*Science, Mass Media, and the Public**

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SCIENCE, PERHAPS AS MUCH as any other popular topic, has been a source of fascination, faith, and frustration in the mass media for the past three decades. We seldom seem to waver from the belief that science holds the key to the mysteries of the universe and the solution to man's greatest problems. At least, our mass media reports and portrayals of science and research have buttressed these beliefs, however skeptical the writers and their quoted sources may have been.

Science reporting today, however, may be starting to undergo some basic changes, partly because of audience reactions which journalists have learned about, partly because of convictions of some writers that changes are needed, and partly because of the growing involvement of science and technology in pressing social problems.

Science and Social Issues

Science today is clearly dominating more space in our print media and more time on broadcast stations. Along with this increased attention, science is being treated more as a public affairs issue than ever before. Science reporting is no less "practical" today than in the past; if anything, science writers probably perceive increased pressure to relate science to everyday problems of people and their institutions. The principal change is that science reporting is no longer confined to reporting of findings and discoveries alone. Mass media increasingly are dealing with questions about who gets research funds, what problems

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will be studied, and whether scientists should take part in public decisions about application of scientific findings and technology.

Many of us remember well the Flash Gordon and Buck Rogers approach to science reporting of the 1930's and 1940's. It may seem curious that so much mass media science content in those days portrayed science as sort of a madcap fantasy, yet predicted, quite well, technological achievements which have since been realized. Whether this early popularized science was more deterministic than prophetic is an interesting historical question, but the important point is that it reflected a monumental attachment to the wonders of research and technology in Western Civilization. There was fascination with the idea of controlling major diseases, splitting the atom, deciphering the genetic code, exploring outer space, and understanding human behavior.

Today it may appear at times that some of our sheer fascination with the dazzling achievements of science has worn off. At least, certain topics have lost much of their former appeal. It appears from opinion polls that the moon landing was opposed, either passively or actively, by a noticeable portion of the population and that a majority felt that too much money was being spent on the project—even before men first set foot on lunar soil in July 1969. Early support for the race to the moon may well have been based more on a national competitive spirit than on an interest in science as such. When Premier Khrushchev pulled Russia out of the race, public support for the U.S. space program waned.

It is important to keep in mind that while interest in specific science projects may have declined, Americans seem to have maintained their boundless faith in the technologic ethic, as it has been called. When asked about the major achievements of science, polled respondents have regularly cited technology and improvement of the standard of living above everything else. In a recent study in northern Minnesota, respondents were presented with this item:

> "Technology got us into the environmental crisis, and technology will get us out."

Eighty-three per cent agreed *(1)*. If there is concern about the side effects of science today, it may well be described as a confident concern.

Popular support for science has never been based on a worship of science and intellectualism in isolation, but on the expectation that scientific research would lead to practical solutions of what seemed to be the pressing problems. Mass media writers have repeatedly reflected this popular reaction by selecting those findings and scientific reporters that seem to bear on specific and widely-recognized human problems. A major difference today may be that nonscientists are no longer willing to let scientists, by themselves, decide what problems ought to be studied.

Descriptive, Consensus Reporting

During the 1950's, particularly, we witnessed a period of what may be termed descriptive, consensus reporting of science and technology. In some areas such as agriculture, the period has been perhaps even longer. Agricultural press services have been feeding research findings from the USDA and state university experiment stations to the public for well over a half century. Many a county agent today would look with envy on the heavy use of agricultural research articles in rural newspapers of the Midwest even before World War I and the passing of the Smith-Lever Act itself. General and specialized farm publications have, of course, been heavily saturated with research content for a similar time period.

Agricultural and medical research reporting have shared at least two important similarities, particularly in the immediate decade or two after the war. First, both subject areas are often reported on a fairly descriptive, one-research-project-at-a-time basis. This practice may stem partly from the tendency in college information offices to base science releases on convention papers and journal articles; other reasons may include a reluctance to confront disagreements among scientists at the same institution working in similar areas. In any case, newspapers and magazines are ordinarily obliged to accept this pattern of reporting or do their own integrative, interpretive writing. Secondly, there has been a strong consensus flavor to both medical and agricultural reporting. By and large, readers of agricultural and medical research in the 1940s and 1950's were led to think that each particular finding was accepted by the scientific community as a whole. It has been a rare science feature article that reflected the doubts, differences, and debates among different researchers.

Consensus vs. Conflict in Science

Social conflict over fluoridation and cigarette smoking in the 1950's should have tipped us off to the possibility that some fundamental cleavages may exist among research experts and between the scientific community and other interest groups and social institutions. Yet, the smoking-cancer issue apparently was not taken seriously by either the mass media or the public until the early 1960's. It was easy to pass off the fluoridation debate as merely an attack on reputable scientific authority by extremists. However, the pesticide issue raised by the book *Silent Spring* in the early 1960's warned writers and the public that science can lead to genuine social conflict in various ways. This book questioned the role of the individual scientist and research organizations in supplying research data without warning society about the possible side effects of the resultant technology. It also illustrated the fact that established researchers in the same disciplines can disagree sharply over interpretation of scientific findings themselves.

In many ways, *Silent Spring* signalled the beginning of a new trend in mass media coverage of science and technological issues. The kinds of issues raised there are now appearing more frequently in news, feature, and editorial columns. We may be witnessing the development of a period when science may be subjected to critical writing much as other areas of social endeavor, such as arts and politics, have been covered. The future seems to promise increased reporting of science-related activity in terms of its various conflict dimensions. We can expect critical, interpretive writing to concentrate on aspects of science which only rarely were held up for public observation in the past. This reporting will deal with science as a social subsystem and the part it plays in collective, public decision-making. It will deal with the role of scientist as an individual in public issues and conflicts. It will deal more intensely with the varying interpretations which different scientists may apply to specific findings and data, particularly as interpretation relates to pressing public decisions.

Research on Science Writing

We have witnessed in the past 20 years not only an increase in science writing, but an increased amount of research on the communication process itself. This research has taken several forms, and it is well to examine the principal results from different approaches to gain some insights into the future of science writing.

One of the more inclusive traditions in the study of communication has been diffusion research, which has produced a great deal of insight into the manner by which farmers, for example, use various information sources at successive stages in the decision process *(2)*. One point about interpretation of these studies is especially important for understanding when and how media information figures in the technological decisions made by people. In several of these studies, farmers were asked to rank sources of information according to their relative importance at each stage. From the findings, it has generally appeared that farmers rank media highest at the **awareness** stage, and personal sources highest at the final adoption (or rejection) stage. This, however, is only part of the story and it would be incorrect to conclude that the function of mass media in agricultural decision-making is merely to increase awareness. When **total use** of information sources is measured, the usual finding is that farmers, along with most people on most decisions, use mass media more at the point of adoption than at any other time *(3)*. But when the crucial point of decision comes, a person is engaging in so much communication behavior, mass media included, that he rates mass media low. This high level of communicative behavior often continues long after adoption. Farm magazine editors know full well that the person most likely to read an article about a new feed handling system is one who recently installed such a system. Car advertisers know that people often read new car advertisements long after buying one. There is ample evidence, then, that mass media content about science and technology may be used, and used heavily, before, during, and after an adoption decision. There may be several reasons. Mass media content may help legitimize a decision for a person who has been in a personal conflict state. Media content may have utility. Or it may be merely familiar and interesting. The point is that decisions take place in a pluralistic environment of information and communication. Modern man often seeks a high level of information inputs when he has to make up his mind about something. A given source may not be decisive, but it may be part of a configuration of information items which shape the way the decision is made, and the way it is rationalized and maintained by the person.

General Population Factors

General population surveys have provided a variety of insights into audience interest in science, and use of mass media content about it. From these studies, conducted nationally and in various states and communities, several conclusions seem warranted.

1. *Compared with public affairs news in general, there is exceptionally high public interest in health, medicine, nutrition, and most other topics relating to everyday welfare.* Medicine and health, moreover, represents a large area in which women consistently learn more from the media than men—even with education held constant. Furthermore, medicine and health is a case in which familiarity and knowledge is often as high among persons whose education stopped at high school as among persons with college training *(4)*. High use by media of medical and nutritional information reflects editorial appreciation of this interest.

2. *In most areas of science – medicine and health partially excepted – public use of science content in the media is highly correlated with socioeconomic status.* This pattern has some far-reaching consequences. One outcome of heavy publicity about a science topic is creation of an ever-widening knowledge gap between social status groups. That is, the difference in knowledge between persons at higher and lower status levels tends to **increase** as a topic is heavily publicized *(5)*. Space research is one example. In 1950, there was virtually no difference across status levels in belief that man would eventually reach the moon. Such belief was low no matter what one's status happened to be then. As time wore on and space research received increasing publicity, a gap developed between high and low education groups, as highly educated persons accepted the belief at a more rapid rate. The gap continued to widen, at least until 1965 when the last such question was asked in a national poll. This pattern leaves us wondering about how **mass** the media really are on this sort of topic. It's still an open question whether television programs can help reduce this knowledge gap.

3. *Strong attitudes and high knowledge of mass media science*

content tend to go together. In a frequently-quoted national survey done in 1957 for the NASW, persons were asked several questions about how favorable they were to science. Those with favorable attitudes tended to be persons who had learned more science from the media, but that difference was often slight *(6)*. A much sharper difference appeared between persons who had any attitude (favorable or otherwise) and those who had none at all. In several community studies in Minnesota recently, we asked individuals to read various science articles and then state their recall and understanding. The findings have marked implications for the view that science reporting of the future will deal more heavily with social conflict. We found no marked tendency for persons with strong attitudes to understand these articles less. In one case—a controversy over a nuclear generating plant—persons with strong attitudes, both for and against the plant, clearly understood news articles about the issue better than persons who hadn't made up their minds yet *(7)*. The implication is that, contrary to some views, learning about science in the media sometimes actually **increases** when there is a controversy. The "touchy" issues of social conflict are often the ones that interest people, and science and technology is no exception. It seems quite likely that recent public debate over nutritional value of breakfast cereal may have stimulated interest to the point where a favorable climate was created for learning about nutritional research. A trend toward more conflict reporting in science, then, may occur at least partly as a reaction to audience interest.

Content Factors

One of the most pervasive conclusions about science writing is that, for understandability, it should contain a minimum of polysyllabic words and a minimal number of words per sentence *(8)*. It may seem curious, given the common sense nature of this statement and its frequency in research literature, that science writers often ignore it. But it may turn out that there is good reason to question the simplistic notion that simpler writing makes for better communication of scientific results. Most of the readability studies have been done in laboratory or classroom situations with written materials varying widely in format and style. In recent Minnesota field studies, we compared audience understanding of various science and environmental news articles. We repeatedly found little or no relationship between Flesch readability scores and understanding of content.

When we further examined content, however, we noticed some patterns which may help shed some new light on the problem of communicating scientific language and terminology.

1. *Sheer number of scientific terms in a news article seemed to bear little relationship to understanding.* That is, in general, articles with few or no technical concepts were understood no better (nor worse) than articles that contained several. However, it seemed quite clear that writers who took the trouble to explain scientific terms were rewarded by higher audience understanding *(9)*. The news article containing a higher number of scientific terms accompanied by explanations seemed to get more meaning across to readers than articles that contained only a few unexplained concepts or none at all. A word of qualification: Articles in these surveys were taken directly from newspapers, as written by reporters. None contained as much technical jargon as might be found in, say, a technical journal.

2. *New scientific terms may be introduced into language quite readily if they are used repeatedly and if each term is given a more or less singular meaning.* In this sense, a term which is brand new to a person may have an advantage over one that sounds familiar but evokes several conflicting meanings. Take space age terms such as lunar module, orbital capsule, missile trajectory, and supersonic transport. Or medical and nutritional terms, such as organ rejection, cardiac arrest, poly-unsaturated fats, and caloric content. Or compare writing about lunar modules on the one hand, and educational modules on the other. It may be that social science concepts require **more** explanation than terms in the physical world, precisely because of the fact that they have an initial ring of familiarity and evoke competing meanings which may interfere with communication.

3. *We may fail to appreciate the ability of numbers – data, if you will – to communicate meaning.* While some experiments have been done on graphic ways of presenting research data, the underlying assumption often seems to be that numbers comprise a necessary evil in science communication. Yet, to a great extent, that assumption may be incorrect. In several Minnesota studies already mentioned, a frequent finding is that people quite readily read and recall numbers—sometimes more readily

than any other single component in the message. Perhaps this shouldn't be surprising. We live, after all, in a data-oriented society; witness our attachment to numbers and our daily use of them. Prices, acreages, crop yields, automobile specifications, clothing sizes, flight schedules, football scores and records, weather reports, stock market quotations—we are immersed in data continually. Members of a quantitatively-minded culture might well be expected to seize upon numerical units wherever they appear—if, of course, these numbers refer to units which themselves can be given some fairly unambiguous meaning.

We reasoned that, up to a point, understanding ought to improve as science news articles contain more numbers. In general, this expectation has been supported, and the relationship is curvilinear *(10)*. There is a point at which massive use of numbers seems to lead to "jamming," and the jamming point seems to vary with the topic. A very worthwhile area for further study and evaluation is the way people respond to different forms of data presentation. Science writers have been reluctant to include data tables. But considering the free use of statistics in sports and business reporting, it may be that an effective communicative device for science reporting is being overlooked.

Reporters, Scientists, and Editors — The System

One of the traditional attractions of journalism, reporting especially, is the opportunity it supposedly provides to exercise individuality and self-initiative. Given the systems within which science writers operate, however, it may be questionable whether such individuality and self-initiative is being exercised in a way that leads to better public understanding of science.

One of the Minnesota studies involved an extensive investigation of the process by which 73 different, locally-written science news and feature articles in metropolitan newspapers were put together by reporters varying in background and experience *(11)*. The articles had been shown to respondents in a survey who read them and stated, as best they could, their recall of article content. Audience statements were then extracted and shown to the scientist-sources who were asked to judge their accuracy. The per cent of audience statements about an article which were judged as generally accurate by the source then provided a measure of understandability of each article, Table 1.

Table 1. Communication Accuracy: Per Cent of Audience Statements Judged as "Accurate" by Scientists Quoted in the Articles

Per cent of statements	Per cent of articles (N = 73)
Over 91 per cent	7
81-90 per cent	7
71-80 per cent	25
61-70 per cent	23
51-60 per cent	18
41-50 per cent	13
Under 40 per cent	7
Total	100

Mean = 64.52 per cent

With this performance criterion, it was possible to look at the process of science reporting from an elementary systems perspective. A basic question was this: Would understandability be more highly related to system **energy** (enthusiasm and motivation) or would it be more closely tied to system **control** factors (such as news policies and supervision)?

In this particular study, it appeared that system **control** was often decisive in predicting understandability of what reporters wrote. For example, articles assigned by editors, and those based on press releases, were both well above average in understandability. In contrast, articles undertaken by reporters on their own self-initiative were about average, and those based on coverage of public meetings were sharply below average, Table 2.

The press release is a case of high control; releases tend to get heavy review before distribution to mass media. Editor assignment may well be both a motivational **and** a control factor. Given the superior-subordinate relationship in most news rooms, it may not be surprising that on these particular news articles, reporters often turned out their best efforts when the editorial chief told them what to do. Furthermore, articles quoting ad-

Table 2. Manner of Initiation of Science News Articles and Communication Accuracy

Method of initiation	Number of cases	Average communication accuracy score
Reporter saw press release or journal article	12	71.66
Reporter learned about topic at public meeting	21	55.62
Reporter originated article on own initiative	25	63.32
Editor assigned reporter to do the article	15	73.20

ministrators were higher on understandability than those quoting teacher-researchers.

Personal contact between reporters and scientists was related to understandability, but only up to a point. That is, articles written after a telephone or single face-to-face interview were well above those based on no personal contact at all, other than notes taken during a talk. But there seemed to be a point of diminishing returns here. In a few cases where scientist and writer had frequent, and long, telephone **and** face-to-face meetings, performance seemed to drop off, Table 3. There seemed to be several reasons; in some cases the repeated contacts were a sign that the reporter was having great difficulty getting the story straight. In other cases an irritation factor may have set in.

TABLE 3. REPORTER-SCIENTIST CONTACT AND COMMUNICATION ACCURACY OF SCIENCE NEWS ARTICLES

Extent of contact	Number of cases	Average communication accuracy score
No contact	11	62.7
Telephone only	17	67.0
One face-to-face	25	63.0
Two or more face-to-face	9	72.0
Two or more telephone plus face-to-face	11	59.63

While inexperienced reporters often showed considerable apprehension about interviewing scientists, they nevertheless tended to perform as well as the more experienced science writers, according to the criterion in this study. Underlying their apprehension is a fundamental status problem between scientist and writer which may raise a massive barrier to interaction on a genuinely professional basis. This status gap was apparent in several ways. For one thing, scientists tended to downgrade the value of journalist occupations, contrasted with medicine and engineering. For another, scientists tended to attribute to reporters a low regard for accuracy in reporting and a disproportionately high regard for "reader interest." Scientists and reporters were asked to rank five criteria for evaluating news stories —accuracy, interest to readers, usefulness to readers, prompt publication, and uniqueness. Also, scientists were asked how they thought reporters would rank these values. Results were similar to those from other studies; scientists rated accuracy No. 1 and generally expected reporters to rate accuracy lower. The reporters own ratings, however, were virtually identical to those

TABLE 4. SCIENTISTS' GENERAL AND SPECIFIC ATTITUDES TOWARD SCIENCE NEWS AND REPORTERS

Attitude	Per cent reporting
Toward science news	
Rate science news in **general** as "generally accurate"	58.9
Rate an article **quoting the scientist** as "generally accurate"	94.5
Toward reporters	
"Very willing" to help "other" reporters in the future	49.3
"Very willing" to help the reporter, who recently quoted the scientist, in the future	63.0

which the scientists gave for themselves. Accuracy was as important in reporter rankings as it was for the scientist.

Scientists' evaluation of science writing is characterized by general criticism and specific praise. Nearly half of the scientists interviewed were highly critical of mass media science reporting as a whole. More than a third of the scientists simply labelled mass media science as "generally inaccurate." But when asked about articles in which they themselves had been quoted, all except two of the 73 scientists judged the articles generally accurate. And in spite of what was often a cautious opening session with the reporter, the scientists ended up in all but three cases as perfectly willing to work with the same reporter in the future, Table 4.

It seems that when a reporter approaches a scientist he hasn't met before, there is an immediate distrust and tension barrier to overcome and the reporter is well aware of it. But the barrier can be overcome and frequently is, as this study demonstrates. What seemed to impress the research specialists most was the ability of reporters to listen, take notes, and ask questions. Specific knowledge of the field being covered was **not** much of a factor in gaining scientist cooperation—at least not in this study.

This wary regard in which reporters hold science, however, would seem to be a principal reason for the continued tendency among many writers to content themselves with descriptive, consensus reporting. While this study was deliberately restricted to locally-written articles quoting a single source, our scanning for content over a three-month period revealed few articles that quoted several different research specialists. The article quoting different scientists who disagree on a topic was almost nonexistent in these metropolitan newspapers.

Yet, if science reporting is to maximize reader interest and provide realistic inputs for public and private decision-making, it may be necessary to move away from the traditional assumption that science produces consensus. There are already some indications that science reporting of the future will reflect more of the debates within science. In fact, as science becomes more of a truly public activity, these debates would be expected to become more widely known as a matter of course. In many cases there will be some surprise and shock registered with the realization that recognized authorities interpret the same data in quite different, and often irreconcilable, ways. A federal judge recently observed this adversary relationship in court proceedings over whether a mining firm should be allowed to discharge taconite tailings into Lake Superior.

Adversary relationships among scientists may well become common public knowledge as research specialists become involved in more and more public and private decisions. It may be that an important generalization from agricultural diffusion research applies to mass distribution of science information in a wide range of media. The generalization is that scientific information from mass media provides inputs for final decisions, but not determinants. Scientific information may affect the decision, but it is not necessarily decisive. Our historical practice of reporting scientific findings as if they reflect both consensus of the scientific community and prescriptions for action may be both difficult to accomplish and unrealistic as major issues arise.

Writers have, perhaps understandably, feared the loss of scientists as news sources through reporting of controversies in science. Yet, writers may also do well to remember that much of the motivation to report science today comes from the research community itself. A rising level of professionalism in science writing could reduce much of the journalistic apprehension based on status differences. Whether such levels of professionalism in fact increase may depend both upon training of writers themselves, and on willingness of media and information organizations to accommodate and reward writers on a basis that makes them professionally comparable to research scientists.

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