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Keynote speech: Natalie Angier at the Dallas annual conference

by Natalie Angier

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(This article presents excerpts from Natalie Angier's keynote speech at STC's 50th annual conference in Dallas.—Geoff)

I believe the vast majority of journalists are remarkably honest, day in, decade out. Maybe some of it has to do with fear of being punished if they're caught. It's the same as it is with scientists. One reads with fair regularity about big, ugly cases of scientific fraud, and you may conclude that there is a lot of cooking of the beakers and petri dishes going on out there, but in my experience, having spent long periods of time in labs, watching scientists do their work, I'd say just the opposite. It's very rare. What's the point? If you cheat in science, two things can happen. Either you cheat on an experiment that's so mundane nobody will pay attention, and where does that get you? But if you cheat and fabricate wonderful, exciting results, well, then, the first thing other scientists are going to want to do is build on your work, and they'll start trying to replicate what you've done so they can take it a step further, and then they'll find out it's all a crock, and then, there you are, bagging groceries at Safeway, or running for Congress. As far as I can tell, being a politician is one job where the ability to lie persuasively not only isn't a deficit, it's an asset.

As for scientists, so with reporters. Either you cheat and fabricate in ways that are rather dull, and so you get away with it for who knows how long, but nobody notices you. Last October, the Associated Press fired Christopher Newton after learning he invented sources, affiliations, and quotations in dozens of stories since he started working for them in 1994. And the reason why they didn't attract attention, as the AP vice president told the Washington Post, is that the invented quotes attributed to fictitious people, were just "not very snappy or snazzy. They didn't raise any flags." One story about President Bush's decision to emphasize financing for education and the Pentagon, for example, conjured up a nonexistent political science professor at the University of California named Patrick Delraj to say, "He's laying groundwork to be in a stronger position next time around." Yup, that's definitely the sort of punchy line worth risking your career for. Although Newman wasn't entirely free of chutzpah. He apparently made up *three* fictitious sources and a make-believe institution for a story about advances in lie detection technology.

"Either you cheat on an experiment that's so mundane nobody will pay attention, and where does that get you? But if you cheat and fabricate wonderful, exciting results, well, then, the first thing other scientists are going to want to do is build on your work, and they'll start trying to replicate what you've done..."

But usually, if you invent stuff that's exciting, and attracts attention, and makes everybody say what a genius you are, then you usually get busted rather fast. That's what happened to Stephen Glass, the "rising star" at the New Republic who, some five years ago, made up things about real and very powerful people, like Clinton's lawyer Vernon Jordan, or the conservative editor and writer John Podhoretz, as well as fabricating stories about having witnessed a holdup of a cab driver while he, the intrepid reporter, was in the cab. Glass was busted, Glass was fired, his ass was, yes, Glass. Although he hasn't entirely vanished from the scene. Glass has a novel out now, called "The Fabulist," about a journalist who fabricates his material. I've heard the novel is pretty bad,

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Editorial: Creativity and the scientific method

by Geoff Hart
(geoff-h@mtl.feric.ca)

There's an old joke that refers to a possibly apocryphal physics exam. In this particular exam, one question asked students to describe how they would determine the height of a tall building using only a barometer. Since barometers are designed to measure air pressure, and since air pressure decreases in a mostly predictable fashion with increasing height above ground, the teacher was presumably seeking a simple answer based on this physical principle.

Students of science, being notoriously recalcitrant, have come up with a variety of creative alternatives that avoid complying with the professor's desire without actually getting into a fight over it. These include a variety of amusing, though practical alternatives:

- Tie the barometer to a long rope, then lower it from the roof until it touches the ground. The sum of the length of rope and the barometer's length add up to the height of the building. (Unfortunately, this solution violates the letter of the question, if not its spirit, because you would need additional equipment—a ruler of some sort, say—to measure the two lengths.)
- A corollary to the first option: If you can walk up the stairs from ground level to the roof, you can use the barometer as a ruler and determine how many barometers high the building is. (Same objection, of course.)
- Use some applied geometry. If the sun is up, place the barometer beside the building and measure the lengths of their respective shadows. The ratio of one shadow to the other is the same as the ratio of their respective heights, so figuring out the building's height is a simple matter of proportion. (Same problem as the first two solutions.)
- Drop the barometer off of the roof and measure the time required for it to reach the ground. The building's height can then be calculated using Newton's formula for the distance traveled during acceleration. (This is also cheating, since you'd need a timepiece to measure the duration of the barometer's last few moments as a functioning instrument).
- Use the physics of pendulums to estimate the distance. The simpler method is to tie the barometer to a rope long enough for the barometer to just miss brushing the ground, then measure the duration of its swing. Alternatively, use a shorter length of rope to measure the pendulum's period at ground level and on top of the building; the difference between the two depends on differences in the strength of the gravitational

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"Natalie Angier..." (continued from page 1)

though, which just goes to show that good fiction, like nonfiction, requires a relentless sense of integrity and honesty.

In fact, I believe that the real reason why most reporters and writers are honest is not fear of getting busted, but because they went into the profession for idealistic reasons, because they seek the truth, in a profound sense of the word. They want to know what the world is about, and why we *Homo sapiens* behave as we do, and why we fight wars, or fall in love, or become obsessed with money, status, Botox, Joe Millionaire, and why on earth it is that every third e-mail I receive is an ad for penile enlargement.

The world is full of errors! I've double, triple, quadruple-checked articles, and still errors creep through. I've had errors made about my name and my work, too. Consider my book *Woman: An Intimate Geography*. A number of reviewers rendered the first part as *Women*, and as for the subtitle, it has come up as *An Intimate Biography*, *An Intimate History*, and, my favorite, *An Intimate Geology*, a revised subtitle that the reviewer in question came to believe in so completely that she started making puns about women's caves, mountains, and peaks.

But perhaps I have mixed feelings about the severity with which errors should be punished because, toward the beginning of my career, while I was a writer at the then-new magazine *Discover*, the editors used to harangue the staff about the number of corrections they had to run, and they began threatening the researchers, who were the fact-checkers and therefore ultimately responsible for errors in the magazine, with the promise that they would be fired if things didn't improve fast. Well, one emotionally frail young researcher took it to heart, and when he realized that he'd allowed a rather substantial error to get into print, hanged himself in his apartment. The editor then turned around and blamed the writer who'd made the mistake in the first place for essentially having driven the guy to suicide. As you can imagine, she quit immediately, as did a number of staffers. It was a miserable time. A threatening, you-stink environment almost never leads to excellence.

"...good fiction, like nonfiction, requires a relentless sense of integrity and honesty"

This is not to say that editors shouldn't be more vigilant than they are. It sometimes strikes me that the copyeditors spend a little too much time on making sure that copy conforms to corporate writing style and not enough on spotting errors or double-checking the dubious. And in so doing, they can add errors of their own into a story. Yet there have been editors who have saved my butt and caught errors, like saying, did you mean chloride here where you say chlorine? Yes, yes, thank you St. Mendeleev! So it would be wonderful if copyeditors spent less time fretting over whether a person has used the word "repertoire"—considered pretentious—rather than repertory, and more time looking over the facts of the matter.

For a science writer, there are many challenges beyond merely getting your names and affiliations straight. Clarity. Go back, reread it two hours later. And then, when you go back to it, read it aloud. It's amazing what you pick up when you read something aloud, how concepts that are separate in your mind while you're writing something get confusingly smeared together when you read it over later, and when you read it aloud, which interestingly enough, is closer to how others will read your work than is reading it to yourself. It's because you can't fool yourself, or fill in the blanks, when you're reading it aloud—just as the person who didn't write the thing to begin with can't read between your lines, either.

"For a science writer, there are many challenges beyond merely getting your names and affiliations straight."

I love science writing, I've been doing it for more than 20 years, and I guess I keep hoping that one of these days, science will be seen as just another facet of life, rather than some rarefied, ghettoized business accessible only to the cognoscenti. I also keep hoping that people somehow have absorbed all the thousands and thousands of articles that have been written about, say, the Human Genome Project, and

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"Natalie Angier..." (continued from page 3)

"The fabric of the universe is so much bigger and grander than fabrication can ever be."

that I won't need to start at the bottom with every story I write. Yet I've learned that it's a terrible mistake to assume any prior knowledge on the part of your average reader. You talk about proteins, people think of sirloin. You mention amino acids, they think of additives in shampoo. I remember one exchange with a copyeditor, who was going over a story I'd written about a genetic study of whales. At one point in the story, just for the sake of variation, I referred to whales as mammals. "Are whales mammals?" he asked. I looked at him to see if he was serious. He was. A few lines later, I called mammals animals. "Are mammals animals?" he asked.

"...the public doesn't know much about science, and those who choose to write about it must bear that in

Okay, so the public doesn't know much about science, and those who choose to write about it must bear that in mind. But what I want to know is, why do other specialty reporters get away with so much? Just yesterday, my husband pointed out to me an article in the sports section about how the Syracuse basketball team had been invited to join the ACC. Wow! What's the ACC? Neither of us had a clue, and do you know, the article never told us. Humph!

Still, it's a great business, covering science, because there is so much beauty in it. Researchers hammering away at "ordinary" science, which means solving equations of the sort of florid density so easily parodied in the New Yorker, and fighting for time at the Hubble space telescope or Fermilab accelerator, and emerging with a reasonable portrait of spaces and places so far and wide it makes my prolapsed mitral valve flutter just thinking about them. Equally astounding is what geologists have discovered about the history of our earth just by going to places like the Grand Canyon and doing something more than complain about the tourists, or what paleontologists have learned about bestiaries gone by; or what biologists have learned about the human genome—that it rambles, and repeats itself, and appears to be a La Brea tar pit for every drunken virus ever to stumble into an ancestor's cells.

This is why I, as a science writer, couldn't imagine faking stories. The fabric of the universe is so much bigger and grander than fabrication can ever be. A scientist once told me that anything scientists or engineers invent in their laboratories, any clever solution to a problem, any whacky idea they can fathom, chances are that somewhere, Mother Nature did it first. She is infinitely more inventive than we are. Mother, as always, knows best. **Ω**

"Editorial" (continued from page 2)

field experienced by the pendulum. Knowing the gravitational constant and Earth's diameter, you can calculate the height difference between ground and roof based on the difference in the gravitational field. (You still need to cheat by using a timepiece.)

My favorite solution involves offering the barometer as a bribe to the building's architect (or a clerk at the land registry) if they'll tell you the building's height. That requires no additional instrumentation, and thus meets the letter of the rules, if not their spirit (i.e., to apply the scientific method to solving the problem).

At first glance, it seems like none of the solutions honor both the letter and the spirit of the original problem. But it's worth noting that the most interesting and important studies in the history of science have come from thinking outside the box and trying something other than the expected approach. That's something we scientific communicators should bear in mind in responding to our own daily tests. **Ω**

(Historical footnote: The original student claimed to be responsible for all of these solutions was Niels Bohr, Danish Nobel laureate in Physics. If true, the story illustrates nicely how his creativity in a simple test was only one early symptom of future greatness.)

Shaping science with rhetoric: the cases of Dobzhansky, Schrödinger, and Wilson

by Bob Andrews (andrewsb@thevine.net)

Book review: Ceccarelli, L. 2001. University of Chicago Press, Chicago, Ill. 204 p. ISBN 0-226-09907-5 (Editor's note: This review originally appeared in the November 2002 issue of *Technical Communication*.)

Have you ever wondered how a new idea becomes accepted (or rejected) by the scientific community? As this book demonstrates, it's an intriguing process in which use of language plays a key part. The principles in this book aren't necessarily just for scientists; they can be valuable to anyone who uses language to present new ideas to a skeptical audience, which is almost everyone at one time or another.

The field of scientific rhetoric examines how scientists use language to package and present their ideas. To gain acceptance, a scientist first needs to understand his audience. Is the new idea going to challenge long-standing assumptions? Are there cultural beliefs and vested interests that will be upset? If so, the new idea must be presented in a way that effectively addresses these concerns. Because words and thoughts are integrally connected, the language and logic of a scientist's argument greatly determine how it is received.

In *Shaping science with rhetoric*, Leah Ceccarelli evaluates three books written by scientists that presented new and revolutionary ideas. The books by Theodosius Dobzhansky and Erwin Schrödinger were successful; their theories were accepted enthusiastically. The ideas in Edward Wilson's *Consilience: the unity of knowledge*, however, were largely rejected. In fact, many who read Wilson's work were persuaded to work actively against his proposals. Ceccarelli evaluates the role of language and rhetoric in the success and failure of these ideas. She explains which strategies worked and which didn't.

One of Ceccarelli's key concepts is "interdisciplinarity". Dobzhansky, Schrödinger, and Wilson all proposed ideas that bridged previously unconnected fields, such as the humanities and evolutionary biology. A radical new idea often requires scientists to change how they perceive the nature of their own work. It asks them to "cross intellectual borders" and shape new scientific communities. A successful argument for interdisciplinarity guides readers toward thinking, at least temporarily, in terms of a discipline other than their own. At the same time, it assures them that their own interests are being served by this new approach.

"Have you ever wondered how a new idea becomes accepted (or rejected) by the scientific community?"

Dobzhansky's *Genetics and the origin of species*, written in 1937, considers Charles Darwin's theory of evolution by natural selection. Darwin's beliefs had many followers, but a competing theory was also popular—evolution by genetic mutation and recombination of chromosomes. Dobzhansky's book explains how the two theories could be combined. Gradual evolution could be explained in terms of genetic changes, with new and improved species being formed as natural selection chooses the organisms with the most favorable genes.

Dobzhansky presents his ideas not as a triumph of one field over the other but as a synthesis of two compatible theories. He was able to break down the conceptual barriers between the two camps without antagonizing them or forcing either to "unconditionally surrender intellectual territory". Dobzhansky explained the geneticists' complex technical and mathematical theories in language that was familiar to the naturalists; he showed how the "hard science" genetics evidence could support the naturalists' beliefs. At the same time, he showed the geneticists how environmental and geographical factors influence natural selection and species formation, and how this works hand

"Dobzhansky presents his ideas not as a triumph of one field over the other but as synthesis of two compatible theories."

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in hand with genetic changes. The book includes a simple metaphor for evolution that includes both genetics and natural selection, enabling scientists in both camps to see their compatibility. By 1947 the two competing camps had united after accepting Dobzhansky's views.

Schrödinger's *What is life? The physical aspect of the living cell*, written in 1944, was an early text in the field of molecular biology. Until this time, biologists were involved mostly with describing the physical structure and function of living organisms. By 1944, great advances had been made in chemistry and physics, and scientists were beginning to examine the molecular basis of living cells. Schrödinger believed that molecular explanations of cell functions were very important and that breakthroughs in this field were "just around the corner". In his book, he encouraged cooperation among different disciplines (biologists, chemists, and physicists) to achieve a more complete understanding of living organisms.

"The principles discussed in Shaping science with rhetoric *apply to any situation in which the goal is to motivate interdisciplinary activity."*

Reading the book, biologists do not feel that their field will be encroached on, and physical scientists do not get the impression that they will become "lab technicians" to support biologists' research. He appealed to common values and goals, and used language that redefined professional loyalties. As a result, the book drew many scientists to the field of molecular biology, leading to important advances in the following decades.

Finally, Wilson's 1998 *Consilience: the unity of knowledge* attempted to make a connection between the natural sciences, the social sciences, and the humanities. Wilson's theory of "reductionism" proposed that all science, including human behavior, could be explained in terms of simple laws of physics. This book was roundly rejected by scholars in all fields. In making his argument, Wilson used strategies that failed to persuade readers to give up their entrenched positions and consider his new interdisciplinary approach. He used metaphors that portrayed different disciplines as "territories" that attempt to dominate one another through expansion and conquest.

"Wilson's... book was roundly rejected by scholars in all fields."

Wilson favors the natural sciences over the social sciences and humanities, and stated that the latter two are in "earlier stages of development." He ridiculed those in the humanities and social sciences, saying that they need to upgrade their methodologies by emulating the physical sciences. He characterized those who disagreed with his theory of "reductionism" as lazy and cowardly. He didn't envision merging or unification of the disciplines, and didn't acknowledge the contributions of some fields. By alienating rather than inspiring his readers, Wilson ensured that his ideas would be poorly received.

The principles discussed in *Shaping science with rhetoric* apply to any situation in which the goal is to motivate interdisciplinary activity. Successful techniques include:

- Emphasizing common ground.
- Using linguistic terms and metaphors familiar to one field to explain concepts from the other.
- Valueing the contributions of each side of a debate.

One technique that is effective but controversial is the use of "strategic ambiguity". This strategy involves using language that can be interpreted differently by those with different viewpoints to convince readers that collaboration is in their best interests. The author warns that this method of "suppressed disagreement" should be used not to motivate people to collaborate for different reasons but rather to appeal simultaneously to different sets of assumptions, professional goals, and linguistic practices. To do this effectively, the writer must understand the assumptions, goals, and practices of each side to be sure that the interpretations do not conflict. Ω

Bob Andrews is a high school science teacher in Los Angeles. He also does freelance technical writing and journalism.

Job opportunity: science writer

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"When Homo sapiens *passed the six-billion mark we had already exceeded by perhaps as much as 100 times the biomass of any large animal species that ever existed on the land. We and the rest of life cannot afford another 100 years like that."—Edward O. Wilson,* The future of life

—

"Homo sapiens *has become a geophysical force, the first species in the history of the planet to attain that dubious distinction."—Edward O. Wilson,* The future of life

—

"[The] new breed of analysts argues that we can no longer afford to ignore the dependency of the economy and social progress on the environmental resource base. It is the content *of economic growth, with natural resources factored in, that counts in the long term, not just the yield in products and currency."—Edward O. Wilson,* The future of life

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"When one tugs at a single thing in nature, he finds it attached to the rest of the world."—John Muir, naturalist, explorer, and writer (1838-1914)

"I am not aware that any practical use has been made of Saturn's Rings… [b]ut when we contemplate the Rings from a purely scientific point of view, they become the most remarkable bodies in the heavens, expect, perhaps, those still less useful *bodies—the spiral [galaxies]… When we have actually seen that great arch swung over the equator of the planet without any visible connection, we cannot bring our minds to rest."—Robert Maxwell, Adams Prize essay*

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"There are two kinds of fool. One says, 'This is old, and therefore good.' And one says, 'This is new, and therefore better.'"—John Brunner, science fiction writer (1934-1995)

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"Technology allows us to put more of our lives in the hands of engineers every day. This might not scare those of you who work in non-engineering companies, but personally, it's enough to make me wake up screaming every night. I know a lot of engineers."—Scott Adams, The Dilbert Future. Thriving on business stupidity in the 21st century.

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There's no cost to join, and you can expect a very low volume of mail. Of course, the more people join, the more traffic there'll be, so please join. It's a great way to make the SIG work for you.

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