ROBERT BAZELL, Science Correspondent, NBC-TV. (?)

..an entire story on what is a complicated topic. It's delivered in a medium where babies are crying, telephones are ringing, dishes are clanking and people aren't paying close attention often to what you are doing and aren't completely involved in it. And, so, the limitations are very, very severe. Even if you start out with the best of intentions and, I think that you all here, anybody who's been involved with journalism and science will either have or have heard stories about television journalists who don't have the best of intentions. So, that's, that's the problem to start with. And the advantage is that you're talking to ten million people or fifteen million people whatever, are seeing that so that the opportunities for education are informing and informing about whether a particular, ah, whatever subject you want are enormous just in terms of the number. But .....

We and our most.....The greatest opportunity we have is not to convey a lot of facts. I don't think that television conveys facts. Television moves, conveys an impression. And that's a very efficient ... ah, very effective. The facts are included in there. But the strongest, the most memorable television news pieces are ones with visual .... and impressions. And probably the most powerful television news stories that was every done was Morley Safer for CBS did a story which I am sure everybody here remembers (almost everyone). I was watching television down at the ... a marine and American legion Vietnam lighting a hootch with a Zippo lighter. And his family ... crying. That didn't convey a lot of information about the Vietnam War, but that image made an enormous impression about our boys with their

Zippo lighters, what they were doing to these people, and to their homes. So, what can we do about something as inherently complicated as science? Well, I think sometimes we can do real good job. Ah. I can't defend that, ah, without showing specific examples of work that's been done, but I think that sometimes we can give the elements of what is, ah, an important item, an important part of the beauty and discovery of science, if you will. I think it happens. Ah, another limitation which I should get back to is that it's sandwiched inbetween hemorrhoid and headache commercials and that's a very important point because when you're conveying information about scientific discovery and the advertisements which are 30 sec. long do so much of a better job often of capturing and conveying a visual image. So, what happens when we have those limitations? What, what do we often resort to? Well, one of the things which television does, although it's certainly not a problem that's unique to television news, is to fall back on the... what I've often heard Dr. Morrison talk about, is the metaphors of war that go with science so often, that we have a revolution, a breakthrough, a conquest of the dreaded enemy. Because that ties in with the more ah, traditional view of what news is, what exciting news is. A war is exisiting news. Ah, we go for the gimmicks sometimes that Mr. Piel alluded to. The new discovery, the new device that's going to be in your hand. And particularly we go for the medical discovery that, because there's a, ah, ... amount. Things being relevant to people's lives. And what's more relevant to people's lives than a medical discovery that's going to help them. Even, in fact, if that, that's not the case. But, the problem isn't all ours. And I don't think that ah, it's just we're rank opportunists who are working in such a limited way that we can't convey the information.

There's.... Scientists are en't that easy to deal with. Ah, and there is not ah, ah, I ah, would beg to disagree with Mr. Piel's remarks about consensus of opinion among a group of people. And sight ah, a group of people with the appropriate facts would always lead to the same conclusion. I would think that human nature is in fact, not quite that way. But more important, science itself sometimes leads to these ah, erroneous statements about revolutions, breakthroughs and the like. That ah, and it's not just one errant scientist who wants to get his name in the paper or his face on television. We, Paul was talking about Augigenes before. And Augigenes are an, a wonderful example of fashion in science. And the latest, anybody often, both scientists and journalists, are guilty of lack of knowledge of history. And anybody who's paid any, much attention to cancer research will know that this is the latest in a long series of what was supposed to be the cause of cancer, which were related to the latest discoveries in biology. And if you look at cancer, it's like a mirror because it has so much to do with all of life's processes. And Augigenes were the latest fad. And there was this great rush to popularize Augigenes and say that this was the latest cure. So, ah, we have a lot of problems in putting this information on television. But I think there would be error if we ignored science. I, ah, the opportunity now is increasing greatly because of something that's happening with network television. That has to do with technology. In the last few years, ah, satellites, satellite distribution of programming, has made it ah, made the day's news much more accessible to local news programming. The difference between local and network television is very important here. And, therefore, the 6:00 news or the 5:00 news, in a local home, in a hometown, can show you ah, the explosion at the embassy in Beruit, or

it can show you President Regean getting off the helicopter or whatever image can be transmitted right away of the day's news. And therefore, network television, in order to survive, television news, has to do something else. And it does more of what are called features. And anytime any newspaper or anyother journalistic entity has ever looked for features, it's always turned to science and medicine. There's more of an interest now in science and medicine ah, in the network news shows. And ah, I think that ah, we're doing a better job on it. I think that you can hear from the backgrounds of both George and me that, that and, you, the people who are versed in science have been hired by the networks. That's, it's not much. I mean, he's the one person at ABC and I'm the one person at NBC and as far as I know CBS doesn't even have one. So, it's not like we're moving well along here. There could certainly be more. And I think there will be.

Mr. X: The one person CBS ah, had ah, was so disgusted with the job, because he could never fight Walter Cronkite from the belief that Walter was in charge of science. That he left in dismay, and took over a local news operation, WNBC. Earl Ubell, one of the, you know, the best communicators we have. Um...on to Sharon.

Sharon Begley, Science Editory, NEWSWEEK

I'd like to pick up on a theme that our, our speakers last night raised, um namely I got the sense that the media was expected to or perhaps could play a role in advancing public understanding of science. Um. I'd, I'd sorta' like to take issue with that based on my media experiences and some of the constraints we operate under, something that Jerry Piel alluded to, the sociological, the economic limits and how those shape what news we present and how we present it. I've been doing this for seven years. It's been a seven years that coincided with what is perceived to be the beginning of a goomlet (?) in science journalism. The launching of a couple science monthly magazines, expansion of science coverage in the daily papers, not just added staff that Walter alluded to, but also regular, weekly science sections of several pages including not just science, basic science, but also technology, health, medicine. At NEWSWEEK, um, we have certainly been influenced by that. Our editors generally come from a political background, sometimes a business background, and there is no doubt that being exposed to science in the daily papers makes them think that science is more newsworthy than it had been. Um, it's another editor's judgement which they can take into account when they determine what will go into our magazine. However, science still is sort of an odd-man-out. Um, we were speaking earlier this morning, among ourselves, and there seems to be a perception, again, at NEWSWEEK, that science falls into one of two catagories: namely that it can be a class

act of the magazine one week, or it's a sort of wierd filler. Um, in the first catagorie, I would put something like serious cosmology, physics, geophysics, astrophysics stories, um, serious biomedical, molecular biology stories. And we do get a few of those in. The reason is not all that commendable. It's ah, not that the editors necessarily think that they have a role in advancing public understanding of science, and that this is the way to do that. But rather, it frankly makes us look good if the previous week we've run a big Michael Jackson cover.

Um, the other catagory is science as, sort of wierd events happening out there. In the last, only two or three weeks, we've sort of turned into the corpse section. We've run dead carabo, dead whales and two corpses found from the Northwest Passage Expedition of a hundred or so years ago. Um, none of which I would catagorize as representative of what scientists are, are really involved with, or, or, that's terribly important. But again, this is something Bob alluded to, science is still expected to conform to a general news catagory. Namely, news is events. And it's that constraint, I think, that truly distorts what we can present to the public and how true a picture we can paint of how science works.

Science is presented as breakthrough after breakthrough. There is very little sense of any process behind it. How science works. There is also a sense that science is certain. I too, would like to take issue with Jerry Piel. I don't get the sense that among informed people, working in a given specialty, that there is always a uniformed consensus about, pick almost any issue, about bisinosis, about ah,

nuclear power, or about starwars. Um, I think that there is a good deal of controversy. Perhaps the media distorts how great the divergence of opinion is, but I think it's there. And, the corollary to that, is that we are still presenting science as dealing in certainties. And I think that can have serious consequences when science enters debates about public issues.

The public gets confused when it sees two scientists testifying on different sides of an issue. I think there's a tendency to sort of throw up their hands. Well, the scientists can't agree. There is no one answer. What really can science contribute to any of this? I think that contributes to a dissatisfaction with science. A distrust of science. Again, I'm not sure how we can rectify that, given the constraints that we have to present science as breakthrough after breakthrough.

Um, the only other point I would like to make was, sort of one of my epiphanic moments in this business, when you're talking about what science can contribute to an enlightened public. Um, covering the creationism trial in Little Rock, Arkansas, what three years ago or so. Some of the most ardent creationists in that courtroom were engineers and doctors. And I, I would just like to leave you with that thought. If you sort of look to the media's presentation of science as a way to a more informed electorate, or, or better technologists, or whatever, I sort of question whether that really is an achievable goal and whether the media is the right one to play it.

Michael Ambrosino: Thank you Sharon.

Anne Gudenkauf, Sciend Producer & Editor, National Public Radio

Each of us fulfills a unique slot in communicating science to the public. Um, we're not like public television, ah, in that we do not have a discrete, regular science program on National Public Radio. We are, however, public broadcasting. We are not print. And we are electronic. Um, we do not have the kinds of time constraints that commercial television and commercial radio face. And yet, we don't have any money. So, with that preface so that you'll understand national public radio, let me tell you about science there.

In 1978, we began discussions with the National Science Foundation about funding science programing at NPR. Our intention at first, was to produce a weekly science radio program. Ah, it seemed like a good idea, it had been done on television. And of course, we thought we needed that much time every week. At least that's what we thought, but the concept gave way quickly in our discussions to the idea of providing increased support for science reporting <in> our daily news programs.

Our thought was simple. We wanted to reach the greatest number of people with science news and featured reports. In a sense, we opted not to consider science as a special area of interest. But instead to be true to our own trademark, to consider all things.

It turned out to be a good idea for us. The financial support that we've received from the National Science Foundation, Hewlitt Packard and others, has made a difference. Right now, by my account, nearly 20% of ALL THINGS CONSIDERED and MORNING EDITION, news reports, interviews and feature pieces talk about science, the environment, technology and related public policy. But we don't usually assess our work with that kind of statistical analysis.

It's perhaps more important to note that in our executive editorial meeting each morning, there are five source editors present. They represent reporters covering politics, government, domestic news, foreign news, and notably science. That meeting is crucial because we share ideas. And now, more of the ideas are about science.

Where the editors might have passed over, say a story about the development of a vaccine for infant diarrhea, now they take note. It doesn't sound like a sickening story. I am able to explain to them that the vaccine could mean, to millions of children in developing countries life itself. And I am able to point out that for those children to benefit, those countries will need more than just a vaccine, they will need, probably, refigerators to store it, people to give it and money to buy it. All of which are difficult to come by.

The story then becomes meaningful and understandable within national public radio. Those are key words in journalism. But if the editorial meeting decides that we're to have time on the air for the story, we still have a job ahead of us. We have to make the story meaningful and understandable for our audience. And that's not easy.

Reporting the story on radio is especially difficult at times. We have no pictures. Our listeners can't backup and re-read a difficult paragraph. We must use the voices of scientists in our pieces. Otherwise, we have what we call a "talking head," a reporter with no actuality. Scientists don't always speak without using technical jargon. So, if it's our goal to capture the attention of people with information about science and technology, science journalists could use some help.

We have to have more money. And I might add a more stable source of funding. It takes time for a science correspondent to mature in his or her field, become good at it. And it's not something that somebody is willing to invest years in if they don't think there're going to be jobs down the road in years.

Financial support is growing. It seems that the more we do on the air, the greater the recognition of the value of the work. But while we can work hard to raise funds, it's not enough. A lot of things that are crucial, are out of our hands. First, we need a larger pool of journalists with strong science educations. We will always live in a world were reporters, even those specializing in science, must work in the same week on stories about particle physics, immunology and paleontology. And no one can be expert in all those fields. But reporters in science must have a clear sense of at least how science functions.

Second, we need more continuing education for working science journalists. More opportunities for science fellowships, for example.

And we need scientists to recognize the need to communicate clearly with us. Science journalists can never turn over their responsibility to explain their stories themselves. Then we wouldn't be journalists. But articulate scientists can convey their ideas so that we are more accurate, more complete, and more interesting. I might add that it might be helpful if, within the scientific community, it was more acceptable for scientists to consider it important to communicate with the media clearly. I sometimes wonder whether or not it's a negative stigma that becomes attached to a scientist who becomes known as a communicator. So, I'm advicating science in journalism schools, writing and literature in scientific curricular and challenging fellowships for reporters and editors.

I think those are things that are worth while because I know that people are interested in science. One of the first special projects that we took on following our NSF grant in 1979, was a story that Sharon's already referred to, about the then growing support for something that was called Scientific Creationism. Ira Flado (?) and I travelled to Boston and Atlanta and Tampa and ah, San Diego, if I recall. We talked with people who were involved in the movement and with scientists who opposed it. After several late nights in our studios, we had two 20 minute reports ready to air. They were reports that allowed the people involved to tell their own stories, in fact Ira said very little during that 40 minutes.

The result was clear to us, and he and I were very pleased. Almost everyone who'd been involved with the pieces was unhappy that the other side had been given too much time or too generous a

treatment. People within NPR kept arguing about the issue long after the piece was aired. And our public informations department called to complain that they hadn't been warned that they would receive a flood of calls and mail. Everyone was aggitated. Some people were angry. And that made us very happy.

No one complains when we take on less emotion-laden science stories than creationism. Cosmology, genetic engineering, ethno-botony, artificial intelligence, all of them are well received when we do them well. We even snuck in a little piece on retro-viruses and not too many people were squirming. So, we can capture the attention of people listening to a general news program, and make them want to listen to science and to learn something about it. But we have to tell the story well. We don't want to be friends with scientists, that's not our job. But we do want to understand each other better. We have to learn to understand each other's language, to communicate.

I'd also like to mention one other thing. It's not just NPR or PBS or the world of public broadcasting that has an eager science audience. I don't believe that. I've heard talk about our unusual audience, our highly educated audience. They'll listen and want what most American's want. Well, my mail is not from Ph.D.'s.

We try to stretch imaginations, not comprehension. My bellweather is Susan Stanberg. She told me that we would be successful if she understands our stories. She said, then anyone will. Her son Josh says that she's right and she keeps us on our toes. Thank you.

Michael Ambrosino: Thank you and thank Josh. George?

George Strait, Medical Correspondent, ABC-TV

Um, let me tell you what science is on ABC. Science is a single editor-slash-reporter, or reporter-slash-editor, who has to read or says everything that is written, everything that occurs. We also have one doctor, who's been recently hired, who gets on the air and does things very doctorially. And we have one science correspondent, Jules Bergman, who, who is probably, ah, I guess the senior television science correspondent, and, ah, he's a tremendous resource for us all. That single editor/reporter, who has to assess and read everything is me.

Ah, science also at ABC is GOOD MORNING AMERICA. And that's defined as 60 seconds or less. Usually something that appeals to a female audience. Because those are the people who watch the show. Science at ABC is also THE WORLD NEWS TONIGHT, which means 90 seconds or less. And science at ABC is NIGHTLINE, which is a half hour or an hour. That's where we can get into some of the things that I think that television can do well in science broadcasting. That is get into some of the public policy questions. Like what's the role of the media in, in the new transplant surgery? And what's the role the media plays in public policy questions like nuclear power? Things where you can spend some time and, and a, expand our band and reduce our negative feedback.

Some of the problems that all of us face are especially acute in television, and have been alluded to here. But probably the biggest problem that I think, is the reluctance on the part of our sources, our sources being the people who write and do the work, that is the scientists. Part of their, of their problem, part of their reluctance in dealing with us and wanting to deal with us on a professional basis, is the often capricious nature of the "Ingle Finger Rule"(?!!).

And also its the scientist's failure to appreciate their responsibility to the general public. And we who communicate to that public. There is a certain tension in the scientist's mind, ah, their responsibility to their peers and their responsibility to the public. Most scientists don't realize, or don't appreciate the fact that their able to work, or that the fact that public is paying their bills. So, they automatically have a responsiblity to the public, to taxpayers, because they're providing the where-with-all for them to do their work. Sure they have a responsiblity to their peers, but also they have a new and emerging responsibility to the public.

They, the scientists, often have a mistrust of us, and I think most of it's justified. We are, and do exist in two different worlds. There's a lack of understanding of their needs by us and our needs by them. And there's a lack of understanding of what drives them and what drives us. Somehow we, as broadcasters, as journalists, are intruders. And for the most part, are not, we are viewed as a serious part of their work.

Of course the other side of that coin is that some of that is

changing. As politicians have learned long ago, we can be used and like being used. And scientists have found that indeed, they can use us too. It seems as though, that um, whenever grant time approaches, that the number of press conferences also goes up.

We're also a kind of a victim of our own interests. Science and health reporters, if you want to get into broadcasting, that's an awful good specialty to have. That's a way to ratings for a network or a local station and it's a way to fortune for an individual journalist. What that has done unfortunately is spawn whole cadre of inexperienced journalists and, who are inggnorant of what they report. Luckily with these august corporations that are up here, up here on the dias, they have a few very well trained scientists and journalists. When you get to the smaller station, the small newspaper, they put the guy on the science beat who yesterday covered the police beat. With little or no training. He may have had biology 101 in college, but that's been the extent of his or her interests or training

Of course there is a way out of all of this. Its been alluded to here. More seminars, more grants, more courses in journalism schools. And indeed more of these kinds of, of a situations where we can kinda sit down and figure out what we do wrong, what we do right and how to better communicate to the public, which is what I think is we all want to do in the end - our bottom line.

Michael Ambrosino: Thank you George. A couple comments and then into the free for all.

Ah, initially when NOVA was begun, the hierarchy at public broadcasting did not have to be convince it was worthy. They thought it was worthy. None of them thought that it would be popular. Ah, it beat MASTERPIECE THEATRE in its first season and continued to do so with the exception of UPSTAIRS/DOWNSTAIRS etc. I add that to the comment that I think Ann's brought up, because that popularity is there for all.

One of the, there are several great myths about public television, one of its myths is the elite nature of it's audience. I have here the statistics for you academically, statistically minded people and if you look at the census/population of the United States, and if you make a comparison to the best public television audience figures, you should see that the tolerance is astonishing. It matches almost perfectly. So if anyone who deals with material indepth, deals with materially intelligently, and as some of have grown up led by professional people, such as yourselves, then the chances are far better for an audience review.

One of the stories I remember greatly about sending a professional act to do a man's job, is right after Margaret Mead's death when we were trying to do a program that dealt with the intellectual importance of Margaret Mead's work. No one would speak to us. It was too soon. Ah, everyone important was writing their own book. We decided to make one major interview and that was Ted Schwartz. And we found Ted then started calling everybody and said the producer I've just spoken to has read my books, knows where I stand, knows who's against me, and is planning to speak to them too. I'd sent a professional to do a man's

job, and that was a woman. And Ann Peck is a producer who's free-lancing at the present time and if anybody wants to hire her, let me know.

Comments now from the floor and from the panel.

DISCUSSIONS

Michael Ambrosino: Comments now from the floor and from the panel. And you have to be adult about this, you have to raise your hand or something.

Yes, David Coon.

As Paula has alluded to science television program at WGBH which I'm now laying the facts for, and the locomotive comes steaming down the line, we are trying to produce a new series of six good science journalists <Can't make out>.

Your sense of the networks' desire for more science programming, are you getting good response to the stories you do do? Will there be a market in the commercial world, at your network? Not only for more evening news pieces, but for lets say more NIGHTLINE analysis of science or news special, half hour news on science, or more documentaries on science on the commercial networks. These people are going to be available <something> will there be jobs for them?

George Strait: It's clear to me that ABC would like to put more on. It's not clear to me that their willing to hire more people to do it. Um, television has a, there are a lot of people who work for ABC and NBC and CBS and CNN and public broadcasting. But most of those people are, are technicians. And the editorial side is very, very lean. And

when it comes to science, bare bones.

While I say that ABC may not have a market for very many more people, one, maybe, not two, but maybe one. Because we have a limited amount of time.

QUESTION: About the answer, I just wanted to ask do you, or any of the other people, how would you compare the percentage <something>fits my own rather random sampling <something>... stories fits this catagory, science, technology, <something> What would you say for national news? My judgement is that it's much less.

George Strait (?): It's somewhat less. I don't think it's a lot if you throw, if you throw in what, I think one of the, if you throw in things like <something> technology and particular the space program, it's certainly that much. And I, I would defend coverage of technology. I mean, I'm not arguing with you, but I know a lot of other people and, speaking here talking about the beauty of science and science, and science has the chauvinism about pure science and I don't, and, and coverage of pure science is somehow our goal. But I think that the benefits of science, scientists want us to ignore the benefits of science, and I think that the space program is something which is very coherent and exciting and makes good television, and should be covered! Along with a lot of other technology. But I think if you include that, the percentage are about the same.

Michael Ambrosino: Phyllis?

Phyllis: I'd like to name three media that are not up there, not because they should be up there, but just because one should remember it. There is nobody up there to just speak for books. And yet in books, books is one of the places where one, ah, has a scientist speaking about the stuff itself, for himself. There is nobody there to speak up there for the science magazines. And yet they've been important. And no one to speak for museums, which are surely media, and which treat science in a very different way, broadening and extending the grasp of what science is.

You have focused, very strongly, on the reporting of science. And frankly, I think <something>. There is the thing which is next to that, which is presenting the science itself. Which has to do with old science as well as new science. And, I would just like to say, that didn't come up. That wasn't a piece of what was being robrought from the center(?). So far, that is.

Anne Gudenkauf: I think that that's old science. The perspective of how we got where we are in science, is something that you will definitely see on NOVA regularly. You will frequently heare it as a small part of a news or feature report on National Public Radio by way of hoping to try to take the moment to tell you that it took sometime to get here. Definetly you'll read about it in the NEW YORK TIMES. By way of telling about a news story, they will mention that perspective. But we really are, except when we're undertaking - and even when we're undertaking a documentary formate - talking about news. And, we like it, I think, as much as you do, that the books exist. And all that. And I agree that that would make this panel seem a little more

representative.

Michael Ambrosino: Walter?

Walter (?): I'd to endorse (?) what Phyllis said about museums in particular. Books obviously. But certainly my experience, ah, I think my interest in science was inspired as much by visiting the gorgeous(?) museum in Munich and then seeing it's counterpart in Toronto, in the fabulous Ontario Science Center, in Washington. And what an outrage it is that New York City, our greatest city, has no science museum. It has the American Museum of Natural History, which tries to fill the gap, but in terms of that little museum that used to be in the DAILY NEWS building. I don't think anybody here will remember it, but there used to be a little museum in the DAILY NEWS building that had the kind of think that IBM has produced. And I think in conjunction with film, wasn't it? The probability exhibits and so on and so forth, <something> was involved. Now that is absolutely facinating. And that makes an enormous impression on young people, I think.

I also want to endorse what Anne said about, haah, having it a little bit more respectable for scientists to be communicators. And to some extent promoters. And there's one person in this room who you will hear from later in the day, who in one single colloquium, made something so exciting that I went out and bought a book about it. Who was that? The book was called We Are Not Alone.

Question: I agree with Phyllis about the <something> in media. Coming back to the reporting of science, Sharon and George <something> have

particularly addressed a feeling that there serious constraints in the media. And one will make sure that our expectations are not too unrealistic for what the media can do. The media cannot educate in the sense of correcting a lack of education in the schools. They cannot address what is not being done in other places with the sciences. I appreciate that. I see those constraints and I appreciate what you're saying.

I wonder if now you could, however, tell us what you think the media can do? Whether you think that there are some areas where the media's effect can be effective? Perhaps not consciously, but inadvertently, in addressing the public's understanding of science.

Michael Ambrosino: Robert?

Robert Bazell: I said before that I, if I do a piece for the air I think sometimes is successful and I could define success in a few ways. One success would be that if a piece I did had the same effect that an exhibit at a museum had in making somebody, or some child, or adult who was in the audience, say 'WOW that is really interesting. I'd like to learn more about that,' and plant that idea. Or if it made somebody or some subset of the audience appreciate that that area of science exists and why it needs to be funded and what it can do or why it's exciting, that would be a success. And definitely worthwhile.

Ambrosino: Other comments?

Sharon Begley: I just want to say that for me, one of the most

rewarding feedbacks I get is when a 12 year old writes a letter saying, 'Oh I read your story on the birth of galaxies and now I want to be an astrophysicist.' So sort of echoing what Bob has just said, I think there is an inspirational role we can play. There is something called 'Science' out there. It is exciting. It is something that you might want to take courses in, that you might want to dedicate your life to.

It's not preaching to the converted. It's sort a' bringing in new people. And that I think is one of the differences between writing for a general news magazine or general broadcasting versus some of the science magazines, where I think you already have your own audience.

Robert Bazell: As I alluded to before, I think one of the things that television does well and has the opportunity to do well is to bring the general public into, into a scientific debate. The general public sees a doctor and sees a scientist as a .... it's almost kinda' monolithic. They're all the same. You can't really approach them because they really do know everything. And we'll just learn from them. But, in fact, there is a divergence of opinion on almost any subject. And there are serious public policy questions raised by various scientific work. And being able to point out that policy review's system, and indeed how public policy can be made I think is something television can do, is important and I think that television can do well.

Michael Ambrosino: I'm biased because I'm an addict. I think that learning something is the greatest addiction. But the most wonderful continuing comment to a series like NOVA or ODYSSEY is mostly from women. Who, if you read between the lines of the letters they write

seem to be saying, 'you've presented something that was understandable and I understood it and it was an area I didn't think I could understand. And I thank you for that 'cause I am a larger, better, more intelligent human being than I thought I was yesterday.' And that's particularly gratifying. It comes from all railings and ages. But the idea that there are things that people cannot understand, and when presented cleanly, intelligently - they do. It does become an addiction for more of us.

Ambassador?

Panel 2: RESEARCH REPORTS

Wilber Schramm: Good morning again, ladies and gentlemen. I'm Wilber Schramm. This is the third panel, the third session which you're going to hear today and you have more to come. This I think, is going to be a very interesting one for you. At the oppropriate time, I shall introduce to you Jon Miller and George Gerbner, if that has to be done.

But this is, I suppose the New Yorkers here think of this as a kinda Triboro Bridge. I mean this is a bridge between people who know a great deal about science and people who know a great deal about the media and people who know a great deal about people. And we are now come to the people part.

We have begun to talk about what is being told to people and what is not being told, told to people. This is the time though when we've assembled a, a small group of the persons here, there are many more persons here then these two who know a great deal about media and what they're in interested in. So may I have the pleasure of introducing you, introducing to you Jon David Miller.

Mr. Miller is the director of a public opinion laboratory of Northern Illinois University at Dekalb. He's political science trained. Ph.D. Northerwestern, as I remember. And he's done a very interesting series of studies on people's attitude toward politics and toward political problems and toward scientific knowledge within politics. At

the present time, he has a National Science Foundation grant on people's attentiveness to science and technologies policy issues in the media. He's done studies on the public's attitude and leadership attitudes towards science and technology. He's done a very interesting study for The Annenberg School, on the public's images of science and what is the role of television in the creation of these images. That's the thing that I think all of us would like to know about.

Well, for the last ten or twelve years, Mr. Miller has been doing studies like this. He has a few tables for you. It seems only appropriate at this panel we have a few tables. And he I think has presented them to you. And I now yeild the floor to Jon David Miller of Dekalb.

Wilber Schramm: ....the distinguished dean of The Annenberg School. Who has since 1973, as you know, been editor of the JOURNAL OF COMMUNICATION. He has a long, long career which I am not going to read to you. Which includes the army, which includes Hungary, which includes Vienna, which includes one time or other the USC Ph.D. and he, George, I don't know what else to say about you, there's so many things that I can. But I think there's three things that you've done that all of us remember. All of us remember what you've done to bring up-to-date what we know about the affects of television violence upon children. And we know what you've done to bring up-to-date, keep up-to-date the story of the treatment of foreign news and the effect of foreign news in the press of seven countries. And we know that you.... I think I better stop there, 'cause I keep think of more and more things that I might mention.

The point is that George is a first rate scholar. George is a great dean and I'm honored to introduce him.

George Gerbner: Professor of Communications and Dean,
The Annenberg School of Communications,
University of Pennsylvania

Thank you Wil. This is a rather extravagent introduction for a very modest contribution. I'm going to follow Jon's analysis with posing the question 'what do we do with that 'reserve army' and even

the people who are outside of the 'reserve army' whom we are reaching with some kind of a message that I'll tell you about in a minute. Are we turning them on or are we turning them off? In any case, what can and should we do about it.

The material that I will present is the first presentation of the highlights of the findings of a two-year study and although I will except Jon's thanks to us, the money really came from the National Science Foundation. We commissioned his organization because it does high quality work on time to do the survey.

But the study was essentially oriented toward the question what is the image of science and scientists in a medium which is inescapable? What are the consequences of exposure to that medium that reaches all of the people, including those who wish to avoid, certainly do not seek, the message of science? And that medium, and the only way to reach all people in a way that is inescapable is through prime-time drama.

The largest, most persistent amount of information about science and many if not most other things in life, come to people through their entertainment. And the most ritualistically consumed non-, by and large non-selectively experienced form of entertainment, in which this information is enbedded is prime-time television drama. The study, the highlights of which I am going to report, and this is so recent that I didn't even have time to produce a handout, but I did have time to produce a few homemade charts, that I apologize for their being homemade, but I made them over the weekend. The two-year study,

National Science Foundation conducted by my colleagues, Nancy Signorielli (who is here), Larry Gross (who's here), Michael Morgan (who is not here, at the University of Massachusettes), and myself, on the image of science and scientists in prime-time television, in which we have a rather large archive of several thousand programs and over 15,000 characters analyzed in great detail, a data base to which we have added, thanks to this grant, and from which we can derive a great deal of interesting information.

Press science makes up about 1% of all news. About 1% of all news. Puzzles and horiscopes and astrologies, much more than that - unfortunatly. But on television, science and technology themes appear in half of all dramatic programs. And seven out of ten of children's weekend, day-time programing. There's no other source of information that comes even close to it.

This is an appearance that can be insidental. When science and technology broadly defined are the main focus, that accounts for 4% of prime-time drama and 9% of children's weekend, day-time, mostly cartoon entertainment.

These dramatic programs on which science plays a significant role are more likely to be, and this is our study of the past 10 years of annual samples of television programs in prime-time and weekend, day-time children's programing, are more likely to be action dramas than comedies or situtation or series. Therefore, there are more tinged with the sense of violence and danger, foreign places and strange people than the general run of television programs. And of

course, they are much more likely to take place in the future. In fact, there is no future on television without science and technology playing an instrumental role. There is simply no future-oriented program that is not essentially revolving around a division, sometimes nightmare, of how science and technology is going to transform the world in the future.

Most people have never really seen a scientist, except on television. On prime-time, a scientist occurs between one and two times per week, and is not a half scientist, but is the average of between one and two a week. Which is much more than anyone encounters scientists in life. Although it is not as much as many other occupations, if you consider the fact that the average viewer of prime-time sees 41 policepeople, 11 doctors, 6 lawyers and 3 judges week in and week out. So it's not as much as some other professionals, but it is still much more likely for most people to encounter a scientist, or the image of a scientist, in their prime-time entertainment than anywhere else. When they do encounter scientists, again because of the setting in which they appear, and because of the account of traditional stereotype, which still persists to some extent, they are more likely then the total television professional population to be foreign, to be a bit older, more likely to be evil, more likely to be unsuccessful. Their failure rate is 25%. That is 25% of scientists as major characters fail, whereas the failure rate of all other professionals is 15%.

Their rate of being killed is the highest of all professions. 14% of them are killed, whereas the fatality rate, the violent fatality

rate of all other professionals is 4%. So, these are some of the highlights of the image.

Now the next question, and the decisive question based upon the survey that Jon's organization provided for us, what happens and against the background of attention and inattention and against the background of those who are interested and less interested, disinterested and non-seekers of science, which is his pyramid, and we're practically really right now focused on the biggest problem of all - which is what is this avalanche of information embedded in our entertainment cultivate in the minds of those who do not seek science?

Let me digress just to say that that problem is a kind of underlying bias even in the focus on issues in this conference, some of which were pointed out this morning. That in the United States, those who seek science information find the richest, highest quality, the most excellent form of information in many competing forms. The real question and the real problem is what is the imformation that those receive now in an information-rich environment, who do not seek out this high quality and excellent source? And this is how we get to prime-time.

What happens to the viewer of prime-time program and how these viewers respond to the series of questions that we have asked them? Because of the general associations with danger, with tension, with failure, with violence, with being killed, we find that on the whole, and this association is not, I should comment, is not characteristic of the majority of the scientists, the majority of scientists on

television are rather positive characters. It is characteristic of a much larger minority, like 25% to one-third, than for any other professionals. So we're talking about a relative loading, a relative negative loading of science and technology type subjects and characters. What are the associations of that relative, negative loading with a series of questions that we have constructed into a series of indicies of a negative attitude towards science. This is what these charts are designed to show. And negative image of science is the general score that respondents got combining a series of questions. And what I'm going to draw for you is not the lines that I invented, but I'm going to trace carefully, penciled in lines. First by education. Now what this means is that the horizontal axis means amount of exposure light, medium and heavy to television. The amount of time that viewers watch television. The vertical axis means the number or porportion of people who respond in this case in a way that indicates a negative image of science on their part.

And the first is by education which means that those who have less than a highschool education, the lightviewers have a rather negative, a very highly negative image of science. The medium and heavy viewers have less of a negative image. They improve. That is they start out, those who the low income, the low education people, viewers, who watch little television, start out with an extremely negative image. And dispite its' connotations, the image to which they're exposed actually decreased the negative loading. With highschool graduates, they are about in the middle and as they watch more television they're image becomes a bit more negative. The principle problem area is precisely among those who for whom and from whom the information seekers and the

supporters of science and scientific resource efforts come. These are the college people. They start out with having the lowest score on the negative image. The medium viewers have a higher score. And the heavy viewers are very close to the low income, low education or highschool education group. There is a significant erosion corresponding to the amount of television they watch in their image of science.

If you look at it by age, people who are 55 and above, older people, start out with or have as light, medium and heavy viewers a fairly negative, negative image. This is the age differential that Jon referred to. Those 35, between 35 and 54 and 18 and 34 as lightviewers, they have fairly positive image. As the amount of viewing increases the erosion, the deteriation of the image, the tendence of respond in a negative way to such questions as science involves danger, there's no fun in it, a lot of odd and strange people involved in it, they have no family life, they work alone, they're likely to be foreigners, they have few other interests, in other words, a rather forbidding image increases.

The next question is what is the difference between those television viewers who don't watch programs like NOVA and other quality programs on television about science and those who do? Between television viewers who don't read science magazines or infro(?) or don't seek out science information because many of them watch television and seek out this information and those who do.

It does make a significant difference. Science TV means those television viewers who are also exposed to or seek out the high quality

science programs on television. Those who hardly ever do have a highly negative image, their score is very high. Those who say they do once in awhile are situated in the middle and those who say the regularly watch science programs on television tend to be the more highly educated, with somewhat higher income group have a low score on the negative image. But as you ask people who watch more television, you find the same deteriation of the image. You can see that watching science programs makes a significance difference. And yet even among those who watch science programs, there is a significance deteriation of the image according to the amount of general television they watch.

Pretty much the same phenominon occurs as with reading. Most who say they never read science material have a high score on the negative image, those who say they do read it start out with a low score, but as the amount of viewing increases there is that errosion. There is that deteriation, that negative tendency of the image itself.

Very much the same situation goes for the negative image of science or of technology, which is a set of questions which have to do with 'what do you think of machines? Are they good or bad? Or computers? Robots? Automatic bank tellers? Nuclear power? Even video games.' Those who respond in a negative way to all of these, or most of these questions, score high on the negative image by education less than highschool. College, the most significant deteriation is among the group that is otherwise as likely or most likely to support it. This phenominon of the heavy viewers coming close together is what we call 'Mainstreaming.' It's a kind of standardizing and homogenizing that takes place.

By age we find very much the same. 55 and above have the most negative. The middle age, younger people, there is an increasing positive feeling, but again the amount of errosion that takes place as an association with television viewing is about the same. The watching of science TV, the pattern is the same. Those who don't watch it have the most negative image, those who do watch have the most positive, or the less negative. But also the distance, or the deteriation, or the negative shift is the highest among those who otherwise are the most likely to support it. The pattern for reading is the same as before. And this is the characteristic pattern.

Finally let me just call your attention to two other questions. One question is are scientists tend to be odd and peculiar people. The less than highschool people are most likely to say so and in fact their image of a scientist is so negative that even the television exposure can't do much damage to them. It remains to be about the same regardless of the amount of viewing. With the college population and the highschool population taking positions in which the college population again suffers the most deterioration. In terms of science, TV watching and science reading, I can tell you that the patterns are the same. Those who watch science TV, those who read science materials are not effected by television. The lines that you see here are those who say they never watch or never read, where the deterioration takes place. So that there is again, there's a significant difference in here, especially among those who do not watch, seek out either science oriented, high quality programs or science oriented materials.

Those who favor restraining science, who respond that scientists

should not be allowed to extend life, to create new forms of life, to discover intelligent beings in outer space, to select the sex of the offspring, in other words the general suspision and hostility. Among those who have less than a highschool education, who as light viewers are the most suspisious and most hostile, television actually recreates a certain positive improvement of the image. Among those who are highschool graduates, it makes no difference. Among those who have had some college and therefore who are the most positively inclined as light viewers is the most significant deterioration.

Finally, as Jon has pointed out there is a significant gender difference in all of these. Which I will just illustrate here. Women tend to be the most negative, the most suspisious and the most hostile towards science. Men less so, but their deterioration, or their association with television viewing is the most striking.

These are then the first glimpes at some of the facts, and more importantly some of the patterns of the association of the enormious amount of information imbedded in our entertainment, prime time television entertainment about science and scientists. And the association of images about science and scientists with exposure to that implicite information.

It provides a challenge I think for our discussion of, at least on two fronts. One is anyone who is engaged today in trying to mobilize that reserve army and of an even larger army that has not demonstrated any interest in science and yet is absorbing an enormous amount of information. This is what any campaign w with any attempt to educate,

with any attempt to inform this very large group is up against. The thing is knowing something about the nature of the battle field, that nature of the terraine is the primary requirement for being realistic and for trying to achieve some success.

Secondly, this is the common ground with which we can engage, or part of the common ground with which we can engage our colleagues, our friends in the media in some conversation about what they think they can do, how we can help them do what they can do because I'm sure you got the message this morning that most of them think that while they're doing what they can do, what they can do under the existing circumstances is not as much and not as good as they would like to do and indeed as they are able to do.

Thank you. Wilber Schramm:

With his usual efficiency, our dean has ended the meeting at exactly the time to go to lunch. And we will go to lunch.

Let me just say this, that if you have never before thought of how much we still have to learn about the part of the Triborough Bridges from the media to the people, this should give you an idea. There's so much to find out and it's up to us, or people like us, to find it out.

Thank you very much.

PANEL 3: EDUCATION AND POLICY

Moderator: Benjamine Shen
Reese Flower Professor of Astrophysics, University of Pennsylvania

..of the School of Journalism and Mass Communication of the University of Wisconsin at Madison. Rae Goodell of the Department of the Humanities at M.I.T. Roger Miller, Director of Communications Staff of the Food and Drug Administration and Dorothy Nelkin of the Program on Science Technology, and Society at Cornell University. I've asked each one of them to give a brief presentation in order that I have just introduced them and I think after each presentation ..... question. So we'll start with Sharon Dunwoody.

Sharon Dunwoody, Assistant Professor, Science Writing,
School of Journalism and Mass Communication,
University of Wisconsin.

Thank you. We'll all, I suppose, be talking about some very general things, but in very different ways. We sort of compared notes and this is going to be a ecclectic panel discussion. But in some sense, I think we're all going to be trying to turn the tables a little bit on some assumptions that people make about the public understanding of science. So let me give that a try.

Two of the sort of very traditional assumptions that are floating around this conference so far, as the best as I can tell, is that people need to know about science and technology. And that, as so often happens, we spend a lot of time talking about how to change the media to fit the goals. How to make structural changes in the way the media do things to fit what we think people need. That kind of an approach carries with it a kind of corollary assumption that the audience is something out there to be worked with. And what I would like to suggest are a couple of different assumptions and then make a couple of recommendations on the basis of those.

How about viewing the audience, no matter who it is, viewing all audience members as dynamic, information seeking individuals. Now you have information needs, they're going to go out after those kinds information under very specific circumstances. And instead of thinking in terms of mobalizing people to like science, how about instead, thinking in terms of getting scientific and technological information

to people who can use it under very particular circumstances. To get it into the public domaine in a way that is usable information. Makes it usable, functionable information for individuals.

From those basic turned around assumptions then let me make some suggestions about the way I think the media work relative to audiences and then some recommendations about what I would do about it, given the freedom to do so. If you assume that the audience is active, selective in what it goes after from the media, then you can take the media for what they are. And I think a fair amount of research is accumulating that sort of bares this up now, which is that they essentially are agenda-setters in a whole variety of informational areas that they serve not to pass along great wads of detailed information, but instead alert us to issues that are becoming important to someone and that somehow get on a kind of national media agenda. This get's back, I think, to Bob Bazell's notion that yeh, media are conveying something but it may not be enormous amounts of detailed information.

Second, I think the research also suggests that as something becomes important to individuals, those individuals turn into information seekers. They may not be information seekers on a real consistent basis. But when an issue rises that is life threatening or that has some direct impact on the kinds of things they are concerned with, most of us become information seekers of some sort or another. And I think the media are responding to that particular phenominon very well by their very structure, and I'll get back to that in a minute. So the question I ask is, when individuals become information seekers then what happens? When an agenda gets attended to by the public, when

people begin to look for information upon which to base reasoned decisions, then what happens? Obviously media information must be as accurate as possible under those circumstances. And I think that you've only to look at the level of training of journalists today, or the kinds of efforts that are going into training people who deal with scientific information for the media. To get a sense that there's been a rather dramatic evolution in the level of expertise of people who communicate science to the public so that, I think that the quality of media coverage of science has been improving rather steadily over time, will continue to do so. But I don't think the media, because of the structure and the kinds of constraints underwhich the media operate, I don't think the media will ever become the kind of mediums, in a sense, that are going to hand over the sorts of detailed information that we all need to make informed decisions about what we're going to do about scientific and technological phenominon that surround us. So as information seekers, you start with the media but you need a level of information that goes way beyond what the mass media can offer you and we essentially need that level to become informed citizens. And I would argue, and this is I guess my main point of my little five minutes, is that that level of information is either not available to non-scientists or is not accessible to non-scientists. It may be there but there is no way for those of us without indepth scientific backgrounds to get at it.

What do we have when get to a sort of different level than the mass media when we get beyond the agenda setting level, we have things like books, we have things like the popular science magazines. And we have the kinds of things that add a little bit to the information base.

But I would argue, do not add the kind of detail, I mean intense detail, that people need in order to make informed decisions about anything. I think the notion of informed decision making is something which goes well beyond what the media provide.

What do we need and, in my few remaining seconds let me just throw out a few things that I think will fill this particular gap, is we need to take advantage of the situational information seeking patterns of most of us. And I think again, to get back to that point I made earlier that the media do a very good job of this. We criticize the media for event-oriented coverage. I'd like to suggest that beyond the sort of production-efficiencies that are involved in covering descrete events. There's a very practical benefit to covering events, and that is that essentially events are the kinds of things that attract non-scientists attention. I think of Three-Mile Island, as lots of people do. I would warrent that during that accident enormous numbers of people became information seekers who do not normally seek information about nuclear power. So that, I think the media, as well as those, can take advantage of that kind of situational nature of information seeking which most people seem to ignore when we talk about the quality of media coverage and how the media operate or should operate.

Two, I think we need to provide audiences with, this is so general it's silly, but with some sort of critical information evaluation skills. This is starting to happen in universities, where essentially you take students with science, with the intent of helping them learn about science and get them into the mass media, get them into a variety

of types of information beyond the mass media, white papers, governmental reports, that provide scientific information. Instead of teaching the science, you teach critical information evaluation skills. What about this are you going to believe? Under what circumstances? Where do you go from here? How do you gather the kinds of information that you need next, and so on.

Third, I think we need a new genre of mass media, if you will - it's not really mass - but that takes things from this agenda setting stage where I think most of our popular media do an excellent job, and begins to provide that sort of secondary, indepth information to us. To those of us who are going to take the next step to seek information about particular topics. Most mass media do not provide this. Interestingly enough, it strikes me that new magazines like the N.E.S. ISSUES AND TECHNOLOGY is in some odd way an attempt at this very thing. To try and to provide kind of policy oriented, indepth information to people who are going to take the time to seek it out.

And finally, I think that for the lay public, there needs to be an increased access to information not provided by the media, but provided by a host of information sources, scientific, governmental. The kinds of information sources that are going to provide the sorts of detail that we all need to ingest in the whole evaluative process. When we're trying to make decisions about issues. Right now I would argue that most lay people simply do not have access to that stuff. They don't know where it is. They don't know how to evaluate it. It's a kind of problem that goes, again, well beyond just the mass media. But I think attending to the media in a way that fits the sort of production

strategies that they now employ, is a somewhat better strategy of incorporating them into this larger notion of public understanding of science, whatever that is, then trying to transform what appears to be a very durable institution in society.

Benjamin Shen: Thank you Sharon.

Are there any immediate comments on Sharon Dunwoody's ... yes here.

Question: <too far away to make out the question.>

Sharon Dunwoody: I think there are a number of magazines that do this. I would simply ..... I guess my point is that there are not going to be lots and lots of people who are going to do this. I don't mean to imply that this is going to be an enormous mass movement. All I'm saying is that information seeking is going to continue to be a very situational thing. It's going to be heavily dependent upon educational level. It's going to be heavily dependent upon walking into, being involved as an individual in some kind of a compelling, I use life threatening because I can instantly think of examples of that. But some kind of situation.

But I would note that those people under those circumstances, when you need information, when you need it, and you're going to go out and try to find it. And it's at that stage, I think, that we introduce people to scientific detail. To the kinds of facts that they need. And these magazines, magazines like TECHNOLOGY REVIEW, SCIENCE

TECHNOLOGY AND HUMAN VALUES, there are a number of them that begin to fill that gap and that do, understandably, very small circulations as a result.

Benjamin Shen: Ok. Thank you.

Rae Goodell, Associate Professor of Science Writing,
Massachusetts institute of Technology

Benjamin Shen: Now we go to Rae Goodell of M.I.T.

Rae Goodell: I decided to focus my initial remarks on just one particular aspect of the science literacy problem, one that I've been working on lately. Namely the role of the scientific community. It's not surprising that I've been thinking about this area. I teach at M.I.T. and I work with students and faculty there on how to improve the relations between the scientific community and the media and public.

I find that scientists and engineers in general that I encounter from the young people through the senior faculty want to be more effective in improving public understanding of science. And I think they can be and should be, or at least they want their colleagues to be more effective.

As much as the scientific community is already doing, I think there are untapped resources in the community. And that steps could be taken to reach them. This is not to say that scientists are not doing a great deal already in the area of public understanding of science. And by the way, if you don't mind, I use the word scientist to mean scientists and engineers and social scientists and positions in the entire community for short hand.

I see much more support of the scientific community than I used to. And the result is an impressive range of activities in the area of

public understanding of science or at least public appreciation of science.

As you know, the professional society, such as American Chemical society, American Institute of Physics, American Psychological Association, and especially the American Association for the Advancement of Science, are engaged in a variety of activities from new popular magazines, to radio shows, to museum support, to how-to-seminars for scientists who want to reach the media. And industry programs are spring up to support and train their staff scientists to interact with the media. And in academic research institutions, new programs offer fellowships to science journalists to allow periods of study on campus, M.I.T., Duke University, Harvard School of Public Health are all just recent examples.

These initiatives are coming largely at the institutional level, however. What I think needs further encouragement is largely the efforts of individual scientists themselves to become involved more actively, more directly in the mass media. In such ways as writing their own books and articles, speaking out at public forums, appearing on talk shows. My thought is to suppliment, not to supplant what's currently going on. I'm not at all suggesting that scientists could do it better than reporters. Or that reporters need supervision, or need scientists to serve as authority. On the contrary, I would like to increase the public's exposure to a diversity of views and a diversity of kinds of people who are actively doing science and engineering.

What do I think more scientists participating in the media, why do

I think it will be helpful? First, some of our finest science writing comes from scientists. And always has. As well as some of our worst. Some of the fine writers are widely known, and Phil Morrison is an example. And some are becoming known. You may know that the winner of the Triple-A/Westinghouse Science Writing Award in the magazine catagory last year was James Treple, Professor of Physics at the University of Virginia, for a series in the SMITHSONIAN. We could certainly use more writers like them.

Second, on controversial scientific and technological issues, we tend to hear from the scientist with strong views, or who work for organizations that have strong views. Because these are the people who are motivated to speak out under difficult circumstances. We, as citizens, need to hear more from the moderates, those who are not so sure and those who see the value in both sides of issues.

Third, the presence in the media of more scientists of all types and persuasions would help, I think, to address the alienation that seems to plague relations between scientists and the public that's been described in this conference. From what we've learned so far in the conference, students at all levels apparently don't see science and engineering as attractive careers. And movies and television reflect those beliefs in our society. Yet, as both Cecily, Kan and Selby and George Gerbner have suggested, how many real scientists do youngsters actually see in their every day lives? To what extent is it a part of their culture?

The presence of large scientific organizations producing materials

for these people doesn't change that feeling. The presence in the media of scientists and engineers themselves perhaps might. And the distance goes both ways. Lacking contact, I think that working scientists often misunderstand and mistrust the media and the public and this is part of the reason why scientists criticisms of the media and efforts to improve the media are sometimes poorly informed and inappropriate. And therefore, why their good criticism are often discounted.

How do we increase the direct involvement of scientists in the media? I think we need to address the reward structure in science. Somehow to improve the status of popularization as an activity for scientists. Recently at M.I.T. we organized a guest lecture series. Inviting prominent scientists and professional writers to reflect on the problems of writing about science for popular audiences. I expected to hear from the scientists, I confess, that most of the old problems were gone, the back-biting, the professional jealousy, the allegations that the popularizer must not be doing good research. The problems from within the community that are negative towards popularizers. Not so, these scientists told me. Attitudes may have changed but not enough. Colleagues often still question whether a popularizer can also be a good scientist, as if they were a contradition in terms. Object to their simplifying technical material and discount the scientific research of the popularizer. The negative attitudes discourage some scientists from popularizing at all and add considerable stress for those who do. And this, by the way, was even true for scientists the stature of Douglas Hoffstadter and Steven J. Gould.

I do see popularization improving a little in status. There's a catagory of activities in sciences, as I observe it, that includes administration, serving on faculty committees, this sort of thing that is acknowledged as a nuisance, but necessary. Most scientists are grateful if someone in their community will do it. I think popularization is inching toward that catagory. And we need to give it a boost to put it firmly in that catagory.

As Dr. Keyworth noted, science is fun and it makes it hard to draw people away from it. But for some scientists participating in the media is fun. And I think we need to give them some support. How to do this? I only have a couple of steps to suggest, and we certainly need more. One idea that I've been working with the Triple AS is the development of a major, annual award for scientists and engineers to recognize excellence in science popularization. There are a number of smaller awards now. AIP and U.S. Steel sponcer one, there's one I know at the Boston Museum of Science, and I know there others. The idea of such an annual award would be to make a strong statement that science popularization is valued by scientists and by society. If funding were to come from a variety of public and private sources, this would strengthen such an idea.

I'm also working at M.I.T. on the possibility of establishing there a fellowship that would bring to campus each year a scientist or engineer who wanted to pursue a project that was in the area of popularizing his field, improving public understanding in his field. Such a fellow might work with other members of the M.I.T. science and engineering faculty, might work with the writing faculty or the new

science/journalism fellows and others. And would produce, presumably, a book, articles, television materials, this sort of thing. A number of such fellowships in institutions around the country might have some impact.

So, I would like to propose that one of many fruitful areas for policy change, which I understood was our assingment this afternoon, is in paving a way for more working scientists on an individual basis to engage part-time in media activities. To encourage, in other words, not just science in the media, but scientists in the media. I would welcome further ideas in this area, because I see considerable potential for envolving scientists more frequently and more imaginatively in the science communication process. I look forward to your ideas.

Benjamin Shen: Bob? Yes.

Question: It seems to me that one of the things we haven't really said yet is science journalism is popular. When I think of science stories and documentaries, I get to say that these are the most illuminous bonds of the human race. It's a rare privilege .. and then six months later I get to cover an entirely new field. It is more fun than anything I've ever done. And I think that's an active field. Good, solid, responsible science journalism. It's enormously rewarding.

Rae Goodell: Absolutely. And I think that we're beginning to see that some students are discovering that. Because we're beginning to see a really dramatic trend for students who's background is in science and

engineering to then move into journalism careers. Specfically science journalism careers. We're seeing it in M.I.T., we see it in the growth of certain graduate programs that take only students with a science and engineering background. We're beginning to see a change in the field where it's actually attracting people with at least some science and engineering background.

Benjamin Shen: Jim?

Jim: Do you see any movement into education?

Rae Goodell: Movement into education?

Jim: <something>

Rae Goodell: Ah, good point. Are we seeing movement into education from students with science and engineering background? I'm not sure if I would be in a position to see it at M.I.T., so I don't know.

Benjamin Shen: One more question from Jim Rutherford.

Jim Rutherford: The idea of individual scientists working more with the media, I think is a very interesting one. But I'm still wondering who, from their policy decisions get made (?) Another way of thinking about it is that scientists and engineers work with people at the time they are making the decisions. For example, on community or city councils, on school boards, on library boards. That is to say, you'll find they participate with other people. They don't have to educate

them. They work together on local problems. The last time I looked, it was hard to find a scientist or ... Is there one way to encourage participation of this sort as .....

Rae Goodell: I think it's a very fruitful area and one I hope to have a chance to explore a bit. Yes, the notion of working at the local level on projects, philonthropic projects, even if scientists are involved in the media, but its at the local level, it's a more immediate kind of an affect because that scientist is more accessible to that community. And to work in the schools, to work in public, I mentioned public forums, as issues arise, very important. Again I see it as a matter of needing to change the perception of the value of that work within the scientific community.

Benjamin Shen: Next we go to Roger Miller of the Food and Drug Administration.

Roger Miller, Director, Communication Staff,
U.S. @Food and Drug Administration

Thank you Ben. One of my jobs at the Food and Drug Administration is public education programs. And I want to talk today about good press that has resulted in good public education programing. A case in point is the sodium public education program that we conducted. We began in 1981 and a little over a year later we did a nation-wide survey and it included a question about how many people were trying to avoid sodium in their diet, and 40% responded that they were. We asked the same question in the nation-wide survey in 1978 and 14% said they were trying to avoid the substance. That nearly a three-fold increase in just about a year's time. And incidently that figure was confirmed when we followed up in 1983 with a study and a nation-wide Roper survey showed that 60% of the people were trying to avoid the substance and last week I saw the figure on a GOOD HOUSEKEEPING magazine's survey, and it was 75%. We did all this with a program, with a campaign that cost less than $700,000. And that's less than it would cost a food company to buy three 30-second spots on 60 MINUTES.

Now how did we do it? It was a multi-media effort. It included articles in our magazines, publications, brochures, exhibits, print, radio and TV public service announcements. All of that was well and good, but I think that the most important thing about it was that it became a news story, although it's hardly a hot news item. Still it made the cover of TIME magazine and I think that was extremely important to legitimize the news story, for one thing. And I think it was that sort of thing that helped push it along.

Now another example of a good public education program and good press is the case of Mexican Vanilla. The vanilla is a product that is sold cheaply in border towns. It's not real vanilla, but it's an imitation that contains Comerin (?). Comerin is banned in the United States and other countries because it's poisoness. A derivitive of Comerin is used in blood thinning drugs. It is also rat poison.

We carried a side-bar piece in our magazine about the phony vanilla in October, 1983. Now the magazine, FDA CONSUMER, is of modest circulation. We've got about 13,000 paid subscribers and I doubt that anyone in this room is familiar with it. Nevertheless, it was reported from the Pheonix newspaper, who saw the side-bar, and had some Mexican Vanilla tested. Sure enough, most of the examples turned up to have Cumerin. One of the wire services picked up...he ran a story...one of the wire services picked up that story. Today it's virtually impossible to buy Mexican Vanilla from those border towns. I think those are two good examples of how the media can focus the public's attention on scientific and health issues.

In one case, it was an incidental story that blossomed into a major item. And I think both of these examples, and I think that blossoming in particular, are good examples of the great interest that the media has in health and science issues. And I think the public's response are particularly good examples, in both of the cases of the Mexican Vanilla and Sodium, are good examples of not only the interest that the public has in those matters, but also it's willingess to pay attention to the media. And I think this is something that this conference hasn't really looked at quite closely enough.

Now in saying all this, I want to throw in a couple of caviots that have already been mentioned. The media can be manipulated and it can be gotten off on the wrong track. Manipulation, an example is when a scientist who's maybe backed by an organization, an association, does an article for science publication and then gets a public relation firm to peddle that article. An example of the media getting off on the wrong track is often, and I think we're all familiar with this, on one study stories. A good case in point here is the prevailing notion that aluminum causes Alzheimer's disease. That story originated from a letter to the editor in the NEW ENGLAND JOURNAL OF MEDICINE. It was several years ago. The writer was a Yale University professor, who was really just hypothesizing and he called for more study at the time. This study study has never been, I mean the hypothesis has never been confirmed. And yet the notion persists. And one reason it persists is because the media keeps hauling it off.

I think we've got to remember that the public wisdom, unlike scientific wisdom, is easily formed. The public holds no consensus conferences to make up its mind. And I also think we have to remember that there is a lot of public education going on. But I think there could be more. Thank you.

Benjamin Shen: Thank you. Any comments? Yes Dr. (?)

Question: I wonder if you touched on a kind of consumer education, admittedly coming out of an agency, not a private institution. And Sharon Dunwoody talked on the receptivity to learning when I have less interest in learning about. According to your experience, do you have

any thoughts about how your efforts might be <something> in a different way, by television, by a drug company, by an electronics company. Again, directed to a particular <something> I know it's not necessary. It's not what you can do in a minute on TV. But you might offer a report on TV or something like that. Is that something that's worth touching on?

Roger Miller: That's been done quite a bit actually. Particularly by drug companies. The Phiser series, for example, they took 30-seconds after the CBS EVENING NEWS. And they're institutional ads that they're not naming the product, but they are talking about how to treat high blood pressure, for example. Of course, what they're trying to do is increase their share of the market or at least maintain their share of the market for hypertension drugs, as an example.

However, what they've found, they do give away booklets. And they're giving them away by the millions. It's a phenominal number. They run print ads also. They're getting a tremendous response from those print ads. And I think this all is further proof of the hunger that there is out there for people, for the very simplest kind of information about, this in particular is health matters, but it's still a science matter. I think there's very much a hunger out there.

Question: It could be extended to the electronics industry ...

Roger Miller: I think so yes.

Benjamin Shen: And last we will go to Dorothy Nelkin, Cornell

University. hunger that there is out there for people, for the very simplest

Dorothy Nelkin, Professor, Program on Science Technology, and Society, Cornell University

We've talked a lot today about the media as perhaps one of our few vehicles for maintaining a continuing level of science literacy in the public, about on going science and technology events. Yet as its been suggested again and again today, there is among scientists a very broad dissatisfaction with the media which is perpetually blamed, I've heard today, for inaccuracy, bias and sensationalism. The discourse on science and the media, usually focuses on the inadequacies of the press. And this discourse has gone on for years and years with no resolution. Yet the terms of the debate really seldom change.

Now, let me turn it around and look at the problem in terms of the relationship between the media and the technical community. And in particular, to be somewhat contentious, to focus on the issue media manipulation or public relations. The increasing public relation efforts involving scientists to shape science news.

Now the relationship between science and journalists must be considered in the context of the journalist's vulnerability in this area. Pressed by the constraints of news work, awed and somewhat fearful of scientific complexity, reporters are often too all too willing to believe scientists and scientists, lets face it, are increasingly concerned about image and increasingly willing to play the P.R. game.

So let me in my five or six minutes focus on some of the ways that

scientists today are involved in public relations. A major genre of public relations efforts involving scientists have been generated by those industries that are involved in controversial science-based technology. Industrial P.R. developed at the turn of the century first as an adjunct to advertising later as a means to influence public policies that might bare on government regulations. As regulatory pressures have developed with increasing public concern about technological risk, for example, many firms have expanded their public relations activity and they are engaging sciencists as an important part of these efforts to communicate technical information to enhance corporate credibility and to legitimate corporate claims.

For example, during the controversy over nuclear power, and I use that because its been raised several times today, the nuclear industry developed an elaborate P.R. apparatus that engaged scientists both at the national level, to convince the public of the safety of the technology, and at the local level to show that utilities were good neighbores. P.R. offices developed strategies to enlighten the press. Recommending that industrial spokesmen do some "semantic soul searching" to eliminate language that might work against them. Polatible symbols for scare words such as 'hazard' or 'criticality' said P.R. people, would facilitate public understanding. In the press releases that followed, nuclear sights became nuclear parks and accidents became abhorations.

As part of the effort, the electric power industry developed a nuclear exceptance campaign - a strategy "to use the right medium to communicate the right message to the right target audience." And they

decided that scientists were the right medium. The public, as I said, has faith in science, believe scientists and would listen. Accordingly, to give one example, Westinghouse hired a P.R. firm specialized in running political campaigns, to train their scientists and engineers to deal effectively with reporters. Between 1976 and 1982, Westinghouse scientists made 300 public appearances and held 300 press and TV interviews.

The chemical industry began to use similar strategies after the news coverage of Love Canal and Times Beach. They employed scientists to provide the facts and to counter the "eronious stories that were being printed and broadcast about the hazards of toxic wastes." Chemical industry leaders believe that the press is disseminating biased information that is creating irrational fear about chemicals. And they coined the term 'Chemophobia' or 'cancerphobia' to describe the public response.

The press claimed one chemical company spokesman is poisoning America. If there is any poisoning of America going on, it is not chemicals that are the culprits, it is the media. Accordingly Dow established a visible scientist program sending scientists, professionally trained in communication skills by public relations firms on media tours. In 1982, for example, 16 scientists visited 26 media markets, held 24 newspaper interviews, appeared on 62 TV and 76 radio shows, reaching an estimated 9 million people.

Following up the press coverage, I found their arguments were uncritically reported in local newspapers as facts. The New York City

public relations firm, Hill and Nolton, also runs a so-called visible scientist program, arranging meetings between corporate scientists and "the right" editors. Hill and Nolton orchestrated P.R. for the Calorie Control Council to counter arguments, Food and Drug Administration arguments, about saccharine. It worked for Met-Ed in order to increase press credibility after Three-Mile Island. And I've just heard here at lunch, also orchastrated the efforts of the asprin industry to counter the FDA reports that related Ray Syndrom with asprin.

Other public relations firms have developed what are called, this is not my language, 'Parachute Score Teams' or 'Truth Squads' of scientists who are ready to move into risk situations in order to difuse opposition and to present the facts. I would argue somewhat tentatively perhaps a recent proliferation of meetings on toxics in the media are perhaps another means to create a science base consensus that is compatable with the corporate agenda. Most of these conferences I have found out are in fact sponsored by industries.

I could go on to enubemmerate the P.R. activities that are increasingly coming from hospitals, research centers, universities and individual scientists who are supposed to be spokesmen or missionaries for their institutions when they talk about their work.

Now from the earliest days of P.R., journalists have regarded such efforts with cynisism. Today reporters are more skeptical than ever. I think any reporter here will talk about the deluge of press releases that come across their desk. However, the fact that they resent manipulation by P.R. professionals does not diminish the influence of

this syndrom. For sensitivity to manipulation is very often dulled by the vulnerability of journalists in reporting complex technical information. And by their often uncritical belief in science as an authoritative source of objective information. In some, the most serious problem in using the media as a source of public information about science and technology, maybe less one of the bias inaccuracy of sensationalism than these promotional activities in the context in which journalists tend to be reluctant to challenge the sources of information.

While political reporters aim to analyze and criticize, science writers usually attempt to allucidate and explain. There are very few I.F. Stone's. Very few Walter Lippman's today that are writing about science and technology. There's very little tradition of investigative or critical reporting in this area. And the few who are occasionally critical are often put down as unreasonable and irresponsible.

It is too often that scientists, and I've heard this come across today, believe that the press is simply a conduit, a pipeline for their views. And too often, it infact, is a conduit for those who use the authority of science to shape the public view about rather critical, important technological choices.

Benjamin Shen: Thank you Dorothy. Comments? Ah, not just on Dorothy's talk. I'm opening the floor for discussion.

George Gerbner: Next hour has a dual purpose. The first is to bring out the contributions, comments, reflections and critiques on the part of those of you who have not yet presented your perspective and on the part of those of you who have presented your perspective and wish to make further comments. In other words, to put all the cards on the table with which we want to deal.

The second purpose is to begin to construct the agenda of action, of recommendations, of thinking for later tonight and tomorrow. Let me ask then first those who wish to make additional comments, I know there are several people, to come out here or there. There are all the mikes, all the channels of communication are open and we would like to hear what you have to say. Please.

Comment: Well obviously <something - about 30 seconds worth> I learned a great deal here. And I'm grateful for all the <something> and forms of thinking that was impressed. However, anybody can <something>, what you really want, as I understand it, is a critique of what we've heard this morning and last night.

First I was a little appalled by the criticism of the media. Rather than criticizing ourselves <something> performance by us on the panel of <something> I think we've have to look towards ourselves.

The second thing that appalled me a little bit particularly after your presentation Dean, dening the calling of the <something>, is obviously this is more information into the field is going to accomplish the objective of making the American public fully conscious

of the significance of science and engineering to them as a nation and to them as an individual. <something>.

Another fact, that a little bit has me worried, nobody has defined the most critical mass market, it could be the press, to accomplish God's (?) purpose. I know you all read, and <somebody> has written, I'm not going to insult you by asking whether you did or not, but there was certainly no evidence that anyone of us has read that by either what came from the blackboard (?) or from us who are sitting here at <something>.

Why is that so important? The knowledge of what that survey speaks. Many hundreds of years ago, I don't want to preface this, I'm not a catholic, Loyola's <something> cleaning up by women, I'm using a <something> polite phrase, <something> back to catholicism, 'we must teach, not kill' <something> And <something> fight back despite the refirmation, a predominantly catholic heritage.

The natures of <something> and the statistic which were plenty here this morning by the two doctors convince me more than ever that only authoritative, indepth recent study of the plight of American education namely that <something> that I have read, and I've read most of them, is White. Our market is the public and private school market of the nation and the parents of those pupils attending the various housing <something> scientists to write. We heard how he wants to do this and he wants to do that. What we are talking about is a reading introduction of, what I like to call, liberal education in your <something> system. Some of you are educators. But do you realize

that one side of this country you had to have calculus. You had to have college geometry. You had to have science <something>. You had to have a foreign language. And you had to have English and you had to have history. Had nothing to do with science as being off the <something> but it ought to do with whether or not people become scientists and those who can't be A+ and educators, we have C- and C+ and B- averages become spokesmen for the discipline that they would like to practice. They know how to write it.

The second thing that appalls me is that here we are talking about <something>, in other words we must <something>. Where is the most .. personal man that we can convey and convince of the importance of science and technology - remember there's one very important <something>, if we can do it, lets do <something> and do that via the importance of science and do that via the importance and the knowledge of the application of science to the things of which <something>.

Now another factor, if I may say so, that worries me very much. We're talking about the <something>. Why hasn't anyone of you right now, in this place - what is the most important, single factor in the freedom of the United States? You would have to think long and hard. And perhaps it is because of personal (?), I can tell you that the fact that the public and private views of this country are locally imposed.

I was an American first, when I graduated from Yale in 1930. And the man who put money into my laboratory was <something> with my attitude. Took me to Europe and threatened that if I didn't go, he'd stop paying <something> in my laboratory. That man, was worth

... young man, was worth millions. Gave his captain and pilot in the first time we ever won the 4-man <something> in the Olympics. And in 1932, discovered that the German threat had taken the nuts <something> of his <something>. By criticizing because he was a 'fightin' boy', and it was fresh in the hearts of everyone in the country, and he turned around to me one night and said 'John when it comes my turn, I'll do <something>.' The man's name, by the way was <something>.

Well, he took me to Europe and a young <something> told me how <something>. It's very simple. If you were a successful man and didn't stop and wonder the road would be torn up under your class or your business. If that didn't work, the railroad track would be. <Something - about one minute>. ..and the Department of Justice have done it in <something>.

And so I say there are two reasons <something> that I think we haven't addressed and we should. One, give me a definition of the market we'll be reaching before we try and figure out how we're going to try and do it. And number 2, how are you going to teach independents in the educational system of our nation so we don't have a U.S.A. that's <something>.

George Gerbner: This was John Curtis, chairman of the Committee of Educational Telecommunications That Work With Instructional Television, in Williamsburg, Virginia. So we know we're in good hands in educational telecommunication. Next. One. Two. You're welcome to take these ....

Comment: There are a couple of things that I want to observe. I've been in Public Television for almost 14 years. And one of the things we really haven't addressed here is that in <something> public radio there is no climate of stability, predictability. <something>. Projects which are piecemeal <something>. In science journalism on public radio, one of the <something> critical <something> predictable projects, so that good people don't have to take on themselves the risk of <something> and the loss, the loss of <something>. It's not as true with <something> as far as I know. <something> work for a newspaper, people who work for the state or the government. You go to work for a good project in health and broadcasting <something>. And you know not where you will go after that. <something> And it's too much to ask of an individual, particularly as we get on in our careers. <something>. It begins to <something> we have to trap people into this business. <something> we want to make it exciting. It isn't exciting. It's sad. A lot of people will <something>. But we may loose some very good ones, because we can't <something>. <Something>.

George Gerbner: I am beginning to compile lists of items suggested to the agenda which we can later on mirge with some of the things that have been said previously.

Comment: <Something>. I happen to be a writer of technology <something>. I have a somewhat <something>. As an observation, I think some of the issues we must be concerned with which is not really out there. For example, it's not clear to me that the principle objective <something> of science communication and the public as a major forum. Why do we want to do this? What is it that we're trying

to communicate?

I would say there are a number of reasons, some of which are rather altruistic, but certainly there are a number of reasons that come to mind to me. Number one, I think, media does have the opportunity to encourage youth to invest their time and exert their effort to become more literate and to participate <something> in the generation of new science and new technology for their own definition of our own benefit. And that's a little bit altruistic. I think it has to be so.

The second thing is there are some pragmatic issues. For example, you have demographics working against us in the future. There will be a significant decline in the numbers of youngsters that are going to college and in particular that's going to have a significant impact on science and technology education on a college level. I think that we are in for even more trouble than we have right now with regard to the quantity and quality of educated scientists and technologist <something> engineers at a downstream point. So I believe that the stimulation of education and literacy is important just by the numbers than by any other consideration <something> the declining number <something>. Another aspect is that there is absolutely no question that the work force in this country cannot do what is demanded of us in the definitive posture world-wide without increased in <something>. And I don't necessarily mean just the Ph.D.'s and scientists and engineers who will be contributing in the research <something>. But rather even on the manufacturer's floor, there is no way modern manufacturing can take place without increased skills in that

manufacturing work force. Confidence in those <something> design computer <something> absolute no industry can get by without it. So, I think there's an absolute necessity to increase the demand of science skill levels throughout the population as a very pragmatic issue <something>.

Another concern of mine is just having <something> the quality of life, I think that technology ..... <something's happened to the mike here> I think that goes along with what was said here about <something> you're going <something> I didn't hear <something> and I think education on the primary and secondary levels continuing on through into the graduate school is absolutely essential <something> The terrible state of affairs for many of people who have <something> to school without having had the opportunity to <something> interests, or have been forced to have math and science education <something> I'm very strong <something>, very strong on basic science and technology. Very strong on the application of <something> which I think is very crucial consideration <something>. George Gerbner: 1, 2, 3, 4.

Comment: Well, I'm certainly astonished that I should be the one to say this. But I would remind us all that television so far has been a throw away media. <Something> and off it went into <something>. It's going to change. The home video, which can be used in the schools too, and the fact that that ephemeral hour now exists in a little box has got to change what we make and will certainly change how it gets used. Just to <something> you remember that one.

Comment: Let me just add one <something>...and that is the importance

of informing the public on technologies that are <something>. Not only on personal <something>. So that these technologies can compete <something>.

Comment: I just want to bring up two points that I hope we keep in mind. First of all, <something> that the media are not on <something>. And in most of our discussions, we are talking about <something> and most of what we can find <something>. <Something>. We have <something> that are barely out of journalism school with very little training in science, who are cutting their teeth on a .... <sound gone> ..... who are reporting in newspapers <something> appealing to their concerns and even to make a referenda. And I think that's something we very much have to keep in mind.

Secondly, in the <something> education studies have shown, recent studies have shown, that most editors are not terribly interested and do not push mid-career training of any sort, from general assignment <something>. They feel that general assignment reporters, if they do have any career training, will leave the publication for a broadcast station or they will become prima donnas and will then not want to cover the cops, the courts and <something> and will want to cover science, health and so on. As a result of that, those of us who have offered programs, mid-career training programs, environment, health and science reporting through oout the nation, have found that despite that these are sponsored by a variety of sources, including supposedly <something> and the Science Foundation, we have only been able to attract anywhere from 20 to 25 to 40 regional <something> to attend these workshops. And the reason we know is primarily that 'well, we

have a small staff. We can't send them for a day and a half, and so on.' That's really not the underlying reason. <Something>.

Last but not least, the education of journalism students, efforts have been made through professional societies of journalism educators to try and discuss with journalism educators, adding more science to the curriculum. I must admit, unfortunately, that there is not a great deal of interest. The questions we get back are something like 'what's so different about science compared to law or economics?' 'What makes science writing so different? It's just another specialty field of journalism.' 'Why should we train our students in science technology? Why shouldn't we train them in economics?' And these are the kinds of attitudes that I think we should be aware of when we talk about educating journalists in science.

Comment: For those who haven't identified me as a wolf in sheep's clothing, you better <something> work in the Pentagon. I have deep concerns about the education attributes of some of our young people. I had the .... <tape fades out>.....<ABOUT ONE MINUTE>. My concern happens to be that we don't have enought <something> to really understand the science of mathematics. We have rationalized that <something> through the years <something>. We have many things that we should be very proud of. One of the things that I think is turning around <something>. Now I'm not talking about war fighting. I'm talking about this, the main problem of America <?>. Part of that is being able to stand on your feet and to be able to do things <something> that are not going to be done unless we have the help of communicators. Media, I still think that <something>, need to educate

the general public about the meaning of national well-being related to science and mathematics. If we don't do that, we don't do that in a very quick time, we're going to be way behind the <something> here. In my job, I travel around quite a bit. <Something>. Other people working around the world seven days a week and they are very energetic, and they really have <something>. <Something>. ..second to none. And I want to kiss the ground <something>. We ought to do something and we ought to get together and figure out exactly how we do that so that we don't <something>. Early on, secondary schools must stick together. We have a great media to do this. And I was trying to <something> down in Georgia, trying to hook up a flight to Georgia Tech because I thought it was a great engineering school, just to get more engineers in there. But most of the young people came to be an officer in the signal corp, and I'll have to admit, I stumbled around for seven years before I went to the University of Michigan. I was an <something> and you can't teach technical engineering too well and you didn't know who they could reach. University of Michigan at least gave me the technical background to challenge. Most of my young officers <something>, 80% of them just do not have the technical background. They had psychology and theology and <something>. They cannot challenge these systems. I have systems that they divide up and go talk to my boss about what global positioning satellites systems, paid <something> radars that look out across the ocean over the horizon radars, these kinds of thinks - you can't do that with a psychology background. You have got to have a science background. And <something> well, before I left <something>. <Something>. And we need to go ahead and spend money to create interest in science and mathematics and use the media in telecommunications to do this. It has

nothing to do with war fighting at all. <Something>. But you have got to have the technological background to put all of these subsystems together. You can't do that with what we're arguing about in 30 seconds on this program and 30 seconds on another. It's going to have to be done through Public Television and private networking <something>.

Comment: <Something> ...when you think about communicating about science. One is, I think it's important that we speak from a common definition of what it is we're talking about. When we talk about communicating about science, will the public understand us? Are we all talking about the same type of <something>? Some of us mean public appreciation (?), are we talking selling science? making people like what we do? getting more public support? I think we have to be really careful that define the terms that we're using and that we don't just assume that when we say something we all mean the samething. <Something>. Another point that I would like to raise is in terms of science information, what types of science information are we talking about? We talk about the need to educate the public in <something> science <something>. Are we talking about teaching facts about science? scientific phenominon? Are we talking about teaching more about the <something> of science? How science works? Are we talking about having people understand a little better the rudiments of science? <Something>. Or are we just talking about people having a greater understanding of the world within which they live? And critical to this, I believe, is who's value systems are we talking about using as we're conveying information about science? Some of our speakers have discussed science as if it is not complete. And have

made statements as if they were fact when in fact the scientific facts are a very small part of what's being discussed. And a lot of the areas which are being discussed <something> the last few hours have in fact, been very heavily in our belief systems and our values. <TAPE ENDS>

Comment: ...just brought out some of the points that are closest to my heart. I thought, in all fairness, since I had a chance <something> last night I was able to see how many of the points <something> have surfaced. And I think most of them, <something>, which to me is the guiding issue is still: what is this understanding about? What is it in a 3 minute news program? What is it in your memory? What is it in the science section of the TIMES? What it is it in the magazines? One of the things I learned today is how very clearly they are different. I have a better understanding of how they are different and I would like to see us work on an understanding of the bottom line of what can be achieved in each place. With the emphasis that I would wish to <something> on you more, Dean Gerbner, is on the children - on the youth. I'm sorry that I haven't heard more people pick up on the emphasis on our final debate last night about the <Something>. The very earliest, the very youngest children. <Something>. One, two reasons. Number one, if you're interested in future leadership and talent you have to start. Every piece of data says that you have to start there. Secondly <something> and all of these children are also going to become parents, we hope most of them. So if we start, if we emphasis the very youngest we're also reaching the next generation. And that is the most productive place to start, with a clean slate, while they're still young scientists in the first grade and still young

technologists before they've had a chance to get conditioned <something>. So, I would wish the youth emphasis could include anything, but particular emphasis on the youngest ones. And in term of Philip Morrison's point about home video, I was also disppointed today not to hear more awareness of the interactive kinds of mixes of technologies that we're going to be interested in in the future. With the home information system, it's upon us. And so, interactive TV, the interactive with the computer combined with the disk may be too <something>. So, if we're talking present <something> they're not exactly here. But they'll be with us very quickly. So the whole idea of the issues of the home informations systems and the degree to which the home is or is not, but at least lets talk about it. Is or is not going to be very much the source of learning, of information and understanding we would hope in ways that we have not quite yet <something> and then to Ms. Roger's point of the bottom line of understanding, I still want to talk to you about the technological understanding, which I think is pretty easily achievable and should be everywhere. In the arts, in the humanities, history as well as science. And science to me is still this other way of looking at the universe. It's like religion, it's like the arts, it's like philosophy. Understanding takes a long time. It's worth every bit of effort. And it deserves the same kind of effort we make in the arts. So, I would push for <something> ranged goals for technological understanding. So, I think perhaps in a time <something> might be to distinguish short- and long-term goals. Obviously if we're talking ages through six, we've got long-term goals. If you're talking a current <something> public, we could decide upon what could be accomplished in short-term for the next referendum of environment or

something. So we have, and I will say <something> short-term <something>, I think perhaps that's about it.

Comment: It was very interesting to hear Mr. Curtis <something> we still have to make sure that we will not

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George Gerbner: Thank you. I think we have made a good tour, in fact tour de force of the various issues and I'm impressed and a bit amused by confirming my long standing suspicion. Which is that the basic arguments among people, and indeed among peoples, are not about whether something is biased or objective, but about what is it to be objective about? That is what are the things that are salient? What are the things that are relevant to our purposes? What are the things that should receive the highest priority of value?

Well you can see that there is a wide variety of perspectives. And so I urge you to consider that in order to come up with something that receives the widest possible support in this group. Consistent with basic objectives, you simply have to acknowledge the fact that there is not a single scale of priorities, there's not a single perspective, but a multiplicity. And indeed they all, or most of them are more likely to be complementary than in conflict.

We're now reaching and will reach in about 30 seconds the end of the time of that phase of our discussions that is devoted to discovery, to information infusion, to sharing, to critiques and the injection of new ideas. I would like to make the following request for our next

phase. Lets stop asking questions, they're not going to be anymore big answers. And lets stop asking other people to do this or to do that and begin to propose schemes and general perspectives ourselves.

The basic question is, is there anything that we can say? Or is there anyway of saying what has been said before? That is new, that is challenging, that extends or challenges some already established, existing concept? Many of the things that we are saying here have been said before. Some have not. And I'm not saying that just because something has been said before it doesn't need ... that might not need reinforcement, confirmation and additional emphasis. Let us now try to be selective and ask the question considering not only what each of us thinks to be important, but this group as a whole seems to be converging on. The kind of perspectives, the kind of directions, the kind of targets to be addressed, the kind of positions to be targeted. What is in that area, some of which are on the sheets that we will be displaying later on. Some of which have been discussed earlier that we'll be reviewing later on. What are the things that are, again I hate to use the word 'new' because 'new' too often means something I haven't heard of before only to discover that many other people have and so instead of saying 'new,' what are the things that we believe extend or challenge something already known? That will provide, will provide the basis for a reasonable, wide acceptance, at least in this group and perhaps in others.

And with that we'll have a bit of rest and I'd like to invite you to come back here at 7:00 for cocktails, dinner and further conversation. Thank you very much.

Dr. @Gerbner's Speech #3

George Gerbner: ... drink a toast to the people without whose inspiration and support and personal attention to every detail this conference would not have been possible, the Ambassadors Walter and Lee Annenberg.

Commentator: May I have your attention. It's working, it's working beautifully. Every none broadcaster in radio and television usually goes 'Thunk, thunk, thunk' and wants to know if the microphone is ready. And every audioman in God's creation then comes out and buys another microphone and sets it up.

I want you to know that you're in for a treat tonight. If someday soon a space ship stops on my back lawn and the alien informs me that she would like to learn about our planet and it's people, I'd call Phil and Phyllis Morrison for lunch. I'll stop now.

Phyllis, a specialist in science and the education of the young, is a teacher, weaver, curriculum developer, exhibit designer, author on her own, and with Phil on such varied topics as geology, weaving, defense matters and recently the marvelous POWERS OF TEN. And tomorrow she leaves for Dehli where she'll be consulting for two weeks on most of those topics.

Phil is a teacher. A teacher-physicist. Many say he created the field of Cosmic-ray physics. His students are energized and activated by bright and patient mentor. And he has been for many years been an explainer of science to the public. Several series on BBC and

hopefully a new 6 program series on the nature of evidence in science that we're trying to find at this moment.

He's been a keen and thoughtful creator of curriculum. Working on the long and important development of physical science studies committee, physics and the elementary science study. Many of you enjoy his monthly delights as the book reviewer for the SCIENTIFIC AMERICAN. He also makes great pasta. And it hurts me to say that, because I thought I made great pasta.

Born in Pittsburgh, he often credits his early interest to a crystal radio receiver. His first degree is from Carnegie Tech. He received a Ph.D. in theoretical physics from Berkeley. Following his teacher Jay Robert Oppenheimer to Los Alimos in 1943.

After the war, Phil joined the Cornell faculty. Came to M.I.T. in 1965. Since 1973, Phil's been institute professor - M.I.T.'s highest honor. It is a really great honor to introduce Philip Morrison.

Philip Morrison: I'm very grateful to Michael for this kind introduction which you all heard. We are partners in more than one enterprise and good friends. And as you can hear, exchanging mutually the recipies for pasta. Which is fine. But I have to say though, in some contradiction - just to keep the record straight - that the last few weeks I've been very much impressed by a little bit, which has appeared on Public Television advertising the fairly charming children's show which was a visit to the Metropolitan Museum with the Muppets. And in that trailer, one of the most conspicuous of the

Muppets with a wonderful turn of expression that I can barely imitate, talking about the father of our country on a certain christmas day when he surprised the Hessians, points and says "New Jersey," now "New Jersey" over that way, that's where I was born. By the way, I extend an invitation to all friends here, Phyllis and I and a few other people in Boston have set-up an organization known as the Academy of Sciences of New Jersey and Immigration. And anybody who claims to be eligible for that will see me, he can have no duties, no dues, but you have the delightful companionship.

All right. I have to come to the end of a long and exciting day, full with information, full of conflicting opinion. I want to try and say a few things that I have seen as coming out of, as describing with some degree of coherence for me at least, some of the issues that were enjoined today. I think that's my task. What I'm going to do less than a summary, but is more than a statement of my own opinions. It is something inbetween. And I hope it will of value for you too to reflect upon what I'm saying as we distilled it from the people who have been here and a few other matters.

Now I have to begin by making a remark which is the remark that physicists would almost always make. And I make it with a little more confidence because I can sight a very distinguished social engineer who made the same remark, but a man without any technical training. Namely the late Chairman Mao, who said "You always ought to know the essential figures in order to understand anything." And while we did hear some very interesting statistical data on opinions and attitudes in the audience, we did not hear what I think are the essential figures worth

thinking about. Because they underlie a good deal of what we see and complain about and dream about in this context. So I want to take a few minutes to talk about them. I think they're accurate. Be glad to discuss their origans with anyone.

First of all, I think it's important to keep this in mind, from the point of view of the viewer or the listener, TV and radio, well-known telecommunications media, have a remarkable property which no other medium has every had. That makes them unique. The speed, the simultaneity, the degree to which you can take any part of the world and transmit essential information about it to any other part of the world in the flash of an eye - or a little longer than that perhaps, if you go by satellite. This is unique. But I don't think since, of course it's true that some of television, perhaps it's best and most important moments are those moments in which simultaneity plays a role. Like the debate we saw in this room. Where the sense that the whole country was at the same time engaged in activity, brings to that activity more importance than if it were two weeks ago, and something we read about and so on, you understand what I mean. And of course the samething is true in much more trivial matters, sports events and so on. There these media have a unique property. And, I call that to your attention.

But I really think that the reason for the enormous penetration and importance of the image-producing and to some extent voice-producing telecommunications media is a simple economic matter. They deliver enormous, all but infinite source of varied image and word, at an extraordinarily low cost. We think, in the producing side

of things, of television as being expensive. But of course the point about television is that it's cheap. Enormously cheap to the viewer. Expensive to make, but that expense is split among so many shoulders that the cost-burden is very, very small.

If you put it all together, counting production costs, delivery costs, maintance costs, power costs - the lot, only not counting the opportunity cost of the time that the viewer spends looking at the tube. I'm not including that, which is much more expensive than anything else. That is, they ought to be getting value from looking at the tube, or else their wasting their time. That cost is about 20 cents an hour. You can't go to the movies for that. You can't eat M & M's for that. There are some other things that you can do, but not very many. Twenty cents an hour is the cost of television per viewer hour.

In elementary school, which is of course a more extended experience, more intense, perhaps I would venture to say even more necessary, the cost is up a good order of magnitude. It runs now-a-days about $3.00 an hour, per student per hour in the school. Now in higher education, which is of course more specialized, again, more diverse, fewer persons to share the economic burden, the costs are quite variable, but if they run from $10 to $20 to even $30 an hour, it's not so extreme.

You see, there are three orders of magnitude here involved: television and school and the university. Now this, I think is such an important economic question. That though I'm not trying to

draw any profound lessons from it, except the one that it shows what accessibility implies, that it shows what is difficult to do to change great numbers if you try to substitute one or another of the these modalities for each other. You can't do it. There simply is no way that we know that we can approach the delivery of manifold change in image and word that we can do by the remarkable process of having a video channel, two megacycles or so wide, that we can bring to every household. A remarkable affair. Now of course there are ways of doing that, I want to comment on again, which is the samething but don't have the simultineity at all (I pointed out that that's important) and I'll say something more about those in a moment.

Now the second point I want to remind you, this was not told us today, but what I am now going to say was told and it's equally important as a kind of fundamental basis for all thinking of reform, modification, appraisal. We learn in our country that are about three distinct teams of people, I should say. 'Team' is not quite the right word, but 'bands' or 'large groups,' 'moieties of people' engaged in this huge activity that we're talking about.

First of all, the formal education system and its informal adjuncts. Speaking of the formal system alone, the people engage in it not as students but who run it, are quite numerous, about 3 million persons — give or take. The entire core of teachers at every level, administrators, school caretakers, you name it, that's summed up in that number. I like that number because that's approximately, and this is a harder number to define because I can't give the class so truly, but that's approximately the number of persons who engage in a

productive way as responsible scientific or engineering personnel, trained personnel, in all branches of science and engineering. That's again, including physicians and surveyers and everything of that sort, again that's about 3 million people. There might be about three times or maybe four times as many people as that engaged at a level of less specialized training assisting those people. The technicians who make the things go 'round. Who carry out the specialized tasks in support of physicians, scientists and engineers.

This makes, of course, of quite considerable block of the population itself. And I think, I would like to know more about this and perhaps our sociological measuring friends will find this out for us sometime, I suspect that those people and their families, now mounting to 15 million people, wage-earners, and another simular number adult family members who share a good deal of the values and interests and attitudes of those, that's already a very substantial number of persons. I suspect that they represent an irreducibly attentive audience for that all that we're trying to do. They identify themselves with science and technology because it is their livelihood and they generally like it and they find, however remote they are from any particular accomplishment, they find that they have some sense of identification with the entire set.

The third great 'team' we're told includes as many, as the numbers show today, is half of the American adult population (from 16 up) who found themselves willing to answer the question 'yes, you're interested in scientific discovery.' Of course that amounts to close to 80 or 100 million people.

So you get some idea of the size and the cost of these things, and I thought that should be placed on the table as a kind of foundation, a kind of underlay, for everything that we try to think about. When you try to make changes you have to think of the scale with which they have to be made, the number of persons they will effect, the kind of resources already being spent in this endeavor and how to substitute them.

Now, I would then like to make some remarks speaking as a scientist, and I've been an intending physicist since I was very small, since I got my first crystal set, just before my fifth birthday on the day of the election of President Harding. It's true. What is the situation? Most of the discussion, not all, most of the discussion that we had revolved around the interest and concern, a short-time concern, of the greatest importance. Namely, the relationship between science and technology and the public understanding of it in the formation of public policy.

Now this is, was viewed pretty much as an issue by issue affair. And in some way it has to be. Because in some way, the details that make the difference are not generalized. They depend upon concrete, specific, usually experimental or accounting knowledge of some particular part of some particular complex system or process. That's the way it goes. Whether it be the strategic defense initiative or nuclear power plants or environmental waste disposal. Anything you mention, those things come it.

Now, here of course, it's not easy to imagine that apart from the

most determined and skillful effort we see, and we see many craftsmen like a, brillant efforts at bringing issues and discussion to the public in this context, that you can do much in a more general way, that is not related issue-to-issue. But there is of course, something you can do. There is a web, a fabric of connection, among all these things. It goes in two directions. It goes in the direction of the process of judging what is true, what is false, what is likely and what is unlikely. Which is the basis of most scientific judgement itself, or technical. Evaluation of evidence, maintance of doubt, tentitive acceptance, these are the things that you might hope to produce as a general phenominon, a general kind of education, in a public which from pre-school to cheerful, late-in-life watching of the tube, would bring with it some sense repeating these ideas again as credentials for the evaluation of any arguer and any authority who appears before the public.

In science authority of course plays a role. It has to be. There's no way in this socially and physically complex world which every person can for herself come to a conclusion about everything. It's not possible. We have to regard ourselves that we are. As a society we have to rely upon people. But the role of authority and science is low. It's not so low when it comes to the media. But it's low to the scientist. Yes it's true that we think the best people do good work and we tend to accept what they say, but we look at their citations. We look at their evidence. We have concern for that.

By and large, the values that are shared among scientists and technical people as a whole, are very modest ones. In the sense they

don't encompase a great many issues in life which we have to cope with. And judgements we have to make. Matters we have to adhere to. But they do manage with some. And these probably are those which could come through a kind of consistency test for everything we might do in science.

The first one I think, and this is a simple one but it's quite interesting, like all human activity it's not invariable, is that by and large scientists try to tell and technologists try to build truthfully the stuff that they build. Because it has the test of performance. The test of repetition, the test of performance are very severe tests. No matter how brilliant a label you print on the box, if the object inside doesn't make the toast than it's a rare consumer who will be satisfied with the purchase. That's not so true for public officials where many circumstances intervene and the official may very well not succeed in fulfilling his promises for reasons beyond his control. But in a simple matter like a product, that's not at all the case. The product is varifiable. And that's true for scientific results and so forth.

This consequence that people try to stick to the truth and that they are very often in error I think equally true, has built for the scientist the structure of tolerance. Not that he remains calm about all this. Dispassion, objectivity, calmness, generosity to the opposition, these are not pre-eminante scientific virtues. There's no sign that they are. Most of my colleagues would blanch if they were accused of any of those things. But they do know one thing. They know you better be tolerant of somebody in error - you say he's wrong. But

that's all. You let him be wrong because sooner or later you'll be in that position yourself. And the notion that you can be wrong and still come back and say something right or that your judgement may be modified. Some very important judgements characteristic of the scientific community, which is not generally true in many other domains of life.

With that there goes the defference of judgement to a later time. The maintance of levels of acceptance which are not that everything is true or everything is false. But things have a plausibility. A half truth. We understand very well that the truth is very hard to come by. It lies in the bottom of a well, as we're told. And you don't always get there, but you get somewhere. And that's why things work poorly at first and inaccurately and uncertainly. And then gradually, gradually, gradually they enter in a good situation, a domaine where there isn't any longer any doubt.

The scholars of europe, the brightest people in the world at the time, and we're not any brighter than they were by a long shot, in the tenth century were quite uncertain about the roundness of the earth. They fealt that it was a good hypothesis. They argued a bit about what happened to the people at the Antipides if they fell off or not. And so on. But it didn't take very much effort to recognize that there had to be something new. Now this issue is long since closed in science, not perhaps to every human being alive, but in science it's definitely closed. The world is a sphere, near sphere, and we understand that the Australians have just as good right to point up and down as we have. Another example of the kind of tolerance which is present.

Now, I would like to make a remark with two examples to it which I found which may compliment what some people said, but was not really much emphasized today. That is that there is a minimal question of quantity which occurs in very many judgements and which is indispensible to science. Not all science is based on quantity. If you read Darwin's book, epoch-making book of the early 1860's, Origin of Species there are very few numbers in it. The few that are are quite important. But very few. Broad qualitative judgements, 'more and less,' 'many and few' were good enough. That's perfectly all right. Those are just as quanitative as ten decimal points. They just don't have as much information as that. But they represent the same kind of attitude. So I don't want to argue that is all important. But there are somethings which are important and which I want to mention because as a close student of print media, I'm really disappointed by the way in which, for a generation or maybe two generations to my knowledge, nothing much has happened in the very best journalistic places to modify what seems to me two heinous sins of commission that I find characteristically in the learned pages of even THE NEW YORK TIMES. Not when Walter Sullivan writes it, but what anybody else does.

And I'll mention these to you. They're very simple. They hurt me and I don't know why and I think that it cannot be the ignorance of the draftsmen and editors that were going to be responsible. I think that it represents a deliberate judgement. And I don't understand why their judgement so falsifies what every quanititative scientist, I think, would agree with me, is wrong.

And the thing that I'm especially talking about is the subression

of zero on graphs. Every few days THE NEW YORK TIMES, I see a graph and it shows the percipitent decline of the importation of marshmellows from Argentina, or whatever it might be. And I look at the curve and it's a rather steep decline. I know its the affect of the administration or something like that. And since I feel that way too, I say 'well another great difficulty.' But I look at the graph and it turns out that this is a decline from 9.7 million tons to 9.2 million tons. And zero on the graph is way down there at the bottom of the page somewhere. But the artist recognizing that the variation is the very point of what he's supposed to draw, or thinking that's the case, has naturally expanded the scale and he has to remove the zeros so you can see the slope.

But of course the main point of that graph is exactly the opposite. The main point of such a quotation is to show that there is no important change, and who knows what that small affect is due to. And if that were just a straight line on the chart, horizontal straight line, and alright then - no point to write the article. And I guess that's ... I really can't understand that it's such a misleading way of presenting graphical data.

I would like to add that a superb book has been published by Professor Tuft of Yale University analyzing graphics as a means of communications or a means of miscommunications. A brilliant work. Full of not only superb criticism of a artistic, geometrical, logical kind. But also with very practical ways of getting over it. He actually supplies solutions for very many people. This is a wonderful book which I hope many will look at.

But I can only believe that this is a case where the communicators do not want to communicate in a clear fashion. The general use of visual representation of quantitative data is so important and so faulty in our country. In fact Professor Tuft also included a very nice account of what happens in other countries. For example, in Japan - now Japan is being held up in many ways to us as being not all that great - but they sure have got a lot of good graphs in the Japanese newspapers, I can tell you that. Much, much better than THE NEW YORK TIMES. And I hope after 30 years <something> I could only see graphs in THE NEW YORK TIMES without the zeros suppressed. I would say 'At least I've done something in this world.'

Well, I wont even go on to discuss the three other points. One point I have is that the matter of ratios again, baffles probably not the science writers, but practically every other journalist who touchs the problem at all. Numbers I can understand. More money, less money. That they can understand. But ratios. That is the amount of the sum quantity corrected by another quantity as a devisor, that gets beyond people. And the most characteristic feature of this is discussed anytime you read a story with a foreign byline from a foreign correspondent of one of the most respectable wire services or newspapers. You could be almost sure if it ever happens to visit a power plant or a dam or any such source of power it will absolutely not get straight, much greater than by chance, the distinction between power and energy, the units, kilowatts and kilowatt hours, they are just not capable of keeping this matter straight at all. And so you read a lot of strange things. You know it's very hard to replace the facts because the facts are garbbled in this terrible fashion. That's

been going on as long as I can remember newspapers. And it doesn't matter what one does, these things still continue.

Now it's not a trivial point. I regard it as a very important point and not easy to understand the difference between energy and power. It's the difference between a firecracker and a horse drawn vehicle running for a week. Should be able to understand that it's exactly the same joke as to why white horses don't eat as much as black horses. I don't know. There are very many fewer white horses, and of course they don't .... But somehow that's never made its way into the general knowledge that supports journalism. In face of these difficulties, I'm not sure that it's easy to make changes of the sort we want. But maybe I've misunderstood. That there's some hidden part of the agenda which has not been given us.

Finally, I would like to try to characterize what I think we really have to consider very seriously in any proposals that we may wish to make. I've tried to outline just from what people said during the day, with my own experience, the kinds of interactions, the kinds of confrontations that individual participants in the media, in all forms of communication, would encounter in the activities of learning something about science and technology. Notice I'm, as I think with most of us, we don't see a strong difference between these two at the more introductory levels. I think that they lie very close to one another. The differences now-a-days are quite strong by historical reasons, but in their beginnings they are one and the same and they remain closely cross-fertilized by each other for all this time. As essentially Selby told us.

The 30-second experience which is the length of a short commercial is one limit of the time frame which something comes to mind. It's a convenient limit. I don't think you can actually see something in a flash less than that. But this is the kind of communication effort we find. A larger limit is a much more heavy engagement of human life, and that is for example the winning of a Ph.D. That takes about 10,000 hours of hard work. So between 30-seconds and 10,000 hours this is a very reasonable span for educational activity.

Now looking at that scale it's plain to me that they can't all do the same thing. And they can't all be approached in the same manner. And there must be involved in our planning and in our understanding a hierarchical set of activities for each of these things, and I'm sure that's well understood by the producers of every one of these objects. But it's not perhaps immediate when one tries to criticize things in a general way.

I wanted to describe really four kinds, and then quit, four kinds of interactions. Each of which can span a considerable difference in time scale. Which represent different stances before communication, which is trying to engage some person in an activity of learning or communication.

First of all, and I think the one that's the most important at the youngest ages and for the widest portion of the population, one which was formally universal and which is now-a-days much less so because of our great urbanization and our freedom from primary physical producation for most human beings in advanced countries today. And

that is what I will simply call experience. The experience of the world. The lifting, the looking at the moon, the growing of plants, the cycles of life and death - everything you can call as the kind of experience which is dealt with at any one of the domains of science. From rocks to stars, from trees to oceans. Experience with this multi-media, multi-sensory synthetic and analytic in all it's domains, this represents the sensory and experiencial foundation of everything that the scientist and the technologist really does. Of course, as one goes on, one becomes more abstract and gradually subsumes a number of greater and greater generalizations and with more and more detail, both of those happen at the same time. But the real thing is you've got to have something about this or it seems to me that the whole enterprise is not going to succeed. I'll say a little bit about why images are not enough in just a moment.

I think this is valuable. And I think for us it represents that which is delivered with some difficulty perhaps by elementary schools, by teachers centers, by museums. It's indispensible and it's something which has the property that it costs a good deal more than the quick pulses which make video image, audio-communication so powerful and so accessible today as I began by saying. It's very important to realize that.

The second is the marvelous product of this image-rich world that we have. I've just been reading a book, a very interesting book prepared by our professor of history of science at Harvard University, Professor Murdock, on the manuscript tradition, mostly of Europe but also of the Arabic world, from the 5th or 6th century to the 14th

century when we come to printing. This was a world of great learning, as we know. And a good deal of powerful exposition and teaching and everything from art to architecture, astronomy, surgery and so on. It lacked image in extreme. Why? Because if you must copy a book by hand, as was done, there's very little chance that you can copy the illustrations. It takes a specialist. It's a very time consuming activity. You can't expect a minature painting to appear in the hands of each copiest. And therefore, the result was you can imagine. The graphics disappeared to the most schemetized and minor activities. Often quite beautiful, but very abstracted, lots of blank fields with text written around them. And then you're supposed to fill in the blank parts with any old thing. You know, it was a framework which everything could fit. This reminds one of nothing so much as the modern computer today, the small computer. Which also is not very powerful graphically. And which also has to deal repetitively with things. And it produces very much the same sense. We can't thank ourselves enough perhaps, can't be grateful enough to our times going back about a 100 years, not more, 150, for the arrival of photograph. The photo-engraving and now a-days the offset-photographic techniques which bring us such a wealth of printed pictures and of course the post-techniques. The electro-magnetic techniques that bring us the marvelous video image which we've celebrated today maybe more than anything else.

Now, TV is not only on the air. TV, or video image anyhow, is now on the tape. And I suppose before very long, quite possibly there'll be a semi-conductor or magnetic media. These will be an enormous source of image, already the video disk is a powerful source of images,

a 100,000 images are not too much to expect on a $20.00 video disk, individual still frames, or the one hour of film. When these become interactive they have to be reconded with. I think that these technologies are extremely important for educational-scientific purposes. And perhaps this is looking more forward than we were most of the day, but some attention should be given to them and to their coming, and I have no doubt that this school is very concerned with what this will bring. Nobody, I think, has a clear view of what will happen.

Then I want to mention again the problem of immediacy. Which is the immediacy of television and radio on the air. This is not so much to do with image, but it's more with time. Because you can know what is happening now. No book. No video tapes scheme. No optical disk circulation is likely to succeed in telling you what happened last week. Just because the preparation time that intervenes is just ... it's humanly possible, but it requires too much preparation to expect it to be the common run of things. Books are slow. Magazines are slow. What is fast is the image going by wire. And this of course, works just as well as the video image or voice. Events, issues and controversy belong to this domain. That is their strength and they need to pay great attention to it and we've heard a great deal about how this can be handled.

I think if they're regarded as inopposition to these other elements. Both in length of contact, I've talked the 10,000 hours, and also in the distinction of experience and rapid, quick controversy on the basis of experience. If they're taken in isolation, they perhaps

would not be so good. As a view that looks at the whole enterprise as one of many kinds of exposure, at many kinds of time scales, with many differences of immediacy until finally as a capstone the colleque occurs between the two or six advocates in the present day. Which is what people think of when they say the public policy on scientific matters is made in the give and take of discussion brought to the legislators and the public as we see it so often today. But that can't happen, I think well, unless behind it and around it and on the basis of which it is built are many, many other things of the sort I mentioned now. So, I think that once you distinguish the richness of image and the immediacy of transmission and recognize that these are two distinct though quite important features of the present media, and especially the mass media - the case of immediacy.

Finally I'm just going to say it's plan that after all of this there comes a question of concentration. It's very difficult to imagine that more than the 13 conventional hours of the American TV season will be devoted to a single extended experience with video image. At least in the present scheme of things. And if it comes to longer engagements than that it means possibly video disks or presentations of another kind, obviously simultaneous is no longer the question, magazines and books, this is the characteristic place where these are important. Newspapers, of course, are somewhere inbetween. They are really quisi-immediate. And yet they are rich in portions which I omitted to save time, this wont be very late tonight, but I just ask you to think about the relation with THE NEW YORK TIMES, it's editorial preparation almost all directed towards text. And the editorial core available for say, CBS news, a very different structure

and a very different output in which a great deal of the effort and human skill of the CBS news is directed not to choosing the image and not to commenting on the image, but to getting the image to you from snatched out of space or from Patigolia or wherever it may be by remarkable series of activities which sound easy until you have to do that. And know how many skillful camera people and tape handlers and switchers and everything else in those long runs of credits are there to make that possible. So, it's not as easy as it looks. But what it does mean is that the editorial effort that is the section of argument in the newspaper is a great deal larger than that in the comperably, ablely done place which gives you the tremendous affect that flows out of the visual experience and cannot flow out of the abstracted, second-hand experience of the words in the paper. But in a very different way.

Well, we need all of these things. We need above all, I think, to empower ourselves, the American population, to judge - sometimes well, sometimes tentitively and so on - the validity and the evidence behind matters presented to them in each of these domains, at each of these degrees of abstraction with each of these time scales.

I think I must stop now. But I wanted to close by saying how moving I found General McKnight's concern for the young men and women whom he tries to engage in following what is an elaborate and marvelous technical structure, the military communications structure, which is a duplicate perhaps of the overall communications structure of the United States. Not so large in volume, but much greater I think in its variety and technical daring. Everyone who looks into the matter at

all knows about satellites and navigation and all these things and mobile radio. And it's clear that we live in a deeply changing world. If we're to have a sustainable future, whether it be in peace or war, whether it be through the military or through the activities of everyday, it seems to me indispensible that we find some way to solve the problem of bringing more and more people into some degree of productive activity. Not to earn dollars necessarily. But to be able to appreciate and not to dispare of dealing with the changes that they encounter everyday. Who's first signal is very often the news story or the image which is before the. I think that's the issue at stake here. And I think, indeed, that the authors of distopias are right when they point out the great danger which I see. It is not, I think, that the systems will come to a halt. Because I suspect that the technicians, the scientists, the technicians, are able enough to transfer sufficient skills to the machines. That it wont be impossible to find that small fraction of the population able to cope with the complicated networks of the future. That wont happen because the people who design those things, the economic pressure to produce them, will guarantee that no system will be put in place unless the manpower or womanpower to operate it is present. And it that requires high training and high skill, that will be provided. But of course the number of persons over which this will be spread will get smaller. And the question to be asked is not what will the systems fail to work, they will work. Question to be asked is what will the rest of the people do who haven't got that degree of comprehension and skill to deal with these systems? They've become ever more complicated while the human being looks just the same as 30,000 years ago.

This is the problem. And it seems to me the problem is quite plan. A democracy cannot endure such a division and that division be based more on opportunity of early learning and maintance of that learning by proper public display than by any other parameter. And therefore, I think the activity we're engaged in here, and the school's engaged in, are activities which lie at the roots of the hope that the Founding Fathers must have had in this city that they would found a nation. <END OF TAPE>.

George Gerbner: As one who has been guilty of the suppression of zeros on charts as late as this morning and who has also been known to mishandle ratios which can equally magnify minor few differences. And who has spent those 10,000 hours, but they seemed more like 100,000 at the time, there's only one thing that I would like to correct. I too, have figured out the how cheap television is. And I've come to a slightly different conclusion based upon a different base.

That is, as you all know, in television the client is the advertiser. The advertiser pays for the delivery of the audience. That includes you and me. And I've figured out that when I'm watching televison in prime time, which is where the audience is the largest, I'm working for the advertiser at the wage of a penny an hour. I think it's a very good deal. Twenty cents may be spread out over the total program.

Philip Morrison: Well, you're paying for the receiver ... and the power.

George Gerbner: It includes the power. It includes the receiver because they're paying <tape skips> of course I'm contributing...

Philip Morrison: No you're contributing ....

George Gerbner: I'm contributing the power, so that if, that's right, if you include the set ...

Philip Morrison: Yes ...

George Gerbner: ... and the electricity ...

Philip Morrison: ... that's what I'm including. That's most of the cost.

George Gerbner: Well, that's fine. I'm still .... whether it's a penny an hour or twenty cents an hour, the point is the same. It's very, very cheap. And therefore, it's very, very pervasive and very, very, powerful.

Well, I must tell you that if you look at your watch you will see that this train has arrived at it's destination for tonight. It's been a long and intensive day. I think it's been a day that will require a bit of sorting out which we're going to do, some of us, tonight, most of us tomorrow morning. May I ask you to go back home. Have a good nights rest and be here at 9:00 sharp when we go into the home stretch and meet in plenary session. Set up our committees, our small groups. Give them their tasks to perform. And we'll ask them to come back

again at lunch time for the final reporting and summary.

Thank you very much, Phil, again. Thank you for all the speakers and for all of you goodnight.

PLENARY SESSION

George Gerbner: ... schedules by people who will be leaving soon .... two kinds of new contributions as well as summary statements .... Is there anybody else who has to leave in a few minutes? ..... Victor Macillani has arrived. Where are you? There you are. Has arrived this morning and is joining us as .... representing a very important organization in the field. So, I would like before we have our lunch to ask these two, and perhaps later on other people, to make their comments.

John?

Incidently there are two microphones here for easy access so we have no difficulty of representation or access to microphones. You can use either one.

John (?): Thank you George for letting me have a chance to say a word before I depart. I have a 1:25 flight, so I am going to be running off to the airport very shortly.

This has been a very interesting conference. I think that we're all extremely grateful to George for organizing it and to Ambassador Annenberg and any other people who have helped support it.

I think that the kinds of dialogues we've been able to have between people who are practicing journalists and people who are in academic research and people who in business and industry are extremely fruitful. And I think that this is the kind of discussion we have too

infrequently because in our own little worlds we only talk to our colleagues primarily.

I feel like I have gained a good deal over the last couple of days in understanding other people's perspective on this very difficult problem of how we communicate science to the public in an era which is increasingly scientific and technological. One of the specific things that I want to mention to you is an idea that George and I have been debating back and forth for a while. Which is that we both feel as we've tried to pull together data, what it is that the public knows about science, thinks about science and more importantly probably doesn't know about science and technology. Is that we would like to explore the possibility of a partnership of sorts between the kind of work that I've been doing and the kind of work The Annenberg School has been doing. And we would, not necessarily right at this moment, but we would over the next few weeks as you think about this, welcome your reactions to the notion of trying to put together each year, at least once a year, an annual science study of a benchmark of sorts, of what we know about the publics attitudes and their consumption patterns of scientific information and technological information.

What attitudes are changing? We have been fortunate for the last four or five years to be able to find sporadic sponsors for pieces of this work. One of the things that I think I have learned, and I believe that George concurs in, is that it is not likely that we will find people who are sources of sponsors who are likely to be able to sustain a year in/year out data collection of this sort.

However when we think of all of the people who have been here and people who have not been able to be here, but who have substantial interest in this area, a consortium or a caravan or coallition may be a viable idea. We're really in the exploratory stages of this idea. But we think with the joint interest that my group has had over the last decade in measuring attitudes towards science and with the very substantial reputation and experience and depth that The Annenberg School brings to this question that we may have the kind of coallition that would be of value to some of the kind of work that some of you are doing also, in addition to the kind of work we're doing.

So, we are really kind of, I guess that there is this one product that may eventually flow from this conference, we would welcome your suggestions, your thoughts, your comments and ways in which you see this type of joint endeavor might be of some usefulness to the kinds of work your involved in. Whether its a corporate objective or a media objective or a show that you're trying to target. Or whether it's a more academic question that you're trying to study, I think that we all need a common vehical sometimes and at least we've started to talk about it. That's the first step. We would like to have more people join into the discussionand please feel free to either contact either George or myself over the next few weeks and let us know what you think about it.

George Gerbner: Thank you John.

Comment: I'm really glad to get a chance to be here. I was very regretful at not being able to be here yesterday and I'm therefore,

particularly grateful to George Gerbner for this summary this morning because it enabled me to get a little bit caught up with some of the richness of yesterday and last night. As some of you know, and I run a program at the Massachusetts Institute of Technology for people who are already committed to science and technology journalism to allow them the chance to come back to a university and to spend an academic year there using in the fullest way they know how, with some local help, other resources of a place like M.I.T., we all know what a fabulous collection of capabilities and resources a university is. We always are astounded by the variety of ways in which those capabilities become available to the society in one way or another. And M.I.T. is therefore conducting an experiment in trying to make it's resources fruitfully available to journalists. I think its a very good thing for a university to do. Universities have news offices, they have bulletins, they have official gazettes, they put out press releases, their people are talking all over the country to alumni and contributers and all these other communications that a university does. But I think that maybe one of the most difficult as well as the finest is bringing journalists to the campus for a year. For activities together and activities seperately. The journalists can take courses. They can go to seminars. They can interview people individually. They can also as a group listen to speakers which I invite for them to hear or go on field trips that I've organized.

One of the most precious things that happen as a result of bringing journalists together in that way is the breaking of the sense of isolation. One of the important problems that a science journalist have is that they're by themselves. They're not only trapped in the

black hole of the television studio or the newspaper, they can never get out of there to cover the stories where they actually are. But they're also in a room where nobody quite understands the language or thinks of them as a little bit crazy or whatever. So to get together for a year as a collegium and really argue out the issues of how to present these topics to the public and it's an enourmously multi-farious business. We're talking about politics and the substance of technology and the substance of science. As well as the craft of how to present these things. But it's a very exciting, breaking down of walls around individual practitioners.

As far as I can see we are really very new at this business. The second group of Vanidar Bush(?) Fellows is at M.I.T. and M.I.T. is gradually learning how to open its doors more and more wide to these people.

My impression is that it's working. What do I mean by 'working?' I mean only at the initial levels. That is that people are able to get the access that they want. That they are able to take the courses that they want. And they're getting a lot of the stimulation that they hoped for or that we had hoped to help them get. Now what the long term impact of such a contribution, there's a whole range of contributions that one can think of to try and improve the quality of the information that's reaching the public, which they have a right to. That's part of the franchise. They live in a scientific and technical civilization and they have a right to participate. Everyone has the right to participate in these things. It is part of being a citizen of now, to have this kind of information. It's not just to be fadder for

factories or for bureaucracies or whatever. It's to be let in on coping and on the fun of being alive now. Both of those things. Our program is making one small contribution to that. And it is obviously a leap of faith. We wont know for many years. And we're going to persist for many years if I have anything to say about it. We wont know for many years what the sum of the contribution of a program like that to journalism is. We know from the experience of the Neimann program at Harvard that it has had an incalculable effect on every aspect of the practice of serious journalism in America and in other countries. It's existed for 47 years. It's made a tremendous difference. So we have hope that some of the achievements of the Neimann program will be achievements of the Vandimer Bush Fellowship program at M. I. T.

So because of this effort that I'm involved in at the end of 25 years of science journalism of my own. Of confronting magazines, newspapers, television, even a little bit of radio, trying to do this. It's very exciting for me now to try to be there, available to a group of younger journalists who also want to do this. Want to take this vow of renounciation of management jobs for a few more years than is usual in order to get ahead with this.

So with all of those pressures and excitements behind me that I was particularly eager to be here to listen to this discussion which is of a more global kind. We're trying to put, at least in a summary form, all of the things that we can think of that will improve the quality of the communications about science and technology reaching the public. So it's a great pleasure to be here.

George Gerbner: Thank you <something> ..who is the director the Vandimere Bush Fellowship program for science writers at M.I.T.

Comment: I just want to take this opportunity to say a few words which came to mind about half an hour ago when we had our little group and we were talking about why science literacy, why the public understanding of science?

Ok, you can think of many reasons for having public understanding of science. One reason would be, if the general population has a greater level of science literacy than there would be many practical results. For instance, if our young people know how to make use of a computer this would aid them in their employment. This has something to do with the technological level of the nation in the long range future. Or it has something to do with how to prevent disease. When do you decide to see a doctor. These are very practical things. That's one of the reasons why we have science literacy, we would like to have science literacy.

Another reason would be, we'd like to understand how science works. After all science is one of the crowning achievements of the human intellect over the past few centuries. And just like literature, music, art, science is one of them. Ok, so we have a cultural reason for wanting to know about science. And this is very well done, for instance, by such magazines as SCIENTIFIC AMERICAN, NOVA on TV and a slew of other things like science courses for non-science majors in colleges and universities.

There's a third reason which has been very often mentioned at these discussions why we need science. And that is the question of public policy. The questioning of the functioning of democracy in our society. The ideal for democracy, according to the Greeks who invented it, was that the citizenry should be fully informed. And that the citizen be able to participate in decision making directly in their society. Now that can be done, of course, only when you have these small city-states such as Athens. It's not possible in a large democratic country. But that ideal democracy has always been in the mind of people who study democracy.

There's something which has happened in the past 10 or 20 years which would have a great impact on this idea of democracy. And that is the communications revolution. If you think about it, the communications revolution which has been rather slow in coming and which seems to be coming eventually, will make it possible not only for our leaders to talk directly to the population in which we have seen very well and graphic examples in the past couple weeks. But also for the citizens to talk back to the leaders. And that will become possible, well it's possible today by telephone, but nobody wants to do that, but in 10 or maybe 20 years. I tend to be pessimistic about how technology gets applied in ordinary life, some people would say in five years, every home will have, and now as you all know, a communications terminal of some kind which is reasonably smart in the computer sense, so that it will be a very simple task for leaders to, for instance, poll the entire population of the United States in a matter of one microsecond. And this can be done repeatedly. I'm not saying this is good or bad, but this seems to be in the offing. Technology tends to

drive the society and this obviously is something which will inevitably arrive.

Now, how does science literacy or the public understanding of science fit into this scheme? If anything close to what I just described were to take place, it would be very important that the citizens polled have a sufficient background to make intelligent decisions. And what kind of decisions do they have to make? The decisions that they have to make have to do with current public issues that have a science or technology component to them. And there are many. Anything that has to do with energy, with health, environment, national competitiveness, the industry. Or have a science and technology component to them.

So if, I would like to draw a picture. A very simple one. You can think of three circles. One is the citizenry in a democratic society. And two, there leaders, elected or appointed or indirectly elected. And the third, is the source of the information. Now it doesn't have to be scientific or technological information. It could be information on foreign policy. Information on the fiscal or monetary policy of the nation. This kind of information which becomes literacy for the citizenry and literacy also for the leaders. There should be some path where this information goes to the citizens, via the mass media. And this information should also influence the leaders, because they are the ones who are going to make most of the decisions. This is the science literacy when we're talking about science that we are talking about. I would like to simplify this and just call this civic literacy of any kind. Of which science is just

one particular component. Civic because it we hope is to be effected as a democratic society. And already we have a line here, via the mass media as happened last Sunday, where the leaders are talking to citizens en masse. And, in the picture there will be a line here through two-way cable. And this might be called citizen feedback. So this is likely to be the way the society will work. And it's probably going to happen. And I think that it's very important that we be prepared for this as a nation. Because it may work very poorly. If you start polling the entire nation you face the very difficult problem of majority tyranny. Which is a well known problem for people who study democracy.

How to avoid the pitfalls of the application of advanced communications technology in the next decade, in the next fifty years to the function of democracy is a major problem of which the question of science literacy is just a component. And I'm glad the we've had this conference at which we are at least studying this problem and I hope that sometime in the future The Annenberg School will be able to look at the whole picture with more detail.

George Gerbner: Thank you for these thoughtful comments. Question?

Question: Would you agree that our form of democracy <something> yet devised where in the leaders <something>. I guess that is one of the reasons why you might have <something> have occurred when the leaders do not need to <something> our democracy for <something> in the Constitution.

Response: Well, I'm not an expert on this but there is an argument to be made for <something>. And that happens all the time. An argument can be made about the ways this is going to work out. For the argument is that leaders elected to use their best judgement. And not to always slavishly follow the majority <something>.

Comment: <?>

George Gerbner: The issue .....

Someone else: ... I can quote Edmond Burke, this was quoted in THE NEW YORK TIMES, a few days ago, Edmond Burke was elected a member of Parlament from Briswold. They had two paragraphs that are quoted in the TIMES. Essentially he says that you elected me, but don't expect me to follow all of your advice. Because I'm getting paid to do your thinking for you, because you trusted my judgement. And the last thing I'm going to do is to follow your judgement now that you have elected me.

That's one way ...

Comment: (?) George Gerbner: Ms Gudenkauf has a comment. Yes, go ahead.

Anne Gudenkauf: It seems to me <something> there are, you are leaving information source unprotected by the citizenry and the leadership.

George Gerbner: Well. Any graphic representation has the advantage of

making things clear. And the disadvantage of making things too ridged and too isolated. But the issue that is being enjoined is not being resolved, but is being joined other than that the soup is on, is that there's a difference between what is called the republican form of democratic government and the kind of instant plebocitary democracy.

Under the republican form of government, which is what we have under our Constitution, a, if not THE principal form of citizen feedback, is what we are going to see in a couple of weeks in the form of a vote. Having voted the citizenry then elects people who are supposed to use their own best judgement. A plebicitary democracy is a very risky and dangerous thing. The communications revolution which is part of the technologies and the sciences that we are talking about for the first time brings an instant plebicitary form of government into the possibility of realization. And as Ben Shen said, whether this is for better or worst, it becomes a possiblity.

The reason for our hesitation and the reason for our caution is that almost every dictatorship in the world today has manditory vote. Manditory plebicite. And the reason for it is that if you can control the medium of communication in a plebicitary instant poll, you can usually get back a reflection of what you are feeding in. Therefore, it is not to be lightly considered as an advance in the form of our democratic government. It has certain potential, but it has certain great risks.

As you are eating your soup, those of you who have gotten it, and I hope somebody is going to make sure that I get mine too, thank you.

Let me just outline our plan of action between now and 2:30 so that you can keep that in mind and kind of mentally prepare for it as we eat.

We had four groups deliberating for the past hour or so. And prepared to bring forth a set of recommendations. These recommendations are of two kinds. They are recommendations for things to say. And they are recommendations for things to do. The two are not always the same.

I would suggest that we make these reports in the following order. First, about, it seems to me, goes and the objectives of understanding what is it to be understood and why, might provide a background for everything else. And then we get down to the question of media education, both explicite and implicite, our formal educational system, schools and training, both specialized and general, and the issues of public policy not as exclusive domains, but as highly inter-related areas in which it is only the emphasis that shifts the focus, the center of attention, around and the peripheries that shift from one topic to another. The end of this we see what we're ending up with.

One action idea or issue that has come up, in fact two - one by Jon Miller which is that there maybe a periodic, perhaps annual survey of the state of affairs. So that the activities that have been set in motion before we ever conceived the idea of this conference the activities that may be generated by this conference and implimented and followed through in a great variety of means, can be monitered to see what progress we're making and if indeed we are making progress in terms of increasing public understanding in terms of encouraging people

to make occupational choices that are more in line with the needs of our nation and in need of the world.

That was one suggestion. Another suggestion that I would like to get your views on is whether you think that the papers, the speeches, the contributions, the comments to this conference which exist in a form of written reports and in the form of recorded proceedings would be worth editing and publishing in the form of a monograph or some such publication that could be used by the constituent organization, that could be distributed to a list of interested people, and as we come back immediately after or during the final few bites of the lunch I would like to know if you think, as I am inclined to believe, that the corgency, the articulation of the objectives and of the problem and that some of the challenges and some of the issues that have been posed provide enough additional contribution between in addition to what is already known and well established, that it might be worth publishing.

Please, yes? sir? <question from the floor> Well if some body's moved, I'll always take what I can get as soon as possible.

Comment:

George Gerbner: Thank you. My soup is getting cold and a good appetite in about 20 minutes, we'll call you back to order.

George Gerbner: ... In someway the combination and in some way the commencement of new activity so I would like to ask group number, whatever number it was originally, the group of goals and understanding

to come out first and present its report and recommendations, Rae Goodell.

Rae Goodell: Let me say that I'll do my best to represent the group. My understanding of the concensus of the group, if however I stray, I hope other members of the group will pull me back on track.

I thought there was a striking concensus in our group. A good deal of lively discussion. But in ways where we were really complimenting what we had to say to each other, but not really disagreeing. What we did was really, in essence, a kind of over view in terms of goals and our understanding of this, not only the concensus of our group, but the concensus of the whole meeting, I think we drew on comments we had heard other times in the meeting and our understanding of what others in the meeting have said earlier as well. And we also touched on clearly as I saw this after our meeting, we really do touch on the other areas as well. And I hope that those of you in the other workshops will see what we did as a sort of skeleton in a sense of perhaps a skeletal outline in a way. But we were in no way, trying to fill in what these other areas are about.

We addressed first the matter of the 'Why.' Why put effort into the exercise of improving scientific literacy? The issue was raised in the morning essentially as a concern for this workshop. And we saw other issues as really flowing from it. And we agree that we saw two reasons. The first one was to allow the country to create the manpower and the womanpower that it needs to fill the jobs that are despirately needed for technological society for that society to function. And

that was a very, very important goal of scientific literacy.

But that we also saw another equally important fundimental goal which was to provide the entire population with the understanding that it needs to participate in society at all levels. To participate in determining the directions of the country. To participate in discussions of public policy, which relates to another workshop. And also to have access to the resources of the society. To have access to the jobs and to the inforamtion, to the experts, to the rich resources that are part of the society. And that without this second sort of thrust in the area of scientific literacy, that we are in danger of creating a division where we do have people filling our technological jobs, but we then have a seperate kind of citizen that doesn't have access to those same resources. And that we agreed essentially with Phil Morrison's point that that's a division that democracy cannot sustain and that that is a very crucial part of what science literacy is about.

We then moved on to the question of 'Then what is the understanding that we see as being needed in order to avoid that division, in order to create an affective and enfranchised citizenry.' And the keys here were to address the feeling of alienation that people see in the population the point really that, essentially made the first night, about getting away from the citizenry feeling alienated from science. And that this would involve changing people's perceptions of what science is about. And the concensus in our group was essentially that science is not so seperate from the rest of human endeavor. That it isn't so different. It may be seperate in our minds, but it is in

fact not so different. And that what we need to do is to sort of de-mystify science in effect. Not to change the, in a sense, the relationship between science and society but to change our perception of that relationship. To de-mystify science on the part of society. That in fact, science is a part of human endeavor. And again, this was another point that has come up frequently in the conference. That the kind of thinking that scientists do for example is very much the kind of thinking that youngsters do early in their education. And the kind of thinking that all of us try to do, what I mean to say - let me correct that. The kind of thinking that scientists strive to do, is the same kind of thinking that citizens strive to do in a democracy, that young people strive to do in struggling to understand the world when they're young and so forth.

That in fact, that what science represents in a way, is a formalization of certain aspects of human endeavor which are really a very familiar part of life. And that what we need to do in addressing public understanding, is to address that familiarity. And to emphasize that familiarity and bring back that concept for the public. And that that perhaps involves talking about how scientists work. How things work. Process in science rather than just the bottom line of the facts that result from scientific work.

The third area we then moved to was who's responsibility is to see that all of these wonderful things happen? And we saw that question of responsibility as dividing into sort of two arees of effort. And here we come back to our workshops. The formal education and the informal education. And we saw efforts in formal education as being critical

for the future of building a more receptive citizenry. For building more competitent journalists, more competitent editors and decision makers with regard to these issues. But we did want to emphasize that we sought informal education. The education that addresses people once they are through with formal education as critically important as well that many, many of the people that we wish to address with our concerns are finished with formal education and the only way that they reached will be through informal education. By which we mean not just the mass media, but also phenomina like museums, workshops, this sort of thing. And we saw this as a critical area to be addressed. Then finally, we, in looking at this matter of responsibility, we recognized that these changes that we feel are important are the responsibility of all segments of society. We don't want the media to take the rap, for example. But rather all segments of society have a stake in a positive outcome for these efforts. And therefore, have a responsibility to put effort into seeing that that positive outcome occurs. And I had made a list earlier in the conference of all the sort of segments of society that in a sense had been represented at this conference and had in fact played a role in putting this thinking together. And that had clearly demonstrated themselves to be not innocent bystanders, but rather very much actively involved.

They included, of course, the journalists. But both local and national. Both specialized and general. The 'specialized' meaning the new science magazines, 'general' meaning more like major newspapers and so forth. Print as well as broadcast as well as wires. You get the idea. In other words, a great variety. It included the editors and the decision makers within journalism. It also included clearly the

scientific community. I think we established very clearly that the scientific community are neither victims of the media, nor innocent bystanders. But really a very active agent. And actively involved in what results in media coverage.

Educators. Educators of journalists and educators of youngsters. And that means both, again, informal (for example, museum staff) as well as formal eduation in our schools. Clearly government has a role. Clearly researchers, Jon Miller raised this point. And that includes researchers of many different kinds. Who study very various aspects of the political and social process. Clearly industry. And not just industry that has a direct stake not just industries that see themselves as at risk if they don't produce the right kinds of personnel for jobs. But the entire industrial base of our society. And finally, the public. I think it was also established that the public is not a sort of inert mass. But rather a very active agent in what we're doing.

I'm sure that I've missed some. This was just sort of scratchings on the edges of other thoughts. But we did want to make the point that all segments of society do have a stake and do have a responsibility and a role in seeing that the changes occur. Does that cover it?

Question: <Something>

Rae Goodell: All right. This quote, as I understand it, comes from John Dewey via a paper of Jon Miller's. And he contributed it to our workshop. And I spoke with him, and I think I have now an idea of

where he saw it fitting in our discussion. It makes the point that in fact, the kind of thinking that goes on in science is in fact the same kind of thinking that we are looking for in all aspects of our work and policy making and daily living. I then checked with Jon and he and I agree that we don't want to see this as something that scientists do and the rest of us don't do. But rather as something that scientists and the rest of us strive to do to be effective. And the quote from John Dewey says that the responsibility of science cannot be fulfilled by methods that are chiefly concerned with self-perpetuation of specialized science to the neglect of influencing the much larger number, to adopt into the very make-up of their minds those attitudes of open mindedness, intellectual integraty, obeservation and interest in testing their opinions and beliefs that are characteristic of the scientific attitude.

George Gerbner: Thank you very much. <microphone turned off>.

Leader of the second group: Well, our group met. We had a very interesting and profitable discussion. And also had a great deal of concensus in these things that we're talking about. One area that we spent a considerable amount of time talking about is that there's a major problem in regards to communication between journalists and scientists and scientists and journalists. Some scientists do not want to talk to reporters or journalists. And at the same time, journalists and reporters may be somewhat afraid to talk to scientists because they do not know all the information.

Now, one of the things that we saw was the need for some research

in regard to this process. To really sit down and try to find out what the underlying problems are in this process of communication. Why are there these stumbling blocks in this process?

We also, as the group before us and I think that this is going to be a theme that we'll hear throughout all of the reports, saw a continuing need for education. Both on an informal and a formal basis. On a formal basis, in regard for undergraduates in both science areas and in journalism to learn about the other person's area. So that journalists should learn something about science. Scientists should learn something about journalism. And while these programs are in existence in a number of places around the country, there's continued need for this and continued support for this. On an informal level of education, there's continued need for seminars for those already established in their careers. Seminars for editors in particular, because editors offen are the stumbling block in journalists really being able to get out there and talk to scientists and also for journalists to be able to attend simular types of seminars. So for editors to find out about what we look for in reporters and how can I make the most efficient use of reporters.

Now, one of the things that came out of our group, and we all felt extremely strongly about, was the need to re-establish NSF's public understanding of science program. And everyone was in total agreement of the need for this to come out.

Now the other area that we sat and talked about for not as long a time was that there is a great need for continuity in science

programming. There's a need for continuity in programming itself. There's a need for continuity in the personnel who are involved with the programming. And there's a need for some continuity in being able to develop new programs. And one of our recommendations in this area, because one of the areas that's of prime concern of this is getting enough funding to be able to maintain the program. Is for the development in the private sector of a consortium in science technology that would help to provide some of this continuity. To provide funding for the continuity so that the programs can continue. There's also a tremendous need for some age specific programming. So that children of different ages can be exposed to science.

The last area that we really didn't get into talking about, and this is something very dear to my heart, so I will just mention it, is a need for continuing in the study of the images of sexual stereotypes in images of science and scientists within the media. And we really didn't talk about that and so I'm sort of over-extending with this. But we just, I guess Julie (?) and I sort of had this little conversation about it and I felt that it is important enough to mention.

So those are the areas. I hope that everybody ... that we have .....

George Gerbner: Thank you very much. Next? Next group?

<tape ends> George Gerbner: ... would like to thank you for helping and for personally attending and we will keep you posted of the

outcomes of our meeting.

Some of us can express our gratefulness in more tangible ways than others and I'm very pleased that he has had the interest and the opportunity and I can just convey to you that both Ambassadors Annenberg felt that they profited from your contributions. They were, I think, very excited by the discussion that went on yesterday and I think we can look to them for continued support of the follow-up and other activities that we're going to recommend. So among all the targets that we shall assign for our recommendations for publication and for action, they should certainly be included.

Speaker for (?) group: Number one. You, the previous speaker, who defined decadence did so well that we wont repeat that which we discussed because they are exactly the same ones. It will save some time.

We also looked at the problem as one that will not be solved over night. That what we really are thinking about is a progressively developing process. As soon as you do that, you automatically ask yourself: what are the markets we want to reach that are continuing markets with potential for learning and who can effect the most people?

And so we return to some data which were presented here by the conference attendees. One was, and the Dean showed us this, that those that even are interested in science, get turned off by what they see on the media. We don't know the explanation for that and we didn't really want to waste our time because that's the minority part of the

population.

And then we looked at the data submitted also at this conference which is very important which is this pyramid. Sure, we've all used pyramids in 101 statistical courses. But let's remind ourselves of the wisdom in such a pyramid. These are the people that we want to influence. Down here at the bottom. The thinkers will rise to the top. Now how can you reach these people quickly and informatively and effectively?

You reach them through two markets. One, the public and private school systems of the nation. And two, the employees of the department of defense. Between these two largees of our educational populations, you are reaching more than 88% of the total population, we estimate. We know that the public and private school populations of this nation are 86.2%. So we added a few percent for those in D.O.D. In other words, lets not waste time with me and thee. Lets get at where the basic population can be reached quickly, effectively. And another we learned at this conference is that it's to their interest.

And that means you have to involve the parents. In the school system of America, you can quickly reach the parent through these children.

Now how are we going to reach them quickly? Number one: you're going to set standards. We started that. You're going to have to train teachers. We thought of that. But most of all, you're going to have to maximize the usefulness of existing resources of the nation.

And to do that, you must make intensive use of modern technology. The technologies we feel in our committee are here. But they aren't being used. For instance, there is only one part of the spectrum where the FCC has set up channels twice that of commercial and public television spectrum space entirely for non-profit, educational purposes.

We believe that and other areas of the spectrum and all the methodologies and there are only six of them, should be utilized. And utilized immediately. And in order to preclude any dictatorship in this nation, we believe there must be at least two competing, non-profit, educational national networks. One of these, we hope, would be dedicated to the public and private school systems of the nation and to the retreading requirements of workers by an economy change.

I've taken six minutes, Mr. Dean. Any questions from the floor? Or additions from the members of the committee please? Did I leave out anything Dottie?

Question: We believe that the federal government should play a more significant role in the life-long structure of communication. Further networks, which you were referring to, extending education to the public who needs it with the limitation of crowd (?) which you referred to.

Speaker: Yes. In other words, the processes of education must not be limited by their geographic restraints. The General that was on our committee pointed out there is one section <something> existing that

might be incorporated in the system that we envision.

But the important thing is an education must be delivered where it requires a minimum amount of time on the part of the user of that service to get to it. And that means the home, it means yes, University of Pennsylvania, but it means any place where education is needed and desired by the consumer.

George Gerbner: Thank you. Public Policy?

Speaker: To try and deal with the issue of science and media and public policy within an hour was an impossibility. So what we decided to do instead was to look at the two sub-topics that had been given to us. One being training of journalists and some of which, some suggestions of which are simular to those which have already come out. And two, to access to some, and we did get to part of that.

Let me start with, we really needed at least another five hours to be perfectly honest to get into this topic. Let me start with the training of journalists however. We felt that we needed a new critical mass of trained journalists in science communication and perhaps in science-related issues. And by that I mean, if not science writers per se, at least general journalists who knew something about science, environmental health and technology issues to some extent.

In order to do this, we felt that these folks needed some incentives such as stability of jobs particularly in the radio and television industry and perhaps even simular things in the newspaper,

the print media. And we thought of some ideas about how to do this. One that I thought was rather interesting was an endowed science - series of endowed scinece reporterships that might be established at various places. There was some discussion as to whether this would be at major media outlets or at smaller media outlets. To create perhaps, an interest in the publication or station staff and to show them that science and health and all of the other things that come under those things are interesting and that readers and viewers are interested in the subject.

We did mention of course that there would be a number of problems with that suggestion, including conflict of interests. Depending upon who would be endowing these reporterships and that perhaps we might need rather high level reporters to take these endowmentships at first in order to make them work. It's an interesting idea.

We also felt that we had to deal with the resistance in the gate-keeper community. The gate-keeper being the editors, the news directors and so on about hiring specialty reporters or at least allowing their general assignment reporters to pick up some specialty training in mid-career level. And to that extend, we decided that we really needed to get to the power brokers in these fields by addressing such groups as the American Society of Newspaper Editors, the American National Publishers Association, the National Radio and Television News Directors Association and bring to them the problems of science and technology reporting and its impact on society and try to convince them that this has as much an impact on our country's future as political reporting and perhaps even sports reporting.

We thought perhaps also, we might throw Mr. Keyworth at them and let them see what he would do with that.

In relating to training in the journalism schools, while we did not get into - and I don't know how we didn't - the training of journalists in some sort of science. We certainly did get into the topic of training journalism students or adding science related issues to training the journalism students in public affairs reporting courses. Almost every college or school of journalism has a standard public affairs reporting course. And in these courses they focus on cops, courts and county government, or city government or whatever. They do not get into the issues that impact on the towns and communities where these general assignment reporters might be working. Such as the cost of health care and environmental issues and so on. And we thought that this was something which needed to be brought to journalism educators attention, to do something about.

Lets see. We wanted to also say that a good secure job at the end of the pipeline is an inducement for bringing people into this field, and keeping them in the science writing field. And that we are aware of the fact that we are eating away currently at our supply of good science journalists. That many people are leaving the profession particularly the older science journalists are leaving the profession and turning to do other things because of the way the journalists feel the structure, you know, can't stay a reporter forever. And after awhile as I think Victor quite put it, when you're a crusty ol' 45 year old, you don't want to be reporting to some whippersnapper 33 year old as you editor. And so there was some concern about that.

We also agree that government support is necessary in particularly two areas also, once again, funding of, restarting of, re-establishing the public understanding of science office at the National Science Foundation, both in support for it's programming and also in it's support for research in this field. And also for the Corporation of Public Broadcasting, particularly again, for programs in science and technlogy. We feel that the people are out there, trained science communicators are out there, and can do these radio and television program, but they don't have the financial sources and support with which to do them. We also felt that scientific societies should make their members aware of the problems of, and many do or I should say, some do, of the problems in science communication and try to address their resources as well to this issue. And lastly, in relation to training of journalists, support mid-career training programs, both financially and try to get editors to send their reporters to these mid-career training programs which they do not do in great numbers.

As you can see dealing with training of reporters, we didn't have a great deal of time to get into talking about access. We did talk primarily first, how to get scientists to be more cooperative. And, primarily then we talked about working for scientific societies to encourage their members cooperation. And also to explain, to have them explain to their members the constraints that journalists work under and how to better communicate with one another. We also felt that support of the media resources center that is being sponsered by CIPISCOPE (?) should be continued and that cooperation for this group from both journalists and scientists should be encouraged. And that we should encourage scientists to work with the media, and as we said I

think rather nicely yesterday, not subject those who do so to career risk. And that this should be something that scientific societies should convey to their members.

As to how to decide to deal with credible sources, which sources are credible and whether media, certain media can cover conflict in policy issues well or cannot or will not. We decided we needed a great deal more time to discuss that and at that point the door opened and we were called down to lunch. So we have not gone beyond that point.

George Gerbner: Is it time for additional concluding comments, reflections, observations, not yet benedictions - that comes later. Observations? Let somebody use the elaborately designed communications system here.

Comment: I don't know if I need it for this purpose, but you asked at the beginning of the luncheon session for comments on whether or not you thought the proceedings of this event ought to be published in some form. I, myself, found the panel discussions among the more interesting parts of the conference. And I thought they were excellently put together and had ideas that had in fact we've used throughout the rest of the conference. We also did, of course, the major talks, but some of those might be in written form already and the panel notes did not appear to be. I would urge because of the need for widely disseminating views of the media panel, the couple of people who spoke about their research issues, George Gerbner and Jon Miller, as well as the afternoon panel on educational policy. Because of the need to really spread these views throughout the community, that we do

infact construct some sort of monograph or something and make it widely available from the conference. I think that would be valuable in addition to any recommendations that might come out.

George Gerbner: Thank you Carol. Is there a general agreement or encouragement to do that? Will you all buy copies of <something>? <comment from the floor> I see. Well free goods are sometimes not valued as much. Any, yes, any other comments? Yes.

Comment: (about 5 minutes - I think).

George Gerbner: Thank you for calling attention to those important aspects. We have to, Bob?

Bob (?): (about 2 minutes)

George Gerbner: And I'm sure that our university news bureau would appreciate that requirement because they work very hard in making all of us communicate to the public in which they're interested, the results of our research and other activities. You're next.

Comment: (about 3 minutes).

George Gerbner: We have time for two more comments. I see two hands there. As long as they don't open up a whole new area of inquiry for which we need another conference, but rather reflect on and conclude some line of discussion that leads to some recommendations and action.

Comments: (about 2 minutes)

Comment: (about 1 minute)

George Gerbner: Yes they are. And they can be reached even more easily than that. There's a, and we will not forget about that group, I can assure you. There is a group called the Caucus of Writers, Producers and Directors in Hollywood. Has about 120 members. And among them they reach 85-90% of the American population every day. That's all you have to do. They can be invited. Willing to talk. And let me tell that they are not only aware of the long range consequences of what they're doing. But are also even more keenly aware of the constraints and limitations placed upon them. And they are among the groups with whom we have to work to assist them to do better. They do as well as they know how to do, which is better than what they can do under existing circumstances. Yes?

Comment: (30 seconds)

George Gerbner: Yes indeed. Well. We come to the end of a very intensive 36 hours. And let me then conclude by making some of my own reflections for what I see both the problem and the source of our efforts might be.

I begin with a few things that came across, that I came across, just this morning. Because we're often talking about a more rarified atmosphere than most of the American people have available to them. It was Mike who gave me, as if I didn't know, you can look at any newstand

any day, it's no different, a copy of the NATIONAL EXAMINER. Which has 'NEW SHOCKER: GOVERNMENT SCIENTISTS PLAN TO TURN KIDS INTO 12 FOOT GIANTS." Now you laugh. But this is very much the diet of a very large portion of the American people, and I'll include the American people and the people around the world. And it attracts an abuse for people who read little else. Although do watch a great deal of television.

Not to be out done. (comment from the floor) Only in the biology department, Bob. (comment from the floor) Well, here's the fruits of your labor. Not to be out done, a much more respectable newspaper, THE PHILADELPHIA INQUIRER, on the front page says 'BREAK THROUGH POSSIBLE IN ORGAN TRANSPLANTS.' It's not a bad story. It's a fairly good, thoughtful story that I think explains quite clearly what's going on. But the head writer is compelled to use the term 'breakthrough' which is such an overused term that it almost trivializes anything underwhich it appears. But nevertheless is one of the problems with which we've been dealing.

Now going into another area of this same scene, this week's advertising page, the chief trade paper of the advertising business that underlies so much of what we're talking about, has an article on science 'CATAGORY IS UNDER THE MICROSCOPE.' And that is, they're research by microscope. And let me read you the first few paragraphs because I think it is very interesting. It's very informative. And just as Philip Morrison and Chairman Mao, I also like to start with a few figures and a few facts.

Five years ago, when the science magazine catagory began to boom, publishers had a good reason to be optimistic about its chances for success. After all the nation's 25-40 year olds, that high profile demographic, had been reared on space walks, friendly computers and organ transplants, break through, organ transplants.

As a group, they are mostly well-educated, had more than a passing interest in problems of pollution, fuel shortages and things nuclear. They were, it seemed, a tailor-made audience for general science journalism. Today there are five magazines trying to bring science to the baby-boom. Mostly with mixed results. The five DISCOVER, OMNI, SCIENCE '84, SCIENCE DIGEST, and SCIENTIFIC AMERICAN take an approach to science journalism that ranges from 60 MINUTES to THAT'S INCREDIBLE in tone. At the extremes of the genre, SCIENTIFIC AMERICAN and OMNI appear to be surviving handly. In the middle, SCIENCE DIGEST, DISCOVERY and SCIENCE '84 are busy jockeying for position in a market gone soft. And then it goes on to discuss each one in turn.

In the same paper, on the opposite page there is an ad that happens to be one of the magazines jockeying for position in a market gone soft, and we'll see in a minute what that market is, is SCIENCE '84. A full page ad appealing to advertisers. The cover is '20 DISCOVERIES THAT CHANGED OUR LIVES.' This says why these 55 advertisers made November our biggest issue ever. And it says why. The impact of 1.5 million readers who can cope with the complex, grass root technologies, etc. Thanks to these advertisers and their agencies, whose investment of over 1.5 million dollars in 81 pages of advertising reaffirms the vitality of a science environment.

Well, you can see 1.5 million readers, 1.5 million dollars. It costs a dollar per reader, which is five times as much as Phil and I established last night to buy a television viewer. But then they buy more than five times as much too. So that makes it immensly profitable.

This leads us, I think, to the general location of the problem of science or anything else through the media which can be represented graphically in using the well known pyramid that John gave us. In which the top is decision makers and then policy leaders. But let me convert this in these terms, in the terms of the market and of the advertiser, into the people with money.

As the largest incomes are in top, that is if you represent the income distribution of the population, you get something roughly like a triangle of this kind. Now if you take amounts of money per person, you have another triangle superimposed on this. Which means that in the top 10%, the top 20%, there is a larger amount of money available to which advertisers can appeal. And it is that group that gets excellent service. Second to none in the entire world. It is that group where the jockeying for position in the market occurs. It is that group that, although can always use improvement and greater skills, has all the riches of the most sophisticated and the most civilized scientific and technological society that is available anywhere.

Are you planning to leave us? Hope not. O.k. We'll be finished very soon.

The group, as you go down the scale, the big diamond in the middle is the television public to which the advertisers on television appear. But as you get to this group in which the amount of money is very little and the number of people is very large, you have the group that is the most poorly served. No advertisers appeal to it because it doesn't pay. They're the ones who provide the audience for the least sophisticated and the most, what shall I say, obscurintist and mystifying kinds of materials, the horiscopes and the astrology and much of television.

And that is where the problem really is. I cannot help but note that it is to the ever lasting credit of the Annenbergs that they have always been concerned which has motivated their concern over getting education over the air. Because that is the group. And that is the avenue which reaches this group. And that is where public education is. Or at least achieves it's most telling and most significant results. That is where our figures about the prime-time, the average prime-time viewer tends to be a realitively low-income, low-education heavy viewer. Kind of person is located.

And it seems to me that that is where the problem is and that is, as Tom has just mentioned and a number of other people, where a very large proportion of our own efforts should be dedicated. What are our efforts? You've heard the reports and I think they're an excellent summary and reflection of many of the discussions and contributions of this conference. That indeed, science is not a mystical, only specialized, highly complex, esotaric kind of activity. But it is a part of everyday life. Is a part of human attempt as you said,

especially prominent in childhood, to make statements about the world that are valid and reliable and a process still trying to improve those statements. That indeed, based upon those statements, technology is a form of acting on some conception of the world that is increasingly reliable, increasingly valid. Acting with our hands, with our minds and then acting with our tools. And transforming the environment in that way. And that some understanding of both of these processes and their impact on human life is essential for full citizenship in the modern world. And that there are many groups, organizations, individuals and efforts that are dedicated to promoting that kind of understanding and that have, either in the forefront or in the back of their minds the most difficult audience, the most difficult problem which is the group that is large in numbers, not so large in pocketbook, that does not have the tastes, the habits of cultural participation that would provide them access to the information <tape blanks>.

The statements that we have heard we will get to work on transcribing, on editing, on circulating, on <tape blanks>. Try to reflect the thrust of this conference and then probably if we're successful <tape blanks>. That the organizations represented by and assisting in this conference themselves, are not only worthy of support, but are among our chief <tape blanks>. .... include the National Science Center for Communications and Electronics Foundations, Inc. They include the National Science Foundation, whose <tape blanks>. They include SIPI, that's the Scientists Institute for Public Information which was well represented and Fred Jerome, who couldn't be here today <tape blanks> ... extremely helpful in helping us to bring

this group together. That includes communications schools <tape blanks> ... we can help them carry forward an understanding, I hope, of what constitutes the principle and most difficult problem, a recognition that science in its everyday process, aspects and in its immediate applications in the form of technology are not beyond the grasp, are in fact very much a part of the lives of all of us, and therefore, can and should be made understandable and that these are some of the avenues, some of the goals and these are some of the objectives that our conference has both confirmed, initiated and encouraged and I hope has generated. And, if nothing else, we have four minutes which I'm sure can be easily filled. But, if nothing else <comments from the floor> I hope this is an exclamation, part of an exclamation mark, which I would like to complete. And whatever else we do, we started on time, we adjourned on time. Thank you very much for coming and have a nice trip back home.