The Duality of Scientific Ethos:
Deep and Surface Structures

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Aristotle's concept of ethos is primarily one based on civic duty, and as such loses its specificity when extended to the scientific forum. By adapting Aristotle's traditional concept of ethos to contemporary social norms of science, a link can be established between classical theory and contemporary practice. In this essay, I use Robert Merton's theory of the normative conditions of science to perform a meta-critique of the use of ethos in four case studies. This meta-analysis reveals the dual structure of ethos as reflected in a surface structure of style and a deep structure of argument. **Keywords:** rhetoric of science, scientific ethos, ethos, social norms, rhetorical critique

Introduction

ARISTOTLE identifies three features of ethos: practical wisdom [*phronēsis*], virtue [*aretē*], and good will [*eunoia*] (*On Rhetoric* 2.1.5–6), features that he explicitly associates with the forms of political constitutions in *On Rhetoric* (1.8.6) and with the qualities necessary for civic duty in *Politics* (1309a33). Aristotle's definition of ethos is therefore one tightly integrated with his view of man as a political animal (*Politics* 1253a2). In his system, the obligation of a citizen is participation in civic life: "The citizen in this strict sense is best defined by the one criterion that he shares in the administration of justice and in the holding of office" (*Politics* 1275a19). Correspondingly, the three species of rhetoric identified by Aristotle—deliberative, judicial, and epideictic (*On Rhetoric* 1.3.3)—are those forums in which man as a political animal is obliged to participate.

However, when we extend Aristotle's civic concept of ethos to the scientific forum, it loses its specificity. Loyalty to the constitution, a high capacity for civic duties, and goodness of character as required by the nature of each constitution (*Politics* 1309a33) are irrelevant when applied to the character of a scientific speaker. For one of science's most cherished ideals is its universal character: it both crosses national boundaries and discounts political agendas. Aristotle's more general definition of the three features of ethos as practical sense, a good character, and wanting the best for others (*On Rhetoric* 2.1.5–6) is an insufficient description of the scientific character as well, in that it fails to account for the vaunted objectivity of the scientist. In particular, if we infer that good will is a form of friendliness—an inference based on the fact that Aristotle addresses friendliness, not good will, in his discussion of the emotions (*On Rhetoric* 2.2–11)—then a sense of interestedness in the outcome of science is implied. Inasmuch as Aristotle's more explicit definitions of ethos are found inadequate, ethos in the scientific forum is reduced to a vague sense of credibility. But the abstract concept of ethos itself is a powerful one. Rather than dismiss Aristotle's basic insight that character affects persuasion, it is more fruitful to retain the abstract concept and redefine its particulars within a contemporary framework. By linking Aristotle's concept of ethos to contemporary social norms of science, and these norms to the text, rhetoricians can establish a link between classical theory and practice that can be exploited for the criticism of scientific discourse.

In this essay, I illustrate this idea by borrowing the sociologist Robert Merton's theory of the normative conditions of science and then using these norms to perform a meta-critique of the use of ethos in four case studies. I begin by arguing that Lawrence

Prelli has provided a conceptually precise definition of scientific ethos based on Merton's social norms, one that fits well within the Aristotelian framework. I then discuss how rhetoricians of science have investigated ethos, focusing on case studies of Gould and Lewontin's "The Spandrels of San Marco and the Panglossian Paradigm," and relate their approaches to Prelli's topical scheme. This meta-analysis reveals how rhetorical critics have applied the Aristotelian proof of ethos as well as how they in turn have integrated theories from other fields. Last, using Noam Chomsky's concept of syntactic transformations as an analogy, I suggest that there are two levels of ethos operating in "Spandrels" and explore the impact of this dual structure on scientific and humanistic readers respectively, using the rhetorical critics themselves as representative humanistic readers. Synthesizing social norms and this duality of ethos into one conceptual framework produces a rich description of Gould and Lewontin's rhetorical strategies and holds promise for future critiques of scientific discourse.

Concepts of Ethos

Prelli uses a classical approach to define his four major classes of rhetorical *topoi* of scientific reasonableness, one of which focuses on scientific ethos. A brief summary of Aristotle's concept of ethos establishes a basis upon which to discuss Prelli's topical scheme.

Aristotle's Concept of Ethos

In Book 1 of *On Rhetoric*, Aristotle defines three *pisteis*, or means of persuasion: ethos, pathos, and logos 1.2.3). Aristotle describes ethos as follows:

> [There is persuasion] through character whenever the speech is spoken in such a way as to make the speaker worthy of credence; for we believe fair-minded people to a greater extent and more quickly [than we do others] on all subjects in general and completely so in cases where there is not exact knowledge but room for doubt. And this should result from the speech, not from a previous opinion that the speaker is a certain kind of person; for it is not the case, as some of the technical writers propose in their treatment of the art, that fair-mindedness [*epieikeia*] on the part of the speaker makes no contribution to persuasiveness; rather, character is almost, so to speak, the controlling factor in persuasion. (1.2.4, brackets in original)

George Kennedy explains in a footnote that Aristotle specifically excludes from this definition the status of a speaker as derived from his or her social position, focusing instead on the character revealed in the speech itself (38). Hence ethos is not found in the person of the speaker but in the character of the speaker constructed in the text and the criterion for establishing ethos is fair-mindedness.

In Book 2, Aristotle extends this concept of ethos to include consideration of the audience: "for it makes much difference in regard to persuasion . . . that the speaker seem to be a certain kind of person and that his hearers suppose him to be disposed toward them in a certain way and in addition if they, too, happen to be disposed in a certain way [favorably or unfavorably to him]" (2.1.3, brackets in original). In summary, the Aristotelian concept of ethos consists of the character of the speaker constructed in the text, exhibiting fair-mindedness and adapted to the character of the audience.

In his discussion of epideictic oratory, Aristotle defines specific *topoi* that can be used to establish ethos. As Kennedy notes, these *topoi* place more emphasis on social and financial position then would be expected from the previous quotations (78–79). For

instance, Aristotle includes "magnificence" in his list of virtues, which Kennedy defines as the quality exhibited by a wealthy person who "expends large sums in a grand manner and in good taste," a virtue consonant with economic success (80). This disjunction between the social status of the speaker and the character of the speaker leads to an ambiguity that forestalls the conceptual precision necessary for rhetorical criticism. Yet Lawrence Prelli's *topoi* concerning scientific ethos are conceptually precise and address the character and the social status of the speaker separately.

Prelli's Concept of Ethos

In his book *A Rhetoric of Science: Inventing Scientific Discourse*, Prelli describes four major classes of rhetorical *topoi* of scientific reasonableness, one of which is *topoi* concerning scientific ethos (105). He defines scientific ethos as "How an audience perceives the *professional character* of a scientific rhetor or group of rhetors" (105, emphasis added), a description complying with the Aristotelian view of ethos as the construction of a speaker's character in a text. Prelli bases these *topoi* on Merton's normative conditions of science, which Merton relates to ethos as follows:

> The ethos of science is that affectively toned complex of values and norms which is held to be binding on the man of science. The norms are expressed in the forms of prescriptions, proscriptions, preferences, and permissions. They are legitimatized in terms of institutional values. These imperatives, transmitted by precept and example and reenforced by sanctions are in varying degrees internalized by the scientist, thus fashioning his scientific conscience or, if one prefers the latter-day phrase, his superego. Although the ethos of science has not been codified, it can be inferred from the moral consensus of scientists as expressed in use and wont, in countless writings on the scientific spirit and moral indignation directed toward contraventions of the ethos. ("Normative" 268–69)

Merton identifies four norms of science—universalism, communality, disinterestedness, and organized skepticism,[1] and subsequent researchers have proposed four corresponding counternorms—particularism, solitariness, interestedness, and organized dogmatism.[2] Prelli views these norms and counternorms as rhetorical *topoi* that provide discursive strategies for establishing perceptions of scientists' ethos (107). The norms and counternorms can be defined as follows:

- *Universalism* requires that knowledge claims be subjected to pre-established, impersonal criteria; *particularism* validates the judgment of research based on personal criteria, such as the ability and experience of the researcher.
- *Communality* dictates that research belongs to the community of scientists rather than the individual researcher; *solitariness* describes situations in which scientists do possess property rights to their research.
- *Disinterestedness* prescribes disinterested scientific activity, which is enforced by the accountability of scientists to their peers; *interestedness*, that scientists try to achieve self-interests by serving special communities of interests.
- *Organized skepticism* requires that claims be critically scrutinized in terms of empirical and logical criteria; *organized dogmatism* endorses the value of expert judgment in spite of incomplete evidence.

Viewed as social norms in Merton's original sense, these *topoi* are consistent with Aristotle's general definition of ethos. They describe the character of a speaker as adapted for a particular audience, in this case a scientific one, and a concept of fair-mindedness that makes that speaker worthy of credence. But the norms are not

precisely comparable with Aristotle's three features of ethos. Although universality and skepticism appear to be aspects of practical wisdom, Aristotle explicitly states in *Nicomachean Ethics* that "practical wisdom cannot be scientific knowledge" (1140a20). Similarly, although disinterestedness seems to be equivalent to good will, which Aristotle associates with friendliness or "wanting for someone what one thinks are good things for him, not what one thinks benefits oneself" (*On Rhetoric* 2.4.2), Merton specifically distinguishes disinterestedness from altruism, claiming that equating the two confuses institutional and motivational elements ("Normative" 275-76). Lastly, even though communality, which consists of the moral imperative for "sharing the wealth of science" (174), can be equated with good will or a concern for the public good, it can be argued that the confusion between institutional and motivational elements occurs here as well. The norms and counternorms also more clearly discriminate between character and social status than Aristotle does in his discussion, addressing the disjuncture noted previously. The norms address features of character: objective, collaborative, disinterested, and skeptical, while the counternorms address status: ability and experience, founder of discursivity, member of specific community, and expert.

Although these *topoi* seem useful mainly as performative tools, the underlying norms and counternorms can be linked to textual features and employed as interpretative devices. For instance, scientists justify their use of passive voice and nominalizations as indicative of scientific objectivity (universalism) (Couture 283).[3] In addition, the denial of personal ownership and textual features such as citations, references, and technical terminology imply communality. The avoidance of personal pronouns can be related to disinterestedness and the use of hedges and qualifiers to skepticism (Couture 284). And the IMRAD (Introduction, Methods, Results, and Discussion) format of experimental reports, which emphasizes methodology and analysis of data, reflects a commitment to impartial criteria and critical scrutiny (Couture 284).

The counternorms can also be related to textual features. For instance, a researcher's academic position and affiliation can influence how others evaluate his or her research (particularism), and in conjunction with sources of funding may also imply interestedness on his or her part. The drive for priority publication (Merton, "Priorities") and the esteem paid to "founders of discursivities" (Miller and Halloran 116) such as Darwin or Einstein illustrate solitariness. Lastly, the use of evaluative language as well as a lack of sufficient evidence may indicate dogmatism (Couture 285).

Thus the social norms and counternorms of science can be used as either heuristic tools for inventing scientific discourse or as interpretive tools for the analysis of textual features. Although Prelli's readings have been criticized for their abstract generality and systematicity (Gaonkar 69), he does provide a conceptually precise topical system of ethos based on the classical tradition. Prelli achieves conceptual precision by particularizing the abstract concept of ethos with respect to contemporary social norms, and it is the theoretical underpinnings of his topical scheme that hold promise for a rhetorical critique of scientific discourse.

Ethos and Textual Features

The interpretive use of Prelli's topical system can be illustrated by a critical analysis of four of the case studies in Jack Selzer's collection *Understanding Scientific Prose*. Each essay in Selzer's collection applies a different method of rhetorical criticism to Gould and Lewontin's essay "The Spandrels of San Marco and the Panglossian Paradigm: A

Critique of the Adaptationist Programme" in order to illustrate the different ways in which scientific texts can be examined. The structure of this collection offers a unique opportunity for investigating how different rhetorical readers have both criticized and responded to a single scientific text.

Two of the essays in Selzer's book, "Reading Darwin, Reading Nature; Or, On the Ethos of Historical Science" by Carolyn Miller and Michael Halloran and "The Reader in the Text of 'The Spandrels of San Marco' " by Gay Gragson and Selzer, address ethos. These two essays use classical analysis and reader-response theory respectively; however, both explicitly discuss ethos with respect to the text and refer to specific textual features in support of their analyses.

The Ethos of Historical Science

Miller and Halloran explicitly state that they analyze Gould and Lewontin's essay using Aristotle's concept of ethos (108). According to them, ethos is comprised of two concepts: the distinctive voice of an individual and the spirit of a community of speakers (121), both of which they analyze with respect to "Spandrels." Miller and Halloran characterize the ethos of Gould and Lewontin as that of argumentative critics based on their use of textual features such as active-voice verbs, first-person pronouns, wit, and ridicule (117-18). These features can also be compared to our previous definition of fair-mindedness. Gould and Lewontin's use of first-person pronouns and active-voice verbs indicate interestedness rather than disinterestedness. They have a vested interest in debunking adaptationism—to make room for their proposed alternatives—and correspondingly establish a clear opposition between 'us' and 'them'. Furthermore, they use wit and ridicule rather than evidence and methodology to persuade and can be described as dogmatic, because they incessantly doubt others' findings but not their own. As Miller and Halloran state, "Spandrels" levels an accusation against adaptationism, story-telling, of which it is equally guilty (121).

Miller and Halloran also explicitly link the community in which Gould and Lewontin function to the text, claiming that a scientific work achieves ethos by articulating the character of its intellectual community (121), or in Merton's terms exhibits communality. By analyzing citations and references to Darwin, an authority figure, they clarify the ways in which Gould and Lewontin establish the ethos of the text through reliance on the community of evolutionary biology. According to Miller and Halloran, evolutionary biology has been called a "historical science" (108), characterized by the use of thick description, sufficient rather than exact explanation, and heuristic rules of thumb (112). Comparing this description to our definition of fair-mindedness, we can argue that the community of evolutionary biology itself does not conform to the norm of skepticism. Evolutionary biology infers the past from rules of thumb rather than deducing it from laws and offers narrative rather than predictive explanations. In contrast, harder sciences tend to embrace a strict interpretation of the norm of skepticism and rely heavily on empirical and logical criteria of judgment.

The Reader in the Text

Like Miller and Halloran, Gragson and Selzer do not explicitly discuss fair-mindedness in their analysis of "Spandrels," yet they implicitly refer to the scientific norms and counternorms. Using text-based reader-response theory, they compare the

readers constructed in the texts of "Spandrels" and John Maynard Smith's "Game Theory and the Evolution of Behaviour." Smith's essay is of special interest because he is one of Gould and Lewontin's rivals and the preeminent evolutionary biologist in Great Britain.

Gragson and Selzer claim that Smith uses highly conventional cues to create a stereotypical role for his readers: the fair-minded biological scientist (185). According to them, Smith consistently conveys an impartial persona through his use of highly technical language, nominalizations, passive voice, impersonal constructions, qualifiers, and personal pronouns such as 'we', 'our', and 'us' (186–88). Furthermore, he does not use the personal pronoun 'I' in the factual sections of the article and leaves only his own work open to criticism (190, 187). All of these features contribute to Smith's ethos as an objective, skeptical, disinterested scientist and he represents not only himself but also his implied readers in this way (189). Gould and Lewontin construct a distinctly different persona and implied reader. According to Gragson and Selzer, they construct the role of a humanistic scientist through their use of cosmopolitan analogies and metaphors, active verbs, and a humanistic vocabulary (193). They flout the stereotypical neutral and objective language of the scientist using wit and sarcasm (194).

Gragson and Selzer also draw conclusions about the social status of Smith versus that of Gould and Lewontin. They describe Smith as professorial-sounding, the authority by whom the implied reader is willingly commanded (190–91). Yet Smith is the preeminent evolutionary biologist in Great Britain and his strategy is therefore consistent with the construction of an ethos based on particularism, or the ability and experience of the author. In contrast, Gragson and Selzer state that Gould and Lewontin constitute their implied readers as colleagues and equals possessing broad, cultural knowledge (197, 192), calling forth the readers' cosmopolitan selves (195).

Neither Miller and Halloran nor Gragson and Selzer explicitly refer to the characteristics illustrated by the norms and counternorms of fair-mindedness and social status. But their analysis clearly focuses on issues of ethos. Most interesting is their failure to question why Gould and Lewontin do not adapt their constructed ethos to the intended audience. Considering the inappropriate ethos of "Spandrels," an examination of its reception by the scientific community should be revealing.

Ethos and The Intended Audience

Two of the other essays in Selzer's collection examine "Spandrels" based on its reception by its intended audience. In "A Study in Rhetorical Reading: How Evolutionists Read 'The Spandrels of San Marco'," Davida Charney uses protocol analysis to examine readers' reactions to "Spandrels," and in "Constructing Scientific Knowledge in Gould and Lewontin's 'The Spandrels of San Marco'," Dorothy Winsor performs a reception analysis of citations of the essay. A brief summary of both articles reveals how both individual evolutionists and the community of evolutionary biology as a whole received Gould and Lewontin's essay.

Reading Strategies of Evolutionists

Charney examines the reading strategies employed by seven evolutionists (four graduate students and three faculty members) as they read "Spandrels." She reports that although the graduate students read linearly, two of the three faculty members read

nonlinearly, a strategy typical of scientists, who have been found to read selectively (212). One of the faculty members explains that this strategy is pursued deliberately in order to maintain a critical edge (Charney 213). In fact, Charney states that all of the participants were both aware of and wary of Gould's acknowledged rhetorical skill (225). By using previewing and skimming techniques, the faculty members were able to undermine the rhetorical force of the article while still attending to the basic argument (214). This concerted attempt by the more mature readers to combat Gould's persuasive power illustrates both the norm of skepticism and the counternorm of particularism. For instance, Charney states that previewing is typical of active, skeptical readers (214). In addition, these readers considered the ability and experience of Gould and Lewontin as writers, a particularistic concern, when actively engaging and diffusing the essay's rhetorical style.

Charney also coded the evolutionists' think-aloud comments as they read "Spandrels." She found that the faculty spent more time evaluating the text both rhetorically and structurally than the graduate students, who concentrated on comprehension (216). The faculty readers' comments on issues such as the significance of adaptationists' activities, the lack of evidence supporting alternatives to adaptation, the scope of the problem, and the representativeness of the examples illustrate that they focused more on the validity of the underlying arguments than on the rhetorical style. In other words, these readers were concerned with universalism, or the agreement of the examples with both their own observations and previously established knowledge, and organized skepticism, the conformance of the examples and arguments with empirical and logical criteria of judgment.

Common Knowledge in Evolutionary Biology

In contrast to Charney, Winsor analyzes the reception of "Spandrels" by the evolutionary biology community as a whole, or the article's reliance on communality. According to Winsor, scientific discourse depends on the consensus of the community in order to attain the status of knowledge (128). She therefore examines both how Gould and Lewontin situate their essay in the field and how it was cited after publication. Using Latour and Woolgar's five types of statements, ranging from speculations to accepted knowledge, Winsor illustrates how Gould and Lewontin promote their own claims and demote rival ones (131). For instance, they use assertions and positive language when discussing claims with which they agree (132); when discussing rival claims, however, they use qualifiers and modalities (131). Although the use of qualifiers and modalities denotes skepticism, it is Gould and Lewontin's failure to use these features when discussing work with which they agree that characterizes them as dogmatic. In addition to their use of references, Gould and Lewontin borrow and reinterpret data collected by other scientists. This practice complies with the norm of skepticism, since Gould and Lewontin critically scrutinize the data against empirical and logical criteria of judgment; however, they do not provide any new data in their essay. Their omission, and their reliance on arguments from authority, can be explained by their means of persuasion: Their argument is not one of logos but one of ethos, or an argument against the attitude of adaptationists, one that is not sufficiently skeptical.

Winsor also searches for and examines citations of "Spandrels," finding that authors citing the paper tended to emphasize one of two ideas: that adaptation cannot explain the emergence of all traits or that solid proof is required when a claim of adaptation is made

(138). In the latter case, Winsor found that most authors cited "Spandrels" as an admonition against story-telling at the expense of proof (139). Therefore, it appears that Gould and Lewontin's paper has been used as a position paper advocating the proper scientific skepticism.

Although neither Charney nor Winsor specifically focus on ethos in their essays, both essays can be re-interpreted from the perspective of scientific norms. The conclusions drawn from an analysis of these essays, however, are distinctly different from those drawn from Miller and Halloran's and Gragson and Selzer's essays. The latter essays depict Gould and Lewontin as distinctly non-scientific; however, Charney's and Winsor's essays show that "Spandrels" is both read thoughtfully and cited frequently. Clearly, there is a discrepancy between these two characterizations of "Spandrels," one that can be explained using Chomsky's idea of surface and deep structures as an analogy.

Surface and Deep Structures of Ethos

Charney poses the pertinent question at the beginning of her article: "How can we understand Gould and Lewontin's choice of a rhetorical stance that apparently accommodates their scientific audience so little?" (205). Although Charney concludes that, rhetorically, Gould and Lewontin's article was not particularly successful in convincing readers of the narrow-minded dogmatism of adaptationists, Winsor finds that the article is still frequently cited as an admonition against dogmatism. I would argue that in view of the article's longevity, Gould and Lewontin's rhetorical stance was successful; the question is why? I suggest that there are two levels of persuasion through character, or ethos, at work in "Spandrels," one of which presents an argument particularly scientific in nature.

Humanistic Style and Scientific Argument

The existence of two levels of persuasion is most obvious in Charney's article. In her introduction, she refers to a review in which a professor of ecology and evolution, Slobodkin, criticized Gould's writing style as unscientific (203). Charney compares his view with that of the Royal Society members who denounced ornate stylistic devices, feeling that these devices obscured issues and could even mislead readers (203). Scientists, who stress the communicative function of language over its persuasive function, see the use of stylistic devices in scientific discourse as problematic.

The issue of style versus a more substantive form of persuasion is evident throughout Charney's article. She describes "Spandrels" as a piece of atypical scientific discourse, one that violates conventions by deliberately employing irony, invective, cultural allusions, etc., rather than conforming to the accepted strictures of plain style (205). It is Gould and Lewontin's style that the faculty readers in her study are attempting to circumvent through their use of previewing and skimming techniques. As one of her readers says, "Gould is one of these people who writes extremely well. And it makes him very slippery. I have found myself disagreeing with Gould on points in popular articles and having the darndest time figuring out why. Because everything he said was so reasonable" (qtd. in Charney 225). However, these readers did not dismiss "Spandrels," but rather attributed its unusual style to Gould's skills as an author or to the genre of opinion pieces in general, or just ignored it (Charney 226).

Significantly, even though these readers bypassed the style of the piece, they still

recognized the underlying scientific argument of "Spandrels," namely a charge of dogmatism against adaptationists. As Charney describes it, "If Gould and Lewontin can demonstrate that the adaptationist program is inherently unscientific and therefore unproductive, then they create the exigence for changing to a different and presumably more purely scientific alternative" (218). This argument is one that is markedly scientific and the readers treated it as such. They confronted Gould and Lewontin's charges against adaptationism–it is reductionist, unfalsifiable, subversive, and unscientific–on a scientific level, debating issues including falsifiability, evidence, the existence of counter-examples, the dependence on preconceived ideas, and the sophistication of the cited researchers (Charney 205).

Viewed on a stylistic level, Gould and Lewontin are notably unscientific, constructing an ethos more consistent with humanism; on a scientific level, they are arguing in favor of organized skepticism. Based on her examination of the way in which "Spandrels" has been cited, Winsor states, "Subsequent writers . . . have hastened to provide what they see as better evidence. 'The Spandrels of San Marco' thus is interpreted primarily as an admonishment to use better methodology, to create better black boxes and harder facts. Its subsidiary argument about method, originally intended to support its overall antiad-aptationist stance, is treated instead as the article's main message" (139–40). However, I believe that this methodological argument was the article's main message. Gould and Lewontin are not arguing against all adaptationist explanations; rather, they are arguing against the failure of evolutionists to consider alternatives that may provide better explanations. From this viewpoint, the problem is that evolutionists have not followed the scientific method consistently: a researcher following a truly scientific approach would be more skeptical, consider all the possibilities, and decide based on empirical and logical criteria.

Even though it is obvious that Gould and Lewontin used ethos in two distinct and contradictory ways, it is still not clear why they did so. Using Chomsky's concept of syntactic transformations as an analogy, we can analyze the relationship between the two levels of persuasion.

Surface and Deep Structures

Chomsky's theory of syntax describes the relationship between the underlying, or deep, structure of a sentence and its surface structure. In his book *Aspects of the Theory of Syntax,* he defines deep structure and surface structure as the semantic interpretation and phonetic interpretation of a sentence respectively (16). Furthermore, these two structures are related by means of a transformational subcomponent, which according to Chomsky performs two functions. First, the transformational component converts an abstract deep structure expressing the sentence's content into a concrete surface structure indicating its form (136). Second, it restricts the distribution of lexical items and sentence structures (225). In other words, a syntactic transformation generates the surface structure of a sentence from its deep structure, constraining it both lexically and structurally.

We can view the underlying scientific argument presented in "Spandrels" as its deep structure, containing its content, and the humanistic style of "Spandrels" as its surface structure, indicating its form. At this point, however, the analogy breaks down, for the surface structure of "Spandrels," rather than being generated from its deep structure, is diametrically opposed to it; neither the converting nor the constraining function of the transformational component is fulfilled. Nevertheless, this breakdown illustrates that

there is a tension between the two levels of persuasion in "Spandrels," one that provides a possible explanation for why Gould and Lewontin chose the rhetorical stance that they did.

Charney claims that Gould and Lewontin use unusual discourse strategies in order to shake up their readers (205). If we accept this motive, then Gould and Lewontin's choice of rhetorical style is understandable and, in view of the responses of the evolutionists and of the rhetoricians in Selzer's book, successful. According to Charney, even though their rhetorical style did not convince the evolutionists of the general claim that adaptationists in general were dogmatic, it did "evoke emphatic response" (227). For instance, one of the faculty readers responded to Gould and Lewontin's characterization of natural selection as omnipotent as follows: "Oh shit. I don't know who the hell believes that. Who really believes that? If you asked them, put it to them that way? No one believes that, right? If you want to explain the appearance of the human knee or the human brain you go to natural selection, you don't go to genetic drift. We shall see" (qtd. in Charney 219). And another said in response to the charge that adaptationist stories may pass without proper confirmation, "Well, that's true. But on the other hand, that's hardly a telling point against adaptation. It's a telling point against being sloppy and simplistic in your thinking. Which is in part what he's doing here" (qtd. in Charney 222).

As representative humanistic readers, the rhetoricians in Selzer's book are no less emphatic. Gragson and Selzer note, "It is not insignificant that the same humanities professor who struggles with Maynard Smith can read the opening of 'Spandrels' with ease and appreciation" (193) and that Gould and Lewontin's "irreverence and progressivism (and implied youth) stand so attractively against the established order" (196). Miller and Halloran characterize "Spandrels" as having a "playful, urbane, and literate quality," and claim that Gould and Lewontin "avoid seeming overly churlish or mean spirited" and in fact resemble the Victorian "man of letters" (118). Whether disparaging or well-disposed, these readers all responded strongly to "Spandrels."

Examining "Spandrels" at two levels exposes the rhetorical tension between its form and its content. Gould and Lewontin's combination of a humanistic style and a scientific argument gave rise to an intriguing and powerful essay, one that, even though its argument was not novel (Charney 222), has been treated as a classic position paper in evolutionary biology. Regardless of whether readers find "Spandrels" liberatory or misleading, it makes an impression.

Conclusion

As shown in the preceding discussion, rhetoricians of science are adapting classical concepts such as ethos using contemporary theories from sociology, linguistics, literary criticism, and cognitive psychology. Miller and Halloran explicitly define ethos in their analysis, a definition that is conspicuously Aristotelian. But they integrate into this definition intertextuality in the form of references to authority figures and the intellectual community. Gragson and Selzer also examine ethos and in the process integrate reader-response theory, a theory that separates the character of the writer constructed in the text and the character of the reader constructed in the text. This view of the speaker and audience is not incompatible with Aristotle's; on the contrary, it simply resituates the intended audience from listeners to the reader in the text. Charney and Winsor, in contrast, focus on real readers and illustrate two ways in which the effects of the ethos of a text can be examined: by protocol analysis, which explores the responses of individual

readers, and citation analysis, which reveals the response of a scientific community as a whole.

Furthermore, Prelli has developed a conceptually precise explanation of scientific ethos based on Merton's normative conditions of science, which although performative in aim can be appropriated to serve an interpretive purpose. The characteristics of fair-mindedness—universalism, communalism, disinterestedness, and skepticism—can be related uniquely to specific textual features. And the counternorms—particularism, solitariness, interestedness, and dogmatism—balance fair-mindedness and thicken the concept of social status in a way that can also be linked to textual features. The development of these norms and counternorms and their relationship to specific textual features provide a conception of ethos that is linked to theory on the one hand and text on the other.

In addition to its hermeneutic function, however, this linkage also provides a causal explanation. Analyzing Gould and Lewontin's essay from the perspective of social norms reveals its surface and deep structures of ethos, explaining much of its tension as well as its enduring influence in the community of evolutionary biology. This conceptual framework also accounts for the differences between Miller and Halloran's and Gragson and Selzer's analyses and Winsor's and Charney's: the two former articles focus on form, the latter two on content. But it is only by considering form and content simultaneously that the complexity of "Spandrels" is disclosed and a truly rich description of its rhetorical character is achieved.

I believe that the suggested relationship between social norms and textual analysis provides a precise definition of ethos as well as a productive conceptual framework. As shown in the articles discussed, the social norms provide a powerful tool for examining both the form and the content of a scientific argument, a tool that rhetoricians have not failed to employ. Rhetoricians of science commonly refer to concepts such as objectivity, impartiality, community, disinterestedness, skepticism, and dogmatism; however, a unifying perspective is needed to generate meaning beyond that found in isolated case studies. Although practice has outstripped theory, it still operates within a clearly delineated conceptual space. It remains for rhetorical critics to realign theory with the ongoing practice of scientific criticism.

Notes

[1] Merton later added the norms of originality and humility ("Priorities" 303).

[2] Prelli cites Ian Mitroff's book, The Subjective Side of Science (1974), in which Mitroff studied NASA "moon scientists" and provided evidence for these counternorms. In his description of scientific norms, Merton also discusses characteristics that correspond to the counternorms. For information on humanistic norms, refer to Richard Rorty's article, "Science as Solidarity," found in Nelson, Megill, and McCloskey's The Rhetoric of the Human Sciences: Language and Argument in Scholarship and Public Affairs (1987).

[3] In "Provocative Architecture," Couture provides a summary of some of the lexical and grammatical textual features traditionally associated with Merton's four norms (283–84). She also cites Rorty's "Science as Solidarity" in her discussion of the linguistic features associated with the humanistic values of individual identity and evaluation (285).

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