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Scientific Consensus

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Scientific Consensus

The phrase "Scientists agree that . . ." is ubiquitous in the popular press. Such statements are employed to sell pharmaceuticals, inspire conservation efforts, and alert the public about health emergencies. Only rarely are these politically or economically motivated statements entirely true, and even when scientists do agree, the assertion that "scientists agree" masks the considerable effort made to achieve agreement.

Still, scientists are motivated to achieve consensus. The concise definition, the identifiable single causal agent, and the elegant proof are the anticipated ends to frenzied, even messy searches or years of deliberate and tedious investigation. The excited conversation, the multiple theories, and the competition are expected to eventually subside, leaving the simple factlike statement—X is the cause of Y, or X *is* Y—distributed in textbooks and protected from unraveling by that hard coating of grammar. This grammar is ideally reserved for only those conclusions that have gone through the rituals of community agreement and demonstration. Or, at least, the community expects factlike statements to be what they seem to be—indications that the frenzied or tedious search has come to an end and a consensus has been achieved.

Yet just as agreement is the goal, disagreement is the catalyst of scientific progress. While every scientific discipline contains a set of core observations, procedures, and theories generally agreed to be accurate, useful, and true—the textbook knowledge of the discipline—no discipline would progress without disagreement. All good scientists hope to identify an unsolved problem, an undiscovered agent, a new disease, a new method that will disrupt and challenge consensus. And all good communication scholars examining agreement in science hope to identify the ways scientists convince each other that their challenge to the consensus, from the modest alteration to the heretical, is credible.

Theories About Scientific Consensus

Communication researchers, along with researchers from other science studies disciplines, study the social dimensions of science and reject the view, now considered naive, that science is a wholly objective, inductive process. The objectivist epistemology holds that consensus is a natural outgrowth of induction and technical resolution. If the fundamental method of science involves generalization from data, then shared data will necessarily induce a consensus among scientists who behave rationally. Yet the objectivist epistemology does not explain those moments in the history of science when scientists could cling to theories that have been deemed, in retrospect, incorrect.

Why, for example, did some scientists believe that women and people of color were less intelligent than Caucasian males on the basis of skull size? How could people who called themselves scientists believe humans to be divided into different species, with some whose members had white skin considered superior to other "species" of humans? These and other less egregiously mistaken theories demonstrate that scientists are, like all human beings, influenced by cultural preconceptions, political commitments, and the sway of language.

So if science is not completely objective, then how is scientific knowledge produced? One important explanation is that mature science is paradigmatic: That is, through shared practice and observation, a field develops a set of methods and explanatory theories that serve to identify and solve the problems that arise. Scientists in any field share a commitment to the paradigm as long as the methods and theories are reliable. But when an anomaly arises that cannot be studied or predicted by the tools of the paradigm, then new methods and theories must be developed, and the old paradigm eventually disintegrates.

Scientific "objectivity" can be thought of as a trained ability to recognize an anomaly that cannot be resolved within the current paradigm and either to develop new methods and theory that may resolve the anomaly or be willing to accept new methods and theories introduced by others. Yet, scientists may cling to consensus, even dogma, not because it is absolutely true, proven beyond a reasonable doubt, but because it is so deeply embedded in the culture and practice of their scientific community, as well as the entire broader culture. Galileo confronted his scientific peers as well as religious leaders when he insisted that Copernicus was correct—the sun was the center of our solar system, not the Earth. While not always as dramatic, some shifts in scientific consensus are almost as difficult to achieve due to the high degree of social, economic, and cultural investment behind any consensus.

Technical breakthroughs do resolve periods of disagreement and stasis. The development of polymerase chain reaction (PCR) to magnify the amount of DNA in a sample led to the possibility of greater certainty and agreement in forensic science. Yet, even in that case, the technical breakthrough resulted from a combination of social forces, including the social context in the laboratory, social negotiation among investigators, and the politics of grant funding. All these processes are guided by rules, some tacit, like the rules of politeness and respect, and some official, like the rules governing peer review of manuscripts and grant proposals.

Researchers invested in the social dimension of scientific consensus, including communications scholars, argue that it is misguided to think about justification as a process that goes on within individuals and is determined solely by their ability to remain objective and rational. But those who study the development of scientific consensus may disagree about how strong a force the social dimension of science is. Some argue that social processes can be objectively reliable means for genuine justification. Others have a more purely social constructionist view that all scientific knowledge is derived through social processes and that concepts such as objectivity and reliability are themselves social constructs.

Language and Scientific Consensus

Language use, even in science, is deeply social, deeply embedded in the cultural forces that participate in the production of knowledge. Scientific communication, whether the informal talk and e-mail exchanges between investigators or the formal written reports in journals, participates in the challenge to consensus and the resolution of disagreements. Informal discourse in the laboratory includes both talk and laboratory notes, constant and varied written observations of investigation and discovery. Some investigators have found that the recursive play of direct observation and the language used to describe observations in the laboratory helps shape and direct investigators' understanding of phenomena as well as their agreements about what they have found and its importance.

Formal written accounts of scientific investigation also participate in the challenge to and the shaping of scientific consensus. Those offering a new theory explaining an anomaly or a solution to a problem that threatens a widely accepted theory must follow the norms of scientific rhetoric that evolved over the last two centuries—a sort of macrolevel discursive paradigm identified by several scholars. Following those norms of arrangement, style, presentation, and attribution demonstrates their professional credibility. They must provide their evidence and argue for its significance while situating their contributions in the context of a credible research program. They must not convey a certainty that is not backed up by their evidence.

Because absolute proof is usually beyond the limits of any experiment, most claims based on the evidence in one report, even when added to a growing database, cannot be proved in any absolute sense. The purpose of rules that place such limits is to ensure that those making statements do not imply greater certitude than their evidence actually reveals. Discourse rules are intended to prevent misunderstandings.

Agreement Is Linguistically Traceable

Generally, the scientific literature of any scientific field is a record of that field's movement from conjecture to facts because that literature contains statements made according to the rules of scientific rhetoric. The more speculative statements contain the most hedging, as in, "X might be considered as a possible cause of Y." The more factlike statements contain less or no hedging.

Typically, the lead sentence in an introduction to an experimental report is factlike as it presents the consensus held by a field about the problem under discussion. The least factlike statements tend to appear in the discussion section as speculations about implications and future possibilities. For example, in the first reports of a mysterious immune deficiency—later called acquired immune deficiency syndrome (AIDS)—in young men who had previously been healthy, authors opened clinical papers with a statement of the general consensus surrounding factors leading to immune deficiency: organ rejection, cancer treatments, and malnutrition. These factlike statements were employed to establish the novelty and seriousness of the disease, as well as to confront the consensus about the causes of immune deficiency. More speculative statements about the possible causes and routes of infection were presented in the discussions.

Challenging Consensus

Even when laboratory evidence is substantial, authors whose claims threaten the orthodoxy can easily be ignored. Such was the case of the Pasteur Institute team, headed by Jean Luc Montagnier, who presented evidence that the virus they had isolated from AIDS patients was a newly discovered agent, unlike the virus that an American team at the National Cancer Institute, headed by Robert Gallo, had announced was the cause of AIDS in 1983. Most virologists around the world dismissed the French team's evidence because the French virus did not fit into the consensus. Yet, the Pasteur team was correct, and Montagnier was awarded the Nobel Prize in 2008, over 20 years after his laboratory's discovery of the cause of AIDS. The French team was abiding by the rules of conscientious rhetoric of science when they confronted a growing consensus by presenting their evidence that the virus causing AIDS was not a known virus. They did not overstate their findings and never stated their main claim in a factlike grammar.

Yet, the American team, headed by Robert Gallo at the National Cancer Institute, may have bent those rules. Understandably, pressure to identify the cause of AIDS was very high in the early 1980s. An aggressive rhetoric asserting the cause of AIDS was a type of cancer-causing virus that Gallo had discovered in the 1970s, coming from the prestigious Gallo laboratory at the National Cancer Institute, could have served the greater good if their claim had been correct. Even though he had isolated a virus from AIDS patients that resembled the cancer-causing virus he discovered, he was mistaken in claiming that the AIDS virus belonged in the same virus family as the one he discovered.

Unfortunately, Gallo's papers contain statements that bear the ring of certainty. Statements claiming the link between AIDS and the virus he discovered lack the hedging and qualifiers that would have signaled the uncertainties growing out of laboratory observations. Clear distinctions between the virus Gallo had discovered and the virus isolated from AIDS patients had been detected by several laboratories. The cancer-causing virus could easily be grown in cell culture because it caused cells to proliferate. The virus that the French team had discovered behaved more like what could be expected of an agent that kills human immune cells: In culture, it killed cells rather than proliferated them, and was thus difficult to culture. Even so, Gallo's bold, certain style attracted many believers, leading the Director of the National Institutes of Health to make a public announcement in 1984 that Gallo had discovered the cause of AIDS and inspiring ineffective clinical treatments based on a cancer model.

Challenging a Paradigm

At times, a challenge to consensus threatens an entire paradigm, the basic theoretical assumptions of an entire field. Scientists who suggest explanations and resolutions lying outside the mainstream consensus face a considerable rhetorical challenge. Such was the case of Stanley B. Prusiner, a neurologist and biochemist at the University of California in San Francisco who in 1982 boldly presented what was considered a heresy in the field of science examining infectious brain diseases in animals and humans. He proposed that the diseases were caused by an agent containing no nucleic acid, a claim that violated the central dogma of modern microbiology—that DNA was necessary for the replication or propagation of all life forms.

In proposing this new theory and thus opposing the mainstream consensus, Prusiner took a bold approach. In an armada of papers published in several journals in the early 1980s, Prusiner promoted his new ideas in a factlike style, asserting that a novel agent was the cause of the brain diseases in the titles and introductions, where one would expect to find a dutiful recounting of the standard viral theory. He also aggressively promoted a new terminology that bore his theory, eventually leading to a wholesale replacement of the traditional virological terminology in the field. Prusiner's theory of a disease agent containing no nucleic acid has still never been definitively established, yet the idea did shift the field from the viral paradigm to a protein paradigm, inviting protein biologists and geneticists to examine how protein structures and genetic mechanisms interact in the infectious neurological diseases.

Conclusion

If the previously discussed cases are any indication, scientific rhetoric participates with other social forces in the challenging and shaping of a scientific consensus or paradigm. On the question about whether consensus beliefs are the outcome of an objectively reliable belief formation process or whether they are a purely social construct, the scholar of communications and rhetoric of science would say that rhetorical processes are necessary in either case. What constitutes objective reliability, whether socially or empirically derived, is still conveyed through the resources of scientific rhetoric. Demonstrating methodological or theoretical reliability is never a matter of simply showing or demonstrating a given phenomenon, as in "seeing is believing." Scientists must choose from among the available resources of scientific language and rhetoric to demonstrate what constitutes the objectively reliable in their work.

Carol Reeves

See also Kuhn, Thomas; Rhetoric of Science; Scientific Method; Uncertainty in Science Communication

Further Readings

Gross, A. G., Harmon, J. E., & Reidy, M. S. (2002). *Communicating science: The scientific article from the 17th century to the present.* Oxford, UK: Oxford University Press.

Kitcher, P. (2003). *Science, truth and democracy.* Oxford, UK: Oxford University Press.

Lakatos, I., Worrall, J., & Currie, G. (Eds.). (1980). *The methodology of scientific research programmes: Vol. 1. Philosophical papers.* Cambridge, UK: Cambridge University Press.

Latour, B., & Woolgar, S. (1986). *Laboratory life.* Princeton, NJ: Princeton University Press.

Longino, H. (1990). *Science as social knowledge.* Princeton, NJ: Princeton University Press.

Reeves, C. (1998). Rhetoric and the AIDS virus hunt. *Quarterly Journal of Speech, 84*(11), 1–22.

Reeves, C. (2002). An orthodox heresy: Scientific rhetoric and the science of prions. *Science Communication, 24*(1), 98–122.

Reeves, C. (2005). *The language of science.* New York: Routledge.