situatedness of reflexivity in his own discourse. It is not clear from Ashmore's account, for example, how place, literary genres and rhetorical modes of discourse impact an explicitly reflexive narrative structure. If reflexivity can be said to be embedded in all discourse, how does a shift, say from objective to fictional SSK discourse, signify a different constitutive politics? Does fiction, then, assume a different epistemic value in each discipline, is the value fixed, or negotiated on site? Moreover, Ashmore's ethnography does not show how "flexible literary modes" (p. 16) either transform given social contexts, or encourage activity adjacent to interpretation. As such, Ashmore's "wrighting" has no pedagogical mechanism and gives way to a host of other questions: Does participation in the process of cannonizing texts, in the

movement from thesis to book, reify the *ethos* of SSK through "New Literary Forms?" How do readings of other texts and cultures, within social groups (e.g., SSK), lead to the composition and reading of reflexive texts? Would certain narrative genres (e.g., fiction, autobiography) more readily enable the expression of subjugated knowledges? Do cross-disciplinary approaches to common problems (e.g., natural science) necessarily provide new discursive and interpretive practices? Is the infinite substitution of signs, practiced in Ashmore's brand of deconstruction, a totalizing discourse? On first gloss, Ashmore's headlong rush to the literary seems void of reflexive contemplation on the accompanying humanist and literary baggage.

After fleshing out the *ethos* and irony of SSK, I wish to sketch three pre-texts to Ashmore's thesis – from Paul DeMan's *Blindness and Insight* (1971), Jacques Derrida's "Structure, Sign and Play in the Human Sciences" (1970) and Alvin Gouldner's *The Coming Crisis in Western Sociology* (1970) – to trace the disciplinary interests found in – and integrated contexts of – reflexive discourse. In turn, I will look at whether or not the interests fostered in the use of nonstandard textual forms and interpretations ferment into a realized epistemic perspective which can be sustained in practices both inside and across disciplines. Specifically, I would like to conclude by looking at how amended reflexive textual practices might fill the breech among the theory oriented ("High Church") and practice oriented ("Low Church") wings of science studies (i.e., Fuller forthcoming).

3. ETHOS AND IRONY

3.1 *Scientism and Revolution*

One source for the *ethos* of SSK resides within the central tenets of the Strong Programme – causality, impartiality, symmetry, reflexivity – proposed by David Bloor (1976). While Ashmore admits that "... almost nothing of subsequent work in the

sociology of scientific knowledge has followed the strong programme in its entirety..." (p. 9), SSK practitioners are located on a sliding scale of scientism divined from Bloor's propositions. The one extreme, coined by Bloor as "optimistic scientism" (from Ashmore, p. 9), reflects the desire to legitimate sociology on the same grounds as other sciences. Scientism can be found embedded in the causality tenet. The other extreme, voiced by Latour (from Ashmore, p. 9), is to resist as "unethical" the temptation of science studies students to accept either the status or role of scientist. One reading of Latour would suggest science studies students avoid being co-opted by natural scientists, but again Ashmore goes a step further, eschewing the formal mantel of either natural or social scientist. For this reason, Ashmore neglects to answer how reflexive theorists and practitioners might place themselves in scientific networks, be affected by disciplinary allegiances and funding, and how their discourse and practices would change as a result. Still, the future of reflexivity does not necessarily depend on its roots in SSK. In fact, some SSK researchers would prefer to ignore the reflexive problem entirely. Ashmore's ethnography highlights an old division within SSK between fundamentalist believers (the empiricists), and reformers (the reflexivists) in the Strong Programme. This division mirrors the difficulty in balancing relativist, nonprivileging discourse with meta-analysis (see pgs. 102-111) – even in fiction:

> In order not to be scientific, one must be outside science; but to study science or anything else from outside is to be scientific. Therefore, in order to study science unscientifically one must abandon objectivity and study it from the inside. But to be inside science means to be scientific. And therefore ... well, I'm sure you take the point. Which is that this rather entertaining metascience paradox gives us an effective rejoinder to Naess's impossibilist tu quoque: in the study of science (and knowledge practices generally) the student cannot avoid being inside and outside at the same time (p. 109).

In unearthing scientism within the Strong Programme, Ashmore reflects on the problematic goal of some social theorists to appropriate natural scientific models for the social sciences. The standard objections to the social sciences someday resembling the

mature natural sciences, while not rehearsed by Ashmore, do influence the *ethos* of the reflexive turn; specifically by dismissing a historical telos from the narrative of SSK. Once scientistic aspirations are removed, reflexivity can rest, contrary to Ashmore's final point above, on internal disciplinary distinctions; not on extra-disciplinary debates (see Laudan/Bloor 1981) as to the scientific status of SSK .

Lost in the argument for blurring disciplinary boundaries, however, has been a concern as to how (or if) social science discourse can be interpretive in a fashion similar to the humanities:

> Since the assignment of meaning is a significantly different enterprise from conjecturing the causes of appearance, and since the formulation of laws and generalizations in natural science aims precisely at the identifiable of causes, the hermeneutical and the naturalistic approaches to the social sciences are often take to stand in opposition to one another ... hermeneutics was made for the humanities because the humanities are concerned with conscious subjects and lived experience, and the understanding of lived experience is a matter of entering into it rather than finding external causal conditions. (Sorell 1991, p. 170).

Spurred by the specter of scientism, reflexive theorists have created a need for interpretive prostheses developed in hermeneutics and literary criticism – for SSK specifically, and the social sciences generally – by reifying the differences among narrative discourses in the natural sciences, social sciences and the humanities. Taking Sorell and Bruner's (see note 10) distinctions to heart for a moment, Ashmore appears to affirm natural scientific discourse as a "natural kind" to be deconstructed by techniques from humanities and social sciences. Nevertheless, Ashmore does not not determine whether the strategies available from literary criticism or reflexive theory have any special relation to their disciplinary locus, and if such strategies could also be uncovered in, or transferred to, any and all discourses. Seemingly, Ashmore wants to have it both ways; to be able to deconstruct authoritative discourse, while granting interpretive authority to, in this instance, postmodern literary prescriptions. Thus while social agents may not remain the same in a relative context (p. 69 and note 39), the interpretive

strategies on which they depend apparently do remain the same and can be used on a given communicative occasion. Quite speculatively, if social agency can be seen as a construction resulting from the use of interpretive strategies, the "essence" of the social agent would remain intact to the degree in which these strategies lead to rhetorically similar cross-disciplinary narratives. For example, anyone familiar with deconstructive textual strategies would be able to generate pluralist accounts following roughly the same procedures; such is the low participatory threshold of interpretive textual strategies. The constant presence of the social agent would be contained in the sustained use of deconstructive (or relativist, constructivist) strategies leading to a multiple accounts. Thus, as presented by Ashmore, reactions to the issue of scientism from SSK uncover a series of assumptions:

(1) a limited interpretive repertoire available within natural scientific discourse,

(2) a distinct and accessible interpretive repertoire available within the humanities, transferrable to SSK and,

(3) a distinct and accessible interpretive repertoire (e.g., new literary forms) available for use within SSK. The naturalism of scientific discourse is set up by the reflexivists as a concept to be deconstructed, even though the interpretive prostheses used stay constant across disciplines and in various rhetorical contexts.

A more specific locus for the *ethos* present in Ashmore's style is a full realization of the reflexivity tenet. The reflexivity tenet holds that the sociology of knowledge "... would be reflexive. In principle its patterns of explanation would have to be applicable to sociology itself. Like the requirement of symmetry this is a response to the need to seek for general explanations. It is an obvious requirement of principle because otherwise sociology would be a standing refutation of its own theories" (p. 5). For a reflexive SSK then, the use of empirical sociological methods to show how scientific knowledge is socially constructed would also be used to show how the empirical claims of SSK are

socially constructed. The natural and social sciences, therefore, share the same reflexive dilemma; the search for epistemological grounding and warrant within a series of social contingencies. Further, SSK has deployed a methodological relativism in crediting historical and social factors for the elevation of physics to its hegemonic position among the sciences. Ashmore summarizes:

> If it could be shown that natural scientific knowledge – whose status as the arbiter and standard for all other knowledge activities, including sociology, is still extraordinarily high, if not entirely unquestioned; if this kind of knowledge could be described as resting on no foundation more impressive than the contingent social circumstance of groups of interested – in both senses – human actors, then the consequences should be quite remarkable. For instance such a conclusion would appear to warrant a reevaluation of the major epistemological thrust of Western philosophy since Descartes (p. 7).

Not only would the hierarchy of the sciences be in jeopardy, according to Ashmore, but the practices of the social sciences would also need to be reconsidered. A complimentary claim has been forwarded by Peter Manicas (1987) who considers the possibility "... that for good historical reasons, the social sciences have been constituted in terms of an untenable conception of what a proper science is. The upshot is the possibility of a thoroughgoing revolution in the received ideas of science, natural and social" (p. 4).

SSK practitioners and reflexivists promise the emancipation from the domination of Western natural science and philosophy as arbiters of the organization, use and diffusion of knowledge by usurping the the rule of physics, and the interrupting the lines of communication built by philosophers of science. Wary of possible turncoats, SSK practitioners would be vigilant of the scientistic menace by inspecting the discipline; identifying card-carrying relativists and constructivists, and uncovering shifting intellectual allegiances. The turn to SSK promises a wealth of new and interesting (see Ashmore pgs.20-25) research projects, once the remnants of scientism and philosophical positivism have been removed. Reflexivists theorists, as rhetorical mercenaries, may be on hand to make sure SSK practitioners keep their ranks in order. If needed, the

reflexivist theorist could arm the SSK researcher with a dazzling array of discursive weapons, newly purchased from literary theorists. While out flanking natural scientists on the "agonistic field" with their own emancipatory battle cry, reflexivists can begin the process of "recruiting new allies" (Latour 1987) by uncovering pockets of false consciousness. Once the people see the oppressor unmasked, they will also recognize the face of their liberator – sociology – that masqueraded as "the lowliest of the sciences" (Ashmore p. 7). SSK practitioners would not make the same mistakes as the natural scientists, or armchair anthropologists, because reflexivists would see to it, through the use of irony and new literary forms, that epistemological and methodological foundations would not become entrenched and oppressive. The new world order would be an inversion of the sciences; ensuring coalitions among the humanities and social sciences, and the felling of disciplinary walls. Everyone would be invited to participate in the process of making knowledge. New world researchers would be versatile and prepared to move to another intellectual site as ideas turned stale and research paths became too well-worn (i.e., one fad to another).

Ashmore's rhetoric and irony is more subtle than my hyperbole, yet the voice of crisis and revolution borrowed from Marx and Gouldner can be tracked through the text. We see Ashmore, once the savvy graduate student, moving through the process of credentialing, mapping the intellectual landscape of SSK (curiously absent of other graduate students) and positioning himself both inside and outside it. Once a pattern of social negotiation is revealed through an analysis of variable accounts, and the results mapped out, possibilities emerge for revising practices. Reflexive theorists, hypothetically, could mirco-manage the false consciousness of selected researchers by flooding the market with fictions of equal epistemic value. Scientific accounts would have to compete on an equal basis with similarly deconstructed claims. Just as clearly, placing SSK practitioners in a position to offer normative prescriptions to scientists, or

placing reflexivists in a position to sway epistemic markets would be a misreading of Ashmore's ethnography.

The reflexive style raises questions as to how the *ethos* of SSK impacts Ashmore's understanding of the relationship among reader, writer, text and previous texts.[15] Although the eulogy for the author has been performed by postmodern critics, Ashmore's implied ideas of social textual participation rarely go beyond the debate over discourse analysts "... studies of 'patterned variations' rather than the content of scientists' accounts" (see pgs.146-147, note 14). Again, the inclination of the discourse analyst is to agree on the variability of scientists' presentations, notion of audience and to how texts may be explicated or cited. The variability of scientists' talk, including social scientists, "... warrants the discourse analytic critique of traditional analysis; it also provides the prime empirical topic for the analysis of scientific discourse" (p. 147).[16] Given the proclivity for discourse analysts to view scientific (or empiricist) communication as the same as other communicative forms, it would be odd to reach another conclusion. The

[15] See Charles Bazerman *Shaping Written Knowledge* [(1988), p. 24]. Bazerman, in examining discourse from the natural and social sciences as well as the humanities, explores the way in which authors must set the rhetorical table from knowledge of '...the object under study, the literature of the field, the anticipated audience and the author's own self.' Ashmore's book seemingly destabilizes the mediation of these four elements by, among other things, demonstrating the variability in scientists' and analysts' discourse. However, Ashmore's familiarity and inclusion of the primary audience into the text, sanctioned authorial voice (1988, 1989) network of established references, within the governed rhetorical function of a thesis (see the introduction), makes his 'rhetorical universe' much more stable, and contained, than would first appear. The tension between maintaining the internal stability of one's own text, while destabilizing the contexts in which it is diffused, becomes a central conflict in Ashmore's text.

[16] DA (discourse analysis) has made a contribution by demonstrating the way in which scientific accounts not only vary from scientist to scientist, but from situation to situation for the same scientist. But by its insistence on taking scientists' speech as an end in itself, DA proposes to change the purpose of sociological research in a direction which is much less interesting. Now, instead of providing a sociological understanding of beliefs and knowledge, we are left with the possibility of providing a sociological understanding of texts alone. While the use of texts is an important element in how scientific beliefs become established, the final question must be how the *beliefs* are established, not how the texts are written. ' See E Fuhrman and K. Oehler p. [303, note 4].

lack of integration among studies (and stories) featuring isolated texts and structuralist analysis opens discourse analysis and reflexivity to charges of being uninteresting, or "... all pots and pans and no pudding'" (p. 21, from Bloor).

Another, perhaps more interesting, problem facing Ashmore and other contributors to the Discourse and Reflexivity workshops held in Britain is the export of their product. Reflexivity, as conceived by the British sociological community, seems to be a curiously location-bound phenomena. One needs to look at how social conformity and social influence have come to shape the SSK and reflexive community. I quote Shadish, Fuller, Gorman et al. (forthcoming) at length:

> One might ... speculate about the pervasive impact that SSK has had in the last decade on a science studies literature in which SSKers were a distinct minority. Diesing (1991), for example, describes them as using minority influence tactics extensively:
>
> > A subversion strategy, Kuhn's "revolution" is more promising if there is a small group willing to pursue it together. They can announce a new paradigm, cite each other's writing, set up conferences published as edited volumes, and (they hope) make a big enough splash to attract disciples. If they succeed, they immediately become the community elite, accumulating symbolic capital rapidly in a stream of publications and citations and appointments and research grants. The mircosociologists are an example of a group pursuing a successful subversion strategy. Their early articles are full of bold pronouncements that something new is happening, something important is being studies for the first time, a start is being made, science is now advancing (p. 196).
>
> ... at least some treatises on reflexivity go out of their way to convey the impression they are not trying to convince the reader of their position (Woolgar 1988, Ashmore 1989). Similarly, SSKers are consistent; they always follow the same game plan of deconstructing our common way of seeing science. Finally, SSKers' positions on science studies tend to be extreme in many respects relative to the positions of other sociologists and philosophers of science. All this would lead us to expect SSK to have a particularly large impact on majority opinion in science studies – to get their attention, at a minimum (e.g., Laudan 1990), and probably to change how they think about science in at least small ways.

Writ large, the irony of Ashmore's ethnography of SSK may be the instructions for, and reflexive criticism of, the process of developing the metalanguage and rhetoric necessary to enable subdisciplines to survive.

3.2 *Balancing Irony*

Irony suffuses the voice and stances of an individual narrator (the partcipant-observer in Ashmore's case) by linking the text "... to the larger social and literary conventions of which it is a function, making any stylistic 'fix' upon 'his' view problematic" (Siegle 1986, p. 16). Instead of a single human voice behind the narrative, there is "'... the human voice of culture" (p. 17) – a voice which is not univocal. The use of irony subverts naturalized conventions and unspoken contracts between authors and readers by manipulating and referring to a variety of histories, social relations, interpretive contexts, linguistic patterns and needed literary competencies. Authorial voice, then, becomes a nexus at which a universe of discursive elements meet and from which an audience can penetrate the complicity of academic writing. Possibilities for producing ironic texts from disciplinary origins, however, raises questions of whether irony must be either stable (local) or dynamic (infinite). Ashmore, and other SSK practitioners (e.g., Woolgar), address these issues by ascribing fictional status to their own stories while discouraging commitments to realism in researcher's own methodologies – thereby encouraging the "dynamism" of discourse communities. Ashmore distances rhetoric, for example, (see p. 76) from a stable persuasive context by categorizing it as fiction. Additionally, Ashmore does not obligate readers to try to decode an ironic passage by comparing it to his intended message; he petitions readers to move beyond the dominant conventions governing texts.

Woolgar (1983), echoing De Man (1971 pgs.192-197), calls for "an appreciation of irony as project" (p. 260) following an investigation into "... what consequences follow

from withdrawing the assumption that members of a fixed and recognizable community of fellow practitioners have equal access to irony?" (p. 260). The irony of which Woolgar speaks "... is not bounded by the text, nor fixed as a specific occasion for sociological work, but highlights for the reader the infinite interpretive possibilities of the text. It is dynamic irony ... (in that the text) has the potential to encourage a reader to move to a level of interpretation of which they were previously unaware" (p. 261). What Ashmore and Woolgar leave unanswered is how socially constructed conceptions of audience and the interpretation – employed by Ashmore's thesis and affixed in the narrative culture and *ethos* of SSK – shapes reflexive discourse. Crudely put, do the use of "subversion strategies" (mentioned above) reserve an audience and limit the number of readings of Ashmore's thesis? The ironicist culture in which Ashmore and Woolgar participate advertises itself as being radically chic. Irony or no, the newness and discontinuity of SSK has been turned into a virtue and basis for criticism of members of the larger science studies community who desire a hand in the process of knowledge production. As an original form of discourse, SSK's brand of reflexivity stays within the hands of a few and is guarded rhetorically as either promoting the cause of the Strong Programme, or the next step in the production of a radical SSK. To illustrate, one can apply Woolgar's "irony as project" reflexively to Ashmore's text. Ashmore has successfully unseated fixed access to the irony of his text and has "... come to realize the variety different ways in which descriptions can be received; he also comes to see the sense in which no one can never know for sure" (p. 260). Couched in Woolgar's terms, Ashmore's "realizations" are socially constructed from the discourse communities in which he participates. These realizations can be ascribed to interpretive settings available in given discourse communities. Since audiences for research on the research of SSK are small and relatively stable, the rhetorical universe in which the text circulates reflects its highly specific subject matter and esoteric language. Ashmore's thesis does have detractors, and he

graciously acknowledges their positions, but he manages their impact through explicit citation and ethnographic vignettes. Internally codifying the positions of both proponents and detractors is a brilliant move by Ashmore; he maintains the stability of the discourse community ensuring the initial reception of the text. The stratification of the text follows, in many ways, Latour's (1987 pgs. 48-62) description of the process of constructing scientific texts. Expressed sentiments to the contrary, Ashmore's fiction "wrighting" (as opposed to Latour's fact-writing, p. 60) encourages the same reactions: "giving up, going along, or working through" (p. 60). Latour holds that "... if you works through the author's trials, you quit the text and enter the laboratory" (p. 61). In Ashmore's case, you quit the text and enter the Discourse and Reflexivity workshops – a writer's laboratory. The irony of the "project of irony" adapted in Ashmore's work is that in order to be dynamic you must first be cloistered in a well-defined rhetorical universe. Woolgar illustrates how the ironicist maintains a relativist, constructivist position in SSK:

> The ironicist struggles for balance on a particularly greasy pole. If he moves too far in one direction, he could slide disastrously towards total relativism, at which point his colleagues might say that he had fallen from the pole altogether. But rhetorically he needs at least occasionally to out stretch an arm in that direction. His solution at these times is to increase the grip of his other arm, anchoring himself more firmly than ever in the reflective end of the pole. At the same time, he cannot afford to be seen to be espousing the reflective line too closely. Consequently, there are moments when he distances himself from the pitfalls of 'naive positivism' by releasing his hold just long enough to wag an admonishing finger at the philosophy of science. But the acute observer will see that while doing this, the ironicist's other arm is hanging on to relativism for dear life! (p. 256)

4. CRISIS AND POLITICS

If, to agree with Latour, there is nothing to transform the stories written by SSK practitioners into non-stories, what would a reflexive fiction look like? Ashmore lists a number of literary-critical studies and novels characterized by the "... intertextual

commingling of the real and the fictional" (p. 51, also p. 52). Examples of reflexive fiction range from Cervates' *Don Quixote*, Hawthorne's *The Scarlet Letter* and Sterne's *The Life and Opinions of Tristram Shandy* to Italo Calvino's *Invisible Cities*, Primo Levi's *The Periodic Table* and Toni Morrison's *Jazz*. As Ashmore (pgs. 51-52) rightly notes (attributed to Swearingen 1977, 1987), reflexive fiction was a "... kind of prefiguration of the philosophic concerns of Husserl and Heideggar and of Nietzsche and Derrida." These works not only blend the real and the fictional, but show, and challenge, how cultures come to naturalize categories and concepts of, among others, reason and adjudication. Siegle argues:

> ... reflexivity is highly charged ideologically precisely because it denaturalizes far more than merely literary codes and pertain to more than the aesthetic "heterocosm" to which some theorists might wish to restrict it ... Word coding, once understood as constituted rather than copied or reflected, is up for grabs, and we come to that point at which a thoroughgoing semiotics borders on ideological critique (1986, p. 11).

Further, reflexivity shares a territorial border with a philosophical tradition (from Plato to the positivists) in which a task of communicators is to develop a 'master vocabulary' mirroring the true order of things in the world. The task and privilege of constructing a master narrative had been ceded to the natural sciences, due is part to its creation of a space in which, They would not speak of that which could not be mobilized into a matter of fact by the conventionally agreed patterns of community activity – thus the importance of legislation against speech about entities that would not be made sensible: either those that indisputably *did* exist (e.g., God and the immaterial spirits) or those that indisputably did not (e.g., the aether) (Shapin and Schaffer 1985, p. 337). The dispute among reflexivists and representationalists rests on the commitment to "... comparing discourse to discourse rather than supposing that we are correlating discourse with the nondiscursive" (Siegle 1986, p. 12, see also Fuhrman and Oehler 1986). Ashmore's "wrighting" plays on "the illusion" of dialectical strain by:

> ... striv(ing) to do what it cannot do; it attempts to; it attempts representation while discarding the the myth of representation; it attempts to transcend its own limitations as a text while never forgetting that these limitations cannot be transcended; it makes a primary virtue of honest and yet proves of virtue by means of cunning tricks. (Caute 1971, p. 178).

The moral of Ashmore's didactic tale lies in superceding representative discourse with reflexive fictions. Like many advocates, Ashmore borrows liberally from the rhetorical strategy of 'crisis and reform' to give warrant for the reflexive thesis. While Ashmore cites sources for reflexive strategies, he fails to locate the substructure of other disciplinary narratives from which they originate. In turn, Ashmore fails to offer any interpretation of the relationship between knowledge and power embedded with reflexivist textual practices. The movement from crisis to demystification in SSK, leading to the reflexive turn, puts into practice rhetorical cues found in three other sources; Paul DeMan's *Blindness and Insight* (1971), Jacques Derrida's "Structure Sign and Play in the Human Sciences" (1970) and Alvin Gouldner's *The Coming Crisis in Western Sociology* (1970).

The opening of *Blindness and Insight* (entitled "Criticism and Crisis") brings an intriguing historical context to Ashmore's book. DeMan recalls the French poet Stephane Mallarme's mocking proclamation upon delivering a lecture at Oxford in 1894: "I am indeed bringing you the news. The most surprising news ever. Nothing like it ever happened before. They have tampered with the rules of verse ... *On a touche au vers*" (from Pleiade ed., 643, p. 3). Mallarme goes on to speak of a series of poets – Gustave Kahn, Charles Morice, Emile Verhaeren – who have begun to reject traditional verse for free verse which Mallarme describes as "polymorphic" – and from which follows an end, or crisis, in French poetry. Although Mallarme seemingly overstates the case, given the historical record and the relative insignificance of the poets mentioned, DeMan argues for an alternative reading. Mallarme was "... well aware of the relative triviality of what

his disciples are taking so seriously. He is using them as a screen, a pretext to talk about something that concerns him much more; namely, his own experiments with poetic language" (p. 7). The lessons drawn from the event Mallarme characterizes as a crisis derives from reflection on the origins, sources and legitimation of criticism.

DeMan's analysis of the reflective function of crisis dovetails the anthropological problem of the relationship of observer and observed, taken from Levi-Strauss to the "... impossibility ... of making the actual sign coincide with what it signifies" (p. 11). In literary criticism there has been a movement to demystify literature as a privileged (original) discourse. DeMan frames, historically, the movement from the romantic mystification of the subject, to the modern demystification of "romantic idealism" (p. 13). While some critics rely on an historical telos in showing the movement from mystification (romantic idealism) to demystification (modern pragmatism), DeMan suggests the movement from blindness to insight is not a successive move in one direction – or, perhaps, in any direction:

> ... the fundamental movement of the literary mind espouses the pattern of a demystifying consciousness; literature finally comes into its own, and becomes authentic, when it discovers its exalted status it claimed for its language was a myth. The function of the critics naturally becomes coextensive with the intent at demystification that is more or less consciously present in the mind of the author. This scheme is powerful and cogent, powerful enough, in fact, to go to the root of the matter to cause a crisis ... My remarks are meant to indicate some reasons, however, for considering the conception of literature (or literary criticism) as demystification the most dangerous myth of all, while granting that it forces us, in Mallarme's terms, to scrutinize the act of writing "jusqu'en l'origine" (p. 14).

In anthropology, the move from mystification to demystification accompanied the move from the assumption of the superiority of white European virtues, to a sympathy for "the native's point of view" (Geertz 1983, p. 55). DeMan cites Husserl as an example who – in his treatise *The Crisis of the European Sciences and Transcendental Phenomenology* – urged thoroughgoing self-reflection on the the goals of " ... all the man-created systems

and achievements" (p. 15). Interestingly, Husserl's thorough-going reflection stops within the borders of Europe. DeMan concludes that the structure of all "crisis-determined statements" (p. 16), and what follows from them, fails to reflect on itself. For their part, demystifying critics fall into the same pattern of error; asserting a crisis, calling for a program of revision, and withdrawing from the implications from a privileged standpoint.

Jacques Derrida in "Structure, Sign, and Play in the Discourse of the Human Sciences" provides another backdrop against which Ashmore's ideas can be outlined. Derrida invokes studies by Lévi-Strauss of the myth-building of cultures to analyze how structures, such as western philosophy and science, are centrally organized. Derrida argues that while a coherent structure provides a basis for "the freeplay of its elements inside the total form" (p. 248), the center also closes off the freeplay it enjoins. In the history of structures, however, a disruption has occurred. The concept of a centered structure predicated on fundamental notions such as essence or substance has been supplied by surrogate principles, substituted throughout history. The fixed locus of metaphysical or epistemological structures has been continuously revised, and in the absence a transcendental signified to arbitrate given claims nothing has really existed but discourse, or the freeplay of signs. As proof of the decentering of structure, Derrida turns to ethnology as an example of a science which could only be born at the moment when the locus of European metaphysics had been dislocated.

Derrida concedes ethnology comes replete with traditional, ethnocentric concepts, and advises a watchful eye on the language and responsibility of discourse in the human sciences. From Levi-Strauss, Derrida examines how the enduring dichotomy of nature/culture can be deconstructed historically. For example, while some ethnographers take incest-prohibition as natural imperative, Derrida suggests how the system of norms and interdicts prohibiting incest can be generated culturally. As natural

and cultural concepts of incest-prohibition are linked through the methodology of the ethnographer, the ontological force of the nature/culture opposition is diffused. The value of the distinction derives from its use as a methodological instrument. Simultaneously, an ethnographic account provides for the use and critique of core concepts. Since the truth value of these concepts has been relativized, an ethnographer could pick and choose the "instruments of method" which are most efficacious. Here, then, lies a crude definition of Lévi-Strauss' notion of a *bricoleur* – as one who borrows, uses and adapts the discourse, methods and texts from what is available. The process of *bricolage* – defined roughly as a reflexive critique of language – entails not only constructing discourse out of preexisting bits and pieces, but mythical reflection as well.

In studying Bororo myths, Lévi-Strauss abandons the structure of scientific or philosophical discourse embracing instead mythological discourse in order to give his account "the form of which it speaks" (p. 257). Derrida concludes from Lévi-Strauss' strategy that bricolage has both intellectual and "mythopoetical" functions. That is, since myths deny the centered structure of western epistemology and metaphysics, Lévi-Strauss necessarily adopts a sympathetic discourse which denies privileged reference to historic origin or telos. Lévi-Strauss risks the elimination of one structure, by bracketing a history, to preserve the integrity of the structure being presented. The totalizing discourse of history, supplemented by its philosophical spearcarrier – epistemology – cannot capture the nature of a field because it "excludes totalization" (p. 260). Put simply, Derrida reasons that a field of discourse "excludes totalization." Although classical conceptions portrayed discursive fields as having infinite permutations, Derrida dismisses the idea. A field "permits infinite substitutions only because it is finite ... instead of being too large, there is something missing from it: a center which arrests and founds the freeplay of substitutions" (p. 260). As a result:

> There are thus two interpretations of interpretation, of structure, of sign, of freeplay.The one seeks to decipher, dreams of deciphering, a truth or an origin which is free from freeplay and form the order of the sign, and lives like an exile the necessity of interpretation. The other, which is no longer turned toward the origin, affirms freeplay and tries to pass beyond man and humanism, the name man being the name of that being who ... has dreamed of full presence, the reassuring foundation,the origin and the end of the game (p. 264).

These two "interpretations of interpretation" coexist in the human sciences, primarily contingent on disciplinary narratives and historical assumptions. Derrida questions the resolution of these two positions, but stakes out a middle ground and hedges a proclamation of the birth of a "terrifying form of monstrosity" (p. 264). Of course, the question facing SSK and science studies practitioners is if the monster is Ashmore's progeny.

Alvin Gouldner's famous biographical epilogue at the end of the *Coming Crisis in Western Sociology* (1970) was an attempt to rectify the personal status of sociologists with disengaged pronouncements on the circumstances of others (Ashmore, p. 78). Ashmore concludes that given such a brief treatment, Gouldner was able only to do "... little in the way of theorizing the nature and consequences of this reflexive implication" (p. 78). Gouldner's reflexive moment occurs at a point when philosophers of science had effectively done away with positivist interpretations of theory/observation relationships in science, and Kuhn began to have wider influence in diverse intellectual matters. Social theory needed to be legitimated on grounds other than evidence and coherence to square with the theorists' own proclivities.[17] As Gouldner explains:

> In a scientific, "value-free" social theory, it is not that the theorist fails to situate his social objects along a good-bad dimension, but only that this assignment, having been conventionally defined as irrelevant to the task, is now defocalized and done covertly rather than being openly accomplished. Yet, if given subsidiary attention only, it continues to function actively, nonetheless. In short, the pressure to situate social

[17] See E. Fuhrman, "Reflexivity and Alvin Gouldner: The Coming Crisis in 1990" *American Sociologist* Vol. 20 (Winter 1989), 357-61.

> objects in term of their moral value abides and shapes the work of social theorists, whatever their professed conception of their technical role. (p. 485).

The radical elements of Gouldner's reflexive sociology come out of the introspection of the moral locus for the use of power by social theorists. Ashmore has skirted the issue of power by commanding the rhetoric of the morally denuded quality of pluralist fictions. Reflexive fictions seemingly have the moral qualities imposed on them by readers. Gouldner's exercise shows how moral value resides in all elements of the social theorist's work. Accordingly, Ashmore shouts down the voice of moral authenticity in his work by diffusing its normativity. In addition, Gouldner's conclusion illustrates another direction in which "crisis-determined statements" (from De Man) can lead: to the introspection of the moral content of one's work. Ashmore has moral inklings – as calls for authenticity, democratization of knowledge and freedom would indicate – but, as Aronowitz argues (1987, p. 104) such urges exist as "*an ethical a priori*" for postmodern thinkers. McGowan (1991, p. 28) adds postmodernism "... finds itself between a rock and a hard place, unable to ground democracy by appeal to external, nonhuman principles, but unwilling to accept human generated principles by legitimate norms rather than further instances of arrangements imposed by power." Ashmore has fallen into the demystifying critics trap by tapping into the rhetoric of crisis – from SSK – calling for revision – New Literary Forms – and withdrawing from the implications – to the "... *habitus* of smaller groups" (p. 29).

5. CONCLUSION

> You're going to have even more reflexive problems, if you like, because for the purposes of this study you're going to have to treat the sociology of scientific knowledge as completely constructed, and having no kind of reality at all, with it kind of being socially negotiated. And yet, boy, you're going to have to assume that your findings have got got some objectivity, have an out-there-ness. That's going to be even harder to pull off than the tricks I do! (H.M. Collins, from Ashmore 1989, p. 24)

Ashmore's thesis does, largely, pull off the "hard tricks." My criticisms of the book center on the "modernist-postmodernist dispute" framing many the debates in the science studies arena. While maddening to read, Ashmore's text achieves reader participation; but in a way in which the reader must also pull off the hard tricks. One cannot help but be thoroughly impressed by Ashmore's knowledge of a field which has grown so rapidly in the fifteen years. The ability to manipulate new literary forms is not a simple feat – Ashmore has the soul of a novelist in the body of an empirical sociologist. I would highly recommend the first chapter to anyone wanting to know about the direction and research of SSK until 1989; and any past or present graduate student can appreciate the rich journey motif in the story of Ashmore's credentialing. However, since the book stands at one end of a spectrum in science studies, it has motivated many of the criticisms I have posed.

Fuller opens his forthcoming book by making two claims: One that ".. rhetoric of science is in an ideal position to heal any rifts that may be opening up between the theoretical (or High Church) and practical (or Low Church) wing of STS, as rhetoric's own constituency reflects the natural interpenetration of theory and practice." The other being "... given the complexity of the world order it is more likely in the long term both sides to a dispute will either win or lose together." Chubin has also begun to look for the means in which science studies practitioners can reach out to other audiences:

> To become content with one set of claims while arguing vigorously for the existence of others is to disavow one's relativism and reflexivity. Yet STS scholars assert that others must embrace the "socially constructed" character of all knowledge. Excuse me, but doesn't this reduce relativistic and reflexive principles to the status and practice of knee-jerk positivism? ... STS practitioners who decry the notion of a definitive reality and champion the notion of a socially constructed world should welcome alternative interpretations that derive from different approaches to and data on science and technology. An interpretation that is arguably a distortion or caricature should have as much initial credibility as any other – and then prompt further study to determine the validity of the "caricature" claim. But sadly , this is not the case (1992, p. 12).

The promise of emancipation from naive scientistic realism by SSK does preclude the participation of scientists, among others, in constructing an understanding of science. Again, Chubin notes:

> So who is promoting public understanding of science? Or, for that matter, scientists' understanding of science? Not the STS community. It is still bedeviled by internalist questions, enveloped by specialist jargon, and feeding an archive of mounting irrelevance. The turning away from the second 'S' (society) is strongly correlated with a turning inward to the rewards of a profession that has been captured by academic politics. The very tendencies STS sought to repudiate now shield the leading lights – its scholarly role models – from the issues of society, polity and the lay culture. Their work, however erudite, grows sterile (1992, p. 13).

Ashmore's book can be seen as an symbol of Chubin's doubts about the future of SSK and Science Studies research, but must also be seen as a necessary step in the development of a study of science. If, as Chubin argues, one mission of science studies and SSK is to promote the public understanding of science, reflexive textual practices will not be of much help. Broadly construed, audiences outside science studies will gain little from looking at reflexive social science texts. Frankly, if one wants to read and employ techniques of reflexive fiction, while Ashmore is quite adept, I would recommend any of the novels mentioned earlier. Yet I would give Ashmore's work another reading; as a first step toward bringing together the diverse elements of STS. Specifically, if made available to practicing scientists and engineers, reflexive textual practices would be a vehicle for constructing a different kind of scientific discourse: a reflexive discourse making room science studies practitioners to participate and assist in the production of scientific and technical knowledge. If, as Ashmore claims, scientific discourse has its own deconstructive mechanisms, such as context-dependent explanations, then the issues of "society, polity and the lay culture" can be put on the table in negotiating – with scientists and engineers – the necessity for new forms of technical communication. This reading violates the letter of Ashmore's thesis, but not the spirit of scientific reform embodied in the practices of SSK.

Yet the hardest trick of all has eluded Ashmore and the reflexive theorists while seemingly being pulled off by rhetoricians of science – providing a theory of scientific discourse that *apparently* leads to *natural* practical consequences for science (see Fuller above). While Ashmore draws no intrinsic distinction between theory and practice, the rhetorical linchpin of *The Reflexive Thesis* is that the translation of contingent social circumstances into communicative practices – *apparently* leads to *natural* epistemological consequences for science. How this translation occurs – or more importantly – how scientists *read* the effects of contingent social circumstances on practice remains a mystery. The success or failure of arguments for a reevaluation of scientific discourse and epistemology in part depends – for rhetoricians and reflexive theorists – on recognizing and appropriating the rhetorical attributions of scientism. In deconstructing the basis for scientism, reflexive theorists have turned inward and sought to purge the Strong Program of Bloor's "optimistic scientism." The inward turn of reflexive theorists has, in effect, given scientism greater rhetorical purchase and been a platform on which the calls for reforms of SSK have been based. In SSK, scientism has been generally equated with scientific empiricism and the naturalistic turn in philosophy. Both positions are seen – correctly – as reductive. However, researchers in SSK have failed to recognize just how their own positions as pluralists or interventionists depends on, or are obscured by, characterizations of scientism. Tom Sorrell (1991) suggests that philosophy, for example, can "mediate" (rather than popularize) the differences between "some arts and some sciences" (p. 127). The idea being that some philosophical problems can be posed to show kinship across the disciplines. SSK's line against scientism has been rhetorically couched as a choice between science for, or science against, the people. This rhetoric brings with it the animus of modernist/postmodernist debates through wholesale adoption of the two cultures distinction, thus pitting scientism against humanism and universalism against localism.

The practical rhetorical outgrowth of building a reflexive consciousness (on both institutional and individual levels) is a means to persuade others that a lack of reflexive awareness about their practices (shown ethnographically) can result in false beliefs. Loath to be co-opted in the service methodological oppressors (natural scientists), reflexive theorists have rhetorically positioned themselves above interventionists (e.g., Low Church educational reformers) by dismissing their presence as interdisciplinary mediators and insisting on the more genuine role of communicative reform at a distance. By employing a rhetoric of metadiscourse, one of the principle features of which is obscurantism, I have shown how reflexive practitioners in SSK have become *asocial* in their emphasis on localism and self-governance.

I have also shown that the development and legitimation of reflexive textual practices depends on an argument for the consistent application of relativism/constructivism in studying science in a postmodern world. This has, in turn, led to the reification and extension of the *ethos* of SSK as a necessary foundation for reflexive textual practices. In looking at other attempts to develop a politics of crisis, revolution and demystification, from Derrida, DeMan and Gouldner, I have shown that Ashmore's reflexive thesis lacks the framework to provide a positive concept of social and moral action which extends reflexive textual practices beyond the self-same community of discourse analysts.

In the following chapter I will examine the kinship between SSK and the rhetoric of science by examining what a rhetorical understanding of science entails – both sociologically and pedagogically. A number of rhetoricians of science have assumed a connection between the social and rhetorical elements of science which, in most instances, fails to be reflexively scrutinized. The way in which sociological and rhetorical assumptions have been weaved together to provide a seamless web among relativist/constructivist sociological images of science, rhetorical theory and pedagogy,

and the practice and revision of scientific discourse will be challenged reflexively. Moreover, a critical reflexive assessment will be used to begin to illustrate and clarify the sociological and philosophical underpinnings of a rhetoric of science enabling rhetoricians (and non-specialist audiences interested in having access to scientific discourse) to "fit" revised neo-Aristotelian categories onto scientific discourse and to appeal to theories of learning (i.e., Piaget) which attempt to reconcile the nature of scientific practices with a public understanding of science.

Chapter Three

Reflexively Rendering Rhetoric: On Appropriating Social Categories in the Rhetoric of Science

By constructivist I mean simply the position that humans construct their own activities and knowledge. The constructivist position in the sociology of science has been associated with a critique of Mertonian social theory as falsely asserting that people behave according to preexisting abstract norms that seem to contradict the individual's immediate interests and actions ... I neither read Merton that way nor agree with the critique. (Charles Bazerman, 1988)

But so serendipitous a relationship between sociological and rhetorical analysis may be an instance of a more general kinship between two allied disciplinary matrices. Perhaps neither has genuine epistemological priority; perhaps social forces, like capitalism and imperialism, forces that seem so impersonal, so like nature itself, are at bottom no less rhetorically constituted, than is a concern for priority in scientific discovery. If that were so, the division of labor between rhetoric and sociology would still hold–sociology would still deal with the structural determinants of social conditions, rhetoric with their symbolic content and style–but for methodological, not epistemological, reasons.(Alan Gross 1990)

1. INTRODUCTION

In this chapter, I offer a critical, reflexive examination of the appropriation and integration of cognitive and social categories by rhetoricians of science as a basis for descriptions and meta-analyses of scientific discourse.[1] By

[1] The term "discourse" has been used in a number of ways in the literature on the rhetoric of science. However, most analyses of scientific discourse stipulate either a locally or universally driven notion of communicative norms. One can attribute to rhetoricians a working conception of discourse essentially derived from either Lyotard (1979) or Habermas (1981). Lyotard's position can be taken to argue against the type of "dialogue of argumentation" forwarded by Habermas. Habermas begins by arguing that: "Only in theoretical, practical, and explicative discourse do the participants have to start from the (often counterfactual) presupposition that the conditions for an ideal speech situation are satisfied to a sufficient degree of approximation." In other words, participants engaged in an argument bring to the table a belief that "in principle" a "rationally motivated agreement" could "be achieved." Consensus among the participants would be gained if argumentation were "conducted openly enough and continued long enough" (1981, p. 42). Discourse, then, in Habermas' sense is the conduct of argumentation under the stipulation that there could be a rationally derived solution to an argument. Lyotard counters by citing the failure of grand narratives and the belief "...that humanity as a collective (universal) subject seeks its common emancipation through the regularization of "moves" permitted in all language games and that the legitimacy of any statement resides in its contributing to that emancipation" (1979, p. 66). "Discourse" taken in the negative sense from Lyotard entails, in principle, "... that any consensus on the rules

positioning rhetoric both as a metadiscourse (culturally, as illustrated by science popularizers) and as an internal component (practically, as illustrated by accounts of theory choice) of scientific practice, rhetoricians have linked the functions of persuasion and reference.[2] Trading on ontological ambiguities concerning the status of linguistic referents in science – words and terms as either transparently referring to natural phenomena, or as embedded in, but not external to, cultural and social contexts – rhetoricians have relied on both the pedagogical and critical aspects of rhetoric to legitimate their practices.[3] Based on the premise that rhetoric is a component of all discourse (maintained or generated at either universal or local levels), rhetoricians can position themselves either as gatekeepers of standards of scientific discourse, or as

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defining a (language) game and the "moves" playable within it *must* be local, in other words, agreed on by its present players and the subject to eventual cancellation. The orientation then favors a multiplicity of finite meta-arguments, by which I mean argumentation that concerns metaprescriptives and is limited in space and time" (1979, p. 66). The movement between modernist and postmodernist ideas of discourse generally corresponds to what can be widely construed as either analytic (case study) or pedagogical orientations of rhetoricians.

[2] Dilip Goanker, "The Idea of Rhetoric in the Rhetoric of Science" *The Southern Speech Communication Journal* (forthcoming) locates rhetoric of science literature "... along an external/internal continuum" that ranges from "... how and with what effect science is made accessible to the general public" to "... how scientific controversies involving theory choice or paradigm shift unfold..." (p. 13, manuscript). Goanker's description appears to follow a parallel line of development to Latour's (1987, see Chapter 1) notion of moving from weak (publicly accessible, open to dissent) to strong (strictly internal, unquestioned) rhetoric as scientific controversies are settled.

[3] R. Allen Harris "The Rhetoric of Science" *College English* (Vol. 53, No. 3, March 1991) in providing a "fuzzy" distinction between rhetoric and philosophy of science states: "... philosophers are concerned with the validity of the ontological claims of science (which is why philosophers of science cluster into position with labels like *realism, anti-realism,* and *constructive empiricism*). Rhetoricians usually, though certainly not always (e.g., Cherwitz and Hikins), follow the sophists and remain agnostic about ontology while focusing more exclusively on the arguments that scientists offer for their ontological claims" (p. 289). Harris' unsubstantiated declaration of rhetoricians' ontological agnosticism illustrates the rhetorical means (through sophistry) enabling rhetoricians of science straddle the ontological fence. More interestingly perhaps, Harris' intimates that rhetoricians are more involved in determining scientists' arguments for the status of their claims, than in their own arguments concerning the status of their research. If true, Harris' point buttresses Goanker's notion (p. 14, manuscript, forthcoming) of rhetoricians' lack of reflexive awareness which may, in part, be attributed to their concept of the role of rhetoric from an interdisciplinary standpoint.

critical researchers uncovering the lost traces of rhetoric in science. The movement between structuralist and constructivist social theory has given rise to confusion on the part of rhetoricians as to whether rhetoric substitutes for reference as a substantial and inseparable part of scientific knowledge (a constructivist ontology), or whether rhetoric serves as medium of presentation (a realist ontology). Accordingly, assumptions as to the universal presence of rhetoric in scientific discourse, whether implicit or explicit, are predicated on a natural ontological attitude[4] toward the description and function of social categories in science. Scientific discourse can be understood as rhetorical given the articulation and institutional attribution of social relations. Science, then, has been held to be "irreducibly social," and scientific discourse has been held to be rhetorical "without remainder." Stipulations as to the universal presence and influence of social and rhetorical forces in science substitute, I argue, for a natural ontological attitude toward the scientific rhetor as a social type. The "scientific rhetor," who has been drawn as both a mental constructivist (taken from Vgotsky and Piaget and related to Kuhn) and social constructivist, has been almost exclusively an author – not a reader.

Recently, however, appeals to the implicit nature of rhetoric in scientific discourse, dubbed "the rhetoric of rhetoric," have been reflexively challenged.[5] A

[4] In this instance, the rhetorician maintains a realist ontology with respect to the existence of social categories, but in the long run chooses, as necessary, a realist or antirealist ontology with respect to an analytical structure which yields a desired rhetorical account. I wish to distinguish the "natural ontological attitude" in rhetoric from the position articulated by Fine (1984), in which NOA is seen as mediating between realist and antirealist ontologies in the philosophy of science. In drawing attention to the ontological stances taken by rhetoricians toward the concept of rhetoric itself, and the structures making rhetorical accounts of scientific discourse available, I want to underscore the tension in conceiving of rhetoric, as a "real," or necessary, element of scientific knowledge, and in conceiving rhetoric as a way to interpret scientific knowledge and discourse. As I will argue, the movement between these ontological attitudes defines internal and external concerns about direction of the field of rhetoric of science.

[5] See, for example, Dilip Goanker, 'The Idea of Rhetoric in the Rhetoric of Science" *The Southern Speech Communication Journal* (forthcoming) and Steve Fuller, "'Rhetoric of Science': A Doubly Vexed Expression" *The Southern Speech Communication Journal* (forthcoming)

fundamental assumption motivating rhetorical analyses of science is that the "... creation of knowledge is a task beginning with self-persuasion and ending with the persuasion of others." [6] While most rhetoricians agree that scientific discourse carries some form of implicit or explicit persuasion, few rhetoricians agree on what follows as a result. The assertion by rhetoricians that scientific discourse is "undeniably," or "implicitly rhetorical," mimics sociologists' claim of the presence of the "irreducibly social" in scientific practice.[7] Rhetoricians of science have argued that readers and writers of scientific texts engage them as socially constructed, rhetorical episodes. In assuming both a practitioners' idea of rhetoric, and a "serendipitous" relationship between sociological and rhetorical analyses, rhetoricians of science have failed to reconcile various conceptions of "rhetoric" with archival, pedagogical and epistemological aims. Consequently, rhetoric of science as a research project has "stalled." [8] Goanker (1993) offers two explanations. "... First, it (rhetoric of science) has misread science, second, it

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[6] Alan Gross *The Rhetoric of Science* (Harvard University Press: Cambridge, MA, 1990) p. 3

[7] Gross (1990) argues that: "A complete rhetoric of science must avoid this accusation: after analysis, something unrhetorical remains, a hard "scientific" core" (p. 33). In offering a "rational reconstruction of the species of evolutionary taxonomy" in rhetorical terms, Gross seeks a complete translation, "without remainder" (p. 33). Goanker (forthcoming) notes the "Gross's vision" demonstrates hopes of rhetoric of science "... to secure for the 'rhetorical in science' the same sort of recognition that SSK has sought to secure for the 'social in science'" (p. 14, manuscript). Goanker goes on to evaluate comparisons between rhetoric of science and SSK, the result of which, he concludes, would lead one to "generate sufficient ammunition to dismiss the current state of scholarship in rhetoric of science (rhetoric of science) as inconsequential" (p. 14, manuscript). Here, I wish to cursorily note the perceived relationship between SSK, as successful and conceptually innovative, and rhetoric of science, as stalled and conceptually stagnate. An indicator of the success and disciplinary "consolidation" of SSK, Goanker suggests, can be seen in its reflexivity. Thus while SSK has ... "put into question the very category of the 'social' in the social sciences, RS has yet to turn its reflexive gaze back on to the idea of the 'rhetorical'" (p. 14, manuscript).

[8] Dilip Goanker "The Idea of Rhetoric in the Rhetoric of Science" *The Southern Speech Communication Journal* (forthcoming, p. 14, manuscript).

has misappropriated (not in a normative sense) rhetoric." [9] In examining the second possibility, Goanker concludes that claims as to the implicit or explicit presence of rhetoric in science (ignoring for the moment how such a presence is determined) trivialize the sense in which an individual scientist can be called a rhetor, or scientific discourse can be characterized as rhetorical. In response, Fuller (1993) addresses rhetoricians who have called for rhetoric of science to establish a separate disciplinary identity. By describing scientific texts as implicitly rhetorical, rhetoricians have sought to demarcate a distinct, legitimate realm of inquiry which gets at the heart of "real phenomena" shaping science. While Fuller sees the "descriptivist manner of speaking" more powerful in grounding a discipline, he notes parallels in the vacillation between descriptive or normative frameworks in the rhetoric of science and the "rational reconstructions" of positivist philosophers of science. Rhetoricians, seeking to demonstrate the presence of rhetoric in science, engage in "... conjuring the specter of hidden tropes and Aristotelian moments in the texts they analyze." Whether scientists themselves recognize, or actively summon, rhetorical tropes seems to be a matter of conjecture. For this reason, rhetoricians run afoul of ascribing persuasive intentionality to given scientists or scientific texts. As well, rhetorical machinations are said to have greater significance for scientists during controversies. Latour (1987), for example, posits that when controversies arise, the literature becomes more "technical" and stratified in order to transform opinions into facts. If their knowledge claims are under dispute, scientific authors can be counted on to mobilize allies both internal (e.g. technical jargon, esoterica, numbers, equations, charts) and external to the text (e.g. friends, instruments, animals, pictures, previous texts). The supposed goal of bringing these resources to bear on scientific texts – which Latour views (p. 61) as an essential function of rhetoric – is "...

[9] Ibid., p. 14 (manuscript).

chasing its readers away whether or not it is successful." New incarnations of rhetoric differ from their Aristotelian progenitors not in that they refer to only a few "external allies," but to "*very many*" (original emphasis) (p. 61). Scientific and technical literature, therefore, "... is so hard to read and analyse not because it escapes from all normal social links, but because it is *more* social than so-called normal social ties" (p. 62).

While I agree with Goanker's description that after a "promising beginning" the rhetoric of science has "stalled," I do not agree this signals the need for a "reflexive turn," at least in the way reflexivity has been recently formulated in SSK.[10] Rhetoric of science *does* need to *justify* its role in examining and interpreting scientific discourse. Justification is *not* the same as reflexive examination, although the two concepts are generally conflated. Arguments for reflexivity in rhetoric of science lean heavily on the perceived development of SSK. In other words, because SSK and rhetoric of science started at roughly the same time in the 1970's, and SSK has been proclaimed the more successful

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[10] I refer to two prominent brands (others include Bordieu and Wacquant, 1992, O'Neill, 1972, Friedrichs, 1970) of reflexivity found in the sociology of knowledge, articulated by Gouldner (1970), and Ashmore (1989) and Woolgar (1988). I endorse the notion that disciplines should constantly examine what has been stipulated as given, especially in the case of rhetoric of science. What Gouldner wished to accomplish was a more genuine form of inquiry in which the cause and effect of sociological study were not seen as divorced from the researcher. Gouldner simultaneously tried to stake out an autonomous, recognizable discourse for sociologists, with an accompanying high degree of moral awareness. As "objective discourse" was rhetorically perceived to be above the vagaries of subjectivity and hence moral and reasonable, reflexive challenges which revealed objectivity did not live up to its own standards would have to be offset by greater awareness on behalf of the researcher. A reflexive researcher, therefore, would fill in the moral vacuum created by the loss of "the grammar of rationality" by monitoring the relation of self and society. Extrapolating from Gouldner, one can see an argument for the moral responsibly of reflexivity. The brand of reflexivity touted by Ashmore (1989) and Woolgar (1988) carries with it the promise of unlimited reflexive play, without moral responsibility. Ashmore ties reflexive play to a notion of postmodernism in which the author is absent, and moral attribution is spread over a local, social level. Interestingly, in dealing with the social responsibilities of individual researchers, reflexive theorists take a cue from Latour (1987, 1986). Latour's solution to dealing with the problem of intentionality in his work is to make it a universal attribution. Given all objects possess intentionality, its attribution does not serve as a distinction. Following Latour, attributions used to describe Ashmore's reflexive researcher (awareness, intentionality, morality) can be found embedded in a web of social relations with no one locus.

project (Goanker, forthcoming), then rhetoric of science, to keep pace, needs to emulate SSK by consolidating its research. Becoming "reflexive" would be evidence of the disciplinary stability of rhetoric of science simply because there exists enough of a coherent research project to become "reflexive about." I, rather, take reflexivity not to be a sign of disciplinary coherence, but of disciplinary weakness (Fuchs 1992). Moreover, it is not clear how a reflexive program applies to rhetoric. Much of the basis for reflexivity follows from a natural epistemological distinction; namely that scientific knowledge is acquired and transmitted socially. SSK has been built on a clear, albeit disputed, relation between scientific knowledge and society. Still, the relation between scientific knowledge and rhetoric (as persuasion) is far less clear and far more disputed. For example, how is scientific knowledge rhetorical? How is rhetoric of, and in, science rhetorical? What constitutes a "rhetorical event" in science? Is scientific knowledge rhetorical in that knowledge, generally, is social and rhetoric derives from social relations? As one purpose of scientific discourse is to present knowledge claims, how do interlocutors conceive of rhetoric? If scientific knowledge is rhetorical, then does consensus indicate a "rhetorical triumph"? Although I can not answer many of these questions directly in this chapter, the ultimate justification for rhetoric of science rests with the answers.[11]

[11] I suggest here that rhetoricians of science need to consider the move from reflexive examination to moral justification of their project. Rhetoricians appear to see reflexivity and justification moral equivalents. Reflexivity has been posed, rhetorically in SSK, as a means for keeping democratic, pluralistic inquiry alive in sociology and science through textual play (see note above). Rhetoric of science has plugged into the notion of "democratizing science," as a justification for its practices, but without a thorough determination of the concept of "rhetoric" on which democratic participation in science would based. The relation of the scientists to the lay public, and the institution of science to other social institutions has not been put into a moral, rhetorical context. For example, are rhetorical techniques in science part of common parlance? If not, do rhetoricians advocate normative guidelines for how scientists (or the lay public) should use rhetoric in constructing science policy? Are the rhetorical techniques found in science generally available for public consumption? In fact, as I will argue later, the more pluralistic rhetoric becomes, the more it looks like SSK; the more structured (and less pluralistic), the less interesting and democratic rhetoric becomes.

1.1 *The Argument*

A conception of science as "... resting on no foundation more impressive than the contingent social circumstances of group of interested actors" (Ashmore 1989, p. 7) cannot be used to sustain either descriptive or normative accounts of rhetoric in scientific discourse. I will argue that insofar as postmodern social categories have been adopted from SSK to achieve a description of scientific discourse, rhetoric, as a explanatory category involving the production of scientific knowledge, becomes uninteresting or irrelevant. Moreover, these social categories cannot support the normative position of rhetoric as a basis for reform. The serendipity (see opening quote) between rhetorical social constructivist analyses stops with postmodernism; as does the relation between the hermeneutic and emancipatory task of rhetoric. I will argue that rhetoricians of science want to have their sociology, as well as their constructivism, two ways. On the one hand, rhetoricians presuppose structural functionalism (specifically Mertonianism) to show a "natural" connection between norms of scientific conduct and classical rhetorical categories (e.g., *logos*, *ethos*, and *pathos*). On the other hand, rhetoricians' appeal to social constructivism shows scientific knowledge as no more than a product of persuasion. Moreover, rhetoricians have turned to cognitive science, generally, and mental constructivism specifically, to link rhetoric with neo-Kantian constructivism. Constructivism, in this sense, follows from the idea that "... no unique 'real world' preexists and is independent of human mental activity and human symbolic language; that what we call the world is a product of some mind whose symbolic procedures construct the world." [12] Since language is a tool that constructs and mediates

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[12] Jerome Bruner *Actual Minds, Possible Worlds* (Cambridge, MA: Harvard University Press, 1986). Alan Gross (1990) endorses this brand of constructivism in arguing: "When scientific truth is seen as a consensus concerning the coherence of a range of utterances, rather than the fit between the facts and reality, conceptual change need no longer to be justified on the basis its

our knowledge of the world, we possess no scientific knowledge apart from language. Rhetoric, widely construed, is found to be embedded in all discourse and necessarily a part of the reality created through language. Here rhetoricians conflate the meaning of rhetoric, or persuasion, as a *function* of language with a conception of language itself. Discourse and language *are not* reducible to rhetoric. Rhetoric *is* a separate function of language. Many claims for the presence of rhetoric in scientific discourse hinge on an essentialist arguments about the nature of language, rhetoric and scientific knowledge.

Specifically I will argue that:

(1) Rhetoric, with respect to science, stands as a empty explanatory category.[13] The ways in which either the institution of science or scientific discourse can be held to be "rhetorical" are so varied as to lend little epistemological consequence to a description of scientific knowledge as rhetorical.[14] If scientific discourse can be described as

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closer approximation to reality. It is instead the *natural* (my emphasis) result of the persuasive process that is science, a persistent effort to renew consensus despite a constant influx of potentially disruptive utterances ... Science is less a matter of truth than of making worlds. In the absence of 'a ready-made world,' waiting to be discovered (Goodman 1978, p. 94), new worlds are necessarily constructed from the old" (pgs 204-205).

[13] Greg Myers "Sociology of Science Without the Sociology" (*Social Studies of Science* Vol. 20, 1990, 559-63) in a review of Lawrence Prelli's book A Rhetoric of Science: Inventing Scientific Discourse notes that: "One problem with this kind of approach (extending rhetorical categories from Aristotle, among others to case studies) is that it is not clear to me what kind of explanation is being given, or whether rhetoric is trying to explain anything ... But as the examples I have given would suggest, these categories are such broad abstractions that it isn't clear what is covered by them ... But what is interesting is just that scientists do not study *stases* and *topoi* and refer to lists from the classics. They have not made their rhetorical knowledge explicit in this way, and they are often unaware of making choices at all. If there are certain stereotypical forms of argument, and stereotypical ways of talking about good arguments (scope, simplicity, elegance, fruitfulness), we must look for there origins elsewhere: to the ways scientists are trained, the structures of their career, the ways they talk in labs and use their equipment, the ways they are funded and evaluated, the ways they write, rewrite, review, and read their papers. That is why those of us who started studying rhetoric often wind up studying sociology of science" (p. 361-362).

[14] Goanker argues that the traditionalist lamentation about the promiscuous use of the term "rhetoric" is disingenuous since traditionalists would be as inclined as postmodernists to proliferate its use. To illustrate, Goanker mentions the recent spate of scholarship involving

implicitly, or inherently, "rhetorical without remainder," then, by itself, such a distinction is irrelevant.[15] Following the ascription of scientific discourse as rhetorical, rhetoric becomes a universalized natural component of language which, as a descriptive category, lends no new insight into scientific practice. If rhetoric has been "there all along" in scientific discourse, then it needs to be shown on what occasions rhetoric has been made explicit, recognized as rhetoric by actors (in the analysts' sense of the term) and effected scientific practice. Further, if rhetoric *can* be shown to be actively solicited and recognized in scientific discourse, an argument needs to be made, other than appeals to self-evidence, that the realist "integrity" of epistemological claims in have been modified or compromised.[16] In addition, rhetoricians need to argue for their own

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the "co-articulation" of rhetoric with other fields of inquiry – "the rhetoric of X" (Goanker alphabetically lists twenty-two fields and titles which could substitute for X) – and attempts to determine if rhetoric substitutes for reference in these fields. Could, for example, science be understood as "... a rhetorical construction without reference?" (p. 46, manuscript). The problem posed in such a question has meaning, and rhetorical impact, only if the concept of "rhetorical" has any general understanding. Again, rhetoricians want to have it both ways. The conception of rhetoric, or the rhetorical, seems to be posed on a sliding scale from objective, referential discourse to falsehood. Rhetoricians employ this sliding scale for "appropriate" Sophistic value corresponding with implicit or explicit analysis. Additionally, the cognitive categories which users of classical rhetoric employ (e.g. arrangement, delivery, memory and style) appear context free; unaffected by history or shifting conceptions of culture.

[15] Here, I have offered a rather stark empirical concept of causation to balance the claim that scientific knowledge and discourse are "rhetorical without remainder." I wish to point out that rhetoricians generally have failed to give either a pragmatic, unificationist or realist account of rhetorical causation in science, but case study approaches suggest an implicit notion of empirical adequacy. However, I do treat differently the reductionism of the claim "all scientific knowledge and/or discourse is rhetorical" and the reductionist theses of physicalists and materialists. Whereas the ontology of physicalist and materialist reductionism is realist, I take the ontology of rhetoric to be constructivist. There is, I suggest, an inconsistency in the reductionism of scientific knowledge and/or discourse to rhetoric which runs counter to conceptions of the constitutive function of language and the constitutive function of rhetoric; both of which remain philosophically undifferentiated by rhetoricians.

[16] Rhetoricians, among others, have argued that science has perpetuated and maintained its privilege to certain knowledge by maintaining the realist relation between observables, experimentation, linguistic reference and projectibility. Since scientific knowledge is embodied in, and cannot be separated from, the vagaries of linguistic and social practices, which are reproduced, more or less coherently, at local levels, then scientific realism must be examined in the broader context of related issues. Gross (1991), for example, speculates:

instrumental realism in being able to recognize and affect the presence, cause and effect of rhetorical phenomena *given* a constructivist position.

(2) Rhetoricians must offer an argument reconciling the ontological status of rhetoric with a given sociological account of scientific practice. If one takes as given that scientific knowledge is necessarily social, it does not follow the "socially constructed nature" of scientific knowledge is a sufficient condition for it being rhetorical. While many rhetoricians hold that scientific knowledge is socially constructed, the description of science as social (in any sense) does not naturally lead to a conception of scientific knowledge and/or discourse as rhetorical. Moreover, if science is nothing more than the product of contingent social circumstances, one could produce a constructivist description or explanation of scientific knowledge or practice that does not include rhetoric. One reason, however, for treating scientific knowledge and discourse as inherently rhetorical has been to provide a counter-argument to claims for scientific autonomy and social privilege based on realist conceptions of reference and objective knowledge. In the face of rather sophisticated social constructivist, ethnographic and anti-realist redescriptions of science, do we then need rhetoric to knock science off its epistemological throne? If we consider rhetoric to be a social force intertwined with

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"Whether, after rhetorical analysis is completed, there will be left in scientific texts any constraints not the result of prior persuasion, any "natural" constraints, remains for the moment an open question. In the meantime, as rhetorical analysis proceeds unabated, science may be progressively revealed not as the privileged route to certain knowledge but as another intellectual enterprise, an activity that takes it place beside, but not above, philosophy, literary criticism, history, and rhetoric itself" (p. 3). Gross goes on to suggest: "To say that a rhetoric of science views its texts as rhetorical objects, designed to persuade, is not to deny that there is an aesthetic dimension to science. From a rhetorical point of view, however, this dimension can never be an end in itself; it is always a means of persuasion, a way of convincing scientists that some particular science is correct ... We can argue that scientific knowledge is not special, but social; the result not of revelation, but of persuasion" (pgs. 19-20). If one agrees to the premise that scientific knowledge is the result of persuasion, it remains to be seen how rhetoric is in anyway *distinguished* from empiricism. I will argue that in the wake of many rhetoricians' naturalism, it is incumbent upon them to show how scientific realism, broadly defined, does not anticipate the role of rhetoric in its epistemology.

many other social forces that effect science, can scientists and the lay public discern the special influence of persuasion apart from other social circumstances? Does the serendipity between sociological and rhetorical analyses simply nullify the significance of rhetorical interpretation?

I will offer an argument with two related claims; one drawn from what follows from a reflexive application of rhetorical concepts to their recently situated sociological origins, the other drawn from the development of a series of pedagogical practices relying on the availability to scientists and the lay public of meta- cognitive and social perspectives. Both of these claims are based on a critical examination of the perceived relation between sociological and rhetorical analyses of science. Initially, I will claim that many of the forms of the rhetoric of science cannot be supported, and are ultimately subverted, by the postmodern, constructivist social theory espoused by SSK. Secondly, I claim that a line of pedagogical development within the rhetoric of science can be traced from Piaget and Vygotsky to James Conant's General Education curriculum, to "the case approach" of Leonard Nash and Thomas Kuhn, and finally to Kuhn's *The Structure of Scientific Revolutions*. From this line of development, a portrait of the scientific rhetor emerges. I will show how this "ideal type" has come to impact normative and descriptive conceptions of the rhetoric of science.

My argument will be presented in two parts. The first part of the argument will explore the philosophical basis for a description and explanation of scientific discourse and practice as rhetorical. The purpose of this argument will be to contextualize and extend calls for a reflexive turn (Goanker 1993) in the rhetoric of science. Out of the "rhetorical" value (or "shock" value, e.g., Harris 1991) of combining science and rhetoric, one purpose of the rhetoric of science has been to open scientific discourse to interpretation and, in some instances, normative intervention. I will look at arguments

for the implicit presence of rhetoric in all scientific discourse, and the explicit study, from the close reading of scientific texts, of acts of persuasion.

The second part of the argument will focus the philosophical and sociological arguments I have made on a portrait of the scientific rhetor; a portrait which in many ways runs counter to rhetoricians' goal of opening science to democratic pluralism. Also, I will draw specific comparisons between the types of "minority influence tactics" (Diesing 1991, p. 196) used by rhetoric of science and SSK. The comparison is important, I hold, as many rhetoricians have begun to call for a separate disciplinary identity. Central to arguments legitimating a rhetorical study of science has been the "bold pronouncement that something new is happening" (Diesing 1991, p. 196), an appeal to a relation between the function of "the social" and "the rhetorical" in science, as well as an appropriation of narrative elements from Thomas Kuhn's *The Structure of Scientific Revolutions.* I will argue that Jean Piaget's model of cognitive development, which had influenced Kuhn's conception of scientific learning, can also be seen in the form of neo-Kantian constructivism on which many rhetoricians concept of pedagogy is based. In advancing both the disciplinary development of rhetoric, and, pedagogically, the rhetorical skills of scientific rhetor and layperson, rhetoricians have relied on a similar form of reflexive awareness in which a discipline or actor has access, through an interdisciplinary perspective, to cognitive and social structures. I will argue that this form of reflexive awareness had, in essence been scripted by Kuhn and roughly substitutes as a form of realist ontology. Given the ambiguity surrounding the ontological status "rhetorical phenomena" in science, rhetoricians have relied on a "serendipity" between structuralist sociological accounts of science and rhetoric to locate "rhetorical effect." While persuasion does act as a social and cognitive force in science, it does not follow that rhetoric leads to a particular action. If a causal relation can be asserted, the question becomes empirical, but rhetoricians have failed to offer a convincing a priori

argument, evidenced in their philosophical and sociological eclecticism, for rhetorical causation. Rhetoricians have come to substitute an "oversocialized" notion of pedagogy for empiricism; that is, that through the knowledge and intentional practice of rhetoric, a scientist can come to affect scientific practice. I will argue that this conception of pedagogy may serve as an effective didactic meta-discourse, if the goals of a description and practice of scientific discourse as rhetorical are clearly defined.

2. PHILOSOPHICAL EXPLANATIONS AND THE RHETORIC OF SCIENCE

Whether analysts of scientific discourse are interested in explaining *why* scientists make the communicative choices they do, or in prescribing what choices *should* be made defines the relation between rhetoric and science. No consensus on the descriptive or prescriptive aims of the rhetoric of science exists. Fuller (forthcoming) frames this debate nicely: "The more that rhetoric of science looks like classical rhetoric, the less exciting its interpretations seem ... Yet, the more that rhetoric of science strays from classical sources and the more provocative its readings become, the more interchangeable its methods seem with those used by sociologists and critical theorists" (p. 1, manuscript). The ends of this spectrum, which Fuller mentions, are represented by Lawrence Prelli's classical approach in *A Rhetoric of Science* (1989) and Alan Gross' sociologically informed *The Rhetoric of Science* (1990).[17] Perhaps the most sustained

[17] Goanker (forthcoming) has provided a detailed and insightful analysis and comparison of books by Prelli, Gross and a number of essays on Darwin's *The Origin of Species* by John Campbell. Goanker's reading reflects that, "... in the case studies by Campbell, Gross and Prelli, though fascinating on their own, neither endorses a revival of the classical model, nor authorize deglobalization, nor make a case (even a practical case) for conceptual precision. On the contrary, they put into question the humanist ideology that gives rise to such recommendations that are largely divorced from the actual practice of criticism ... Campbell refuses to let go of the image of Darwin as a rhetorical superstar who is always in command of the situation ... Gross succeeds as a critic largely by ignoring the approach he recommends ... Prelli's critical exegesis forced to conform to a preconceived method gets caught in a relentless taxonomic redescription that yields results that are mechanical and unexciting" (pgs. 24-25, manuscript). While Goanker's conclusions influence my own, I wish to consider the works of

attempt to integrate these two perspectives come in Charles Bazerman's thoroughly eclectic *Shaping Written Knowledge* (1988).[18] In this section, in order to outline the philosophical assumptions of these three works, I will provide two basic arguments: 1) I offer a reflexive, constructivist argument against rhetoricians' descriptions of scientific discourse as implicitly rhetorical. Such descriptions are predicated on a naturalistic conception of scientific discourse which can be refuted by the same social constructivist views that allow a number of rhetoricians to make these claims in the first place, and 2) I will argue that claims as to the explicit role of rhetoric, as affecting, for example, conceptual change, must be situated *both* empirically and historically. I suggest, for instance, that philosophical and empirical justification be provided for the way in which a close reading of "starred" scientific texts serves to effect scientific practice. For these arguments, I will begin to flesh out what type of social theory is implied in descriptive and performance oriented conceptions of rhetoric in science.

2.1 *Implicit and Explicit Rhetoric*

The relation between descriptivist and prescriptivist schools of thought in the rhetoric of science can be seen, in the current context of science studies, as owing to

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Gross and Prelli from the standpoint of the social and cognitive categories they appropriate as the theoretical basis for their work.

[18] Prelli's book is featured in a series on studies in rhetoric/communication published by the University of South Carolina Press including Cherwitz and Hikins *Communication and Knowledge* (1990). The books in this series tend to reflect and apply classical rhetorical categories and epistemological distinctions to current interdisciplinary perspectives on a given topic. In many ways the studies in rhetoric/communication series is countered by a series published by the University of Wisconsin Press on rhetoric in the human sciences – titles include Charles Bazerman's *Shaping Written Knowledge* (1988), Nelson, Megill and McCloskey (eds., 1987) *The Rhetoric of the Human Sciences*, and Steve Fuller (1993) *Philosophy, Rhetoric and the and of Knowledge*. Generally, the books in this series take interdisciplinarity not as an opportunity to transplant classical perspectives to another field, but to make practitioners aware of how the routinization of disciplinary methods and perspectives has guided the development of a given discipline. Many of the authors in this series counterpose the success or failure of these disciplinary routines with explanations of how a discipline may have developed otherwise, given another set of explanatory and research goals.

methodological conclusions from the postmodernist/modernist debate. In trying to establish a disciplinary identity, rhetoricians of science have begun to define their cultural position as critics. Goanker (forthcoming) states that:

> ... a rhetorical analyst is required to discharge a double burden: she must simultaneously make the practice/artifact under scrutiny intelligible (either imminently or contextually or by some combination of the two) and also specify how the intelligibility of her reading is grounded in a theory of rhetoric. This, I believe, is evident in our critical practices.
>
> However, what is not so evident is the two radical consequences which are implicit in our critical practices: *first, what is rhetorical in any given case is invariably an effect of one's reading rather than a quality intrinsic to the object being read. Second, if what is rhetorical is an effect of one's reading, then a master reader can produce such an effect in relation to virtually any object. Hence, the range of rhetoric is potentially universal.* Thus, it turns out that the interpretive turn in rhetoric is inextricably linked to an impulse to universalize rhetoric (original emphasis, manuscript p. 4).

While most rhetoricians readily possess a familiarity with the historical narrative of their discipline, Goanker cites the shifting character of modern/postmodern society as responsible for the absence of cultural markers which distinguish rhetorical from non-rhetorical events. The "interpretive turn" in rhetoric (positioning rhetoric as an interpretive metadiscourse redescribing science) would seemingly accomplish much of what the "sociological turn" did in science studies. Natural science would provide the toughest case for establishing either social or rhetorical forces as causal factors shaping the production of knowledge; and if rhetoricians could establish a beach head there, could the rest of the discursive universe be far behind? Rhetoric of science has gained much of its scholarly capital by positioning itself as aiding in the reconception of science in the post-positivist era. If, however, general agreement exists on the progress and instrumental reliability of scientific methodology given a constructivist perspective, rhetoricians must explain the unparalleled rhetorical success of certain scientists in the face of extraordinary historical and social opposition. Mirroring Putnam's statement (1975) that: "The positive argument for realism is that it is the only philosophy that

doesn't make the success of science a miracle;" one could argue that the *negative* argument for *constructivism* is that it is the only philosophy that makes the success of science a *miracle of rhetoric.*

Many rhetoricians have attempted to stake their intellectual claims about science in arguing that the defeat of the logical positivists, at the hands of, among others, Toulmin, Hanson and Kuhn, carried with it the opportunity to recuperate the rhetoric in scientific discourse once hidden by philosophical justificationism. Evidence for the existence of rhetoric in science has been derived through neo-Kantian (or constructivist) conceptions of scientific knowledge emphasizing antifoundationalism and theory-dependent notions of rationality and the incommensurability of standards, methods and terms. While alternatives to scientific realism and empiricism have been recognized by some rhetoricians (attributed loosely to "epistemic rhetoric"), these approaches do not seem as hospitable to a robust "rhetorical recovery." Here, I want to note that it is the choice of a particular historical, philosophical or sociological narrative which serves as a general, and interdisciplinary, justification for a rhetorical study of science. As rhetorical descriptive claims about scientific discourse are predicated on the elements of a given local narrative, from a postmodern perspective, these elements could be eliminated or embellished to lend either a stronger or weaker account of, say, scientific realism or constructivism. The legitimation of rhetorical research, and accompanying meta-theoretical connections to other disciplines concerned with science, remains anchored in the grand narrative which tells the story of the demise of positivism. In contrast, the practice of rhetoric in science (as told in case studies) can be found in local instances of scientific acculturation. Accordingly, the rhetoric of science looks at once empirical, anti-humanistic, in line with certain received views in the philosophy of science, and postmodern. However, the tension between the modernist theoretical underpinnings and

the local concept of rhetorical practice can be illustrated in the conception of writers and reader of scientific texts – a point which I will explore later in more detail.

Rhetoric (as persuasion leading to assent or dissent) stands as a second-order relation to scientific explanation: an explanation about discourse concerning explanation.[19] If rhetoric stands in a second-order relation to the normative image of science, it is unclear how rhetoric explains anything about scientific practice, or "actual" unpublished scientific discourse. Rhetoric (except as implied in all language) has not been shown to be a social actor or artifact affecting scientific practice "in the heat of the moment;" rather rhetorical categories have been excavated from scientific discourse which, for the most part, appears "after the fact." If one concedes that scientific journal articles are a "cleaned up" version of a rather sloppy practice, rhetorical analysis gives us only an interpretation of a scientific image – much like a picture of a picture. Indeed the problem, as many rhetoricians have suspected, is reflexive. Rhetoricians have inherited the *tu quoque* arguments which come from relativism/constructivism. As a result, most rhetoricians have failed to come to grips with the ontological status of rhetoric. In case studies, for instance, persuasion, has been taken to be a "real" phenomena which has been historically evidenced. Many rhetoricians remain realists about the existence of, and correspondence among, communal social norms, the use and function of rhetoric and the resulting behavior of scientists and their community (assent

[19] R. Allen Harris (1991) defines rhetoric of science quite generally as "... the study of suasion in the interpretation of nature" (p. 284). This definition follows from the rather general set of observation that "... scientists interpret the empirical domain. What rhetors do is influence one another. What scientists do as rhetors is influence one another about interpretations of the empirical domain." Implied in this general formulation is that rhetoric stands in meta-analytic relation to an interpretation of "the empirical domain." Even if one were a thorough going constructivist, from this formulation, rhetoric would be understood as a reconstructed by-product of scientific interpretation. Here, rhetoric is set in no formal relation to the expression of natural phenomena in language in anything other than a *de facto* manner. The ambiguity in the use of the term "rhetoric" as either the *study* of the persuasive use of scientific language, or as an *inherent* function of language and, hence, any scientific communication lends to the confusion.

and dissent),[20] while maintaining an anti-realist [21] stance toward science. Rhetoricians' conception of persuasion naturally occurring in scientific discourse begs the question of the realist orientation of their own practices. If rhetoricians were to be reflexively consistent and remained agnostic about the ontological status of, and relation among, rhetoric, social structure, and behavioral action, then rhetoric (as persuasion) would fail to serve as an explanation of scientific action. Since the results of the use of rhetoric could only be determined relative to stipulated historical and social contingency, then one could substitute any linguistic function to explain, say, conceptual change. Put another way, if rhetoricians were reflexively consistent, rhetorical persuasion could not be forwarded as a causal explanation for any given occurrence in science. Accordingly, the research avenues which have been opened by juxtaposing rhetoric and science would, ironically, lose rhetorical force. If, however, the "realist integrity" of scientific discourse has been compromised by the revelation of the presence of rhetoric, and the self-image of science and scientists has been brought down a peg or two, then the general impression than rhetoric, in itself, is *mere* Sophistry has been confirmed. That is, scientists are Sophists in the worse sense of the word because they have deceived, either intentionally or unintentionally, an unwitting public. If, in contrast, the manner and image of scientific practice and communication have not been changed, and arguments for scientific progress have currency (a criteria for arbitrating rhetorical success or failure), then scientists are simply master rhetoricians in the best sense of the term. One

[20] As I will argue later, "rhetorical realism" entails a type of behaviorism in which scientific interlocutors act in a given manner based on, usually, assent to a programmatic change. To illustrate, if a scientist successfully answers challenges to their experimental results, members of the community are compelled, in the face of the evidence, to assent and integrate the findings with their work, or dissent and become marginalized. The behavior of the community is then altered accordingly. Rhetoricians tend to concentrate on rhetoric which has successfully persuaded an audience to act. When the scientific rhetor is successful, rhetoric seems to act as an irresistible force which, once recognized, compels assent.

[21] I use the term broadly here to cover relativism/constructivism.

example of this tendency occurs when rhetoricians, concentrating on case study approaches to revolutionary moments and "great men" in science, tend to endow actors with a robust sense of intentionality. Great scientists win the day through extraordinary rhetorical ability.[22] Much like Latour's scientific actors who, through complex social calculation, gain allies.

2.2 *Three Rhetorical Tales*

Each published a year apart, Charles Bazerman's *Shaping Written Knowledge* (1988), Lawrence Prelli's *A Rhetoric of Science* (1989), and Alan Gross' *The Rhetoric of Science* (1990) suggest a range of possible applications of rhetoric to science. Each book fashions a particular rhetorical method to a series of case studies from which are rendered a series of descriptive, prescriptive and pedagogical claims. I will limit my analysis of these three works to examining the integration made between posited socio-cognitive structures and rhetorical practice in science. Specifically, in extrapolating from these three works, I will argue that the cause, practice, function and effect of rhetoric in science, given the Kuhnian *ethos* from which it derives, can either be explained away, or

[22] Take for example Charles Bazerman's (1989) hyperbole: "In eventually finding that his material was amenable to a tightly sequential form, constraining and constructing the reader's reasoning, experience, and perceptual framework, Newton not only quieted his critics and won the argument; not only did he establish his "facts" as reliably reconstitutable phenomena for all to see; not only did he create a perceptual/behavioral/empirical complex so strong that he closed off serious investigation of alternatives for a century; not only did he invent a way of arguing that led to the even more mighty *Principia* that seemed an immovable mountain for two centuries; but, most powerfully, he provided a model for the form of scientific argument that influenced all of scientific practice" (p. 317). If one adopts, philosophically, a constructivist stance toward "fact making" in science, Newton's strokes of rhetorical genius, as presented by Bazerman, appear all the more fantastic. Newton had not only come to understand and present a salient description of the phenomena he had observed while defeating his critics, but took into account the cognitive, social and historical contexts in which he participated, while anticipating the challenges of interlocutors *two centuries* after his death! Newton pulled off this feat by modifying Baconian rhetorical categories into a book-length narrative leading the reader through a step-by-step process of discovery fully supported a series of experiments and mathematical derivations. Bazerman's rhetorical account seems curiously void of the social – social influences being narrowly conceived as without due influence given, at the time of Newton, an ill-bounded physics community .

explained otherwise. Still, Bazerman's work speaks most directly and successfully to the interdisciplinary perspectives being brought to science, due, in part, to the integration of Mertonian and constructivist sociology with a thorough attention to pedagogy.

To position themselves as agents of change interested in reforming scientific discourse, rhetoricians of science have sought to demarcate what "counts" as successful or failed scientific rhetoric in given historical and social contexts, and, as a result have offered arguments and analyses for how rhetors recognize and use social structures to their persuasive advantage. Given rhetoricians' nostalgia for determining, invoking and extending the *locus classicus* of rhetorical categories to scientific discourse, questions remain whether rhetoric of science has anything interesting to contribute to debates concerning the modern/postmodern character of science in society. As mentioned earlier, rhetorical analyses have turned on the assertion that all discourse generally, and scientific discourse specifically, carries undeniable, implicit persuasive elements which can be found if one knows where to look, just as one can find the effect of "the social" in scientific practice. In emphasizing this point, I wish to underscore how Thomas Kuhn's map of science in *The Structure of Scientific Revolutions* makes so many serendipitous perspectives available (e.g., the relation between social and rhetorical analyses), while supplying disciplines such as composition and rhetoric with credibility. If Fuller's (1992) argument is correct, and I suspect on this point it is, then: "... the life cycle of a Kuhnian paradigm merely repeats without making progress. Moreover, not only does Kuhn confine progress to a given paradigm, he also throws up formidable epistemic barriers to anyone wishing to peer beyond the current one" (p. 273). Fuller goes on to suggest that Kuhn, in ignoring his own historicity, has managed to convey the notion that: "... the scientific process remains essentially the same whenever and wherever it occurs" (p. 273). Pursuing the point more generally, I suggest the adoption of Kuhn's narrative has

visited upon rhetoricians of science the same sort of "blindness and insight" (See Chapter 2).

Frequently cast as owing to Thomas Kuhn's parentage, rhetoric of science and SSK share more than a family resemblance to the collective endeavor of science studies. Although the value of rhetoric of science and SSK in offering (Ashmore 1989, Gross 1990) redescription of selected theories and practices posed under the rubric of "science" continues to be debated, there has been recent occasion for calls in both fields for programmatic reflexivity. Quite speculatively, I suggest that studies founded in the name of the Kuhnian paradigm – especially in the rhetoric of science – or the opportunities made available by the narrative structure of *Structure* – have been fully presented, or made available. Barnes (1982, p. 15), for example, offers a related position:

> It could even be argued that work in the sociology of scientific knowledge has relied too heavily on Kuhn, whose academic interests have not at all been identical with those of social scientists. Kuhn has not sought to develop sociological theory, or to understand knowledge and culture in the most general possible terms. On the contrary, his explicit aim has been to discover what is particularly distinctive and efficacious in scientific research, and he has tended to discourage the extension of his ideas to forms of culture other than science (cf. Kuhn, 1969).

Cases of disciplinary retrenchment, and calls for separate disciplinary identity (e.g., composition studies, rhetoric of science) may be evidence for this point. Likewise, it has been postulated that the truly radical implications of *Structure* have been worked out better by someone else, or "lost" entirely (Bazerman 1988, p. 295, Fuller, 1992, p. 274). In a postmodern vein, I suggest that the need for programmatic reflexivity in SSK and rhetoric of science may be answered, or completely eliminated, if the Kuhnian narrative, as a source of for legitimating and grounding studies of science, was abandoned. Following Kuhn's historiography and the sense of telos he brings to the development of science, an argument could be forwarded that current developments in studies of science

were anticipated, or "rhetorically captured" by *Structure*.[23] Less radically, however, the point I wish to make is that the structure of the social and cognitive categories leading to the description and practice of rhetoric in science in the works of Prelli, Gross and Bazerman, can be traced to the sociology of science made available by Kuhn.

2.2.1 Invention and Cognition, Sociology and Rhetoric

> Why is Prelli so laboriously trying to redescribe and extend Kuhn's insights into the language of rhetoric? ... The proponents of rhetoric of science, whenever they canonize a text "implicitly rhetorical" as they have done insistently with Kuhn's *The Structure of Scientific Revolutions*, claim that they are drawing out rhetorical implications that never get adequately thematized in the text itself. The occlusion of rhetoric in the text is partly explained as an effect of the author's lack of familiarity with the rhetorical tradition and vocabulary ... Nevertheless, the proponents of rhetoric of science continue to find more and more evidence of implicit rhetorical analysis. To a certain extent, the site for discovering examples of implicit rhetorical analysis has shifted from HPS to SSK. Instead of Kuhn and Feyerabend, these days Steven Shapin, Bruno Latour and Steve Woolgar are treated a doing implicit rhetorical analysis. (Goanker, forthcoming, manuscript p. 43-44)

> In American research on writing, interest in invention revived in the 1970s at the same time as cognitive accounts of the writing process became popular. Like these cognitive accounts, Prelli see writers as individuals endowed with an explicit goal, an ethos, and an analysis of a given audience and situation, but isolated and without history, moving through a series of discrete stages (paralleled by the chapter of the book), with a detached overview of all the possible choices at each stage. The anthropologist Dan Sperber has argued 'Rhetoric is a branch of cognitive science', and approaches like Prelli's would seem to support him. But I don't think that has to be the case (Myers 1990, pgs. 562-63).

Invariably a tension exists in rhetoric of science between approaches emphasizing the cognitive (Prelli) or the social (Gross) aspects of the communicative practices of scientists. While none of these aspects is presented separately from the other, emphasis

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[23] I offer a twist to a process Latour (1987, p. 57) calls "captation" illustrated as: "All the objectors'(to a scientific claim) moves should then be controlled so that they encounter massive numbers and are defeated. I call **captation** (or capatio in the old rhetoric) this subtle control of the objectors moves." Not invoking the implicit metaphor of the agonistic field, and with due reflexive irony, I suggest the availability of Latour's own position may have, partially, been created and already anticipated in Kuhn's description of science.

on either the cognitive or the social generally determines at which point the rhetorician has entered the field of science studies. In looking at Prelli and Gross' work, I do not provide a critique of their methodology, rather the philosophical and sociological assumptions acting as the basis for their respect descriptive, normative and pedagogical account. More specifically, I will show how these assumptions inevitably lead to a call for reflexive awareness on the part of scientists as well as rhetoricians.

Goanker argues that "... Prelli's claims that scientists who become rhetorically self-conscious (i.e., understood his topical system in relation to their work) would change their practices is simply unconvincing. If reflexive writing is difficult for social scientists and *litterateurs*, then it would be institutionally nearly impossible for natural scientists" (manuscript, p. 40). To broaden Goanker's diagnosis, I would begin to argue that rhetorical self-awareness specifically following from the Kuhnian narrative may be reflexively impotent not only for scientists, but rhetoricians as well. Since Prelli's notion carries an inherent pedagogical component, I detect the "oversocialized" (hence "underhistoricized") conception of pedagogy in science. Put over dramatically, given a shift in the classroom and the laboratory away from the artificial constraints imposed on scientific discourse, to a full recognition of the rhetorical and social contingency of scientific discourse (from which follows a constructivist philosophical position), the scales would fall from the scientists eyes in recognizing the lack of sophistication in their ideas of meaning and reference, and come to value more accessible, reflexive and rhetorically savvy forms of discourse. Putting aside for the moment the profound lack of resources for such reform, one can see the type of global reconstitution of scientific discourse following from Prelli's (cued by Kuhn and Piaget) derivation from cognition to the manufacture and use of rhetorical categories. Goanker (p. 42) counters: "... By globalizing rhetoric, so as to be sure to include science, he (Prelli) obliterates the classical boundaries on the domain of rhetoric (such as the restriction to deliberative contexts)

that made topical analysis plausible." From Goanker's comment, one wonders how rhetoric, and the audience to which it is directed, must be circumscribed in either a global or local sense to make for a plausible analysis; and, perhaps more importantly, who, or what social institutions, lend the boundary conditions? Given the postmodern condition, the choice of a meta-narrative empowering the rhetoric of science can be seen as an "ends" driven condition. In other words, in order to achieve some designated end usually involving the perceived public good – the democratization of knowledge, opening science to public participation, relieving the false consciousness of scientists – rhetoric of science is empowered by a sponsoring meta-narrative. I lend the following narrative template synthesized from the introductions of books by Prelli (pgs. 1-3) and Gross (pgs 3-20):

The Introductory Narrative

> Natural science "... is thought to be the pinnacle of human achievement conceptualized as a body of stable, certifiably 'objective facts' interrelated validly by rigorous logic ... and is seen as promising progress in knowledge and in human control over the phenomena and forces of the universe." Recently, however, scholars and scientists have become aware "... that the concepts associated with formal logic are insufficient to describe the activities of 'doing science.'" The "... foundationalist program of the Vienna Circle" which equated formal logic and scientific rationality has been dismantled by the work of "... Popper, Polanyi, Kuhn, Hanson, Toulmin and Feyerabend" who, while their positions "... differ in many respects on how to characterize science correctly ... have made clear that science has an other-than-formally-logical face." The old view of science is "... characterized by a high degree of agreement and consensus concerning scientific knowledge." Historians, sociologists and philosophers set out to explain consensus formation and from their research we were given a picture of science as historically moving "... progressively toward universal consensus," as sociologically governed by "normative structures" and as philosophically understood as derived from "formal logicality."
>
> With the demise of positivism, science has been opened to redescriptions which suggest that it might just be like other social institutions. Today, "We live in an intellectual climate in which the reality of quarks or gravitational lenses is arguably a matter of persuasion." The "... idea that there is a 'rhetoric of science' may strike some as peculiar." But while the rhetorical view of science "... does not deny 'the brute facts of nature'; it merely affirms these 'facts,' whatever they are, are not science itself, knowledge itself ... Whatever its source, the breach between the world of science and our human world is real enough, and the task of reconciliation is pressing... rhetoric of science is a gesture of such

> reconciliation ... We can engage in a systematic examination of the most socially privileged communication in our society," and in this way "... we can argue that scientific knowledge is not special, but social; the result not of revelation, but of persuasion."

Certainly the methods and results of the works by Prelli and Gross differ, but the consensus concerning the historical pre-text for their work reveals a similar legitimating strategy (see also Ashmore 1989, Chapter 1). Broadly construed, and invoking the right rhetorical sensibility, rhetoricians (and reflexive practitioners, see Chapter 2) find themselves at an historical nexus. We (those who study science) know now that the positivists were wrong, and provided an open and leveled field of "play" (in the postmodern sense) we can begin to construct alternative accounts of scientific practice. Since postmodern sensibilities declare that no one account has privilege, science studies practitioners can endlessly multiply accounts – historical purism, especially on behalf of rhetoricians, not withstanding. However, it remains unanswered how, in the spirit of open play and democratic pluralism, positivistic accounts of science could be immediately ruled out. As with the ironic appeals of reflexive theorists to "anti-elitist humanism," tolerance toward competing positions extend only so far as they meet ideological requirements.[24] The "rightness" of an account is posed rhetorically on what it

[24] Fuller (1993) puts the point another way: "Not surprisingly, it is common today to confuse *entertainment* with *influence*, one's ability to command people's time and money on an occurrent basis with one's ability to transform people's underlying dispositions. Yet none of this puts an end to power. It just means that power can be effectively exercised only by people whose projects are insulated from, and perhaps even camouflaged by, the endless circulation of limelight. Thus, the diffuse marketplace atmosphere of postmodernism's "antipublic" is ultimately a playground for Machiavellis (cf., Elster 1989, on market vs. *polis*). Political naiveté aside, the postmodernist herself trades on a certain epistemic asymmetry, allowing a privileged perspective to her own position that she explicitly denies to her opponent's. If the postmodernist were correct that contemporary democracy lacks a public sphere to center its activities, and hence is no longer the sort of thing that one can centrally (or philosophically) plan, then how could she have come to know such a thing? What sort of global understanding would she have had to attain–what type of surveillance operations would she have had to perform–to reach this conclusion? What would be the implicit "center" of her own conception of contemporary democracy? My point is that the postmodernist needs just as sure and comprehensive a grasp of the knowledge system as the modernist to conclude that any major change in our epistemic institutions would be misguided" (p. 292).

can afford others (the opportunity for desired participation), but the fragmentation of the rhetoric of science project, as well as invitations for reflexive examination, would suggest rhetoricians need to overcome, rather than celebrate their eclecticism. Both Prelli and Gross rely on a similar conception of the democratic *polis* to sustain their methodology; sustained through a global conception of rhetoric (regarding use and effect) which is accessible cognitively and diffused socially. From Prelli's perspective, the scientists could, in practice, refer to an indexed set of scientific *topoi* and apply them as the rhetorical situation demands (see, for example, Chapter 11). Prelli's traditionalist approach, however, does recast the problem of reflexivity in a modernist light. If, for example, rhetorical categories were fairly static and accessible in a given discipline, a "reflexive rhetor" could effect, monitor and cancel rhetorical influence. The globalization of rhetoric, from a modernist perspective, does not, reflexively, lead to the conclusion that describing scientific claims as rhetorical undercuts rationality. In this instance reflexivity acts as a medium for rationality; persuasive claims would become accepted because they are rational. Given Prelli's model, scientists would have access to an historical index of rhetorical categories. Even though the communicative situations would vary there would be enough similarity (as Prelli's case studies intimate) so that, hypothetically, the radical implications of "The Introductory Narrative" (above), and a sponsoring met-narrative, could be countered as desired. Goanker (forthcoming, see note 12) forwards the idea that rhetoric seems both globalized and situated because the concept of rhetoric has proliferated through a series of "co-articulations" (the rhetoric of 'X', or the 'X' of rhetoric). Be that as it may, rhetoric does, in many instances, serve as a place holder for a more radical conception of 'X' from a populist standpoint.

I wish to digress just slightly to offer a broad, reflexive interrogatory of certain ethnomethodological aspects of "the rhetoric of public science policy" (Harris 1991, p. 296; e.g., J.A. Campbell, 1974, Gross, 1984, Killingworth and Steffens, 1989 and

Waddell, 1989, 1991). In theory, science studies practitioners will come to occupy significant roles in public debates concerning science and technology policy. On the surface, more than a passing knowledge of rhetoric would be helpful in this pursuit. In practice, the science studies practitioner could serve as an arbiter in such debates. Armed with a knowledge of rhetoric, the STSer would be able to shape dimensions of the debate; for example, making sense, for the layperson, of the various rhetorical maneuvers of experts. A knowledge of rhetoric in this instance would be a means of bridging STS theory (High Church) and practice (Low Church) by lending populism the necessarily theoretical gloss.

The basis for the loose scenario I have presented comes out of the introductory narratives for both rhetoric of science and STS (e.g., Cutcliffe 1989), and corresponds to the public outreach objectives of both fields. In several instances rhetoricians of science have found their social laboratory in town meetings – and the town hall seems to be located in university towns in the Midwest. Questions arise as to whether, or how, the *ethos* (either globally or locally derived) of participatory democracy in university-centered communities differs from, say, larger and more educationally diverse communities. Who, for example, populates this conception of the *polis* public policy researchers and participants have in mind? Would analyses of the rhetorical content of scientific discourse clarify a given issue? Are concepts of rhetoric geographically bound? In what local communities do these debates take place? Can rhetorical techniques be tracked from one debate to the next? Whose perspectives are available and emphasized in a given rhetorical account? Can "rhetorical norms" in science and technology debates be gleaned from case studies? Does the localist bias of postmodern conceptions of rhetoric, democracy and participation preclude rhetoricians from determining norms? If rhetorical norms do exist in public policy debates are they the same when the participants talk about science and/or technology? Prelli's hypothesis regarding the

applicability of inventional theory to situated scientific discourse authorizes a type of "instruction manual" approach to all forms of science policy debate. Provided a list of "... available lines of thought, indexed by *topoi*, into specific kinds of arguments that can potentially evoke an audience's cooperation in modifying logically crucial issues" (p. 261), the scientist or educated layperson could, in theory, direct the debate to a desired conclusion.

Yet as calls for a reflexive consciousness would indicate, rhetoricians of science may be running into similar methodological problems as psychologists whose experiments were conducted almost exclusively on university undergraduates. In the arena of public science and technology policy, the members of the "Low Church" congregation may have greater access to the decision-making process than the populist rhetoric of rhetoricians of science might indicate. Consequently, the populist rhetoric and appeal to disciplinary *ethos* (e.g., public outreach) in rhetoric of science, as well as STS and SSK, must be seen in reference to genuine practice; not only in terms of disciplinary narratives and as a means to gain entrée into science and technology practice. Two other assumptions ground a cookbook rhetoric orientation to public policy debates regarding psychology and temporality. If the air of reasonableness does pervade public science policy debates, then how and what kind of rhetoric serves as the appropriate medium? Does, for example, "reasonable rhetoric" inspire reasonable behavior? The psychological types on which the rhetoric of science is predicated appear to arise from the same mythological structure (as evidenced by the canonization of scientific text by rhetoricians) rhetoricians have come to dispute. Additionally, no psychological relation has been shown that under similarly constrained circumstances in science, rhetorical *topoi* cause a certain behavioral effect. Also, as the pace of scientific debate has changed historically, there has been little investigation of how scientific rhetoric is effected by time. The rapidity of scientific debate would indicate the need for constant attention to

the shifting rhetorical (and reflexive) ground from which knowledge claims are generated. Therefore, disciplinary structures, rhetorical categories, *topoi*, audiences, as well as the socio-cognitive function of persuasion affording a rhetorical presence may change radically, even in science, from one moment to the next. To go back to a point made earlier, if scientific knowledge is fully a socio-cognitive construct, the burden on a scientist, as rhetor, would be great – especially in constructing a successful groundbreaking claim. Rhetoricians have failed to give a separate historical account of the changing function of rhetoric of science, aside from Kuhnian historiography. While rhetoricians generally have quite a clear sense of an internal historical lineage, in dealing with either Sophistic or Platonic ghosts, they have failed to come to terms with the history of rhetoric in a particular scientific field. Case studies are presented within a relatively short historical context and do not deal with the long term reception or eventual rejection of a scientific claim. For their part, reflexive theorists in SSK have mimicked the short life of their own epistemological claims through narrative textual devices. Rhetoricians of science have largely ignored the historiographical and ontological questions following the study of the particular function of a discourse (rhetoric) which is embedded in a greater narrative (natural science). So, for instance, do certain rhetorical gambits have "staying power?" Can a separate historical line of development be traced for a given set of rhetorical topoi? Are rhetorical topoi in science historically linked, or when a scientific revolution occurs are topoi in some way reinvented? Are rhetorical categories transhistorical? As Prelli's topical invention and Gross' neo-Aristotlianism would indicate, rhetorical categories take the static social structure at face value, delineated by their global or local application.

2.2.2 Neo-Aristotlianism and Social Construction

> To practice the rhetoric of science, then, is to make the *Rhetoric* the master guide to the exegesis of scientific texts. To perform this task effectively,

> the *Rhetoric* must be updated ... In my work, I view the techniques of rhetoric expounded by Perelman and Olbrechts-Tyteca, techniques such as analogy, as the means by which we are persuaded that any mode of inquiry, including that of science, is a mode of truth ... The incorporation of views as divergent as those of Propp, Freud, and Habermas into a neo-Aristotelian rhetoric of science necessitates the abandonment of strong ontological claims ... Our choice among these patterns must be based not on their relative truth, a judgment we cannot make, but on the amount each contributes to the understanding of the ways in which rhetorical processes constitute science. (Gross 1990, pgs. 18-20)

The circularity of Gross' reasoning reflects the difficulty of universalizing Aristotle's limited scope for rhetoric. Aristotle, in book 1, chapter 3 of the *Rhetoric*, grouped rhetoric into "...three divisions of oratory – (1) political, (2) forensic, and (3) the ceremonial oratory of display" (p. 1335); or "deliberative (advisory), legal and epideictic" (editor's note). Gross counters that:

> In spirit, the *Rhetoric*, my master theoretical text, is also Sophistic, its goal 'to find out in each case the existing means of persuasion.' It is a spirit, however, that Aristotle holds firmly in check by limiting the scope of rhetoric to those forums in which knowledge is unquestionably a matter of persuasion: the political and the judicial. If scientific texts are to be analyzed rhetorically, this Aristotelian limitation must be removed; the spirit of the first Sophistic must roam free" (p. 3).

The "Sophistic spirit" Gross evokes is directed toward a series of case studies of "starred texts" in exclusively concentrating on the textual mechanism tracing the "invention" of scientific claims. Scientific "discovery" "... is properly described as invention" (p. 7) and texts are the artifacts of that invention. Further, given the movement of scientific texts within the greater universe of discourse, (specially the texts Gross chooses) they become ripe for interpretive inquiry through a "proper" meta-narrative (e.g., Freud, Propp, Habermas). Reciprocally, the strong ontological claims of both science and (Aristotelian) rhetoric have been swept aside with the myth of scientific discovery, while questions about the epistemological status of constructivist claims seem connected only to the relative location of a laboratory and a text. Gross uses this neo-Aristotelian view as a way to insinuate rhetorical analysis with critical theory. In many instances, Gross

abandons any pretense of rhetorical analysis (e.g., his reading of *Narratio Prima,* see Goanker pgs. 35-37) for a preferred interpretive construct. Goanker complains, "Since many of Gross' other case studies are also free of rhetorical terminology, one is left with the same question that surfaced after an initial reading of Campbell: what makes these cases studies instances of *rhetorical* analysis" (p. 36). The constructivism embedded in Gross' form of neo-Aristotelianism frees rhetoric of its ontological constraints, but at the price of making rhetorical analysis indistinguishable from literary criticism. Once the myth of scientific discovery is debunked, and with it claims of epistemological privilege, the reader draws the "proper" conclusion that science "is just like X." When the cultural privilege of science is erased, however, so is the "rhetorical" value (the debunking of science) of doing a rhetorical study. As a result, a rhetorical analysis of scientific discourse looks just as interesting, or as insignificant as any other analysis (from Freud, Propp, Habermas) of scientific discourse. That Gross does not come to grips with the sociological implication of constructivist sociology indicates the necessity of a point of contact between rhetorical categories and corresponding sociological norm. For that connection, Gross turns to Robert Merton.

Gross concludes in Chapter 11 of his book, a set of case studies of the rhetoric of priority disputes in science, by examining the "ambience" of rhetorical and sociological analyses:

> If my analysis is correct, rhetoric is an essential component in social change, and rhetorical analysis is an essential ingredient in sociological analysis. But the complementary nature of rhetorical and sociological analysis may indicate a deeper kinship. Writing this chapter, I was struck by the ease with which I selected priority disputes as a strategic research site for rhetorical analysis ... In addition, I was surprised by the ease of fit between Merton's central insight and my rhetorical analysis. In part, the source of this ease is Merton's own awareness of rhetoric as a category of sociological evidence (pgs. 177-178).

While Bazerman (see opening quote) acknowledges that social constructivism, in principle, provides a critique of Mertonian structuralism, these views seem compatible to

Gross. In order for a text to "construct" a knowledge claim, favorable socio-cognitive structures must already be in place. Gross fails to show, however, in what instances these structures act as pre-existing norms, or are in themselves constructed. Merton's structuralism appears to be taken at face value, hence the "ease" of fit between rhetorical and sociological analyses. That this complete serendipity does not set off an alarm affirms a point made earlier regarding the naturalistic assumptions of many rhetoricians. The social norms Merton describes are assumed to be a natural pre-existing condition of scientific practice, insofar as structuralism supports the normative aspects of rhetorical analysis. Unburdened by the need to offer an explanation, the eclecticism in rhetoric of science may be attributed to the lack of meta-narrative constraints on rhetorical accounts. Gross goes on to state that "... rhetoric is an essential component in social change" and that his analysis of ".. the rhetoric of Bacon, Sprat, Olddenberg, and Newton" was "... so serendipitous, a confirmation of the essential correctness of Merton's central thesis (on priority in discovery) that more than mere confirmation seemed involved." (p. 178). From Gross' analysis, however, it remains unclear whether "the social" in rhetoric functions the same way as "the social" in structuralism and/or in constructivism. Goanker puts it another way: "Gross' neo-Aristotelianism is a phantom; it does not exist. And yet his critical practice is unhampered by its absence" (p. 37). Again, however, Gross sees a rhetorical view of science as a "... close resemblance to the 'radical relativism' to Nelson Goodman's *Ways of Worldmaking* (1978, p. x)" (p. 205). Still, Gross fails to reconcile the cognitive elements in Goodman's brand of neo-Kantian constructivism, and "the cognitive" in rhetoric of science. By assuming the global presence of rhetoric, it must seem to rhetoricians that the various social and cognitive elements of which a given account depends must be *the by-product of rhetoric*. Persuasion, then, must be the prime mover in whatever scientific claims get constructed as a matter of consequence. While this conclusion may not be surprising, the notion of rhetoric becomes

diluted to a point where it is no longer recognizable; hence the disappearance of Gross neo-Aristotelianism.

2.2.3 The Practical and the Eclectic

Although I have given earlier treatment to Charles Bazerman's *Shaping Written Knowledge* (Chapter 1), I want to return to consider the viability of the synthesis Bazerman forges among structuralist and constructivist sociologies of science, and the cognitive aspects of composition studies and technical writing. I quote Bazerman at length:

> ... textbooks in scientific writing contain highly elaborated models of linguistic forms for students to follow. As a socializing and educational practice there may be some warrant for this attitude, despite significant pedagogical dangers in freezing forms and isolating them from practice ... However, such an approach to scientific language reduces its use to a matter of following prescriptions and avoiding prohibitions. Such a view isolates writing from the larger process of formulation and interaction by making it merely an editing-for-propriety process, rather than a complex social event ... Studies of scientific discourse coming from sociologists of science have indeed emphasized the agonistic force of language in the competition over claims, power and the stratification of interests ... By representing scientific argument as an unbounded free-play of competing interests, however, these studies have erred in the opposite direction ... Typically, most sociological studies of scientific discourse treat the previous literature as a persuasive resource, a validating set of scriptures to be effectively arrayed through references, but these studies do not consider how this prior literature helps define the current work (pgs. 155-156).

In arguing that prior literature imposes normative constraints on scientific and technical writing, Bazerman begins to detail aspects of a rather fundamental claim that anchors his work; namely, that scientific writing is complex business. It is Bazerman's emphasis on social complexity (evident in his prose), embedded in scientific discourse and manifest in textbook prescriptions which leads to both the eclecticism of his account and an oversocialized conception of pedagogy. Undoubtedly, textbook presentations of scientific discourse present a fairly simple notion of the one-to-one correspondence between linguistic symbols and the objects to which they refer. Bazerman does not

denigrate the textbook approach, but rather urges appropriate distrust of scientific language. Both neo-Kantian and social constructivism inform Bazerman's notion that scientific language is opaque, and the direct access to the world entailed in scientific empiricism is itself a social construction The problem, as Bazerman sees it, is that what is lacking in bringing together social constructivism, empiricism and the way "... we have become accustomed to think about language in this century" (p. 295) is "... a unitary concept of signifying events simultaneously contexted within and realizing linguistic code, social relations, psychological cognition, and perception of the ambient world" (p. 295). To this end, Bazerman goes back to the work of Lev Vygotsky.

Reviewing *Shaping Written Knowledge*, Gorman[25] finds that in railing against the "unreflecting slavery to current practice" (p. 171) taught to students of technical communication, Bazerman advocates "a kind of meta-cognitive awareness of goals and contexts, but does not situate it in the appropriate literature, or in the practices of writer and editors discussed in earlier chapters" (p. 171). Bazerman's eclectic synthesis of the social and linguistic elements of science attempts to "... reconcile social constructivist and empirical views of science by coupling a Vygotskian gloss that is popular in composition studies, with Ludwik Fleck's views on scientific activity" (p. 171). Hence, the scientific rhetor possesses a kind of meta-cognitive and meta-social "... awareness of goals and contexts" which can be derived from regularities in social forms of scientific experimentation and communication. "Regularities," states Bazerman:

> ... occurred because individuals perceive situations as similar and make similar choices. Institutionalization and codification occurred because repeated choices appear to the collective wisdom (or wisdom a few powerful actors) to be generally and explicitly advisable ... References, citation practices, and embedding of contributions in theory gave textual form to the increasing explicit intertextual activity of each individual

[25] Michael Gorman "Review of Charles Bazerman, *Shaping Written Knowledge: The Genre and Activity of the Experimental Article in Science*" *Social Studies of Science* (Vol. 20, 1990, 169-172).

> author. The success of the genre in carrying out the business of the scientific community has also turned the genre into another kind of social fact, as an authoritative model to be emulated by other disciplines, interpreted through their own perceptions and problems (p. 316).

Although textbooks, in presenting scientific discourse as purely referential, have failed to address the constitutive nature of discourse (as mediating reality), Bazerman argues that it is a function of this same set of discursive regularities (or norms) that make meta-cognitive and meta-social perspectives available to scientific rhetors. Once scientists (or science studies researchers) begin to talk about the regulative function of language, then the constitutive elements become apparent. To extend Bazerman's point further, constructivist theorists, or rhetoricians, require a narrative conception of imposed regularities (whether Mertonian structuralism, or positivism) to make their accounts available. Bazerman's rather healthy understanding of what discursive resources become available to the scientist upon reflection (or reflexive practice) comes out of the Vygotskian psychology. Like a child, the scientist goes through stages of development and socialization:

> ... she will have developed the scripts, schema, and plans appropriate to participation in the community. Thus the apprentice chemists learns to think and behave like a chemist, such that when she walks into a laboratory, she will perceive the surrounding material and will have acquired framework of chemical formulations and will behave with respect to the material so as to reliably reconstitute phenomena accepted by chemists as reliably reconstitutable. (p. 307)

Bazerman's adoption of Vygotsky takes the correspondence between the manipulation of materials and linguistic behavior and super-imposes it on Kuhn's notion of normal and revolutionary science. It is the "developed" scientist, within a developed scientific community, who, confronted with paradigm change can appropriately adjust, or translate current techniques and discourse to another paradigm. The cognitive and social development of a scientist and a scientific community roughly parallels the paradigmatic progress of the research. Much like developing a moral sense, the scientist (and the

scientific community) recognizes the need for developing, manipulating and testing behavioral, social and linguistic constraints.

Bazerman charts this development as somewhat naturally occurring, in that scientific disciplines do not take intentional steps to gain a reflexive consciousness in order to mature. Put another way, a scientific discipline becomes mature, as does an individual, through time and experience; this maturity cannot come through self-declaration. This naturalistic conception of growth, which follows the psycho-historical narrative Bazerman adopts, seems to neatly explain a number of things; the development of the natural sciences with respect to the social sciences, the type pedagogical emphases in scientific and technical communication, the break through of individual (great) scientists and the demise of certain research programs.

In bridging the social and the cognitive in science, Bazerman takes pre-existing social norms at face value. The behavioral regularities imposed by these norms foster a form of community and individual growth by making meta- cognitive, social, and historical perspective available. Adherence to these norms allows a neophyte to work in the community. As the neophyte becomes a full-fledged practitioner, she gains reflexive knowledge, through experience, and can see how social barriers, for example, constrain development and how those barriers can be tested and modified. This perspective may or may not be shared by the community. Pedagogically, Bazerman warns, potential scientists need to become aware that "slavish" devotion to these communicative norms cuts off practitioners from a necessary knowledge of their own field, and other fields of influence. A scientific practitioner must have reflexive knowledge of the internal and external influences on their discipline and themselves in order to adopt to paradigmatic change. While a "didactic macro-perspective" in Bazerman's work is evident, he seems to lend to much emphasis to the "natural" pedagogical process in bringing scientists to a reflexive awareness. Interdisciplinary studies of scientists have typically treated them as

either as dopes or as geniuses. Bazerman's "oversocialized" concept of pedagogy tends to give credit to scientists for a reflexive awareness they are not due, but, accepting the uniform institutional nature of pedagogical practices, places "meta-perspectives" in the context of social structures. A scientist, then, does not need to be a genius recognize social norms in order to construct scientific claims. Thus, although Bazerman's Mertonian emphasis lends context to his constructivism, he places too much emphasis on pedagogy as the medium of individual and communal developmental exchange.

3. PORTRAIT OF A SCIENTIFIC RHETOR

Formulated in the wake of the "Kuhnian revolution," radical reconceptions of the structure, purpose, and rhetorical function of scientific discourse have failed to be realized in much of the pedagogy involving scientific and technical communication. What *had been* realized, by social scientists and humanists concerned with science and technology, although seemingly lost on Kuhn,[26] was that *The Structure of Scientific Revolutions* contained narrative and methodological elements which, once appropriated, could reconstitute their field of inquiry into a science. One of the most intriguing aspects of the rhetoric of science, from an STS perspective, has been a dual commitment to theory and practice.[27] The recent origin of a rhetorical theory and practice of scientific

[26] Kuhn's surprise at, and distancing from, readings emphasizing the radical implications of *The Structure of Scientific Revolutions* appears in the postscript to the second edition and in "Reflections on My Critics" in Lakatos and Musgrave *Criticism and the Growth of Knowledge* (1970, pgs. 231-278). Fuller (1992) has argued that, in part, the revolutionary impact of *Structure* has been mediated by "Kuhn's Aristotelian picture of science-as-organism"; a view which has held sway over "science policy thinking and research" and "served to diminish the normative dimension of the policymaker from prescriber to evaluator" or, analogously, from "*planner* to *forecaster*." (p. 271). "The triumph", Fuller suggests, "of his (Kuhn's) paradigm of scientific change has marginalized the forums for a radically critical rationalism, one that questions the ends of science as well as the means" (p. 274).

[27] Fuller, in his upcoming book *Philosophy Rhetoric and the End of Knowledge* has urged: "If the old false dilemma of STS was "normative" versus "empirical" approaches to the study of science, I suspect that a new false dilemma is emerging between the High Church's "theoretically" informed perspective and the Low Church's "practically" oriented one... Rhetoric of science is in an ideal position to heal any rifts that may be opening up between the

discourse owes much to *Structure*. In the rhetoric of science, a line of pedagogical development can be traced from Piaget and Vygotsky (e.g., Bazerman, Chapter 11, 1989) to James Conant's General Education curriculum as realized in "the case approach" of Leonard Nash and Kuhn.[28]

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two STS sects, as its own constituency reflects the natural interpenetration of theory and practice. Perhaps the most visible group to identify openly with the rhetoric of science is the Project on the Rhetoric of Inquiry (POROI) at the University of Iowa, which also houses one of America's leading rhetoric departments. From POROI has come such landmarks as Donald McCloskey's *The Rhetoric of Economics* (1985) and the anthology *The Rhetoric of the Human Sciences* (Nelson, Megill, and McCloskey 1987), which abundantly illustrate how distinguished humanists and social scientists use the resources of rhetoric to stem the tide of disciplinary fragmentation and the academy's growing irrelevance to public debate" (p. xiv). In placing Fuller's claim; "Rhetoric of science is in an ideal position to heal any rifts ... as its own constituency reflects the natural interpenetration of theory and practice" in a broader context, I suggest it is precisely this formulation of a "natural" correspondence between rhetorical theory and practice which serves as a critical gloss occluding questions as to the way in which rhetoric, in science, leads to greater public participation. A main line of argument for rhetoricians (as well as STS practitioners) has been that changing the image of science (to which rhetorical studies have contributed) from an autonomous institution to a social institution like all others, opens the avenue to greater public participation in scientific decision making. While I am sympathetic to that line of reasoning, it needs to be shown clearly how disciplinary debates about science, even in an interdisciplinary context, can be translated into public concerns, debate and participation in science. Although Fuller's comment seems to be limited to aspects of STS, I think the idea of the natural relation between theory and practice (specifically depending on the type of rhetorical theory and practice selected) in rhetoric needs to be updated with respect to modern public debate. Prelli (1990) stands as a negative illustration of my point. However, Waddell (*Social Epistemology* forthcoming, see also Zappan forthcoming), for example, has begun to apply rhetoric more directly to public participation in scientific decision-making.

[28] Fuller (1992) has argued that social scientists, among others, were attracted to *Structure* as a narrative resource of scientific legitimation; neglecting the fact that Kuhn's historical examples were drawn almost entirely from physics and chemistry. Borrowing from J. Hillis Miller's account of the social function of narrative, Fuller suggests that the "clearly labeled plot structure of Kuhn's account of scientific change" has "verbally co-opted" (p. 269) sociological followers of the text in one of two ways: by scripting conceptual change and/or by dissipating challenges to the social order on which Kuhn's narrative depends. Rhetorically, then, Kuhn's sociological followers have been verbally co-opted into mistaking and substituting the object-level discourse of, say, political economy (in the use of terms such as "crisis" and "revolution") with the metaphorical sense of the narrative. Kuhn's narrative, Fuller contends, has headed off the radical and comprehensive elements of a critique of the natural sciences by the social sciences by casting metaphorically "elements that threaten the social order which sustains the narrative's legitimacy" (p. 269). *Structure*, therefore, has been used as a rhetorical means to maintain the autonomy and authority of science by defending the "organism" of science against interference in the process of growth; thereby relegating policy makers to the role of scientific product handlers. For example, Alvin Gouldner's attempt to distinguish the rational

Held two years before the initial publication of *Structure*, the Woods Hole Conference, sponsored by the National Academy of Sciences, was convened to discuss science teaching in the public schools (see Chapter 1). The final reports of the conference

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basis for a critical, reflexive form of empirical sociological inquiry was, according to Fuller, co-opted by the desire of sociologists to follow Kuhnian paradigms and develop their discipline into a "real science." As a result, proposed radical changes in the conduct of the sciences was dissipated by *Structure*'s influence. However, Fuller fails to offer a reflexive examination of the Hegalian telos built into the rhetorical basis for his account. Slightly more confusing is Fuller's endorsement of historiographies of science that "get right" critical narratives of the origin and use of disciplinary metaphors.

Following from Piaget's influence, Kuhn's relativism was tempered by the idea that scientific paradigms and revolutions could be recognized by "trace" elements which could be located in each scientific episode. Fuller suggests Kuhn's positing of the historical constancy of these elements resulted in his lack of attention to his own historicity. To make a broader point with respect to the rhetoric of science, rhetoricians have engaged in the same process of identifying and deriving discursive strategies based on constant, identifiable *sociological* phenomena (such as interest). These sociological phenomena are treated as "ontological givens" which are not situated within the relativist context of scientific claims; this lack of philosophical consistency has been at the crux of the reflexive problem in rhetoric.

Apparently, *Structure*'s rhetorical strength has developed in the absence of interdisciplinary criticism. Fuller (1992) holds that while disciplinary practitioners feel that Kuhn's account of their own field is thin, it is "truly enlightening in some other field" (p. 275). Accordingly, if practitioners began to talk across disciplinary boundaries, the social order supporting Kuhn's narrative would also be shifted, and a more robust critical examination would follow. However, Fuller fails to articulate what rhetorical apparatus is necessary for this anticipated interdisciplinary reading to take place. Why would, for example, interdisciplinary dissensus lead to a "satisfying" critical inquiry and intervention into the process of science? Given that intra- and interdisciplinary discourses share identical syntactic and semantic structures, would ambiguity lend insight? Much of Fuller's argument rests on rhetorical appeals – involving participatory access and redistribution of power – to interdisciplinarity and pluralism. Woolgar, for instance, counters that "one needs to be cautious about interdisciplinary endeavors" promoting "pluralistic tolerance." (Woolgar p. 4 manuscript, forthcoming). The reason being that the compromises and intellectual positioning necessary to get disciplinary practitioners to the table would "necessarily blunt the cutting edge of disagreement." (Woolgar, p. 4). Here Woolgar points to a few of structural problems in interdisciplinary meta-narrative Fuller proposes. While Fuller does not debate the rhetorical effectiveness of Kuhn's account, he finds the results pernicious. The same could be true of an interdisciplinary meta-narrative. An interdisciplinary meta-narrative would script conceptual and social change by promoting the verbal cooptation to those opposed. Again, Woolgar paints interdisciplinarity as "*so* coercive ... Those who resist the call to interdisciplinarity appear imperialistic, unyielding, difficult and, above all, unreasonable" (p. 4). I wish to point out that the call to interdisciplinarity has served as a legitimating argument for rhetorical analyses of science. While I agree with Woolgar that fundamental disciplinary assumptions need to be problematized, I suggest a more genuine attempt be given to providing a philosophical argument for the displacement of certain assumptions other than to deny the hegemony of a certain account.

were presented in Jerome Bruner's book *The Process of Education* (1960). Even though the primary focus of the conference was science education, Bruner found an application for Jean Piaget's model of cognitive development in writing instruction. Earlier, Bruner had brought Piaget's influence to bear on Kuhn while lecturing at the Harvard School of Education and through his influence on Conant's General Education curriculum. During the sixties (in book publications in 1963 and 1966), Bruner came to influence the funding of decisions of the U.S. Office of Education for research projects in English. Later, through the work of Nelson Goodman (1984, 1978), Bruner would come to more fully integrate Piaget's developmental theory with Goodman's neo-Kantian constructivism. Bruner's interpretations of Piaget, funneled through his gestalt experiments, would come to be the cornerstone of Kuhn's conception of "revolutions as changes of world view:"

> Only after such transformations of vision does the student become an inhabitant of the scientist's world, seeing what the scientists sees and responding as the scientist does. The world the student then enters is not, however, fixed once and for all by the nature of the environment, on the one hand, and of science on the other. Rather, it is determined jointly by the environment and the particular normal-scientific tradition that the student has been trained to pursue. Therefore, at times of the revolution, when the normal-scientific tradition changes, the scientists perception of his environment must be re-educated–in some familiar situations he must learn to see a new gestalt (1970, pgs. 111-112).

Partially realized in Kuhn's notion of a tradition-bound field of research were the boot-strap cognitive and social mechanisms for a scientist to re-educate herself after a paradigm shift. Mayes (1983, p. 170) contents that for Piaget "... rational discourse arises as a result of an interchange of ideas or propositions between individuals. This interchange can be described in terms of what sociologists nowadays call social exchange theory ... Thus the feelings we experience and the normative judgments we make are to be described in terms of transactions between ourselves and others" (p. 170). Bruner held with Piaget that "... our thought activities can manifest logical structures without our being fully cognizant of them, although we can become conscious

of them at a later date" (Mayes 1983, p. 177). Mayes suggests that Bruner had misread Piaget's implied theory of social exchange, in that Piaget spoke of the formal structures of thought, "... as they occur in our thought processes, are a function of our relationship to others and the way we adapt ourselves to the world around us" (p. 179).[29] In effect, Bruner had come to overemphasize the cognitive aspect of the structure of formal reasoning in relation to individual development. Subsequently Kuhn's pedagogical take on Piaget and Bruner's model of cognitive development can be formulated as a prescription for scientific discourse with two distinct purposes.

One purpose has been to pose conventions of expression (especially scientific writing) as seemingly asocial sets of instructions to be repetitiously followed by students indoctrinated into a given scientific paradigm. These conventions (e.g., form, content, citation patterns) would be used to maintain the image of science as a largely self-sustaining project with an audience of like-minded thinkers possessing roughly the same amount of knowledge about a given subject. Appreciating the conventions of expression, and not blindly following them, the neophyte would be able to easily situate herself within the practice of normal science, while, as an experienced practitioner, coming to realize the constraints and opportunities these conventions afford. Aspects of linguistic reference would also be couched in the manner of these conventions and set as a series of institutional priorities. As a result, the anti-realist radicalism of neo-Kantian constructivism would be diffused through the access to meta- cognitive and social perspectives made available through a series of recursive developmental mechanisms. That is, the linguistic conventions present in a particular period of normal science would be recognized by practitioners and could be revised accordingly. Here, the scientific rhetor has been attributed with great deal of expressive and creative intentionality;

[29] Wolfe Mays "Reflections on 'The Growth of Logical Thinking'" *Jean Piaget: An Interdisciplinary Critique* Sohan Modgil et al. eds. (London: Routledge & Kegan Paul, 1983).

corresponding to modernist conceptions of the relation between author, audience and text, and augmented by constructivist doctrine and the role assigned to language in creating reality.

Another purpose attributed to the pedagogical lessons of Kuhn has been to bring about a form of scientific discourse through which the public, from an informed understanding, and hence, appreciation of science, would have access to issues involving science and society; scientific funding, for instance. In science studies, conceptions of scientific thinking have been cut loose from their gestalt and Piagetian moorings, socialized, and shown to be accessible to laypersons and scientists alike through interdisciplinary contexts. The scientist, then, does not have a clear and distinct idea of the logical structures she uses in problem solving, rather these structures are (depending on the brand of constructivism) constituted or mediated by social relations and language. Politically, an endorsement of social constructivism, as mentioned earlier, has been equated with populism and democratic pluralism. In deconstructing the aspects of neo-Kantian constructivism leading to the mystification of scientific practice, supported by notions of scientific genius (the arrival at the ultimate stage of Piagetian development), and found in Vygotsky's concept of internal language and Polyanyi's tacit knowledge, the social constructivists have claimed the moral high ground. Whether or not Piaget, Vygotsky and/or Polanyi describe an actual state of affairs is beside the point. What matters seems to be the fundamental reconception of the narrative (either local or global) in which science and science studies are cast. Pedagogically, then, it stands to reason that the more one knows about the elements included in a particular narrative, then the more one will be able to make an informed decision about practice or policy. As Fuller has argued, "Conant's key presumption that survives in Kuhn and ... in SSK is that the bridge between science and society is best constructed by the public growing more accustomed to science – rather than by scientists growing more

accustomed to the public" (1992, p. 262). Here, the scientific rhetor is less aware of the social structures influencing her communicative choices, while the static conception of author, audience and text have been placed in a postmodern context.[30]

The scientific rhetor needs to be seen as a situated reader. Minimally, the portrait of a scientific rhetor entails an attention to the constitutive aspects of language, but do scientific rhetors see themselves as involved in the process of persuasion? Do scientists read texts with the attention lavished on them by rhetoricians? Fuller (forthcoming) provides the following challenge:

> ... reading itself is a culturally variable process ... This point is epitomized in the following unanswered questions: What did it mean to "read" a text at the time the scientific author was writing? With what other social practices was reading associated? How much of a text would one feel compelled to read: How interested would the reader typically b in understanding the author in his or her own terms ... vis-à-vis understanding the author "strategically," that is insofar as it served the reader's purposes (manuscript, pgs. 6-7)?

Bazerman (1988) counters with the following pedagogical remarks:

> To hold every statement up for rhetorical examination is, of course, an unrealistic demand. Both art and science are long, and life is short. We must make choices as to where we devote our energies. It seems enough to ask a physicist to learn physics and the symbol system of mathematics. Should we then also demand competence in the other symbol system of words? And how much competence? ... Scientists ... are unlikely to recognize difficulties in framing successful investigations and claims as rhetorical, unlikely to be even aware that their claim making can be fruitfully conceived in rhetorical terms, they may have little idea of what the relevant branches of rhetoric are, what books to read, whom to talk to ... Only with a communally share, reliable set of formulations will we be

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30 Woolgar, for example, (forthcoming in Biriotti and Miller) looks at conventional concepts of scientific authorship in order to devise how "... certain key ambivalences in both theoretical and empirical work in SSK" can be "exploited." (p. 2, manuscript) These analytic ambivalences, argues Woolgar, lie at the heart of the significance of SSK by challenging more generally accepted forms of representation in scientific practice. As a result, Woolgar's recent advocacy of new literary forms (1988) has been characterized "as an essential aid to an authentic reflexive practice" (Ashmore 1989, p. 83) by merging programmatic disciplinary concerns (vis-a-vis Bloor 1976) with practical outreach (e.g. providing alternative forms of scientific expression). However, it is Woolgar's "distrust" of pluralism in the "seductive guise" of interdisciplinarity that illustrates the attempt of reflexivists to manage and capitalize analytic tension between theory and practice.

> able to develop intelligent criteria to meet the local rhetorical needs of students entering into specific knowledge-generating communities, to frame efficient analytical procedures to allow writers to analyze their rhetorical situation and rhetorical options, and to present to other disciplines a knowledge and technology that will be of obvious use and power (pgs. 331-332).

Reflexivity seeks to problematize the relation between author, reader, text and previous texts; but attribution, with specific respect to a particular quality to discourse (as rational, rhetorical or reflexive) appears to involve some type of privileged positioning, or meta-perspective. To take the available next available regressive, reflexive step, one could argue that the reflexive perspective serves as hegemonic positioning. With respect to reading, rhetoricians must not only address questions of practice as Fuller raises above, but questions as to their own practice. How do rhetoricians read texts? Why should (or can) laypersons read scientific texts rhetorically? Does a rhetorical or reflexive reading of a scientific text entail a special competence which necessarily privileges some skills over other? Is the choice of interpretive apparatus a form of privileging? Is interpretive privileging anti-democratic? Why are increasing numbers of perspectives on a text, scientific or otherwise, a good thing? Should the benefits of the possible rhetorical production and interpretation of scientific texts be weighed against the prospect of limited resources?

In the midst of this series of question one finds the scientist, who Bazerman concedes is unlikely to see the benefits of a rhetorical reading of scientific texts, once confronted with the possibility. If one also concedes that the production of scientific texts has increased in a staggering fashion, a radical argument can be made that a rhetorical reading by scientists, or the teaching of rhetoric to students would not be efficacious to the production of scientific claims. From the historical propensity shown by some rhetoricians, a truly effective rhetorical scientific text has not been written and read widely, since Watson and Crick in 1953. While I do not advocate that scientists be

assured of semi-autonomous isolation, unaffected by humanist insight and conjecture, rhetoricians appear to fall back on the tried and true argument of humanists to pursue a subject (read knowledge) for its own end. Recent appeals to interdisciplinarity seem to confirm this point which entails that all perspectives on a given subject must be explored in order to foster a proper critical, local understanding. While rhetoricians, then have departed from "... the humanistic tendency affinity of articulating the "ideal reader," one who knows everything that could be known at the time about his or her discursive situation, but who also enjoys the leisure of applying that knowledge to a comprehensive understanding of an author's meaning" (Fuller forthcoming, manuscript p. 6), they have transferred this ideal to the interdisciplinary project of accounting for as many perspectives as possible. The ideal reader and writer is simply takes a thoroughgoing interdisciplinary perspective. Kuhn's "demystification" of science by combining historical and philosophical arguments has been fashioned into a meta-narrative containing the interpretive elements for reading and writing scientific texts.

4. CONCLUSION AND THESIS PERSPECTIVES

While I have generally presented rhetoric of science as an organized field of inquiry, this is hardly the case. Practitioners who declare themselves rhetoricians of science have begun to make efforts to consolidate the diverse aspect of their research. While the diversity and eclecticism of accounts of scientific discourse has been seen by some rhetoricians as a strength, because of its interdisciplinary import, others see the weakness in the multiple meanings and uses of definitions and conceptions of rhetoric. In attempting to draw disciplinary boundaries, some rhetoricians have called for reflexive inquiry into the notion of "rhetoric" in the rhetoric of science. I have argued that the reflexive impulse of rhetoricians has come from comparing the relative merit of their research with respect to SSK, and the proclivity to see reflexivity as a sign of

disciplinary maturation. That disciplines are seen as having this type of developmental trajectory, I suggest, comes out of the developmental psychological component of Kuhn's *The Structure of Scientific Revolutions*. In the same vein, I have drawn comparisons between the type of neo-Kantian constructivism prevalent in composition studies, which acts as both a pedagogical and interpretive basis for rhetoricians of science, and which supplies Kuhn with the psychological framework of *Structure*. However, neo-Kantian and social constructivism remain philosophically undifferentiated; functionally, rhetoric has been collapsed from a means of interpreting scientific discourse, to an implicit element in the construction of scientific knowledge. Rhetoricians have suggested that this can be done, ideologically, because the defeat of the positivists has shown that scientific discourse has no ontological privilege. In contrast, I have argued, rhetoricians, have granted ontological privilege to an undifferentiated constructivist perspective. Whereas reflexive theorists have methodologically maintained a consistent relativist stance, rhetoricians take their realism and constructivism where ever they can get it. The tension in the rhetoric of science as a research project can be seen in how the historical mission of rhetoric, as normative or descriptive, has been interpreted. In response, I have connected the availability of meta-theoretical and structural perspectives on scientific discourse to the sociological, philosophical, and pedagogical assumptions developed from a conception of a more democratic and pluralistic science by rhetoricians of science and SSK practitioners. I have argued and shown the following:

Ambiguity surrounding the ontological status of rhetoric has been used as an argument for the implicit and global presence of rhetoric in science. Scientific discourse has been held to be "irreducibly rhetorical" just as scientific practice has been held in SSK to be "irreducibly social." I have argued that philosophically, such a description holds no explanatory or causal consequence provided rhetoricians own conception of scientific progress. Attributing the quality of "rhetorical" to scientific discourse does nothing to

undermine argument for the realist ontology or referential quality of scientific claims, if rhetoric is an implicit global component. That rhetoric does affect scientific practice is an empirical claim and needs to be demonstrated as such. The "rhetorical force" in describing scientific discourse as "inherently rhetorical" has been seen as a radical component of the Kuhnian perspective of science. I have argued that the consequences of describing scientific discourse as rhetorical, as leveling the hegemonic cultural status of science as the preeminent knowledge generating institution, are inscribed in the Kuhnian narrative itself. In essence, Kuhn's account anticipates the analytical perspectives, and pedagogical practices of rhetoricians. Just as social scientists attempted to model their early methodology after physics, rhetoricians looked to Kuhn for similar methodological and pedagogical guidance. I have argued that just as Kuhn's narrative has been shown to short-circuit more radical inquiries and interventions into science, it has done the same to the rhetoric of science. In looking at the works of Prelli, Bazerman and Gross, I have shown the strategies used to integrate various rhetorical analyses of science with other interdisciplinary perspectives; namely SSK. The eclecticism of these perspectives signals how the misappropriation of social categories has served as a basis for the description of rhetoric as a social actor. That rhetoricians note the similarity of their perspectives with Mertoniansim, but see no critique of Merton as part of their social constructivism serves as an example.

Finally, I have shown how pedagogy in scientific and technical communication, from a rhetorical perspective, can be seen as "oversocialized." While I do not hold that individual students of science can be seen in terms of their group characteristics, I note the burden placed on pedagogy, from the rhetoricians standpoint a primary agent of social change. I find evidence for this position from the extension of neo-Kantian constructivism (in Kuhn and from Piaget) to pedagogical practices relying on the meta-cognitive and social perspectives which can be gained by students of science by either

rhetorical invention or by the adoption of social constructivism for rhetorical interpretation. In looking at a number of unanswered question involving reading scientific discourse, I have tried to underscore the dependence of rhetoric, in accounting for its significance, on arguments integrating democratic pluralism with for the need for interdisciplinary perspectives on science.

References

Agger, Ben. *The Decline of Discourse: Reading Writing and Resistance in Postmodern Capitalism* (New York: The Falmer Press, 1990).

Agger, Ben. *Socio(onto)logy* (Urbana and Chicago: University of Illinois Press, 1989).

Aristotle. *The Basic Works of Aristotle* Richard McKeon (ed.) (New York: Random House, 1941).

Aronowitz, Stanley. "Postmodernism and Politics" *Social Text* Vol. 18 (1987), 99-115.

Ashmore, Malcolm. "Social Epistemology and Reflexivity: Two Versions of How to be Really Useful" (manuscript).

Ashmore, Malcolm. *The Reflexivity Thesis: Wrighting Sociology of Scientific Knowledge* (Chicago: The University of Chicago Press, 1989).

Barnes, Barry. *T.S. Kuhn and Social Science* (New York: Columbia University Press, 1982).

Barnes, Barry. *Scientific Knowledge and Sociological Theory* (London: Routledge and Kegan Paul, 1974).

Barthes, Roland. *S/Z: An Essay* (New York: Hill and Wang, 1974).

Bartholomae, David "Inventing the University" *When a Writer Can't Write* Mike Rose (ed.) (New York: Guilford Press, 1985).

Bauer, Henry. *Scientific Literacy and the Myth of the Scientific Method* (Carbondale, University of Illinois Press, 1992).

Bazerman, Charles and Paradis, James. *Textual Dynamics of the Professions: Historical and Contemporary Studies of Writing in Professional Communities* (Madison: University of Wisconsin Press, 1991).

Bazerman, Charles. *Shaping Written Knowledge: The Genre and Activity of the Experimental Article in Science* (Madison: The University of Wisconsin Press, 1988).

Berger, Peter L. and Luckmann, Thomas. *The Social Construction of Reality* (Garden City, NY: Doubleday, 1966).

Berkenkotter, Carol. "Paradigm Debates, Turf Wars, and the Conduct of Sociocognitive Inquiry in Composition" *College Composition and Communication* Vol. 42, No. 2 (May 1991), 151-69.

Berlin, James A. "Rhetoric and Ideology in the Writing Class" *College English* Vol. 50, No. 5 (September 1988), 477-94.

Berlin, James A. *Rhetoric and Reality: Writing Instruction in American Colleges, 1900-1985* (Carbondale, IL: Southern Illinois University Press, 1987).

Berthoff, Ann E. "I.A. Richards" *Traditions of Inquiry* John Brereton (ed.) (New York: Oxford University Press, 1985).

Billig, Michael. *Arguing and Thinking: A Rhetorical Approach to Social Psychology* (Cambridge, UK: Cambridge University Press, 1989).

Bloor, David. *Knowledge and Social Imagery* (London: Routledge and Kegan Paul, 1976).

Bokeno, R. Michael. "The Rhetorical Understanding of Science: An Explication and Critical Overview" *The Southern Speech Communication Journal* Vol. 52 (Spring 1987), 285-311.

Bourdieu, Pierre and Wacquant, Loïc J.D. *An Invitation to Reflexive Sociology* (Chicago: University of Chicago Press, 1992).

Britton, James. *Language and Learning* (London: Penguin Books, 1970).

Brodkey, Linda. *Academic Writing as Social Practice* (Philadelphia: Temple University Press, 1987).

Bruffee, Kenneth A. "Social Construction, Language, and the Authority of Knowledge: A Bibliographical Essay" *College English* Vol. 48, No. 8 (December 1986) 773 -90.

Brummett, Barry. "A Eulogy for Epistemic Rhetoric" *Quarterly Journal of Speech* Vol. 76, No. 1 (1990), 69-72.

Bruner, Jerome. *Acts of Meaning* (Cambridge, MA: Harvard University Press, 1990).

Bruner, Jerome. *Actual Minds, Possible Worlds* (Cambridge, MA: Harvard University Press, 1986).

Bruner, Jerome. *Toward a Theory of Instruction* (Cambridge, MA: Belknap Press of Harvard University Press, 1966).

Bruner, Jerome. *On Knowing: Essays for the Left Hand* (Cambridge, MA: Belknap Press of Harvard University Press, 1963).

Bruner, Jerome. *The Process of Education* (Cambridge, MA: Harvard University Press, 1960).

Burger, Ronna. *Plato's Phadrus: A Defense of the Philosophical Art of Writing* (University, AL: University of Alabama Press, 1980).

Burke, Kenneth. "Theology and Logology" *Kenyon Review* n.s.,1 (Winter 1979), 151-85.

Burke, Kenneth. *A Grammar of Motives* (Berkeley: University of California Press, 1969).

Burke, Kenneth. *A Rhetoric of Motives* (Berkeley: University of California Press, 1969).

Burke, Kenneth. *The Rhetoric of Religion: Studies in Logology* (Boston: Beacon Press, 1961).

Caute, David. *The Illusion* (London: Andre Deutsch, 1971).

Cherwitz, Richard A. (ed.) *Rhetoric and Philosophy* (Hillsdale, NJ: Lawrence Erlbaum Associates, 1990).

Cherwitz, Richard A. and Hikins, James W. "Burying the Undertaker: A Eulogy for Eulogists of Rhetorical Epistemology" *Quarterly Journal of Speech* Vol. 76, No. 1 (1990), 73-77.

Cherwitz, Richard A. and Hikins, James W. *Communication and Knowledge: An Investigation in Rhetorical Epistemology* (Columbia: University of South Carolina Press, 1986).

Chomsky, Noam. *Aspects of a Theory of Syntax* (Cambridge, MA: MIT Press, 1965).

Chubin, Daryl E. "The Elusive Second 'S' In 'STS': Who's Zoomin' Who?" *Technoscience* Vol. 5, No. 3 (1992) 12-13.

Clifford, James and Marcus, George. (eds.) *Writing Culture: The Poetics and Politics of Ethnography* (Berkeley: University of California Press, 1986).

Conant, James B. (ed.) *Harvard Case Histories in Experimental Science* Vol. 1 (Cambridge, MA: Harvard University Press, 1966).

Conant, James B. *Modern Science and Modern Man* (New York: Columbia University Press, 1952).

Collier, James and Toomey, David M. *Scientific and Technical Communication for the 21st Century* (New York: HarperCollins, forthcoming).

Collins, H.M. *Artificial Experts: Social Knowledge and Intelligent Machines* (Cambridge, MA: MIT Press, 1990).

Collins, H.M. "Knowledge, Norms and Rules in the Sociology of Science" *Social Studies of Science* Vol. 12 (1982), 299-309.

Collins, H.M. "Son of Seven Sexes: The Social Destruction of a Physical Phenomenon" *Social Studies of Science* Vol. 11 (1981), 33-62.

Collins, H.M. "The Seven Sexes: A Study in the Sociology of a Phenomenon or the Replication of Experiments of Physics" *Sociology* Vol. 9 (1975), 205-24.

Collins, H.M. and Harrison, R. "Building a TEA Laser: The Caprices of Communication" *Social Studies of Science* Vol. 5 (1974), 441-50.

Collins, H.M. and Pinch, T.J. (eds.) *Frames of Meaning: The Social Construction of Extraordinary Science* (London: Routledge and Kegan Paul, 1982).

Collins,R and Restivo, S. "Development, Diversity, and Conflict in the Sociology of Science" *The Sociological Quarterly* Vol. 24 (1983), 185-200.

Congreve, William. *The Way of the World* in *Six Restoration Plays* John Harold Wilson (ed.) (Boston: Houghton Mifflin, 1959).

Cozzens, Susan E. and Gieryn, Thomas F. (eds.) *Theories of Science and Society* (Bloomington: Indiana University Press, 1990).

Cunningham, Stanley B. "Rhetor Redux: A Rejoinder to the Cherwitz/Hikins Definition of Rhetoric" *Philosophy and Rhetoric* Vol. 21, No. 4 (1988), 290-93.

D'Angelo, Frank J. *Process in Thought and Composition* (Cambridge, MA: Winthrop Publishers, Inc. 1975).

Dear, Peter. (ed.) *The Literary Structure of Scientific Argument: Historical Studies* (Philadelphia: University of Pennsylvania Press, 1991).

Dear, Peter. "*Toitus in Verba*: Rhetoric and Authority in the Early Royal Society" *Isis* Vol. 76 (1985), 145-61.

DeMan, Paul. *Blindness and Insight: Essays in the Rhetoric of Contemporary Criticism* (Minneapolis; University of Minnesota Press, 1983).

Derrida, Jacques. "Structure Sign and Play in the Human Sciences" *The Structuralist Controversy* Richard Macksey and Eugenio Donato (eds.) (Baltimore: Johns Hopkins University Press, 1970).

Douglas, Mary. *How Institutions Think* (Syracuse, NY: Syracuse University Press, 1986).

Emig, Janet. *The Composing Process of Twelfth Graders* (Urbana, IL: National Council of Teachers of English, NCTE Research Report No. 13, 1971).

Enos, Richard Leo. (ed.) *Oral and Written Communication: Historical Approaches* (Newbury Park, CA: SAGE Publications, 1990).

Fay, Brian. *Critical Social Science* (Ithaca: Cornell University Press, 1987).

Ferrall, Thomas B. "From the Parthenon to the Bassinet: Along the Epistemic Trail" *Quarterly Journal of Speech* Vol. 76, No. 1 (1990), 78-84.

Feyerherm, Joel. "Applications of Kenneth Burke's Theories to Teaching Technical Writing" *Technical Writing Teacher* Vol. 17, No. 1 (Winter 1990), 41-49.

Fine, Arthur. "The Natural Ontological Attitude" Boyd, Gasper and Trout (eds.)*The Philosophy of Science* (Cambridge, MA: MIT Press, 1991).

Finocchiaro, M.A. *Galileo and the Art of Reasoning: Rhetorical Foundations of Logic and Scientific Method* (Dordrecht, Holland: Reidel, 1980).

Fiske, Donald W. and Shweder Richard A. (eds.) *Metatheory in Social Science.* Chicago: University of Chicago Press, 1986.

Flower, Linda. "Cognition, Context, and Theory Building" *College Composition and Communication* Vol. 40, No. 3 (October 1989), 282 - 310.

Flower, Linda and Hayes, John. "Problem-Solving Strategies and the Writing Process," *College English* Vol. 39 (December, 1977), 449-61.

Foster, David. *A Primer for Writing Teachers: Theories, Theorists Issues, Problems* (Upper Montclair, NJ: Boynton/Cook Publishers, Inc., 1983).

Foucault, Michel. *The Order of Things: An Archaeology of the Human Sciences* (New York: Vintage Books, 1970).

Fuhrman, Ellsworth, "Reflexivity and Alvin Gouldner: The Coming Crisis in 1990" *American Sociologist* Vol. 20 (Winter 1989), 357-61.

Fuhrman, Ellsworth R. and Bailey, Carol A. "Metatheory, Metatheory -- A review of *Metatheorizing in Sociology* by George Ritzer" *Sociological Perspectives* Vol. 35, No. 3 (1992), 525-530.

Fuhrman, Ellsworth R. and Oehler, Kay. "Discourse Analysis and Reflexivity" *Social Studies of Science* Vol. 16 (1986), 293-307.

Fuhrman, Ellsworth and Snizek, William. "Neither Proscience nor Antiscience: Metasociology as Dialogue" *Sociological Forum* Vol. 5 (1990), No. 1, 17-36.

Fuller, Steve. *Philosophy, Rhetoric and the End of Knowledge* (Madison: University of Wisconsin Press, forthcoming, 1993).

Fuller, Steve. "'Rhetoric of Science': A Doubly Vexed Expression" (manuscript) *The Southern Speech Communication Journal* (forthcoming).

Fuller, Steve. "Survey of the History of Rhetoric" (unpublished annotated syllabus).

Fuller, Steve. "Being There With Thomas Kuhn: A Parable for Postmodern Times" *History and Theory* Vol. 31, No. 4 (1992), 241-275.

Fuller, Steve. "Book Review -- *Shaping Written Knowledge: The Genre and Activity of the Experimental Article Science*" *Science Technology & Human Values* Vol. 16, No. 1 (Winter 1991), 122-25.

Fuller, Steve. "Is History and Philosophy of Science Withering on the Vine?" *Philosophy of the Social Sciences* Vol. 21, No. 2 (June 1991),149-74.

Fuller, Steve. "Social Epistemology and the Brave New World of Science and Technology Studies" *Philosophy of the Social Sciences* Vol. 21, No. 2 (June 1991), 232-44.

Fuller, Steve. "Back to Descartes? The Very Idea!" *Social Studies of Science* Vol. 19 (1989), 357-60.

Fuller, Steve. "Book Review -- Communication and Knowledge: An Investigation in Rhetorical Epistemology" *Philosophy and Rhetoric* Vol. 21, No. 3 (1988), 234-37.

Fuller, Steve. *Social Epistemology* (Bloomington: Indiana University Press, 1988).

Fuller, Steve. "Recovering Philosophy from Rorty" *Philosophy of Science Association* Vol. 1 (1982), 373-83.

Fuller, Steve and Raman, Sujatha. (eds.) *Teaching Science and Technology Studies: A Guide for Curricular Planners* (Wesleyan University, CT: NEH Summer Seminar "Science as Cultural Practice," 1991).

Gaonkar, Dilip Parameshwar. "The Idea of Rhetoric in the Rhetoric of Science" (manuscript) *The Southern Speech Communication Journal* (forthcoming).

Geertz, Clifford. *Local Knowledge: Further Essays on Interpretive Anthropology* (New York: Basic Books, 1983).

Gergen, Kenneth J. "The Social Constructivist Movement in Modern Psychology" *American Psychologist* Vol. 40, No. 3 (March 1985), 266-75.

Gieryn, Thomas F. "Relativist/Constructivist Programmes in the Sociology of Science: Redundance and Retreat" *Social Studies of Science* Vol. 12 (1982), 279-97.

Gieryn, Thomas F. "Not - Last Words: Worn-Out Dichotomies in the Sociology of Science (Reply)" *Social Studies of Science* Vol. 12 (1982), 329-35.

Gilbert, Nigel G. and Mulkay, Michael. *Opening Pandora's Box: A Sociological Analysis of Scientists' Discourse* (Cambridge, UK: Cambridge University Press, 1984).

Gilligan, Carol. *In a Different Voice* (Cambridge, MA: Harvard University Press, 1982).

Goodman, Nelson. *Of Mind and Other Matters* (Cambridge, MA: Harvard University Press, 1984).

Goodman, Nelson. *Ways of Worldmaking* (Indianapolis: Hackett Publishing Company, 1978).

Goodman, Nelson. *Fact, Fiction and Forecast* 4th ed. (Cambridge, MA: Harvard University Press, 1979).

Gorman, Michael. "Review of Charles Bazerman, *Shaping Written Knowledge: The Genre and Activity of the Experimental Article in Science*" Social Studies of Science Vol. 20 (1990), 169-72.

Gouldner, Alvin. *The Future of Intellectuals and the Rise of the New Class* (New York: Seabury Press, 1979).

Gouldner, Alvin. *The Coming Crisis in Western Sociology* (New York: Basic Books, 1970).

Graves, Richard. *Rhetoric and Composition* (Upper Montclair, NJ: Boynton/Cook Publishers, Inc. 1984).

Gross, Allan G. *The Rhetoric of Science* (Cambridge, MA: Harvard University Press, 1990).

Gross, Alan G. "Public Debates as Failed Social Dramas: The Recombinant DNA Controversy" *Quarterly Journal of Speech* Vol. 70 (1984), 397-409.

Gusfield, Joseph. "The Bridge Over Separated Lands" *The Legacy of Kenneth Burke* Herbert W. Simons and Trevor Melia (eds.) (Madison: University of Wisconsin Press, 1989).

Habermas, Jürgen. *The Theory of Communicative Action: Reason and the Rationalization of Society* Vol. 1 Thomas McCarthy (trans.) (Boston: Beacon Press, 1981).

Hairston, Maxine. "The Winds of Change: Thomas Kuhn and the Revolution in the Teaching of Writing" *College Composition and Communication* Vol. 33 (February 1982), 76-88.

Halfpenny, Peter. "Talking of Talking, Writing of Writing: Some Reflections on Gilbert and Mulkay's Discourse Analysis" *Social Studies of Science* Vol. 18 (1988), 169-82.

Halpern, Diane. *Sex Differences In Cognitive Abilities* (Hillsdale, New Jersey: Lawrence Erlbaum Associates, 1986).

Haraway, Donna J. *Simians, Cyborgs and Women: The Reinvention of Nature* (New York: Routledge, 1991).

Harris, R. Allen. "Rhetoric of Science" *College English* Vol. 53, No. 3 (March 1991), 282-307.

Harris, R. Allen. "Assent, Dissent, and Rhetoric of Science" *Rhetoric Society Quarterly* Vol. 20 (1990), 13-37.

Hofstadter, Douglas R. *Metamagical Themas: Questing for the Essence of Mind and Pattern* (Toronto: Bantam Books, 1985).

Hofstadter, Douglas R. *Godel, Escher, Bach: and Eternal Golden Braid* (New York: Basic Books, 1981).

Hofstadter, Douglas R. and Dennett, Daniel C. *The Mind's I: Fantasies and Reflections on Self and Soul* (New York: Basic Books, 1981).

Horkheimer, Max and Adorno, Theodor W. *Dialectic of Enlightenment* John Cumming (trans.) (New York: Seabury Press, 1972).

Hunter, Paul. " 'that we have divided/In three our kingdom': The Communication Triangle and *A Theory of Discourse*" *College English* Vol. 48, No. 3 (March 1986), 279-88.

"Investigation of the Challenger Accident: Hearings Before the Committee on Science and Technology, House of Representatives," Ninety-Ninth Congress, Second Session. (Hearings held June 10-July 24 1986).

Jakobson, Roman. "Linguistics and Poetics" *Style in Language*, Thomas A Sebeok (ed.) (Cambridge: MIT Press, 1960).

Kaplan, Nathan, Choy, Marcella H. and Whitmore, John K. "Indochinese Refugee Families and Academic Achievement" *Scientific American* (February 1992), 36-42.

Kinneavy, James. *A Theory of Discourse* (Englewood Cliffs, NJ: Prentice-Hall Inc., 1971).

Kitchener, Richard F. *Piaget's Theory of Knowledge: Genetic Epistemology & Scientific Reason* (New Haven, Yale University Press, 1986).

Kitzahaber, Albert. *Themes, Theories and Therapy: The Teaching of Writing in College* (New York: McGraw Hill, 1963).

Kitzahaber, Albert. "New Perspectives on Teaching Composition" *College English* Vol. 23 (1962), 440-44.

Knorr-Cetina, Karin D. "The Constructivist Programme in the Sociology of Science: Retreats or Advances?" *Social Studies of Science* Vol. 12 (1982), 320-24.

Knorr-Cetina, Karin D, and Cicourel, A.V. *Advances in Social Theory and Methodology: Toward an Integration of Micro - and Macro - Sociologies* (Boston: Routledge & Kegan Paul, 1981).

Kripke, Saul. "Identity and Necessity" *Naming, Necessity and Natural Kinds* Stephen P. Swartz (ed.) (Ithaca, NJ: Cornell University Press, 1977).

Krohn, Roger. "On Gieryn on the 'Relativist/Constructivist' Programme in the Sociology of Science: Naiveté and Reaction" *Social Studies of Science* Vol. 12 (1982), 325-28.

Kuhn, Thomas. *The Structure of Scientific Revolutions* 2nd ed. (Chicago: University of Chicago Press, 1970).

Kuhn, Thomas. *The Copernican Revolution: Planetary Astronomy in the Development of Western Thought* (New York: Vintage Books, 1957).

Lannon, John M. *Technical Writing* 5th ed. (New York: HarperCollins, 1991).

Latour, Bruno. *Science In Action: How to Follow Scientists and Engineers Through Society* (Cambridge, MA: Harvard University Press, 1987).

Latour, Bruno and Woolgar, Steve. *Laboratory Life: The Construction of Scientific Facts* (Princeton, NJ: Princeton University Press, 1986).

Laudan, Larry. " The Pseudo-Science of Science?" *Philosophy of the Social Sciences* Vol. 11 (1981), 173-98.

Lynch, Michael and Woolgar, Steve. (eds.) *Representation in Scientific Practice* (Cambridge, MA: MIT Press, 1990).

Lynch, Michael "Going Full Circle in the Sociology of Knowledge: Comment on Lynch and Fuhrman" *Science Technology and Human Values*, Vol. 17, No. 2 (Spring 1992), 228-33.

Lynch, William T. and Fuhrman, E. "Ethnomethodology as Technocratic Ideology: Policing Epistemic Boundaries" *Science Technology and Human Values*, Vol. 17, No. 2 (Spring 1992), 234-36.

Lyotard, Jean-Francois. *The Postmodern Condition: A Report on Knowledge* Geoff Bennington and Brian Massum (trans.) (Minneapolis: University of Minnesota Press, 1991).

McCloskey, Donald. *The Rhetoric of Economics* (Madison: University of Wisconsin Press, 1986).

McGowan, John. *Postmodernism and Its Critics* (Ithaca: Cornell University Press, 1991).

Melia, Trevor. "Scientism and Dramatism" *The Legacy of Kenneth Burke* Herbert W. Simons and Trevor Melia (eds.) (Madison: The University of Wisconsin Press, 1989).

Mayes, Wolfe. "Reflections on 'The Growth of Logical Thinking'" *Jean Piaget: An Interdisciplinary Critique* Sohan Modgil, Celia Modgil and Geoffrey Brown (eds.) (London: Routledge & Kegan Paul, 1983).

Merton, Robert K. *The Sociology of Science: Theoretical and Empirical Investigations* (Chicago: University of Chicago Press, 1973).

Merton, Robert K. 'The Matthew Effect in Science" *Science*, 159 (1968), 56-63.

Miller, J. Hillis. *Versions of Pygmalion* (Cambridge, MA: Harvard University Press, 1991).

Miller, Perry. *The New England Mind: From Colony to Province* 2nd ed.(Cambridge, MA: Harvard University Press, 1981).

Miller, Richard W. "Fact and Method in the Social Sciences" *The Philosophy of Science* Boyd, Gasper and Trout (eds.) (Cambridge, MA: MIT Press, 1991).

Mirowski, Philip. *More Heat than Light* (Cambridge University Press: Cambridge, 1989).

Mitchell, John. *Handbook of Technical Communication* (Belmont, CA: Wadsworth Publishing, 1962).

Mitroff, Ian. "Norms and Counter-Norms in a Select Group of the Apollo Moon Scientists: A Case Study of the Ambivalence of Scientists" *American Sociological Review* Vol. 39 (August 1974), 579-95.

Moffett, James. *Teaching the Universe of Discourse* (Boston: Houghton Mifflin, 1968).

Moran, Michael G. and Journet, Deborah. (eds.) *Research in Technical Communication: A Bibliographic Sourcebook* (Westport, CT: Greenwood Press, 1985).

Mulkay, Michael. *The Word and the World: Explorations in the Form of Sociological Analysis* (London: Allen and Unwin, 1985).

Mulkay, Michael. "The Scientist Talks Back: A One-Act Play, With a Moral About Replication in Science and Reflexivity in Sociology" *Social Studies of Science* Vol. 14 (1984), 265-82.

Mulkay, Michael, and Gilbert, Nigel G. "What is the Ultimate Question? Some Remarks in Defence of the Analysis of Scientific Discourse" *Social Studies of Science* Vol. 12 (1982), 309-19.

Mulkay, Michael and Gilbert, Nigel G. "Putting Philosophy to Work: Karl Popper's Influence on Scientific Practice" *Philosophy of Social Science* Vol. 11 (1981), 389-407.

Mulkay, Michael, Potter, J. and Yearly, S. "Why an Analysis of Scientific Discourse is Needed" Karin Knorr-Cetina and Michael M. Mulkay (eds.), *Science Observed* (London and Beverly Hills, CA.: Sage, 1982).

Murray, Donald M. "Teach Writing as Process not a Product" *The Leaflet* (November 1972), 11-14.

Myers, Greg. *Writing Biology: Texts in the Social Construction of Scientific Knowledge* (Madison: The University of Wisconsin Press, 1990).

Myers, Greg. "Book Review -- Sociology of Science Without the Sociology" *Social Studies of Science* Vol. 20 (1990), 559-63.

Nelson, John S., Megill, Allan and McCloskey, Donald N. (eds.) *The Rhetoric of the Human Sciences* (Madison: The University of Wisconsin Press, 1987).

North, Stephen M. *The Making of Knowledge in Composition: Portrait of an Emerging Field* (Upper Montclair, NJ: Boynton/Cook Publishers, Inc. 1987).

Nuyen, A.T. "The Role of Rhetorical Devices in Postmodernist Discourse" Philosophy and Rhetoric Vol. 25, No. 2 (1992), 183-94.

Odell, Lee and Cooper, Charles R. (eds.) *Research on Composing: Points of Departure* (Urbana, IL: National Council of Teachers of English, 1978).

Olsen, Leslie A. and Huckin, Thomas N. *Technical Writing and Professional Communication* 2nd ed. (New York: McGraw Hill, 1991).

Phelps, Louise W. *Composition As a Human Science: Contributions to the Self-Understanding of a Discipline* (New York: Oxford University Press, 1988).

Potter, Jonathan, Stringer, Peter and Wetherall, Margret. *Social Texts and Contexts* (London: Routledge and Kegan Paul, 1984).

Potter, Jonathan and Wetherall, Margaret. *Discourse and Social Psychology: Beyond Attitudes and Social Behaviour* (London: Sage Publications, 1987).

Prelli, Lawrence J. *A Rhetoric of Science: Inventing Scientific Discourse* (Columbia, SC: University of South Carolina Press, 1989).

Rabinowitz, Peter J. "Our Evaluation of Literature Has Been Distorted by Academe's Bias Toward Close Reading of Texts" *The Chronicle of Higher Education* April 6, 1988.

Richards, I.A. *The Philosophy of Rhetoric* (New York: Oxford University Press, 1965).

Ritzer, George. (ed.) *Metatheorizing* (Newbury Park, CA: Sage Publications, 1992).

Rorty, Richard. *Contingency, Irony, and Solidarity* (Cambridge, UK: Cambridge University Press, 1989).

Rose, Hilary. "Hyper-Reflexivity – a New Danger for Counter-Movements" Nowotny, H. and Rose, H. (eds.) *Counter Movements in the Sciences*. Sociology of the Sciences Yearbook Vol. 3 (Dordrecht and Boston: Reidel, 1979).

Rose, Hilary and Rose, Steven. "Radical Science and Its Enemies" *The Socialist Register* (1979), 317-35.

Roy, Rustum. "The Relationship of Technology to Science and the Teaching of Technology" *Journal of Technology Education* Vol. 1, No. 2 (1991), 5-17.

Rubin, Donald L. "Four Dimensions of Social Construction in Written Communication" *The Social Construction of Written Communication* (Norwood, NJ: Ablex Publishing Co., 1988).

Rutter, Russell. "History, Rhetoric, and Humanism: Toward a More Comprehensive Definition of Technical Communication" *Journal of Technical Writing and Communication* Vol. 21, No. 2 (1991), 133-53.

Ryan, Alan. (ed.) *The Philosophy of Social Explanation* (Oxford: Oxford University Press, 1973).

Searle, John. *Speech Acts: An Essay in the Philosophy of Language* (Cambridge, U.K.: Cambridge University Press, 1969).

Shadish, William and Fuller, Steve (eds.) *The Social Psychology of Science* (New York: Guilford Press, forthcoming).

Siegle, Robert. *The Politics of Reflexivity: Narrative and the Constitutive Poetics of Culture* (Baltimore: Johns Hopkins University Press, 1986).

Simons, Herbert W. (ed.) *Rhetoric in the Human Sciences* (London: Sage Publications, 1989).

Snow, C.P. *The Two Cultures and the Scientific Revolution* (New York: Cambridge University Press, 1959).

Sorell, Tom. *Scientism: Philosophy and the Infatuation With Science* (London: Routledge, 1991).

Staudenmaier, S.J. *Technology's Storytellers: Reweaving the Human Fabric* (Cambridge, MA: MIT Press, 1985).

Swearingen, James E. "Reflexivity and the Decentered Self in *Tristram Shandy*" *Self-Reference: Reflections on Reflexivity* Steven J. Bartlett and Peter Suber (eds.) (Dordrecht: Martinus Nijhoff, 1987).

Swearingen, James E. *Reflexivity in "Tristram Shandy": An Essay in Phenomenological Criticism* (New Haven: Yale University Press, 1977).

Toulmin, Stephen. *Human Understanding* (Princeton, NJ: Princeton University Press, 1972).

Unger, Roberto Mangabeira. *Social Theory: Its Situation and Task.* (Cambridge, UK: Cambridge University Press, 1987).

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

Wells, Susan. "Jürgen Habermas, Communicative Competence and the Teaching of Technical Discourse" *Theory in the Classroom* Cary Nelson (ed.) (Urbana and Chicago: University of Illinois Press, 1986).

Winterowd, W. Ross. *The Rhetoric of the "Other" Literature* (Carbondale, IL: Southern Illinois University Press, 1990).

Woolgar, Steve. "What is a Scientific Author?" Forthcoming in M. Briotti and N. Miller (eds.), *What is an Author?* (Manchester, UK: Manchester University Press).

Woolgar, Steve. "The Very Idea of a Social Epistemology: What Prospects for a Truly Radical 'Radically Naturalised Epistemology'?" *Inquiry* Vol. 34 (1991), 377-89.

Woolgar, Steve. (ed.) *Knowledge and Reflexivity: New Frontiers in the Sociology of Knowledge* (London: Sage Publications, 1988).

Woolgar, Steve. "On the Alleged Distinction Between Discourse and *Praxis*" *Social Studies of Science* Vol. 16 (1986), 309-17.

Woolgar, Steve. "Irony in the Social Study of Science" *Science Observed: Perspective on the Social Study of Science* K. Knorr-Cetina and M.J. Mulkay (eds.) (London and Beverly Hills, CA.: Sage, 1983).

Woolgar, Steve, "Laboratory Studies: A Comment on the State of the Art" *Social Studies of Science* Vol. 12 (1982), 481-98.

Zagacki, Kenneth S. and Keith, William. "Rhetoric, Topoi, and Scientific Revolutions" *Philosophy and Rhetoric* Vol. 25, No. 1 (1992), 59-78.

Zappen, James. "The Rhetoric of Science and the Challenge of Postliberal Democracy" *Social Epistemology* (*Social Epistemology*, forthcoming).

Zappen, James. "The Discourse Community in Scientific and Technical Communication: Institutional and Social Views" *Journal of Technical Writing and Communication* Vol. 19, No. 1 (1989), 1-11.

Zappen, James. "A Rhetoric for Research in Sciences and Technologies" *New Essays in Technical and Scientific Communication* P.V. Anderson et al., (eds.) (Farmingdale, NY: Baywood, 1983).

VITA

JAMES H. COLLIER

750 Tall Oaks Drive
Apartment 1700 D
Blacksburg, VA 24060-4332
Home: (703) 552-9263
Office: (703) 231-7687
E-Mail: COLLIER@VTVM2.CC.VT.EDU.

EDUCATION:

Virginia Polytechnic Institute and State University
(Virginia Tech)

Ph.D. candidate (current) Science and Technology Studies
M.S. Science and Technology Studies, 1993
M.A. English, 1987
B.A. Philosophy, 1983

EXPERIENCE:

Assistant Editor, *Social Epistemology*
September 1991 - present

Managing Editor, *Technoscience.*
May 1991 - September 1991

Part-Time Instructor, English, Virginia Tech
September 1989 - May 1991

Part-Time Instructor, English, Virginia Commonwealth University
J. Sargeant Reynolds Community College
September 1988 - August 1989

Instructor, English, Virginia Commonwealth University
September 1987 - August 1988

Graduate Teaching Assistant, English, Virginia Tech
September 1985 - June 1987

AWARDS:

Graduate Assistantship, Science and Technology Studies
April 1991, 1992, 1993

PRESENTATIONS:

"Rhetoric and the Public Face of Knowledge"
Southern IllinoisUniversity, March 1993

"Should Science Studies Practitioners Be Reflexive?"
Thursday Seminar Series
Virginia Tech, February 1992

"What Kind of Science is *Science in Action*?"
The Society for the Social Studies of Science
MIT, November 1991

"Technical Communication for the 21st Century"
The Society for the Social Studies of Science
MIT, November 1991

"Perception, Rhetoric and the Emergent Self"
Conference on Rhetoric and Science
Virginia Tech, April 1991

UNDER CONTRACT:

Scientific and Technical Communication for the 21st Century
(HarperCollins, forthcoming, 1994)

PUBLICATIONS:

"Reflections on Reflexive Wrighting: *The Reflexive Thesis: Wrighting Sociology of Scientific Knowledge*"
(review, forthcoming, *Social Epistemology*)

SERVICE:

Student Representative, Steering Committee
Program for Science and Technology Studies
September 1990 -August 1991