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Science Journalism from First Principles

During the spring of 2005, I spent two months at the University of California, Santa Barbara, serving as the science journalist in residence at the Kavli Institute for Theoretical Physics there. One of my duties was to present a lunchtime lecture to the physicists about science journalism. I called it "Science Journalism from First Principles," an allusion to the desire in physics to explain natural phenomena from the fewest possible number of irreducible basic premises (remember Ockham's razor).

While it was aimed at a specific audience of physicists, I think that talk provides a good outline of the principles and issues that should be of interest to anyone contemplating science journalism, either as a practitioner or a critic. So I will present those ideas here as a sort of introduction to what will follow in subsequent chapters. I will keep this brief, as the details and examples will come later on. But I think it's worthwhile to summarize the whole story concisely at the outset.

For starters, as I told the physicists, everything stems from the fundamental First Principle of Journalism itself: The public has a right to know (almost everything). That was the point of Chapter 1, but there's never any harm in reiterating it. For it leads directly to the foundational principle of science journalism — that the purpose of science journalism is to tell the public what scientists are doing. A science journalist ought to report to the public on how scientists are

using the public's tax dollars (or anybody's dollars, for that matter).

I said something like that once to an audience of scientists. Their response was something like "we knew it, you're out to get us." Au contraire. Telling people what scientists are doing ought not to automatically reflect negatively on scientists or science. To the extent scientists do good things, coverage of what they do should reflect favorably on their enterprise. But when science, or scientists, go wrong, the public deserves to know that, too.

I think some scientists don't like my first principle because of some of its implications. For one thing, it's clear that I'm saying it is *not* the purpose of science journalism to promote science! Yet many scientists believe that that is exactly what science journalism should do. To them, I reply, that science journalism may in fact have the effect of promoting science, indirectly. After all, if scientists do good things, and the practice and pursuit of science benefits society, then good journalistic coverage of all that ought to serve science's desire for public support and adulation. But it's not the science journalist's job to help spin science's story for that end.

In a similar way, many scientists believe science journalism should serve as a conduit for science education. Again, that approach violates the fundamental principle. The purpose of science journalism is not to *teach* people science, but to *inform* them about science in progress. There is a big difference. But again, benefits to science education may very well accrue indirectly from good science journalism.

That is not to say anything against the importance of science education or the need for improvement in that arena in America today. It just isn't the job of the journalist. Personally, I think schools could make more use of science journalism as a tool for instilling interest in science and demonstrating its relevance to real life. But if science

journalists tried to do the job of educating, it would probably be a lot less useful for inspiring students to want to find out more about science. In any event, if you concern yourself with education, your attention will be distracted from your real purpose, which is finding out what scientists are up to and letting your audience know about it.

And so now, given that, here are my declarations of the foundational principles on which science journalism should be built.

Principle Number 1: Be in favor of factual accuracy.

Everything else is worthless if what you write isn't right. Surprisingly (to me), this simple principle seems to be rather controversial. Many writers, many editors, many science journalism education programs, seem exclusively concerned with the style of the writing, demanding above all that it be interesting and easy to understand. Those are perfectly fine goals, but they kind of defeat the purpose (i.e., informing people) if the alleged facts aren't right to begin with. Psychologically, I'm pretty sure that many journalists emphasize style over substance because it's easier to figure out if something is understandable than it is to know whether or not it is right. That's not a good excuse. Your obligation is to provide the reader with reliable information.

Principle Number 2: Be against stupidity.

Part of providing reliable information involves leaving unreliable information out of your story. And it particularly means not writing stories at all about things that are stupid. I know, this is a rather nasty shorthand way to label something, but it sadly often fits what many journalists write (and what some scientists sometimes peddle). If a claim is made that is contrary to established laws of physics, it is probably stupid. In some rare cases you might need to

check with reliable sources to make sure, but it is usually safe to say that such claims warrant no coverage at all.

Principle Number 3: Balance is Bogus

This one never goes away. Supposedly, basic principles of ordinary journalism (when it was alive) included an admonition to provide balance in every story, reporting "both sides" or finding someone to offer a contrary opinion. This notion is usually applied wrongheadedly in most journalism and really does not apply to science journalism at all. If strong scientific evidence supports a particular conclusion, it is moronic to seek out someone who disagrees to quote in a story in order to give it "balance."

That doesn't mean you just report what scientists say uncritically. And it does not mean that you should print scurrilous allegations without giving the target of those allegations an opportunity to reply. (In this sense, I think "fairness" is a more appropriate consideration than "balance.") If Scientist A says Scientist B is a crank, you really should ask Scientist B for a response (if it is necessary to report what Scientist A said in the first place). But in any case, the ultimate idea is providing readers with the evidence that applies to the issue in dispute, not merely quoting antagonists back-and-forth without attempting to figure out the facts behind the controversy.

Which brings up the next principle.

Principle Number Four: Seek Independent Comment

While archaic ideas of balance are balderdash, it is nevertheless lame to write a story in which the only source is the scientist who did the research you're writing about. Readers deserve to get some idea about whether anyone without a vested interest also thinks the research is worth reading about. Consequently it is important to seek

comment from experts in the field who are in a position to provide an informed judgment on the work's validity and importance.

Depending on the importance of the story, of course, you may need to talk to several people. For short, quick-hit stories there may be time to talk to only one outside source. The important thing is to choose whom to talk to wisely. How to know whom to choose is a matter for further discussion later.

Principle Number 5: Eschew Sensationalism

Yes, it is important to let people know how important something is. Part of the journalist's job is selling the story — that is, trying to get people to read it. To do that, you need to express the most exciting, interesting, important aspects of the story clearly and compellingly. But you must do it honestly. You shouldn't report hints or clues as established accomplishments. You shouldn't give sick people false hope that their disease will soon be miraculously cured.

But there is nothing wrong with writing about interesting things enthusiastically. There are critics out there who think science journalists are just cheerleaders for science and that it is bad to express fascination with the wonders of the universe or the potential commercial applications of a newly discovered molecule. In short, sensationalism is bad, enthusiasm is not — if you've done the reporting thoroughly enough to ensure that the enthusiasm is not misplaced.

Principle Number 6: Put it in Context

The best antidote to sensationalism is to make sure the story you write puts new developments in proper context. You need to tell people how what's new fits in with what was previously known. And how it relates to other

issues, within science and without. And what the implications are for future research or events.

It's true that there is not always time or space to do all of this contextualizing as well as you might like. But you have to provide as much context as you can.

Principle Number 7: Articulate Salience

Part of putting science news in context is describing how it fits into science; another important part is showing how it fits into the rest of the world, occupied by your audience. I am *not* saying that science news should always be "news you can use" or of immediate relevance to what anybody should choose to eat for breakfast. But it's part of the science journalist's job to tell the audience why something chosen to be reported as news is salient to their interests. For many readers, it's just a matter of personal interests such as hobbies. In some cases, the news may be relevant to their jobs, their habitat, their membership in particular groups, or diseases they have or have had (or that afflict friends or family). There are many ways in which a new scientific development can have salience for the audience, and the journalist should figure out what those ways are and articulate them.

Principle 8: Strive for Accessibility

Being understandable is the flip side to being accurate. For sure, being understandable is worthless if you're wrong. But being right isn't enough if you don't succeed in communicating it. It's very much a priority in science journalism to tell the story in a way that makes it accessible to anybody interested in reading it, regardless of any special background knowledge (or lack thereof) that such readers have.

A mistake commonly made be newspaper editors is insisting that the writing be accessible to *anybody*, no matter how uneducated or uninformed. I'm sorry, but that is not possible unless you want to give up on the idea of conveying any information at all. (I suspect newspaper circulation has declined so precipitously in part because editors want the stories to be written for people who can't even read.) Nevertheless, it *is* important to make stories readable, and there are a bunch of principles underlying readable writing that will be presented in detail in subsequent chapters.

To foreshadow, I'll just list a few points here without much comment. A good science writer will simplify the complexities of science, using short words (concrete rather than abstract ones) and short sentences (ideally containing no more than one idea each). Information will be imparted in plain English, using the vocabulary that readers already possess, with unfamiliar ideas related to familiar ones (cars, money, food, for example). Good science writing will evoke images through the use of analogies, metaphors and illustrations, and convey a clear, focused message, with perspective and context.

What's news

So much for the first principles. There is a second layer of the foundation to get out of the way before going on to the rest of my advice. And that is a quick discussion of what counts as news.

I have to admit that in this regard I have some qualms about listing (let alone enforcing) the standard rules. For now, I will lay out what the conventions of journalism define as news and how those conventions translate into science journalism. But I must warn you, the conventions are BAD. In fact, the standard way of doing science journalism

couldn't be better designed — if your goal is to make sure that most of what it reports is wrong. We'll get to the reasons for this in more detail soon. For the moment, try to keep in mind that how things are done isn't necessarily the way that things ought to be done.

In any case, the basic idea of defining news is pretty simple, at least the way I see it. News is new, interesting and important. Or perhaps at least two out of three. Ideally, a story would rate high on all three of those scales. But if something is really new, and very, very interesting, you might count at as news even if it's not really all that important. Or something new and extremely important might pass the test even if the details are a tad boring.

Of course, defining new, interesting and important isn't always without its ambiguities, either. But I'll try to tell you what I mean.

New

"New" ought to mean something that has never happened before, something happening for the very first time, some discovery of something previously unknown. On the other hand, there is a reason people go around saying there's nothing new under the sun. True newness is rare. So most of the time you're trying to figure out what aspect of a report is actually new.

Some journalists define "new" a little differently. It's "new" if it has never been *reported* before. So even if some new discovery was discussed at a conference months ago, it might be considered new when it appears in a journal today if no journalists wrote about it at the time of the conference.

Sometimes, a reporter comes across a topic that is interesting, and important, but that has been around for a while without getting much attention. In that case, you could just wait around and hope somebody publishes something new to give the topic a "news peg." Or you could manufacture a news peg — come up with some lame excuse

for putting a time element in the story to trick your editor into thinking this was something new. Perhaps an anniversary related to the topic is coming up. Or a congressional hearing. Whatever. Traditionally, news media editors really like a current time element.

(This is not entirely a bad thing. Without news pegs, science stories can easily lapse into a mode that makes them similar to encyclopedia articles. You really do need to tell readers why what you write is worth reading *now*.)

Important

This one is a little easier. Importance can be established in lots of ways. Often something is important simply because, in one way or another, it affects a lot of people. A surprising new finding about a disease that kills a gazillion people a year naturally qualifies as important. Another common measure of importance is money. If a new finding offers a way for people to get rich, or requires spending that will bankrupt an industry, or could lower the price of gasoline, then you've met the importance test.

Interesting

Interest gets generated in a wide range of ways, and all you really need is one. Some subjects are just intrinsically fascinating. Often a new research report comes as a surprise, and surprise typically equates with interest, especially when it's surprising because it contradicts previous belief. Stories about cute animals abound, even if the newness and importance don't rate so high, because people find cute animals interesting. Hot research fields (say, stem cells) are hot because they generate a lot of interest, so even trivial new results in such arenas get a lot of attention.

Scientists, Journalists, Right and Wrong

So, there remain two points to be made here.

First is, all science journalism isn't what regularly gets categorized as "news." There's also "features." For the most part, though, the three criteria for news also apply to validating science features. Feature stories come in many varieties: trend stories, follow-ups to news reports, features that find connections between different lines of research, explorations on the research frontiers, or investigative features that probe what goes on behind the headlines or identifies important issues that never make it into the news at all. While all these kinds of features require some differences in approach, the elements of new, interesting and important are all still usually present.

Second, as I alluded to earlier, these criteria drive science journalism in the direction of error. Obsession with newness — particularly, jumping to write about "firsts" in a field — has a problem, because "first" findings are the most likely to be wrong. Seeking the interesting "surprising" findings is similarly suspect, because findings that contradict previous belief are likely to be wrong. Being quick to cover new reports from the hottest research fields suffers the same problem, because results from the hottest fields are also among the most likely to be wrong.

Why is that? You'll have to skip ahead to the chapters on evaluating evidence to get the whole story. But the bottom line is that the reliable science, the most likely to be correct, comes in reports that replicate previous studies, that confirm beliefs established by earlier observations. Those reports are not new, not as interesting, and often apparently not as important as reports that fit the traditional news criteria. This is a serious problem that has not been adequately recognized by science journalists (or any journalists at all, for that matter). But let me say one thing clearly right now — inaccuracy about science in the media is not all the journalists' fault.

A few years back I addressed this in column meant to warn readers that accounts of science in the news are not exactly the sort of thing you should take to the bank. I picked out a few examples: *Human genome completed. Speed-of-light limit broken. North Pole melting. Cancer (almost) cured.* Newspaper stories had hinted, surmised or flat-out declared all of the above pronouncements. But in reality, I pointed out they were all headlines from the future. The human genome wasn't finished, cancer wasn't cured, and light still retains its world record in the 100-millimeter dash, and all other races.

Of course, it shouldn't be surprising that science stories are especially susceptible to inaccuracies, distortions, and out-and-out errors. Science is complicated, obscure and technical. Getting it right all the time requires powers possessed only by certain characters from DC Comics. The only journalist in that category who comes to mind is Clark Kent, and he usually sticks to covering crime. So however hard human science journalists try to get things right, they sometimes fail.

To a point, I am sympathetic with the scientists who criticize journalists for these failures. But some of those critics are not so sharp themselves. I was especially annoyed by comments from mathematician John Casti in his book titled *Paradigms Regained*, in which he castigated the media for jumping too uncritically onto rickety scientific bandwagons. He condemned media overkill in covering faulty science, starting with the cold fusion fiasco and going on to list other grievances.

"It's by now difficult to count the number of similar cases of mediazation of science in the last decade — life on Mars, the cloning of Dolly, Fermat's Last Theorem, all represent cases of the media jumping the gun before the science is even close to being settled," Casti commented.

Of course, he didn't really address why all these reports were so faulty, perhaps because the obvious answers would be to blame the scientists.

Attitudes like Casti's widen the gulf between the journalists who want to cover science well and the scientists who could help them. And his implication that the media should not report science until it's "settled" is silly. It would be as senseless as refusing to report on the World Series, just revealing the winner after all the games were over. Or banning all media coverage of political campaigns until the day after the election. (Well, that might not be such a bad idea.)

After all, scientists did claim they had produced cold fusion, and published a paper saying so. Scientists insisted they had found evidence of life on Mars, and experts have been arguing about that report ever since. It's not "settled" now, and may not be for years (although by now few other than the original researchers still believe it). The journalist's job is to tell people what scientists are doing and saying, not to relay only what ultimately will make it into textbooks. And some of the things that scientists do and say turn out to be wrong.

That's not to say journalists shouldn't do a better job of seasoning their stories with a dash of critical skepticism. In early 2000, all major media reported that the "rough draft" of the human genome — a catalog of the whole set of human genes — had been completed. But the government's rough draft really covered only 85 percent of the total; the private competitor in the genome race claimed 99 percent. Careful reporters included the "detail" that the draft wasn't really done. But all the coverage conveyed the general impression to the public that the book of life's last page had been sent to the press.

Similarly, misleading reports about the lack of North Pole ice and laser beams traveling faster than the speed of

light suffered because reporters swallowed what they were told without seeking adequate outside assessments.

In a very important sense, the foibles of science reporting merely mirror the practice of science itself. All reports by anyone about anything suffer inevitable inaccuracies in the process of observation and transmission through numerous filters, physical and psychological. Science's reports about nature get edited, revised and sometimes retracted, just as do media reports about science — or about crime, politics and even sports.

Nevertheless, journalists are supposed to provide their readers with reliable information, and it's not acceptable to say that science journalists can only report what scientists tell them. We need to be better.