

352 AUTHORS IN SEARCH OF A PAPER

A precision measurement of the mass of the top quark. Nature 429: 638-642, 2004.

- 352 authors
- ~6000 words
- ~18 words per author

And who was the senior author?

A good example of a multi-author paper – perhaps exceptionally so with 352 authors – and dealing with one of the major scientific issues in physics – the anticipated discovery of the Higgs boson. It is not almost certainly not intelligible to anyone outside the physics community, nor was it intended to be. Science has developed over the past century into a bewildering set of disciplines, sub-disciplines and sub-sub-disciplines (and perhaps sub-sub-sub....), each with its own arcane terminology. This is particularly true in the area of biology.

Scientists speak with their own language(s) that are not designed to be easily intelligible. By some standards scientists have become the “new priests” speaking in tongues and demanding that society tithe their support. Scientists who attempt to “popularize” science are often slighted by their colleagues. It does not have to be this way. Indeed, if it continues it will be to the detriment of science, mankind’s greatest intellectual achievement, and to society that will increasingly rely on science and technology to solve the current and impending problems of the 21st century.

**CLEAR AS A BELL OR CLEAR
AS MUD???????**

“There is no form of prose more difficult to understand and more tedious to read than the average scientific paper”, Francis Crick, Nobel Laureate.

The Astonishing Hypothesis, 1994

THE COP, THE STRIPPER AND THE HOLY TOAST

Or – the further adventure of a toasted cheese sandwich.....only in America!

This is the saga of one Diana Duyser of Hollywood, Florida who made a grilled cheese sandwich from two slices of Publix white bread and two slices of American cheese. She took one bite and then realized that the sandwich carried the image of the Virgin Mary. She kept the sandwich for 10 years and it was ultimately sold on e-bay for \$28,000 to a casino in Las Vegas

Jim DeFede, The Independent, www.independent.co.uk. December 16th 2004..

This is a headline to die for – if this is all one ever wrote in a lifetime it would guarantee something close to immortality.

The title of the article in the British newspaper The Independent was Jim DeFede “*The cop, the stripper and the Holy Toast*”. (www.independent.co.uk; www.rense.com/general60/holy.htm).

SCIENCE AND THE PUBLIC

GETTING THE MESSAGE OUTSIDE OF THE ACADEMIC BOX

David J. Trigg
SUNY Distinguished Professor
and
SUNY University Professor

The United States continues to show a remarkable lack of public and political understanding of science, the scientific method and the application of science to the problems of the 21st century. This is shown at the elementary school level where student performance in science and mathematics is below world standard, at the university level where science and engineering graduate programs depend heavily on the availability of foreign graduate and post-doctoral students, at the public level where Gallup and Newsweek polls show that a majority of the population do not believe in evolution (or believe that there are equally credible alternatives such as divine creation and intelligent design), and where an increasing number of school boards and political bodies advance policies and legislation that reduce or eliminate the presentation or discussion of evolution in high school science curricula.

The 21st century will pose a number of extremely serious challenges and policy decisions to be made including those around energy availability, climate change, gene-based technologies (foods, stem cells, cloning, diagnostics, enhancement etc), surveillance and privacy, intellectual property and knowledge privatization and economic and cultural globalization. Decisions in these areas will require a substantial public dialog. This course will explore the relationship between science and its applications to a set of contemporary problems and will examine how science policy is made and translated.

TEN SCIENCE-PUBLIC POLICY ISSUES FOR THE 21ST CENTURY

1. Global climate change
2. Energy demands and energy production
3. Asteroid impact
4. Environmental issues: water availability
5. Genetically-modified foods
6. Stem cells, cloning, gene therapy and the new medicine
7. Reproduction and population control
8. Intellectual property and the privatization of knowledge
9. Economics 101: Universal prosperity/universal poverty
10. Surveillance, privacy: the forthcoming totalitarian state

Session Essay. II Consider the above 10 issues. Are these the most important issues? What other issues would you consider to be of equal or greater importance? Which of the issues provided would you consider not to be important? Do you agree with the rank order provided?

Additional reading. You may find “*High Noon*” (not the Gary Cooper movie of the same title and a classic Hollywood movie of good and evil) by J.F. Richard of use (Basic Books, 2002, New York) of use and of interest. The subtitle is “20 Global Problems. 20 Years to Solve Them”. Another useful source is Lord May’s 2005 Anniversary Address to the Royal Society, entitled: “Threats to Tomorrow’s World”, available at www.royalsociety.ac.uk.

Carl Sagan....

“It is suicidal to create a society dependent on science and technology in which hardly anybody knows anything about science and technology”.

Quoted in Sejnowski, Science 301: 601, 2003.

Carl Sagan, a professor of astrophysics at Cornell University, was known both for his science and for his ability to communicate science to the public. His television series Cosmos was but one example of this ability. Comment briefly on the above quotation (you may wish to obtain the original article) and whether in your opinion it is more or less valid today than when it was originally written. If you are not familiar with Sagan’s work you may wish to research this. You should also ask the question as to whether his ability as a public communicator of science hindered or helped his reputation in the professional science community.

**Alien tells Bush
and Clinton:**

FIVE U.S. SENATORS ARE SPACE ALIENS!



Washington is reeling from a space alien's stunning allegation that five members of the U. S. Senate are extraterrestrials. Is he telling the truth? President Bush and Governor Clinton met with the creature for 90 historic minutes to discuss the situation on October 14 and all hell has been breaking loose since!

WHO ARE THEY?
Turn page for the full story and shocking Senate list

Perhaps you are surprised that so few US Senators are aliens. Taken from Weekly World News and reasonably typical of their content.

CHALLENGE #1

What conditions are necessary for a rational analysis, understanding and *communication* of science and technology issues?

Exercise Outline what these conditions might be

FRAMING SCIENCE

“Without misrepresenting scientific information on highly contested issues, scientists must learn to “frame” information to make it relevant to different audiences”.

“To engage diverse publics, scientists must focus on ways to make complex topics personally relevant”.

Nisbet and Mooney, Framing science. Science, 316: 56, 2007.

“Consider global climate change. With its successive assessment reports summarizing the scientific literature, the United Nation’s IGPPC has steadily increased its confidence that human-induced greenhouse gas emissions are causing global climate change. So if science alone drove public responses, we would expect increasing public confidence in the validity of the science, and decreasing political gridlock. Despite recent media attention, however, many surveys show major partisan differences on this issue.”

“Most Americans rank global warming as less important than over a dozen other issues. Much of this reflects the efforts of political operatives and some Republican leaders who have emphasized the frames of either “scientific uncertainty” or “unfair economic burden”. In a counter strategy, environmentalists and some Democrats have framed global warming as a “Pandora’s box” of catastrophe; this and news images of polar bears on shrinking ice floes and hurricane devastation have evoked charges of “alarmists” and further battles.

TWO AUTHORS AND ONE PAPER

Watson and Crick, Molecular structure of nucleic acids,
Nature 171: 737-738, 1953.

- ~1200 words
- ~600 words per author
- *“We wish to suggest a structure for DNA. This structure has novel features which are of considerable biological interest”.*
- *“It has not escaped our attention that the specific pairing we have postulated immediately suggests a possible copying material for the genetic material”.*

One of the most important scientific papers ever published – all in one page and with masterly clarity and understatement.



Exercise Define the differences between the scientific and popular definitions of “theory”.

MIND YOUR LANGUAGE

Scientists are culprits too:

- String theory and evolutionary theory
- Inflationary theory

Lawrence Krauss, Mind your language,
New Scientist Dec. 3, 2005.

A scientific theory is a logically coherent and predictive system that has been tested against experiment or observation. It explains observable phenomena and makes falsifiable predictions about them.

String theory is a broad set of mathematical concepts which have yet to be incorporated into a rigid theoretical structure that makes precise predictions unlike the electroweak theory which makes specific predictions about particle physics.. Nor does it make specific falsifiable assertions about observable phenomena, as evolutionary theory does in biology.

String theory is not the only culprit. Another example of the incorrect use of the term “theory” arises in cosmology, where scientists commonly speak of inflationary theory to describe the hypothesized growth of the universe soon after it began. Inflation is not so much a theory as a paradigm, a generally accepted perspective that is not associated with any particularly compelling mathematical model at this point.

THE ETHOS OF SCIENCE

The four principles:

- Universalism
- Communalism
- Disinterestedness
- Organized skepticism

Robert Merton, *Science and the social order*, 1938

Robert Merton defined the ethos of science as composed of four principles:

Universalism – whereby truth-claims in science are independent of the personal or social attributes of their protagonists (race, nationality, religion, class or personal qualities). From Pasteur, *“Le savant a une patrie, la science n’en a pas”*

Communalism – the products of science are assignable and assigned to the community and constitute a common heritage. *“A law or theory does not enter into the exclusive possession of the discoverer and heirs, nor do the mores bestow upon them special rights of use and disposition”*

Disinterestedness – considered to be a basic institutional element shared in common with other professions. The scientist should have no vested interest in the outcome or the conclusions of scientific work other to ensure that they represent the most accurate and honest representation of the work achieved.

Organized skepticism - Science asks questions of every fact, whether considered established or not. It is the constant challenge and testing of hypotheses and theories that advances science

From R. K. Merton, *Science and Technology in a Democratic Order*, J. Legal and Political Sociology, 1: 115-126, 1942. Chapter 20 in “On Social Structure and Science”, University of Chicago Press, 1996.

Exercise How well does Merton’s ethos of science correspond with your impressions of the contemporary practice of science.

And the Achilles heel, the chink in the armour, the weak spot, the Maginot line in the Ethos of Science is.....?

- Organized skepticism.....

Exercise: What do you understand by “skepticism”. What qualities should a skeptical scientist have?

MANUFACTURING “UNCERTAINTY”

Tobacco and disease.

“Doubt is our product since it is the best means of competing with the “body of fact” that exists on the minds of the general public. It is also the means of establishing a controversy”

Editorial policy for publishing in Tobacco and Health Research:

“The most important type of story is that which casts doubt on the cause-and-effect theory of disease and smoking”.

Brown and Williamson document 335506.

Tobacco Institute document 502051941-502051954. Oct 18, 1968

<http://tobaccodocuments.org.rjr>;

FURTHER READING

- J Knight, Clear as mud. Nature 423: 376-378, 2003.
- S. P. R. Rose, how to (or not to) communicate science. Biochemical Society Transactions, 31: 307, 2003.
- G. D. Gopen and J. A. Swan, The science of science writing, American Scientist, Nov/Dec, 1990. Freely available at: www.americanscientist.org.
- A protocol for science communication for the public understanding of science, www.ucl.ac.uk/sts/miller/sciencec.htm
- D. P. Hayes, The growing inaccessibility of science, Nature 356: 739-740, 1992.
- R. Ness, Writing science: the story's the thing. <http://sciencecareers.sciencemag.org>