Why we aren't always convinced by facts

Dies lecture by

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Madam Rector Magnificus, highly esteemed audience,

First of all, many congratulations on the 448th anniversary of the foundation day of Leiden University – I could give a whole lecture on the number 448 but I'll restrain myself because I want to talk instead about the value of science.

What does the Higher Education and Scientific Research Act have to say about the task of universities? I've looked it up for you, and this is what article 1.3, paragraph 1, says[1]: 'It is the remit of universities to provide academic education and conduct academic research.' You probably already knew these two core tasks of universities but the Act has more to say about what universities are required to do: 'In any event, they provide initial academic teaching programmes, conduct academic research and convey knowledge that will benefit society.'

So, the Act states that, in addition to research and teaching, we also have to ensure knowledge transfer for the benefit of society. This so-called third mission of universities appears in policy documents and strategic plans in many different forms. The big underlying question is: How do we ensure that knowledge has value for society? And science communication is a crucial part of this mission.

What is science communication?

In preparing for this Dies celebration, we were advised that most people in the audience would know nothing about our specialist field, and that we should avoid using jargon. It's rather ironic that I, as a professor of science communication, only recently realised that the term 'science communication' is itself a type of jargon. And to put it much more strongly, it is one of the most dangerous forms of jargon: it's a term that means different things to different people, which means they can all too easily talk at cross purposes without even realising it (Illingworth et al., 2015).

When it comes to science communication, some university managers think mainly of student recruitment, while journalists fear that it is just a marketing ploy. And there are researchers who interpret science communication as hitting the headlines with your research.

The modern, broad definition of science communication encompasses all the ways that people outside the scientific world can be involved with scientific research (van Dam et al., 2020). This could include, for example, developing research questions together, explaining scientific results or discussing the implications of scientific insights.

We often distinguish here between *public understanding* and *public engagement*. The basic assumption with public understanding is that the general public lacks knowledge, interest or trust. This is referred to as the deficit model, reflecting the supposed lack of these attributes among members of the public. To make sure the public understand more about science, experts disseminate information and explain things as best they can.

Scientists often use this approach – in fact, I am standing here now literally as an expert transmitting information to you. But there are some caveats to this approach to public understanding.

The assumptions about deficits in society aren't always correct. The supposed lack of trust in science, for example, is nowhere near as widely held as is often assumed. In the most recent poll conducted

[1] https://wetten.overheid.nl/BWBR0005682/2019-01-01

by the Rathenau Institute, the Dutch rated their trust in science at 7.4 – the highest of all institutions (Van den Broek-Honingh et al., 2021).

The main problem with the public understanding approach is that facts are not always convincing, as we were all able to observe during the pandemic. There are whole series of studies that show that an approach based on public understanding is not that effective for improving the relationship between science and society (Bucchi, 2008).

As a result, in terms of activities and policies, in recent decades we have seen a shift from public understanding to public engagement. With this approach, the public are involved rather than informed – and the intention is that this will benefit both society and science.

The *Bruggenbouwers in spagaat - Wetenschapscommunicatie door wetenschappers aan Nederlandse universiteiten* (Bridge builders between two stools – Science communication by researchers at Dutch universities) research report published last year cites scientists who undertake public engagement. They do this to learn from interactions with relevant target groups, and in so doing strengthen their research. 'Only they do not see these activities as science communication, but as part of their scientific work.' (Frank Kupper et al., 2022)

This is also in line with the principles of the Open Science movement. Marieke Adriaanse, Professor of Behavioural Interventions in Population Health, described it as follows in her inaugural lecture the other day: 'For me, therefore, Open Science is mainly about the relationship between science and society, about transparency and engagement – and Open Science starts with the questions we ask and who we involve.'

As someone who did a PhD on the ergodic properties of irregular continued fractions, I understand all too well that it is not easy to engage in dialogue with a wider audience on every research topic. But it is good to bear in mind that you don't always need to engage in dialogue about the very latest research findings. During my PhD research, I started blogging about mathematics with Jeanine Daems – and we learned so much from the responses we got and the conversations about mathematics we had with all kinds of people. Those conversations ultimately made me change my field of research, from pure mathematics to communication science – less drastic about-turns would also be conceivable.

Values in science

One of my favourite publications about the relationship between scientists and society goes under the title of *Do Scientists Understand the Public?* (Mooney, 2010). Like many reports that have a question in the title, the answer is 'No'. This report from the American Academy of Arts and Sciences makes a number of recommendations, one of which is to take the values held by society more into account.

The general public in their turn sometimes – rightly – ask questions about the values held by scientists: questions that some researchers prefer not to answer because they believe it's not appropriate. Last year, together with Ini Vanweesenbeeck and Noelle Aarts, I produced a theme issue for the Journal of Communication Science on science communication (I get a lot of pleasure from the Droste effect in this sentence). In our foreword, Aarts wrote the following about the values of scientists:

'[We see] that the public sometimes have doubts about scientists' neutrality, and that scientists themselves are then very quick to defend their objectivity. Many studies and research questions are based on problem definitions within society that are by definition value-driven (and therefore not neutral). For example, depending on their values, a researcher may explore options for the biological control of diseases and pests in agriculture, or for making pesticides less harmful. In either case, the

knowledge generated can be objective, but from the viewpoint of society this knowledge is not neutral. Citizens will always interpret science according to their values and problem definitions. Scientists are by no means always aware of this.' (Aarts et al., 2022)

And how researchers look at science communication is, of course, based on values. Apart from our legal task, there are all kinds of reasons to engage in science communication. There are three main motives mentioned in the literature: democratic, cultural, and economic.

For me personally, the democratic motive is the key one. Science plays an important role in our society. For democracy to function well, people have to have enough scientific knowledge to make decisions about their own life and about society in a broader sense. At the same time, it is also important for the scientific community to listen carefully to society.

From the perspective of the cultural motive, we see science as part of our culture and want to share it with others, just like art or history. Then there are the economic motives: all sorts of jobs require people who know enough about science – and, after all, we are here largely thanks to taxpayers' money so society has the right to expect something in return.

Valuing science communication

Do the public get 'value for money' with science communication? In the most recent Eurobarometer, only 20% of Dutch people surveyed agreed or agreed strongly with the statement: 'Scientists spend enough time meeting people like me to explain their work.' (European Commission, 2021). Admittedly, this question is primarily about public understanding, but I suspect that that 20% is also a good indication of satisfaction with public engagement.

This may be because there are not such strong incentives for scientists to do that. I am well aware that some scientists have little desire to engage in public engagement. They see science communication as a box that has to be ticked because it is required by funders or institutes. In my opinion, it would be preferable if these people were taken out of the science communication loop in the future.

The crux of R*ecognition and Reward* is that different qualities are needed in the scientific world and that there need to be different career paths. Not everyone has to do everything, but we do have to make sure that those things that are important are done by *someone*.

Anyone who takes on science communication as a task must also be assessed seriously on their performance. You can agree in the annual performance and development interviews, for example, that a member of staff will be given time for this, discuss which goals he or she wants to achieve in this area and then check a year later how successful it was.

For institutes that want to get started with this: Maastricht University's STEM faculty has just launched a well-designed pilot programme aimed at embedding and professionalising science communication. They are happy to share their plans with colleagues who also want to do something similar. You can e-mail them at: fse-outreach@maastrichtuniversity.nl.

The science in science communication

It sometimes amazes me how colleagues who rely on theory, facts and evidence in their research are then happy to engage in science communication trusting only to their intuition. And that while there is a lot of theory and knowledge in this field too. Let me give a few examples of the research in our Science Communication & Society department.

The Intergovernmental Panel on Climate Change (IPCC) and all sorts of other institutes use tables to translate probabilities from their models into words – based on the idea that people are better at dealing with words than numbers. For example, they use a term like 'very likely' for a probability greater than 90%. Together with Sanne Willems and others, I investigated how people interpret these kinds of probability words (Willems et al., 2020). In our experiment, the term 'very likely' was used to refer to the range from 70 to 95 per cent in neutral sentences. We concluded that you have to be careful with these kinds of probability words, that it is wise to use numbers as well as words and that, above all, you should occasionally talk to the people you communicate with to see how they interpret information.

A project funded by the Leiden University Fund on fact-checking graphs is currently underway – together with Peter Burger from News Checkers, again Sanne Willems from psychology and postdoc Winnifred Wijnker. In our first experiment, we looked at how best to correct a misleading bar graph (Wijnker et al., 2022). This is the kind of graph that shows that Dutch people are the tallest people in the world and then has the axis for body height starting at one metre fifty, so that a Dutch person in the graph appears more than three times as tall as someone from Indonesia.

We found that a correction with an accurate chart alongside the original misleading chart is most effective – and that people who get this correction a week later are still less likely to get worked up by new misleading charts. We now use these corrections in practice in the Chart Police section at News Checkers. This year, we are going to do a second experiment with post-secondary vocational students looking at misleading graphs as they pop up on social media.

We also conduct thematic research on science communication in particular fields. Julia Cramer heads the Quantum & Society group and Pedro Russo leads the Astronomy & Society group. We are starting a new Biodiversity & Society group this year, a topic on which we hope to collaborate with many others inside and outside the university.

What is good science communication?

In our department, we're often asked: 'What is good science communication?' I would say this question is just about as difficult to answer as the question: 'What is good research? or 'What is good teaching?' But we do have some guidelines for these other difficult questions.

Fortunately, in recent years, more and more guidance is emerging on what constitutes good science communication. The Assessment Instrument for Science Communication developed by Alex Verkade lists a number of criteria such as clearly defined goals and a well-defined target group (Verkade, 2017). In practice, we see many scientists starting a communication project based on a resource: 'Podcasts are popular. Let's start a podcast about our work too!' It would be good if these researchers first asked themselves who they want to reach, and whether those people are looking for a podcast about their work, not to mention whether a podcast is a good medium at all for what they want to do.

There are all kinds of instruments available to check whether a communication activity has achieved its goals. There's the ImpactLab, for example – a collaboration between Utrecht University, Leiden University and the National Science Agenda. My colleague Anne Land is heading this project, together with Madelijn Strick, and they are developing handy tools to help researchers with impact measurements. I have already used many of them myself, handing out surveys with smileys at children's lectures and having workshop participants send themselves a card with their main conclusions. All ImpactLab's materials are free to use and can be found at impactlab.sites.uu.nl.

And there is more to come. The Minister of Education, Culture and Science has announced that the Netherlands will have a national centre for science communication this year. The aim of this centre is

to promote an equal dialogue between science and society. Together with Alex Verkade, I have been commissioned by the minister to act as coordinator and present a blueprint for the centre this spring. One of the aims of the centre will be to ensure a better exchange of knowledge on science communication. We believe that researchers at the university can learn a lot in this field from colleagues at, for instance, universities of applied sciences or the National Institute for Public Health (RIVM), but also from staff at science museums like Rijksmuseum Boerhaave or from communication professionals.

Finally, I hope that with this lecture I have encouraged at least 448 people to do more to get the value of science across to society.

In university research and teaching, we do not strive to do the minimum required by law. No, our aim is to achieve the highest possible quality. So let us also strive for science communication that is of a high standard, with clear goals and evidence-based approaches wherever we can.

Thank you.

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