

Lecture for the International School Ettore Majorana, Erice, august 1<sup>st</sup> 2012

Ladies and gentlemen,

Allow me to start this lecture with a few remarks about myself and my career.

I studied physics and astronomy at the Universities of Nijmegen and Utrecht, but already during my study I realised I wasn't cut out to be a scientist, and afterwards I turned to science journalism. For about 25 years I worked for several magazines and newspapers. My latest job was science editor for a free Dutch newspaper called De Pers. This paper was in fact a unique experiment: it was free, handed out at railway stations, business parks and the like, comparable to the world brand METRO newspaper, but with a big difference: De Pers set out to be a quality newspaper. News stories were not simply bought from news agencies or plucked from the internet, and printed without any comment. De Pers had a big editorial staff and it wanted to deliver a real contribution to the Dutch media landscape. Alas, after its launch in the spring of 2007 the economic crisis (starting that same summer) soon made it clear that this approach was financially very weak. De Pers was very much appreciated by the Dutch public, but ultimately in March of this year the owners were forced to stop publishing. And since then I'm out of work.

I'm not telling you this to arouse your pity, or so you might offer me a job – the failed experiment with De Pers illustrates an important point: the growing problems quality media have within the modern media landscape. Not only in Holland but world wide. Modern media consumers don't have to pay for information. It comes to them every second, and totally free. In that way, we can expect free dailies to become more important the coming decades. But can these free papers uphold the traditional high standards of the paid newspapers? De Pers wanted to show that was possible. That quality and free could go together. Unfortunately, it failed. Maybe just because of the economic crisis, but the failure underlines that the availability of free information threatens the future of quality media. And also of science journalism. But more about that later. First, I would like to give my opinion on the relation between science, science journalists, and the media.

A few weeks ago I interviewed a Dutch cell biologist who was doing research on transporting medicine into the brain, across the blood-brain-barrier, using nanoparticles. As you may know the blood-brain barrier is a thick layer of cells that protects the brain from dangerous chemicals. Only a few molecules are allowed to enter the brain, after they have been recognized by the cells from the barrier. This researcher had succeeded in sticking a specific peptide, that was recognized by the barrier cells, to a nanoparticle, and so the nanoparticle could enter the cell layer, and then the brain. Which goes to show that a healthy brain has no objections to nanoparticles. These nanoparticles may one day be used as nanocarriers, containing psychopharmacological drugs. Up until now, it is very difficult to get the drugs across the blood-brain barrier, but that problem might soon be over.

After the interview I asked the researcher whether he expected, or could understand, that future patients would refuse this form of nanotherapy, because they wouldn't like the idea of nanoparticles penetrating the brain. The question amazed him. He considered such a refusal highly unlikely, if not unthinkable. But if such a fear would ever occur, scientific organisations, doctors and we (and at that moment he looked at me) should all work hard to prevent it from spreading.

Science and science journalism should be working closely together to inform the public. That is the conception scientists have of the role we science journalists should play. And I must admit, many science journalists see themselves in the same role. In the Netherlands there are about a hundred science journalists, they have a very active and lively organisation, the VWN, and discussions

within this club often stress the strong moral ethos science journalists should uphold, as defenders or propagandists of scientific research and scientific progress. Many consider themselves as natural proclaimers of the wonders of science to the general public. Personally, I see that role rather differently and, in the future, fundamentally different. But before giving my opinion on the role of science journalism, let us return to the public acceptance of nanotechnology in the Netherlands.

There is in our country, at this moment, no clear organised resistance against nanotechnology. The Dutch environmental movement hardly looks into the subject. It has concentrated its efforts and campaigns for the last ten years almost exclusively on raising public awareness concerning the Greenhouse effect, and preventing genetically modified crops. These two topics appeal much more to the imagination than, say, nanotechnology. And as resources are limited, we don't have to expect initiatives on that subject in the near future.

Then there are the Dutch unions, who of course traditionally show concern for the health and safety of its members. In the last few years the unions have regularly warned that research should be done into health effects of nanoparticles, and this has led to a few scientific studies. I mean surveys of scientific literature, which resulted in a long list of unknowns and maybe's – the usual stuff. In the last few years, this interest from the unions has almost completely disappeared. The main reasons for this, I think, is that due to the economic crisis the unions need to concentrate on their core business: defending the wages and pensions. Concerns about the dangers of new technologies are nowadays considered, to use a popular Dutch phrase, 'hobbies of the left.'

Despite this lack of an organised resistance, there is a small but noteworthy suspicion concerning nanotechnology among the Dutch public. And the authorities and industry do fear that this suspicion might one day grow into something bigger, and nastier. That would be dangerous indeed, because as we all know nanotechnology is at the moment revolutionizing biomedical research, and within Dutch science and industry, biomedical research plays a leading role. So during the last few years, the Dutch government has done its best to promote public awareness of nanotechnology. Three years ago it installed a Commission to stimulate a national discussion on nanotechnology. In two years time this commission, the Nanokaravaan, organised many meetings, festivities and discussion platforms, in collaboration with local organisations, scientists, artists, et cetera. And did this campaign have any effect? At the start, in 2009, 46 percent of the Dutch had never heard of the word nanotechnology. Two years later, that percentage had declined to 36. A rise in awareness the commission generously attributed to its own activities.

The Commission's goal was clearly limited to raising awareness – not to influence public opinion pro or con nanotechnology. These opinions should simply come forward during the meetings, so the public could decide. And of course we, science journalists, were expected to report on these meetings, and carry the discussion forward.

But of course, it didn't work like that.

In these years I visited, or even helped organise, a few of the festivities and meetings. Of course the Commission wanted these meetings to be a success. To be guaranteed of a wide audience, it organised them mainly in university towns, in cooperation with the local university. The consequences are easy to guess: the audience consisted mainly of students and scientists who knew what nanotechnology is, and were already convinced of the beauty and blessings of nanotechnology. In fact, during these meetings dumb questions and critical remarks were frowned upon. As I experienced at first hand. One day I was asked to chair one such meeting, in the city of Nijmegen. On stage, I interviewed two scientists, active within the field of nanotechnology, and I specifically asked them, several times and in several ways, whether society as a whole could, or should, trust scientists when it comes to nanotechnology. Should the general public have the right to veto certain research directions. Before grilling them in this way, I had spoken to them, and warned

them what kind of questions they could expect, so they could prepare their answers. The following debate was fierce – and they enjoyed it. But not the audience. A vociferous part made it clear they considered my questions inappropriate. Directly after the meeting I was severely criticised by the organisation for being too harsh. I had been hired in to heighten the festive atmosphere, not to ruin it. They were very disappointed. And so was I.

The organisation of this kind of meetings was, in other words, preaching to the converted. In my opinion, the Commission failed in reaching those who had no idea what nanotechnology is, or who are suspicious of nanotechnology. And if they would show up, they had better not open their mouths.

What about writing articles? Does that have any influence on public opinion? I must admit, in these years I haven't written one single time about one of these meetings. All in all I haven't seen any article in Dutch magazines and newspapers solely based on one of these meetings. They simply weren't news. This appears to me to be the second mistake of that Commission. Whatever the members might have thought, those kinds of meetings are not the stuff science journalists write about. Unless something remarkable happens, like a good row afterwards, but I don't want to be the subject of my own articles.

I sincerely doubt whether articles have in any way influenced public opinion on nanotechnology. There are two reasons to doubt this influence. First, there is the declining impact traditional written media have. Second, there is the way in which the public reads such articles.

In my 25 years as a journalist I have almost exclusively written articles for printed media. In the last few years I started blogging and using twitter, but these are still more hobbies, or ways to express my amazement or anger. But the role of digital media will of course become very much bigger in the coming decade. While the role of printed media will become smaller and smaller. We all know in the last 25 years the influence of the printed media has declined slowly but steadily. Not only in the Netherlands: this can be seen in all modern western countries. Quality papers keep losing readers and losing advertisers, and also sensational newspapers (sometimes gathered under the name 'tabloids') and local newspapers have ever greater problems to remain profitable. Their social role is also on the decline. 25 years ago the printed media reached about 90 percent of the general population, now that is about 50 percent. So advertisers and politicians increasingly turn to television to get their message across. But even television is getting into danger. Modern youth don't read papers AND they are hardly interested in television. For them the internet is the only source of entertainment and information. They are completely used to the idea that information is free, and within one or two decades that idea will have pervaded all of western society. Which is bad news for scientists and science journalists.

Newspapers will come under more and more pressure to work more and more cheaply, that is: without a costly editorial staff. At the same time, the flood of free information will in the next decade become overwhelming. Everybody, every company, every organisation and every fool with an internet connection can deliver free information. Filtering and assessing that information, finding out what is good, bad or bogus, will become impossible. But the public doesn't really consider that a problem. It simply seeks what it wants to read, or hear. Instead of turning to a specialist, a science journalist for instance, which costs money, the public will search the internet for more free information that confirms the opinions they already have. They don't need experts or science journalists. As soon as they have found confirmations for their opinions on several sites, that will be enough.

This urge to search almost exclusively for what we already know to be true, is not a deplorable effect caused by internet. It is nothing new. We like to read, and conclude, we were right all the time. We hate reading an opinion we disagree with, but can't refute. When it comes to the impact of

written articles, my articles, I have often met the same psychological reaction.

When interviewing for an article on nanotechnology, I regularly asked the scientists involved, if they have any thoughts on the risks involved. And in such an article I try to give due consideration to uncertainties and possible risks. This has never led to any problem with the scientists involved. As I noticed before, scientists consider journalists as comrades in the 'battle' against misinformation. But at the same time they are (in most cases) fully aware that we, as journalists, also have the responsibility to tell the whole story. As for the readers, they fall into four groups. The biggest of these doesn't read such articles at all, as they couldn't be bothered. The second one, a small one I'm afraid, reads and appreciates the article, and welcomes the fact that I made some critical remarks. The other two groups read it, but afterwards deplore publication. Either because of the fact that I clearly state the dangers involved – which I shouldn't have done. Or (the fourth group) because I clearly state the dangers involved – so if I know how dangerous it is, why give these mad scientists so much space? In other words, when you try to write well balanced articles, they are in most cases instantly picked apart. Some deplore the cautionary signals, others see them, however slight, as confirmation of their negative opinion.

You may find this a rather pessimistic view on journalism. You might even think that this conclusion says more about my work as a journalist, than about science journalism in general. But unfortunately, it is all too well known that the influence of journalism on public opinion is rather limited. Still, we can have some influence. To know when and how, we first have to ask ourselves: what is public opinion really based upon? When is it really formed?

In these same two years that the above mentioned Commission tried to heighten public awareness on nanotechnology, public opinion on nanotechnology among the Dutch had not changed a bit. At the start a rather big minority showed reservations; two years later that percentage hadn't changed. The Commission stressed that the fact that opinions on contested and unfamiliar issues such as nanotechnology are not based on information but on an individual heuristic search within his/hers social environment. (This mechanism you might be familiar with thanks to the paper by Dan Kahan, from the Yale Law School, published in Nature Nanotechnology, in 2009.) When pressed to form an opinion, people first ask themselves the following questions:

1. Which other issues, of which I already hold a opinion, resemble this new issue?
2. What do relatives, or people I respect and trust, tell me about these issues?

The central concern for these uninformed civilians is not to gather reliable information on the subject, on the basis of which they can form a personal opinion, but to assess the potential status of this new subject within its own peer group, and to adopt the predominant opinion within their group. In other words: for most of us an opinion is not a logical conclusion, but a way to confirm and strengthen our bond with our social equals. The logic of a certain stance, comes afterwards.

As I said, this whole opinion-forming-mechanism only gears up when people feel somehow pressed to form an opinion. And this pressure only comes to the fore when a subject becomes the subject of a national debate. This kind of debate isn't started by quality newspapers, in which case science journalists might have a moderating influence, but usually starts with an incident, after which more sensational newspapers and of course television stations, are very apt in sensationalising what happened, and formulating the moral and political questions they think arise. Should we allow this or that technology? Shouldn't there be a law against such and such research? Should such-and-such a factory not be forbidden? Sometimes the connection between the incident and the questions that well up in the media afterwards, can be very thin. Just think about putting the whole concept of safe nuclear energy under questioning just because an extremely high tsunami wave severely damaged a nuclear power plant. But for these quick sensational media making the jump to such 'big questions'

is very attractive because this effectively leads the media and its consumers away from the often much more relevant but difficult scientific and technological questions. Questions they can't explain because they don't have the editorial staff that can gather and wisely deliver such information. The scientific background to what happened (and we are all well aware of that phenomenon) often only appears in the quality media well after the discussion on these so-called more fundamental questions has started. Sensational media simply are afraid of, or are blind to such information. To give an example: the Dutch national television organisation, the NOS, who makes the main news programs on the Dutch non-commercial networks, has a staff of over 350 editors, but not one of them is a science journalist. The director simply says he doesn't need one, because any editor or journalist should (in his opinion) be able to handle scientific subjects. Several scientific gaffs and blunders in NOS-media stories the last few years show what this short-sighted policy leads to.

Under normal circumstances, without attention-grabbing incidents, science journalism is often simply the hatch between science and the general audience. Scientists are doing complicated but very important things, and the science journalist had the noble task to explain to the general public what the scientists do, and why their work is important. On such moments the science journalist is the only way information on science reaches the public. Other journalists don't care for science; members of the general public don't actively gather scientific information and don't actively contact scientists.

But in times of crisis, the situation is very different. Then this one-way system doesn't function any more. Then everyone will suddenly feel the need to have an opinion on this, and will start looking around, to find out what others think. What we ought to think.

We've seen this happen with nuclear energy about thirty years ago. And we've seen it happen with climate change. Nanotechnology is not very visible in daily life, and so it doesn't arouse as much concern as, say, climate change, radiation, nuclear energy, or (when they start digging in your back garden) the storage of carbon dioxide in empty gas fields. Still, the moment may come that nanotechnology does become the subject of an incident, a cause for scandal, and the victim of negative publicity. Then people start sounding out the opinions within their social peer groups. The great mover here is, of course, internet. In the last few years the science community has discovered to its horror that internet provides the opportunity for the spontaneous formation of communities that seek their own information about science, and draw their own conclusions. Let me give you two Dutch examples.

A few years ago the Dutch medical authorities tried to introduce the vaccination of young girls against the HPV-virus, which causes cervical cancer. Fully convinced of the value of this vaccination, they were quite astonished, and overwhelmed, when confronted with internet communities run by concerned mothers, who raised grave concerns. They actively gathered and disseminated dissenting scientific information and spread scary gossip on the hazards of vaccination. Scientists were accused of not telling the whole story; science journalists who defended the campaign were seen as simple accomplices. This spontaneous protest movement seriously threatened the vaccination campaign.

Another example, one you will be more familiar with, is the panic caused by the outbreak of Mexican flu two years ago. When, during the summer of 2009, it became clear that the dangers of this outbreak had been exaggerated, innumerable social media groups sprang up, ranging from quite well informed to downright insane. A widespread opinion, still popular today, says that the flu pandemic warning was nothing but a plot by Big Pharma, eager to sell vaccines.

We all know what is happening here. Social media like Facebook and Twitter offer readymade tools to organise new bigger groups than ever before. And unfortunately, it are exactly the groups that

heighten collective fear, that stimulate speculation, that are the biggest growers. They attract more attention – not just from the general public but also from other journalists, not science journalists, looking for controversy, for a good story. Member of the groups actively seek scientific information that confirms their opinions.

Our first task, on such an occasion, is of course to stop thinking in the standard way. Science journalists must step backwards. People don't need science journalists to tell them what scientists do, or say. They are in a defiant mood. Scientists are changing the world, and the inhabitants of that world want to speak to the scientists themselves. Humiliating as that may be, in practice that can have excellent results. Let me remind you that the public trust in scientists is still very high. Around 80 percent consider scientists in general very reliable. Journalists, on the other hand, bungle around 20 percent – which is not very far from politicians.

Of course, this dismal figure concerns mainly non-science journalists, but I have already pointed out that in the abnormal situation when a scientific subject becomes a hot topic, the borders between science and non-science journalists becomes vague. So also science journalists we shouldn't be surprised to be distrusted. Still, we can do useful work.

Journalists know the way in the scientific literature. They can search more effectively, and often – not always – distinguish good studies from bad. As me and my colleagues discovered, in this way we can advise these groups to look a little further than the handful of studies they have googled up, and send around, endlessly. Although science journalists are usually distrusted, initially, by those groups – as they are usually seen also as sloppy hatches for the scientists they have come to distrust, I discovered this kind of service is very well appreciated – even if you come up with studies that don't concur with their vision. But you should never – I repeat: never – assume you can tell them what they should think because science says so. The best policy is: Stay polite, let them draw their own conclusions, and you'll notice that they interpret your interest as a token of recognition. Which is what they crave for most of all. Then you are treated as someone that can be trusted, and often they come back to ask for advice. Only in that position, that is independent of scientists and on an equal footing with your public, you may hope to have any influence on their opinions.

Still, when it comes to changing human lives, to translating scientific work into practical policies, we science journalists must leave the field for the actual scientists who carry that responsibility. And we must refer groups of concerned civilians to the scientists themselves. Coming into contact with scientists can have very good effects. As some Dutch examples show. In the HPV-crisis I sketched earlier, direct personal contact between these groups of concerned mothers and Dutch virologists ultimately led to a softening of their positions. They felt finally recognized. Though their distrust of vaccination never fully disappeared.

Allow me to finish this lecture with a few conclusions.

1. The old system, in which there is an one-way flow of information from the scientist, through science journalism, to the general public is still in perfect working order in quality media that sincerely search, evaluate and disseminate scientific information. But these media are in decline, so:
2. Scientists, and science journalists, who think that this one way system is the Royal Road along which public opinion on scientific issues is formed, are, I think, wrong.
3. Public opinion is mainly formed under abnormal circumstances, in a crisis situation when the public realises science is changing their lives, and when they feel (or are pressed to feel) the need to form an opinion. These crises are created by incidents, and the public debate afterwards is set and led by sensational media, such as television.
4. In forming their opinion the public doesn't fall back on science journalism but on the

opinion of the ones we trust. Already existing opinions on science and technology are at that moment a dominant factor. And these opinions are at the moment, as we all know, rather mixed.

5. Internet stimulates the formation of communities of concerned civilians, who actively search for information and develop their own interpretation of the work of scientists. Scientists and science journalists must accept the challenge of breaking into that system – not by confrontation but by building trust.
6. Journalists will have to show they are trustworthy, and more than hatches between science and society. Which means they must take into consideration non-scientific arguments and must genuinely search for balance in the debate.
7. The challenge for scientists is different. In case some incident causes a media storm, they cannot hide behind science journalism. If scientist say they will change the way we live, that science transforms society (and scientists like to say that very often), then they must understand that the general public doesn't simply want information (which it can get from journalists) but wants to get a grip on that change. Which means: the public wants to have direct contact with scientists. On such moments, scientists, must treat that public as equals. As colleagues, one might say. Which means: be clear, be patient, and never use arguments based on authority.
8. And to finish on a more general note: In the future media delivering free information, coming directly from all kinds of parties, varying from wise till downright loony, will dominate the information flow to the general public. Handling that information flow – and this applies to politicians, scientists, and all types of journalists – is impossible. We must adapt to that situation. Science journalists will have to invent new and creative ways to make themselves useful. And as far as scientists are concerned: they will have to prepare themselves for media storms, caused by sudden incidents, that will lead to questions on the desirability of their research, or even on the necessity of complete research fields, such as nanotechnology. On such moments, they, and only they, can answer these questions. The public wants to have a say in the way scientists are going to change their lives. They want to talk directly to those who are responsible. And they are, of course, absolutely right.