

The Science Communication Conference  
22<sup>nd</sup> – 23<sup>rd</sup> May 2003

Day 2 : Keynote Address

Chair: Dr Gill Samuels CBE - Senior Director, Science Policy & Scientific Affairs, Pfizer

Dr Alan Friedman Director, New York Hall of Science - Missions and media: how much can science museum exhibitions be expected to accomplish?

Dr. Alan Friedman, Director, New York Hall of Science: Missions and Media – how much can science museum exhibitions be expected to accomplish?:

Good morning, and I very much want to thank the British Association and the Royal Society for inviting me to come to this meeting, as the only American here I think, it's quite an honour and we don't have meeting quite like this in our country. We have science educator meetings, we have museum educator and director meetings, we have scientist meetings, we have journalist meetings, but never all in the same room. So It's very exciting to be in a room with people from all these areas of science communication.

The question which Dr. Samuels has just offered is whether science museums can help accomplish some of the goals we've been talking about, particularly the goal of engaging the public in a discussion in thinking about contemporary issues, and these can be controversial issues or issues that aren't yet controversial, the early warning scheme.

Well can they? Of course I started being a....I'm an experimental physicist.....30 years ago, and I've been in the field ever since, and I'm not sure if this is a common expression here, but when your favourite tool is a hammer everything starts to look like a nail, so for someone in the science museum field, if there is a challenge of communicating with the public, why obviously the first thing to try is science museum exhibits.

So let me go through some of the possibilities, and most of my 20 minutes is going to be spent with some real examples of things that have happened.

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First, let me say that this is a topic that science museums have been discussing for at least 30 years. I helped organise a conference in Paris in 1983 which we spent 3 days talking about whether we could present social, and economic aspects of science, and the issues around them, in the new science museum in the (Cite de science) Paris. And after two days of discussion and a publication and a lot of discussion in fact the museum almost completely avoided trying to do so. And some of the reasons I think will become clear as I go through the talk. But in the last 30 years there have been some exciting experiments, some spectacular failures and a few maybe successes, so that's what I would like to describe to you this morning, and encourage you to make up your own opinion about whether this is worth pursuing, and I'll have some suggestions for how to pursue it if you think that it is.

Well, why science museums? In the first place, they are the fastest growing sector of the museum world, which is a pretty big world. The American Association of Museums has 10,000 institutional members, which includes historic houses and botanic gardens and zoos and science museums, but by far the fastest growing part of this is the science museum world. Several of these museums open somewhere in the world every year. In the 1980's it was one a month opening somewhere. In the United States alone there are 350 of these museums, the budget for the museums just in the United States is combined over \$1 billion per year. 177,000,000 just in the United States and about 60,000,000 of those visitors are school children on field trips, so clearly this is a medium which attracts a lot of attention and resources. It's especially interesting because these museums are all independent, there's no single funding source, the museums each fight for their share of that \$billion in producing it, and the fact that the industry has grown so dramatically I think suggests that they must be doing something right. And the fact that almost all of those 177,000,000 are there voluntarily, well maybe some of the school kids are coming because the whole class got on the bus so they had to go too, but in fact there is a large repeat visitorship. The kids bringing their parents and siblings back on the weekends.

So something good is happening, why not use it for this topic? Well the first question to ask is 'well what is actually happening on these visits? Do people learn things? Do they think? Are we engaging them in anything?'. There are fortunately a growing number, and this was not true 30 years ago, but a growing number of really impressive evaluations of the effectiveness of museum learning. What happens to kids to adults to families when they visit a science museum? There have been critical literature surveys, there's a conference which meets once a year for people around the world, for four days, just to talk about what we are learning about what's happening to visitors in museums. And there have been some extended analyses at the beginnings of creating a theory of what happens when people learn outside of the formal classroom setting. 92% of our lives are spent not sitting in a collage classroom, or an auditorium even as comfortable as this one. What happens during that 92%?

And the results of these evaluations are that, among other things, the visitor demographics are really good. Much, much broader than the demographics of who is in a college classroom, or who goes to an Art Museum by the way? Despite the fact that the visit is often brief, and there is a high noise level, which many people say 'Ah, noise and learning are antithetical to each other', not true. Visitors actually do learn in museums. There are both cognitive and effective gains which are measurable and which happen for a wide variety of visitors. In fact the most recent study by John Fox Group, suggests that the learning gains are adversely proportional to how much you already know. It's the people that know the least learn the most. People who learn the most reinforce what they already know, but they don't learn that much new. The cognitive gains are modest. I mean after all, we are not talking about 40 hours in a classroom with homework, we are talking about 2 ½ hours including lunch, and bathroom breaks, and the gift shop. So the amount of cognitive gain is relatively modest, but that modest amount of cognitive gain leads to a very significant affective gain, primarily in people's interests in a topic and their own confidence in their ability to learn about that topic. So all this sounds so promising for dealing with contemporary issues of science and technology.

But when you look at what museum exhibits actually cover, you will find that the overwhelming majority are just in a narrow range of pretty much non-controversial topics, fundamental principles of science and technology, the lever, the bending of light through a prism, and the relationship between one celled and multi celled micro-organisms. Fundamental stuff. There are lots of examples but they tend to be the happy examples, so we talk a lot about penicillin for example, it's such a nice example. There is very little treatment of either historic issues which were controversial at the time or contemporary issues which were controversial.

And why is that? Well, I've given a lot of thought about this, because I have often wanted to do things and I'm trying to figure out why I don't do them, and partly I think we have to look at the practical process of how museums are organised. There are at least 4 groups of stakeholders, there are scientists and curators, both within and without, and what do they want to happen? What do they expect to happen in an museum exhibit? They certainly want to deliver vital facts. Everyone should know that a molecule is bigger than an atom and a cell is bigger than a molecule and a mouse is bigger than a cell. So people should know these basic facts, which, by the way most Americans don't. They can't tell you whether an atom or a cell is bigger.

They would like to discuss the process of science, how is it that we are so clever in our laboratories. And they would like to celebrate the achievements and accomplishment of science in general, and scientists, especially themselves in particular.

The second group of stakeholders are the staff of science museums, who after years of evaluations have relatively modest ambitions for what a museum exhibit can accomplish. We can tell some simple stories, we can have a sensory impact, it's beautiful, it's ugly whatever, and we can celebrate how clever we are as exhibit design is.

Then you have the public visitors, the people who are in one way and another paying for all this. They almost never say 'oh I'm coming because I want to learn which is bigger, a cell or a molecule', they say 'we're coming to have fun', they would like to find personal relevance in everything. Penicillin is a great story because they got a penicillin shot when they were sick once and it made them better. They are relatively less interested in something abstract that doesn't seem to have any relevance to them personally, even though we know it's terribly exciting, and finally, they would like to celebrate something about themselves. People like exhibits about their home town, about people who have worked in their area and did something famous.

And finally you have the outside funders, government, corporations, foundations, and they want to be associated with something really excellent. Undisputedly excellent. Hence no controversy thank you. They would like to generate economic activity, if not directly buying their products at least making people feel good about technology, and finally they would like to celebrate what they do. The intersection of all these points is celebration, and there's not a whole lot of room in this list for dealing with tough, controversial issues which we are not sure what the answers are, and in fact the whole topic may be unpleasant in some way or another.

So this is why I think museums tend to be relatively un-aggressive in their choice of topics. There's also the practical aspect. This incredible diversity of audience ages and backgrounds, how do you design one exhibit or programme which is going to work for 177,000,000 people. The visit durations are short. How much of a complex issue can you really get across when the average time in front of an exhibit unit is 2 minutes, 30 minutes for a whole exhibition, and 2 ½ hours for a whole visit to the entire institution. And again, those stakeholder expectations don't really fit in well with delving deeply into a thorny difficult topic.

However, having said all that, there are some exciting and important experiments, and that's what I want to tell you about for the duration of my talk.

Let's start with the 'welcome wing' because I presume all of you have been to the welcome wing of the science museum in London? Anyone? Or how many people have been to the welcome wing? Okay, excellent. There's a series of issues there which I am actually not sure how the people at the science museum designate them, but I call them 'issues exhibits' that deal with some contemporary issue, and almost all have this feature which is illustrated in the photograph on the right, cast your vote...you are asked to choose, agree, disagree, or uncertain, and then you can delve more deeply into the issue, and sometimes you can vote again. And this is a technique which seems to inspire people to think a little more about the issue. Just the fact that they have the chance to push one of those three buttons makes it more interesting than saying 'some people say this', 'some people say that'. The fact that not only does it say 'what do you think?', but you get to push a button to register your opinion.

This is actually the most time-honoured way of dealing with issues in museums. 20 years ago the Franklin Institute in Philadelphia set up a series of choices discussions. An audience would gather like this, just off the museum floor and they would talk about how to save energy. Would you rather drive a smaller car, or insulate your house...? Or again, a series of choices you could make. The audience was asked to vote, and then there'd be some discussion and then they'd get to vote again.

They later mechanised this with the choices theatre. Every seat had three buttons next to it, and you were asked to vote, 5 or 6 times over a 30 minute period. The criticisms of these choices exhibits, interestingly, the more people know about the issue, the more unhappy they get with having to choose 'yes', 'no' or 'uncertain'. Invariably the way the issue is framed makes a huge difference and people who feel strongly about something can point out how

biased the presentation is. And there is almost no way to present a really good, hot topic in simple yes or no terms. You have to deal with a range of alternatives, and that doesn't lend itself to three buttons on the corner of your armchair.

The models that are being used, some of these exhibits for example have had either analogue or digital models. You change something. You change the average mileage of a car, or you change the length of a visit, or some other parameter and then you see how that affects the overall energy consumption of society, and it's easy to challenge those models. Well, that assumes everybody is driving a gas car. What about the new hybrids? So it's so easy to dispute the validity of the choices and the way the presentations are made that I think while this does tend to engage the audience and get some thinking going, it really doesn't get us very far.

Let's look at some other examples. The exhibition at the National Air and Space Museum of the Smithsonian Institution in Washington DC the most visited museum in the world, over 8,000,000 visitors a year, was one of the great disasters of the 20th century for the museum world. The original exhibition was going to be an historical look at the issue of strategic bombing. And of course this was something that Franklin Roosevelt and Winston Churchill discussed, came to some resolutions and the bombing of civilian populations, which of course London had been one of the first major victims, but not only, was an important issue in the intersection of technology and society and ethics and morals and practicality, so it looked like looking back on this from a perspective of 40 or 50 years might be a reasonable way to begin to engage the public in a dialogue.

The exhibit was never actually built and the final exhibit called 'The Enola Gay' the aeroplane which dropped the bomb on Hiroshima was less than a quarter of the size, and vastly less ambitious than the original exhibit. The difficulty was I believe traceable to expectations. When the script...a draft version of the script was deliberately sent by the museum to various stakeholders, for

example to the Mayor of Hiroshima and the President of the American Veterans of World War II, to get their honest opinion. How did they think it was going? How did they suggest the exhibit be modified? And produced an immediate firestorm in part because of expectations. The American Veterans believed that an exhibit about them should be an exhibit about their heroic sacrifice. They did not want to have an exhibit about 'possibly the generals made a mistake', or even that it was debatable. It was difficult even for such people....I had a fascinating talk with Mel Cransburg the distinguished historian of technology, who said 'well of course this is an important issue, and of course it should be discussed'. On the other hand, he was a soldier waiting on an island in the Pacific to be sent to the invasion of Japan, and as far as he was concerned, dropping the bomb on Hiroshima saved his life most likely, and he wasn't sure he could be dispassionate about discussing this issue. In the end the exhibit was basically scrapped, the director of the museum was forced to resign, and Congress threatened to cut off all funding for the institution, and what was finally built, an exhibit called 'The Enola Gay', is primarily concerned with how clever the people at the Smithsonian had been in restoring the aircraft. The only discussion of the atomic bomb is on the one panel on the right in the second paragraph. That's it.

So, this in many ways was a cautionary tale. Try and do something controversial and you may lose your job and risk your funding and see your exhibit turn into a travesty of the original concept.

Actually, an equally controversial but in many ways a much more successful exhibit, also at a Smithsonian Museum, the National Museum of American History, is an exhibit called 'Science in American Life'. It in fact is a cautionary tale about the relations between science and technology and society, illustrated by covering a 200 year history of America. And it doesn't look controversial on the surface. I mean here is a diorama with manikins of two scientists, Ira Remson and Constantine Fahlberg in their chemistry lab at Johns Hopkins University in the late 19th Century. Now, what could be controversial about that? Well in fact the curators had a very distinct point of view, that the

American vision of science and technology has gone from one of almost euphoric belief that anything science and technology does produces progress, and progress is good, to a much more sceptical attitude that maybe scientists and engineers can't really predict all the impacts of what they do. And maybe sometimes they are just bad ideas.

For example this laboratory, which you can see in the photograph on the right, has the manikins of Remson and Fahlberg talking about the discovery of saccharine, which one of them, Fahlberg, has made, but the discussion quickly turns into 'is it appropriate for research scientists at University to be working hand in hand with industry, that's going to make money?' and 'is Remson trying to snatch the credit for this discovery from Fahlberg because it was Remson's lab, and not Fahlberg's lab?'

The American Chemical Society that paid for this exhibit was outraged, livid, furious. It's supposed to be, as one Nobel Laureate said in a private meeting that I was bought in to try and be a mediator between the scientists and the curators, and the scientist said that 'the function of an exhibition at the National Museum is to glorify science'. And he was dead serious. The American Physical Society which didn't actually pay for anything in the exhibit was even more outraged. And Rod Park a physicist and in many ways a spokesman for the physics community announced that the 'exhibit missed no opportunity to criticise science and scientists and would leave the public feeling terribly dismayed at how evil science was and unwilling to support science in any way'.

What did the exhibit in fact accomplish then? Before an evaluation was done I actually went into print and here is my prediction, and here's what I said 'I think visitors will come away pleasantly surprised that the scientific establishment is able to consider itself so thoughtfully without the hard sell for the benefits of science that the establishment musters before congressional committees. Scientists recognised that their work may significantly affect daily life and they must be self-critical when they use science to try to improve the human

condition. That is an image that would go a long way towards restoring hope and promise to the public image of the scientific enterprise'.

Well, who do you think was right? Was I right in that optimistic view that this would raise the public's impressions about science and technology? Or was Rod Park right when he said it would destroy the public's confidence in science and willingness to fund it? Anyone render a guess?

Delegate I'd say it was you

Anybody else?

Delegate Neither of them.

Ah and why is that?

Delegate Because of the way you put it, that something else was in between

And you are right. The Smithsonian, another branch (IA) did an excellent thorough (IA) evaluation and discovered that the public went into that exhibit, the people that chose to go into that exhibit, aside from looking at the First Lady's dresses over history, or transportation history, the people that chose to go into an exhibit called 'Science in American Life' were overwhelmingly pro-science and technology and they left the exhibit equally overwhelmingly pro-science and technology. There was no measurable change in their attitudes.

And this suggests the other major difficulty. Even when we try and do a controversial exhibit, the public in general doesn't get the controversy. People tend to reinforce what they already believe in a museum exhibit. We can make small incremental changes, we can get people more interested in the topic, but can we get them to re-think their whole attitude towards something?

Probably not. Now maybe there are other media that can do this. I have certainly gone to movies and plays and read books which I close the book and

feel outraged and amazed and surprised and delighted. I rarely get that depth of emotion visiting a museum exhibit. There's something about standing up all the time, having to keep moving, having this array of choices you have to make, do you want to go to this one, or maybe I'm hungry....it's a very different attitude than the attitude you take with you to the theatre, when you see the play Copenhagen and think about moral choices of scientists, it's very different from seeing an exhibit about the history of science.

We developed an exhibit on AIDS which was by the way partially funded by Pfizer, which turned out to be controversial. On the left is the original version of one of the graphics from this exhibit and on the right the final version. And let me say a word about this, because this is one I personally suffered over. We knew from studies we'd done that there was a great dangerous misconception among American teenagers, caused in part by public health advertising, which said that 'condoms are the way to prevent the sexually transmitted diseases'. Teenagers however interpreted this to mean 'birth control is the way to prevent sexually transmitted diseases' and thus the overwhelming majority of American teenagers believed that if a woman is taking the birth control pill then neither party can get a sexually transmitted disease.

So we set about to correct that lethal miscomprehension with an exhibition. The first version shown on the left didn't work. We interviewed the teenagers after seeing the exhibit they believed the same things that they did when they came in. The version on the right, an evidently more graphic presentation, this is of course one screen out of about 20 screens and then computer interactive, in fact doubled teenagers comprehension of which kinds of birth control can prevent the spread of AIDS and which can't. You have to remember that America is a rather puritan society and we had teachers come in and literally pull the plug out of the back of the exhibits so the kids wouldn't see these illustrations. We had one staff member who was so offended that he tried to organise a staff strike because of this material being presented in the museum where children were present. In the end we stuck to our guns, the exhibit was eventually copied and distributed nationally, and at least one newspaper article

said that 'thousands of lives might be saved as a result of teenagers seeing this exhibit'.

It's interesting that no one else has funded us to do an exhibit like this, since the controversy.

The final exhibit I want to talk about I think is one of the most successful, and it was developed in Canada by Drew Ann Walker and James Bradburn, they went on to develop similar, but I think not quite as gutsy exhibits for New Metropolis, which James did. It's an exhibit which has an interesting approach. They took a controversial issue, the location of mines in Western Canada, if there's any place you decide to put a mine there will be howls of protest, perhaps legitimately, but rather than doing an exhibit about one particular actual mine location, they created a hypothetical situation. The visitors would go through the exhibit and gather other data about the animal population, the history of an area, the mineralogy, the rivers that flow through it, and the periodically the staff would sweep through the museum and escort the visitors into the 'hot zone' on the right, a little theatre, and very quickly get the visitors to come up with a recommendation – 'put the mine here, or here or nowhere at all'. And then the visitor's recommendation will be typed up and it will be displayed on the giant screen up here, and everyone felt very good about having gathered scientific data, cultural data, environmental data and made recommendation.

And then, on the screen comes a simulated newscast, and the reporter says 'I'm standing outside City Hall where the recommendations of the Scientific Committee have just been announced and they have recommended site B for the mine. Let's interview some people leaving the hearing', and of course the first one goes 'I am absolutely outraged, how can those idiots destroy the greatest Indian Cultural Treasure in Western Canada, by putting the mine right on the site of an ancient burial ground?', or, if they chose another site the mine owner says 'They are crazy if they think I'm going to dig a mine there, there's not enough soil over there to get anything worthwhile out of it. There will be

no jobs, we will go elsewhere and the community will collapse', or if they choose site A, we hear about the endangered red fox and how this is the last place where the endangered fox is safe in Western Canada. Whatever decision they made, there's public outrage, by experts, with good reasons for being outraged. The audience is now invited to reconsider their choices and they come up with ways to ameliorate whichever choice they make, because of course, whatever choice they make, they are going to get a different tape telling them why it's the wrong decision. It's a brilliant exhibition, and I sat through and watched some groups doing this. I think it suggests some of the ways we can actually deal with these issues. There is real controversy, but, by selecting a hypothetical example instead of a real example people don't come in with preconceptions about whether this was a good decision or a bad decision. They have to make a decision, they have to discuss some of these consequences, and then they have to try and come up with a better decision.

The sad thing I have to tell you though is that the exhibit has been closed. Not because of controversy but because it was simply difficult, sweeping together visitors, training the staff to do these discussions in an efficient manner because the limitations of the visit, even though the visit was supported by the mining industry, the environmentalists and everyone else, thought that this was a terrific way to represent the difficulties and tentative resolutions of those difficulties.

Well, finally, what do we do next? We have some promising examples, we have some cautionary tales that make Museum Directors like me quiver in our shoes. I think we ought to keep trying. There is some promise here, especially shown by that exhibit in Canada that it is possible to deal with these issues and keep your job, and even attract visitors. How do we reduce the risk aversion of people like me who don't want to get burned frankly, who know that an unpopular exhibit is as dangerous as a bad exhibit, is as dangerous as an exhibit that gets congress to threaten your funding. Well, part of this I think would be by establishing dedicated funding just to do this. You can apply for funding from grants, from private or government foundation or corporation,

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only if you are willing to tackle a difficult controversial topic. Otherwise, go to our other division, where you can do more exhibits on rainbows and you know...they history of science from Galileo to Copernicus.

The third thing that we can do is that it is essential that we evaluate what we are doing. Where like the Science in American Life, after all the furore, the exhibit having no significant difference result, particularly attitudes and understandings of the complexities of science in society. I think we need to try. It's an exciting opportunity, it is not obvious we are the best medium for doing this, if frankly it was my money I'd put it in the Science Theatre, and plays like Copenhagen or Acadia, my favourite Tom Stoppard play, which, despite its English pastoral setting actually deals with thermodynamics chaos theory and the relationship between science and society.