

The Rhetoric of Science and How Metaphor Constitutes Knowledge in Science



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Ways of asking, “what is science?”

- **Philosophy of science:** Assumptions and methods in science, difference between science and non science. Does science seek *Truth* or functional information?
- **Sociology of science:** How do scientists interact, what are the power relations, and how do those social aspects affect what counts as scientific knowledge?
- **Rhetoric of science:** How is the language of science persuasive to an audience, how does it constitute and deliver knowledge?

Classical Rhetoric to the rescue?

Three forms of persuasive appeal in rhetoric:

Logos, which presents rational arguments, such as enthymemes, to appeal to reason.

Ethos, which persuades by virtue of the speaker's character.

Pathos, which appeals to the emotions of the audience.

Five parts of rhetoric:

Invention: Coming up with the points of your argument (proofs), planning.

Arrangement: Deciding the order of presentation of your argument.

Style: Choice of discourse techniques to *present* your case.

Memory: Tricks for memorizing a speech.

Delivery: Later called "elocution." How to present your case publicly

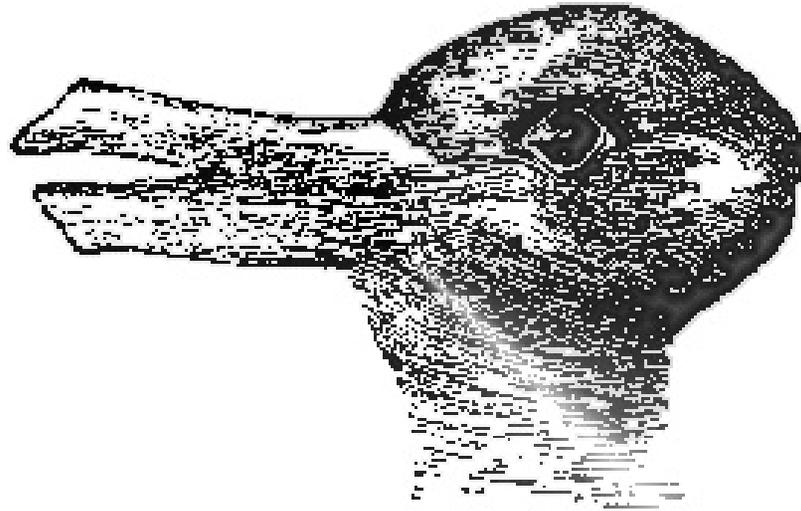
Some ways of making appeals (artistic rhetorical proofs)

Commonplace arguments (topoi). These are general strategies or discipline specific (special) strategies, such as arguing that more is better than less, patriotism is good, etc.

Rhetorical figures or tropes, such as **metaphor**, metonymy, chiasmus ("Ask not what your country can do for you, but what you can do for your country.")

Some key dates in rhetoric of science

- 1962: Thomas Kuhn *Structure of Scientific Revolutions* introduces “paradigm shifts.”
- 1976: Philip C. Wander, speech communication, coins the term Rhetoric of Science to consider “ambience” between these two modes of thinking.
- 1990: Alan Gross argues scientific texts are rhetorical objects.



Kuhn uses this famous duck-rabbit image to illustrate how perception is affected by prior expectations (paradigms).

Academic goals of Rhetoric of Science

- **What have we researched?**
 - Argument and commonplace strategies in texts.
 - Rhetorical figures in science texts (metaphor, metonymy, etc.)
 - Text production stories (ethnographies in a lab, the writing of psychiatry classifications).
 - Science and public policy debates (environmental, etc.)
 - Science writing for different audiences (e.g., accommodation for popular audiences).
- **What are we teaching? Keywords from various syllabi in English, Communication Studies**
 - Critical analysis of theory
 - Case studies, historical developments in science
 - How and why or scientific persuasion
 - Health and medical communication.
 - Postmodern/post human science (robotics, genetic engineering, etc.)
 - Relationship between science and technology (nanotechnology, etc.).
 - Ethical issues in science
 - Science in society (Intelligent Design challenge, etc.)

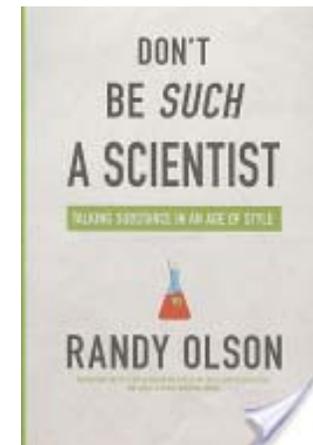
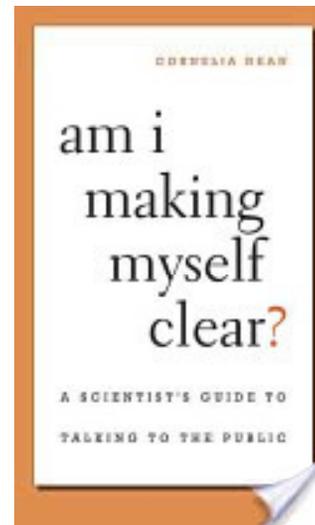
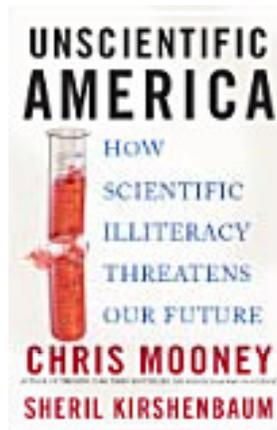
Professional goals

Assist scientists with planning and disseminating research

Editing journal articles

Helping with grant writing

Helping scientists to communicate with lay public and show the relevance of their work



Scientists recognize the importance of rhetoric, even if they shy away it

From *Microbe* (Vol. 5, 2010)

- Author Bernard Dixon objects to misuse of terms like “genetic code” or “superbug” by microbiologist in an interview:

How can scientists “best promote public understanding of science, given the additional challenge of working with language that is not static, but evolving” (pp. 460)

From *Science* (Vol. 335, 2012)

- Guest editorial writer Gottfried Schatz laments “degradation of verbal communication” among scientists out to impress with presentations “so overloaded with unnecessary information, so obsessed with technical detail, and so cluttered with abbreviations, jargon, and acronyms as to be nearly incomprehensible to anyone but the specialist” (pp. 635).

An Age-old Problem

Torbern Bergman, Swedish chemist (1735-84)

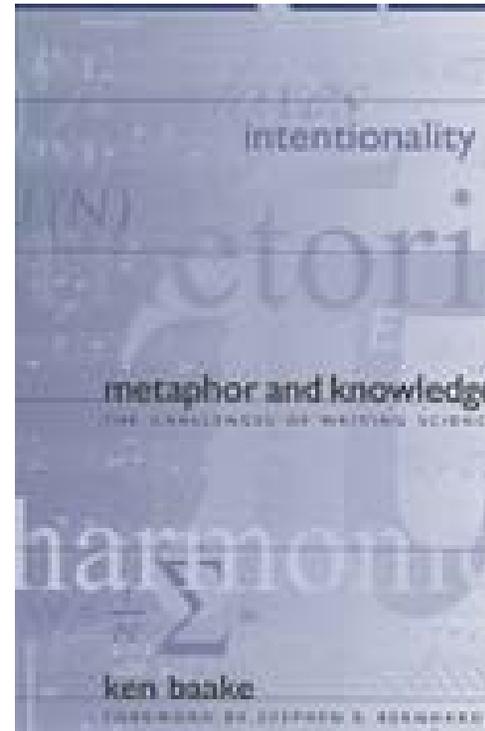
“I am not ignorant that words, like money, possess an ideal value, and that great danger of confusion may be apprehended from a change of names; in the meantime it cannot be denied that chemistry, like the other sciences, was formerly filled with improper names. In different branches of knowledge we see those matters long since reformed; why then should chemistry, which examines the *real nature* of things, still adopt vague names, which suggest false ideas and savour strongly of ignorance and imposition?” (Italics mine, from Crosland, M.P. *Historical Studies in the Language of Chemistry*, New York: Dover, 1962, p. 146.)

One rhetorical debate: A 1999 lecture at the Santa Fe Institute

- Political scientist talks about “rules” in allocation of irrigation rights. Biologists ask, “what do you mean by rule?”
- Political science:
 - enforceable actions permitted, mandated or prohibited in a social group
- Biology:
 - observed regularity among agents

What is metaphor?

- Greek *meta phora*, “transfer or bear across” (My love is a rose.)
- To carry an image from one concept to another, in both directions.
- Words change meaning according to context; metaphors resonate with multiple meanings—like musical “**harmonics.**”
- Constitutes theory rather than merely deliver it.



Ken’s book, 2003, that studied the challenges of metaphor and other language issues at the Santa Fe Institute—an interdisciplinary complexity science think tank

A problem of word meaning at the SFI

- Political scientist talks about “rules” in allocation of irrigation rights
- Biologist asks “What do you mean by rule?”

Political science: enforceable actions permitted, mandated or prohibited in a social group

Biology: observed regularity among agents

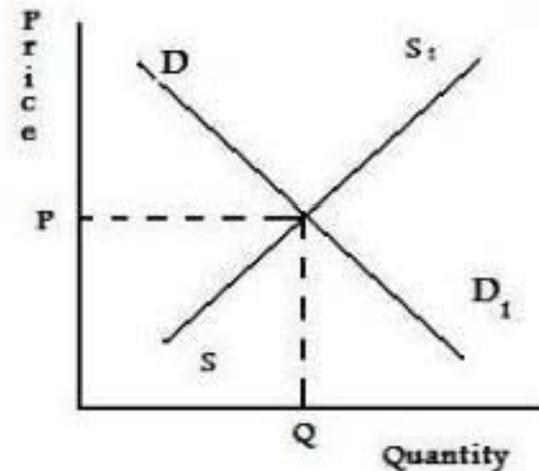
Examples of oscillating metaphors

“Signaling” in biology



Biologists would say the yellow bee is “signaling” danger to potential predators. Is the brown beetle then signaling he is safe to eat? Can something signal if its intention is genetically determined, or must signaling be a conscious action?

“Equilibrium” in economics



Economists refer to the point where supply of a good equals demand as equilibrium, a term borrowed from physics with harmonics implying “well being, balance.” But an economy in equilibrium also has people who are poor and deprived.

Game theory as a metaphor in physics

Political science, economics

Physics

	Prisoner Bonnie Stays Silent (Cooperates)	Prisoner Bonnie Betrays (Defects)
Prisoner Clyde Stays Silent	Each serves one year.	Clyde serves twenty years Bonnie goes free
Prisoner Clyde Betrays	Clyde goes free Bonnie serves twenty years	Each serves ten years

When "frustrated" by their arrangement, magnetic atoms surrender their individuality, stop **competing** with their neighbors and then practice a group version of spin control—**acting collectively** to achieve local magnetic order—according to scientists from the Commerce Department's National Institute of Standards and Technology...writing in the Aug. 22, 2002, issue of the journal *Nature*.

Troubling harmonics: Can atoms play a game? Do humans making economic decisions function like atoms determined by laws of physics?

Metaphor harmonics are useful

- By confronting the multiple “sounds” and potential dissonances, scientists constitute their theories and refine their insights.
- Harmonics insert ethics into potentially dangerous neutral science (such as game theory).
- Science cannot avoid the paradoxes of language.

Implications for technical writers

- Technical writers can help scientists to negotiate the complexities of language, especially metaphor.
- No perfect word exists, but the search for it leads to new insights.
- “...we can say that technical writing is rhetoric harnessed to turn imperfect lodes of reality into gems of knowledge” (Baake, p. 208).

Questions?