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AUTHOR Friedman, Sharon M.
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ABSTRACT

Explaining complex scientific and environmental subjects in the mass media is difficult to do, particularly under such constraints as short deadlines and lack of space or time. When a scientific controversy and human health risk are involved, this becomes an even harder task to accomplish. The subject of electromagnetic fields (EMF) involves complex scientific concepts, disagreement among experts, and potential human health risks, particularly for children. Unfortunately, much of the heavy media coverage in the United States about EMF during 1993 was sensational, contributing to public fears over the issue. Such fears, however, are not as yet supported by scientific evidence. Three science writers did provide in-depth explanations of the problems with the science of EMF and the Swedish studies that apparently indicated an association between EMF and childhood leukemia. More in-depth explanation is needed in the United States media and elsewhere. Those who teach science writing and other forms of journalism must make sure that they do not lose the forest for the trees--that in teaching students how to explain the small things, they neglect to teach them how to explain the big ones. (Contains 29 notes and 1 table of data). (RS)

EXPLANATIONS, EDUCATION AND ELECTROMAGNETIC FIELDS

Sharon M. Friedman

Department of Journalism and Communication

Lehigh University

Bethlehem, PA, USA 18015

Presented at the Session on
"Communicating Complex Science:
State-of-the-Art Perspectives from
Practitioners, Educators and Researchers"

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ABSTRACT

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Sharon M. Friedman
Iacocca Professor and Chairperson
Department of Journalism and Communication
Lehigh University, Bethlehem, PA USA 18015

Explaining complex scientific and environmental subjects in the mass media is difficult to do, particularly under such constraints as short deadlines and lack of space or airtime. When a scientific controversy and human health risk are involved, this becomes an even harder task to accomplish.

The subject of electromagnetic fields (EMF) involves complex scientific concepts, disagreement among experts and potential human health risks, particularly for children. Its policy and economic implications are numerous and could affect not only the utility industry but also citizens themselves by determining the availability and cost of electricity in the future.

In reporting about a ubiquitous risk such as EMF, which can arise from household appliances as well as high-voltage power lines, journalists must be especially sensitive to avoid scaring readers and viewers when they write their stories. Unfortunately, much of the heavy U.S. media coverage about EMF during 1993 was sensational, contributing to public fears over the issue. Such fears, however, are not as yet supported by scientific evidence.

This paper reviews some good and bad examples of EMF media coverage, concentrating on "in-depth explanation," that is explanation about the entire issue including the scientific, statistical, political and economic factors. It looks at various tools reporters used successfully and not so successfully to help explain the EMF controversy. It also suggests several ways journalism and communication educators can help students learn to write in-depth explanations that can help objectively educate audiences about important environmental risks.

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Sharon M. Friedman
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Introduction

Explaining complex scientific and environmental subjects in the mass media is difficult to do, particularly under such constraints as short deadlines and lack of space or airtime. When a scientific controversy and human health risks are involved, this becomes an even harder task. Yet, explanations that can help an audience become more educated about environmental risks are vital so people can make policy decisions based on facts and not emotion.

Providing explanations for issues dealing with risks involves not only explaining the scientific details--although that is critically important. It also involves explaining the larger picture that includes statistical information, political and economic consequences or rewards, and the murky field of relative risk. This larger form of explanation is not new, but is growing in importance as shown by the Pulitzer Prize for explanatory

writing. For ease of discussion in this paper, the larger form of explanation will be called in-depth explanation.

To explore the need for and current situation with in-depth explanation related to environmental risks, a case study will be examined--U.S. media coverage of electromagnetic fields (EMF). However, before looking at this specific situation, it is important to briefly examine why in-depth explanation is important based on the influence of media risk coverage on public perceptions.

The Mass Media and Public Perceptions of Risk

The mass media are one of the major ways that the public learns about environmental risks and about science and technology in general. According to sociologist Dorothy Nelkin: "Journalists are...brokers framing social reality and shaping the public consciousness about science. Through their style of presentation, they lay the foundation for public attitudes and actions" (1).

There is no question that the mass media find risk events newsworthy and the way they report about them sets the tone for how the public responds to the issue. Johnson and Tversky showed that people increased their estimates of being harmed by risks by reading about them (2). Findings consistent with those by Johnson and Tversky came from a study of an individual's perceptions of the risk of AIDS by Dunwoody and Neuwirth, where they found that exposure to media messages about AIDS led to increased estimates of the likelihood of contracting the AIDS virus (3).

Media coverage also amplifies risks in the public's mind.

Slovic, Fischhoff and Lichtenstein found that events considered by laypersons to be more frequent or more serious than by experts (aircraft collisions, tornadoes), often received substantial coverage; others considered more safe (asthma or falls) are less sensational and therefore often remained unreported (4).

Kasperson, Renn and Slovic noted that repeated stories in the media direct public attention to "particular risk problems and away from competing sources of attention. Moreover, the media tend to become the battleground where various participants vie for advantage. However balanced the coverage, it is unclear that reassuring claims can effectively counter the effects of fear-arousing messages." They also note that "high volumes of information also mobilize latent fears about a particular risk...." They believe, as do others, that debates among experts tend to heighten public uncertainty, decrease the credibility of official spokespersons and increase concern about the risks already feared (5).

The Public and Electromagnetic Fields

Given this evidence of the media's impact on the public's risk perceptions, it is no wonder that many Americans appear to be scared to death about EMF. A barrage of negative coverage, which occurred in late 1992 and early 1993 in the U.S. media, not only alerted people to the possible dangers of EMF, but also seemed to convince many of them that the dangers were far more severe than most scientists believed.

Public awareness of EMF was shown at an all-time high of 63% in February 1993, compared to 45% in 1992 and 41% in 1991 by a

Cambridge public opinion survey (6). The public's concern was demonstrated in a write-in poll done by *USA Weekend* in January in 1993 in which 35% of the more than 4,500 people returning their polls said that EMF should be this nation's top environmental health priority (7).

The major factor driving people's concern about EMF was mass media coverage, which was heavy early in 1993. There was television coverage on "Street Stories," "Larry King Live," "Good Morning America" and on both national and local newscasts. Numbers of articles in the major newspapers across the nation increased considerably. A search of the Nexis database showed 400 articles that included the term "electromagnetic fields" in major newspapers in 1993, compared to 185 in 1992. An average of 33 articles a month appeared in 1993, with articles in February, March, May and August totaling 40 or more.

The 1993 coverage figures were even larger when smaller newspapers were included--548 articles versus 233 in 1992. There also were 216 magazine stories in 1993 compared to 101 in 1992. The story did not die in 1994 either with 151 articles mentioning EMF in major newspapers from January through June 4, 202 in all newspapers, and 73 in magazines (see Table 1).

The primary subjects of the 1993 coverage were follow-ups to the announcement of two Swedish studies that showed an association between childhood leukemia and exposure to EMF, which will be discussed in detail below; the controversy over whether cellular phones caused cancer; lawsuits against utilities for causing cancer in children; and EMF exposure in and near schools.

TABLE 1

A Nexis Database Search on Articles Including The Term "Electromagnetic Fields"

Year	Number of Articles
Major Newspapers	
1990	128
1991	220
1992	185
1993	400
1994 (until 6/4/94)	151
All Newspapers	
1990	182
1991	283
1992	233
1993	548
1994 (Until 6/4/94)	202
Magazines	
1990	87
1991	117
1992	101
1993	216
1994 (Until 6/4/94)	73

Hollywood even took notice of the EMF controversy and included it as a central part of the Eddie Murphy movie "The Distinguished Gentleman," as the cause of a youngster's cancer. In another movie, "Honey I Blew Up the Kid," the giant child got bigger whenever he passed near power lines--suggesting that the lines had significant biological effects.

Hollywood was not the only source of sensational tales; much of the media coverage was sensational too. The January 28 edition of "Street Stories" started out with Ed Bradley, the host, reporting that "...around the world, communities are facing a chilling possibility: that a power that has improved life could also destroy it" (8). The story itself begins--like another CBS piece did about the accident at Three Mile Island--with a litany of people suffering from cancer. Their plight is quickly linked to exposure to EMF.

Television, however, was not alone in its sensational coverage of EMF. A cover story in *USA Today* led with this paragraph: "For the first two years of Mallory Zuidema's young life, her parents say, a silent menace hovered overhead, turning their home into 'a microwave on slow cook' and giving their child kidney cancer" (9). The January 1-3, 1993 edition of *USA Weekend* asked on its cover, "Is My Electric Blanket Killing Me?" (10)

This deluge of coverage sent people running to call their local electric utilities. A utility in the eastern United States had twice as many EMF inquiries in the first two and one-half months of 1993--about 500--than in all of 1992. One in California received 2,000 customer EMF inquiries during March 1993, with about 60% requesting EMF measurements be done in homes (11).

Despite all of this fear, scientific studies do not appear to justify it. One of the reasons the public does not understand this is due to the way reporters have explained the issue, particularly relating to findings from the various scientific studies. These studies were indeed complicated and difficult to explain, but had most reporters taken more time and been more careful--as some science journalists did and were--their stories would have been more accurate and perhaps readers and viewers would not have been as alarmed as they were.

Explaining or Not Explaining EMF

To discuss in-depth explanatory issues, this paper will not deal with Paul Brodeur, a writer for the *New Yorker* magazine, who is credited with breaking the EMF story in a series of long articles and a book called *Currents of Death*. He has led the sensationalist charge on the EMF story and detailed it in an unbalanced fashion, not only in his own articles and book, but also in discussions during television appearances to plug his book. There are many examples of his poor and unbalanced explanations, but since these were probably done purposefully to augment his alarmist journalism, examining them will not illuminate the problems of reporters who are trying to be more fair in their approach.

Providing in-depth and balanced explanations about the scientific controversy surrounding EMF is not an easy task. Reporters have to explain complicated information involving molecular biology, epidemiology, low-level radiation and electri-

cal processes; scientific studies that sometimes show a health effect and sometimes do not; disagreements among experts; statistical concerns related to the probabilities of cancer clusters occurring; and serious potential human health risks, particularly for children. To be effective, they also have to help readers comprehend the issue of relative risk: if EMF is a risk, just how big a risk is it compared to other health threats such as toxic chemicals, smoking cigarettes or eating foods with high cholesterol levels? And they cannot ignore the economic considerations of making changes in how electricity is delivered to people's homes. Such changes would not only affect the utility industry but also citizens themselves by determining the availability and cost of electricity in the future.

A case study that involves most of these problems concerns media coverage of two studies from Sweden released in November 1992, which were called the most comprehensive studies done of EMF. These were epidemiology studies: the one that received extensive media coverage was done by scientists associated with the prestigious Karolinska Institute and it involved a review of the medical and residential histories of 500,000 adults and children living near high-tension power lines as well as control subjects. It found a dose-related statistical association involving leukemia in children living near power lines. The other focused on adult men with occupational exposures to EMF and also find a statistical association, but it was rarely discussed in the media.

Here is what the co-author of the children's study said about it on ABC's "World News Tonight." According to Dr. Anders

Ahlbom: "From our side, the study actually does support the theory that there an association between magnetic fields and cancer" (12). On CBS's "Up To the Minute," he said: "It's a fairly consistent pattern for childhood leukemia, in that we have an association between estimated magnetic fields and- and [sic] a cancer risk" (13).

Both of these are fairly careful scientific statements--notice he did not say that magnetic fields caused cancer--he said there was an association. And in the second comment, he talked about estimated magnetic fields, which are different from measured magnetic fields. This is an important point because earlier U.S. studies that showed an association between EMF and some forms of cancer also involved magnetic fields estimated from electrical wiring configuration diagrams. However, in both the U.S. and Swedish studies, the association did not appear when *actual* magnetic fields were measured in the same houses for which the fields had been estimated from the wiring diagrams. Scientists are unsure about why this happened, but this important inconsistency has not often been pointed out in EMF media coverage, including most articles written about the Swedish studies.

Given the Swedish findings, what did some of the media report? Here is an Australian television example from interviewer Lucienne Joy. She said: "In fact, according to these reports [the Swedish studies] the electromagnetic fields from the power lines cause cancer" (15). No association here, just plain cause and effect.

Back in the United States, the *Wall Street Journal* noted:

"Last November, researchers from Sweden's prestigious Karolinska Institute reported finding nearly fourfold higher leukemia rates among Swedish children living near power lines" (15). A similar number was used on a local newscast on WNBC-TV in New York City (16). This statement is correct as far as it goes, but it is the worst-case scenario. There was a fourfold increase for those receiving the highest EMF dose, but this increase became lower as the level of magnetic field children were exposed to decreased.

This was explained better in an article in *Legal Times*, which noted that the Swedish study

> found that children exposed to electromagnetic fields of more than one milligauss--the standard unit of measurement for such radiation--developed cancer at twice the rate of children exposed to lesser amounts. Children exposed to more than two milligauss developed cancer at three times the normal rate, and those exposed to more than three milligauss had a cancer rate four times the normal one (17).

What is wrong here is that the Swedish rate was for childhood leukemia only, not all cancers. Lucienne Joy made the same mistake.

Some of the fears that readers and viewers have about EMF come from not understanding what the word "association" means. A report by the U.S. Office of Technology Assessment (OTA) on EMF explained: "Remember that 'associated' means 'occurs together with,' it does not imply a causative link...." (18). Yet the public does not appear to be aware of this differentiation, primarily because reporters rarely explain it to them. A woman living in Scranton, Pa., where there was a major EMF controversy over siting a high-voltage power line told a National Public Radio reporter: "EMFs cause leukemia in children. A Swedish

study was done" (19). The mayor of Scranton related to "Street Stories" that:

> Well, right now there's enough information to show that it's causing cancer in children or it could cause cancer in children and that's enough for us to say, "Well, then, don't put it on this street until you can tell us conclusively that it doesn't cause cancer in children" (20).

Other problems with the Swedish and other scientific studies also have not been explained well in media reports. The OTA report pointed out that confounding variables and household and other exposures have to be taken into consideration when evaluating EMF studies. Related to occupational studies, David Savitz, one of the leading U.S. EMF researchers, explained that "because these studies are based on job titles rather than on exposure data, we really don't know if the individuals with cancer have been exposed to elevated field levels" (21).

In-Depth Explanation on EMF

There are a few bright spots in the EMF coverage, however, where reporters provided in-depth explanations of the problems with the science of EMF and the Swedish studies. Interestingly, all were written by science writers. The sample size is too small to say there is an association here, but maybe...

In November 1992, when the Swedish studies were released several articles including in-depth explanation appeared. A news story announcing the results of the studies by Thomas Maugh II, science writer for the *Los Angeles Times*, explained why people were excited about the studies and included a warning:

> The studies are also the first to show that cancer risk goes up with increasing exposure, a finding that is considered crucial in validating an epidemiological study. But experts, and the researchers themselves, cautioned that reaction to the reports should not be hasty because even the increased risk is still very small "about one out of 20,000 children a year," according to epidemiologist Maria Feychting of the Karolinksa Institute in Stockholm (22).

Maugh was one of the few journalists to mention that the Swedish studies had not yet been published in a journal and had only been circulated to peers.

The 1993 coverage on EMF that also discussed the Swedish studies appeared after there had been more time to digest the facts of the studies. Three examples stand out as involving effective types of in-depth explanation. The first one is a relatively short article in the *Seattle Times* by Bill Dietrich, which examined the question of the degree of health risk.

First, he reviewed the scientific situation in a balanced approach and then put the problem into some perspective:

> Since 1979, a number of studies have compared the power-lining wiring configuration outside homes with the incidence of childhood leukemia. While some studies (including one in Seattle and several in Britain) have found no correlation, others in Denver, Los Angeles and Sweden have shown an increased risk of the disease with wiring types researchers predicted would produce bigger magnetic fields, ranging from twice to four times as high.
>
> While this is disturbing, it should be kept in perspective. Childhood leukemia is a rare disease that kills about 500 American children a year. Under the worst assumptions, power lines may be contributing to some portion of this. By comparison, the American Cancer Society estimates that in 1993 160,000 lives will be lost to tobacco smoking and 17,000 more to cancer caused by excessive drinking.
>
> Moreover, the connection is far from proved. When scientists have turned from the type of power line to the measurement of actual magnetic fields generated

by those lines inside the houses, the correlation disappears (23).

Dietrich continued on for several more paragraphs explaining that biological effects did not seem to increase with the strength of the fields, and that a convincing mechanism has not been proposed as to how magnetic fields would affect the body. He then said, however, that concern was broadening and described some current research, reviewing a number of different types of studies including epidemiology, occupational and laboratory studies, rather than just presenting one or two out of context.

At the end of the article, he pointed out some of the economic perspectives of this issue including that ratepayers would pay for the cost of utilities' lawsuit defenses along with bills for changing sites for power lines, rewiring houses, and widening rights-of-way.

While this is a really good example, it does have a few explanatory problems such as mentioning the wiring configuration situation, but not explaining what a wiring configuration is. The comparisons to drinking and smoking also are a problem. Smoking and drinking are voluntary risks and exposure to magnetic fields usually is not. In addition, most young children do not smoke or drink.

A second example of in-depth explanation was done by science writer Richard Harris on "All Things Considered" on National Public Radio. Rather than a piece designed to provide perspective as the last one was, this excellent overall story was primarily a long news feature on the EMF controversy in Scranton, Pa. It started out talking about four separate studies that had

suggested that children living near power lines have a somewhat higher risk of developing cancer.

In this discussion, Harris pointed out the number of actual childhood leukemia cases found by the Swedish study--one of the very few journalists to do so. He said: "The researchers found seven cases of childhood leukemia in homes near power lines where, given the size of the population, they had expected to find just two or three" (24). Most other journalists talked about fourfold increases in risk, not even Maugh or Dietrich let readers know that only seven cases of leukemia were involved. For some people, that number might have made a difference in the level of fear the story invoked.

Harris then tried to put the finding in perspective.

> Now the study does not prove that the electromagnetic fields, or EMFs, are causing cancer. That question is still wide open. In fact, major government reviews in the United States and Britain have both concluded that electromagnetic fields are probably not a health threat. And the Swedish study found that the risk of cancer from electromagnetic fields, if it is real, is quite small. The extra cancer cases in this huge population is like having one added case of cancer in Oregon annually" (25).

Later in the story, he explained that in the U.S. studies when scientists have actually gone to measure magnetic fields in houses near power lines where children develop leukemia, they do not find unusually high magnetic fields and that there could be many other factors involved including pesticides sprayed under power lines, auto pollution, since big wires tend to run along big streets, or the socio-economic status of people who live in the shadow of transmission line towers. He noted, "It's going to take quite a long while to sort out all of those questions" (26).

The last article showing in-depth explanation was the first of a two-part investigative series written by William Allen, a science reporter for the *St. Louis Post-Dispatch*. While the main story focused on the EMF levels Allen had measured in St. Louis schools, he also wrote an explanatory sidebar on "What's Known and What's Not About Magnetic Fields," using a question and answer format. This sidebar was accompanied by a chart that tried to put EMFs in perspective as a cause of leukemia and brain cancer deaths for children by showing the frequency of this occurrence compared to other causes of childhood deaths. Another sidebar explained how Allen had conducted his investigation and EMF measurements (27).

In his main story, Allen carefully explained the scientific controversy:

> EMFs and their health effects are controversial largely because so little is known about them.
>
> Some studies have linked EMFs to various cancers, especially leukemia, lymphoma and brain cancer in children. Some research has raised concern about the body's reproductive, nervous and immune systems.
>
> Critics say those studies are flawed and note that other studies show no link. They emphasize that statistically *linking* EMFs to disease is not the same as proving they *cause* it.
>
> The U.S. Environmental Protection Agency says the studies have raised the "possibility of a public health concern," but there's simply not enough information to say whether EMFs pose a health risk or not.
>
> Experts say three points are clear:
> --Even the most damning studies say that EMFs present nowhere near the danger of other health risks, including auto accidents and smoking.
> --People won't give up electricity.
> --Conclusive scientific answers won't be in for at least five years" (28).

What do these four stories have in common? Some might say

that they all downplayed the EMF health risk, but this is not true. What they did was explain that scientists do not know enough yet to say whether there is an actual health risk or not. More importantly, they all included in-depth explanation, trying to put the situation into perspective so people would better understand the complexity of the scientific situation, realize the small number of children potentially affected and the large costs involved in taking immediate action. These reporters went out of their way to avoid sensationalism and to give background details so that people could understand why no one study will provide *the* answer about EMF. Surely there were other excellent EMF stories written during 1993; an exhaustive search of every EMF story written was not done for this paper. However, these four articles serve as fine examples of what can be done to clarify and explain complex information.

Educating about In-Depth Explanation

More in-depth explanation is needed in the U.S. media and elsewhere. By not providing in-depth explanation about important issues such as environmental health risks, journalists are contributing to a serious problem that made one recent U.S. television program question "Are We Scaring Ourselves to Death?" This program heavily criticized the media, particularly television talk and news shows, for their unbalanced and superficial treatment of health and environmental risks (29).

What can journalism educators do about this problem? Simply, they must teach students how to do in-depth explanation and

show them that it goes beyond detailing how a machine works, or a process operates or an organism functions. In-depth explanation involves the big picture--policy, economics, science, statistics--and journalists cannot ignore explaining these important factors if they want to be effective. In addition, educators must think not only about teaching how to develop explanations involving scientific concepts and principles but also how to help explain statistical measurements and inferences. And they must show students that although journalistic constraints will make in-depth explanation sometimes difficult in a news story, there are other opportunities for it in sidebars, series, feature stories, magazine articles and television news magazine stories.

Those who teach science writing and other forms of journalism must make sure that they do not lose the forest for the trees--that in teaching students how to explain the small things, they neglect to teach them how to explain the big ones.

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