Technical Writing

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Why do I need to write about my research?

So that other people will be able to use your information to improve the world.

What are the different kinds of technical writing?

- *Article* in a magazine or a newspaper
- *Paper* in a conference (local, regional, or international) or a journal (non-profit society or commercial publisher)
  · review ("update")
  · overview tutorial ("curiosity")
  · fundamentals tutorial ("career booster")
  · research
- *Technical Report* of a university or a research institution
- *Book*, monograph, treatise

What are the qualities of good technical writing?

- It is honest. The information is correct and not presented in a misleading manner. All the sources of information are cited and acknowledged.
- It serves a purpose. It can be used by others to improve a product or a process, or to do further research. Preferably, it does not duplicate information found elsewhere.
- It is presented well. It is structured and contains all necessary information. The grammar, spelling, and style are correct.
- It is refereed or peer-reviewed. An authority has certified that the work is honest, useful, and well presented.
- It is permanent. Its contents and location do not change with time.

Is it honest?

Does it refer to previous work? If not, then you imply that you are the first.

Does it refer to work by others? If not, then you imply that the work is unique and was done only by you.

Is the data reliable? Is the sample size large enough? Did you consider errors in measurement?

Does the conclusion follow the results?

(*Note*: "Is it honest?" is not the same as "Is it ethical?")

Similar Graphs Raised Suspicions on Bell Labs Research

New York Times (05/23/02) P. A23; Chang, Kenneth
http://www.nytimes.com/2002/05/23/technology/23PAPE.html

Lucent Technologies' Bell Labs has convened an independent panel to investigate the possibility that Bell Labs physicist Dr. J. Hendrik Schon may have doctored data in a number of research papers concerning molecular electronics. The panel will probe into five articles, but two of them are most prominent: One claims that researchers fashioned a transistor that featured an electronic switch with a thickness of one molecule, which was met with skepticism by other scientists; the other details another transistor with a single-molecule electronic switch. Princeton physics professor Dr. Lydia Sohn notes that "The data was just too perfect, and we knew something was wrong." The sticking point was that the papers—although published in different journals and involving different devices—featured graphs whose data was nearly identical. What is more, the graphs detailed patterns of noise that should be random, explains Dr. Sohn. The journal Nature published a correction in which the Lucent researchers admitted that they had misrepresented the molecular conductivity, but said the conclusions were still valid, while a similar correction will be published tomorrow in Science. However, scientists who tried to repeat the Lucent experiments have not been able to reproduce the results, which has engendered suspicions of misconduct, although that in itself is not a sign of misconduct.

Bell Labs' Saswato Das says the investigatory panel has been organized in order to review these concerns "fully, independently, and objectively."

Prominent Physicist Fired for Faking Data

Los Angeles Times (09/26/02) P. A1; Piller, Charles
http://www.latimes.com/news/science/la-sci-physicist26sep26.story

Reported discoveries of single-molecule transistors from Bell Labs have been discredited as a scientific panel found Dr. J. Hendrik Schon, who authored much of the work, to be guilty of fraud. Schon was found to have faked data 16 times in papers advancing the work of molecular electronics, but his colleagues were cleared of wrongdoing. Bell Labs fired Schon on Tuesday. The panel wrote that "this is a clear, unambiguous case of scientific misconduct," and accused Schon of either intentionally or recklessly distorting his work. Schon, in a statement issued with the panel's report, admitted making mistakes, but insisted "that the reported scientific effects are real, exciting, and worth working for." It is the first case of scientific misconduct at Bell Labs in the organization's 77-year history, but Malcolm Beasley, chairman of the review panel and a professor of applied physics at Stanford University, says the peer- review process for such work should be examined. Lucent says it will tighten its internal processes for reviewing manuscripts. Dr. Donald Kennedy, editor of the journal Science, which had published Schon's paper on single-molecule transistors, said the scientific peer-review process was not

designed to catch intentional data fraud, and Beasley noted the "the normal processes of science worked—they ferreted it out." Schon was working on ways to wire transistors to create miniature electronic devices by using a single layer of molecules, and his work would have been revolutionary if it had help up to scrutiny. However, scientists trying to reproduce his results could not do so. Still, in checking Schon's work, Thomas N. Theis, director of physical sciences at the IBM Watson Research Center, said scientists have been led "toward further possibilities" and "interest in the field continues to grow rapidly."

Berkeley Crew Unbags Element 118

Charles Seife, *Science* 2001 August 3; 293: 777-778

Physicists who thought they had created the most massive chemical element have retracted their claim ...

... researchers went back and reanalyzed their original data. "Those analyses showed that the chains reported are not there" ...

Is it presented well?

Does the title correctly describe the contribution of the paper?

Does the abstract correctly summarize the content of the paper?

Does it contain all the important information: an introduction, a justification of why the work is important, the methodology used, the results obtained, an analysis of the results, a comparison with other work, and a conclusion?

Does your target audience find it easy to understand but not condescending?

Does the bibliography contain complete information?

Words often used in titles of papers

analysis separation into components; list of parts; close examination; assessment

characterization a description of the character or nature of something

design create a detailed plan of; plan and make; intend for a use; invent

development adding details to a basic plan or idea; arising and then increasing or progressing to a more complex state

implementation a way something is put into effect or action

optimization the act of enhancing the effectiveness of something; the act of solving in the best way possible

synthesis combining of different elements into a whole

testing a trial run-through of a process or on equipment to find out if it works

A Scrutiny of the Abstract

Bad

Abstract: The behavior of editors is discussed. What should be covered by an abstract is considered. The importance of the abstract is described. Dictionary definitions of abstracts are quoted. At the conclusion a revised abstract is presented.

Good

Abstract: The abstract is of utmost importance, for it is read by 10 to 500 times more people than hear or read the entire article. It should not be a mere recital of the subject covered, replete with such expressions as "is discussed" and "is described." It should be a condensation of the essential qualities of the paper.

The tone should be professional.

Good

Testing of the fabricated chip showed that the actual performance was better than what was predicted in simulations. This may be due to the conservative settings used in the simulations.

Bad

The real chip was even faster than what the computer said it would be! We were so happy that the whole team spent a day off to celebrate.

In most cases, space is expensive.

Bad

You should always try to be ‘straight to the point.’ Do not use redundant or unnecessary words. Try to use as few words as possible without losing the original idea or meaning and without introducing vagueness.

Good

Your writing should be brief but clear.

Better

Be succinct.

Make sure you use words correctly.

use to put something into action or service

employ to make use of something such as a tool or a resource in a particular way

make use of to use what is readily available, especially in a sensible or economical way

utilize to find a practical or unintended use for something

Bibliography

[1] G. Blake and R. Bly, *The Elements of Technical Writing*. New York: Macmillan, 1993.

[2] S. Landes, "A Scrutiny of the Abstract," *Bull. As. Assn. Petrol. Geol.*, vol. 35, no. 7, 1951. Posted on `http://www.ece.utep.edu/courses/ee3329/ee3329/abstract.html`

[3] J. Noche, "Enhancing Engineering Education through Undergraduate Research Projects," presented during the *Philippine Association for Technological Education General Membership Meeting*, April 26-28, 2001.

Additional tips:

Include adviser's name in your paper as co-author.

As much as possible, don't use material that are unrefereed and not permanent (e.g., documents on the internet, especially lecture notes (changes in the URL, changes in version)).

All figures, tables, and references must be referred to in the text.