SCIENCE COMMUNICATION

POCKET GUIDE



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Author: Dirk Hans, Lecturer on the DESCOM Science Communication Course

Graphic Design & Cover Illustration: Eglantine Denis

DESCOM

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TABLE OF CONTENTS

1	Introduction	
2	What is science communication?	6
3	Why do we engage in science communication?	
4	Who are the communicators engaging in science communication?	10
5	Stakeholders in science	
6	Channels of science communication	
7	The right approach: the Stakeholder-Channel-Matrix	
8	Personal communication	
9	Website	
10	Events	
11	Social Media	
12	Multimedia: Video	
13	Print Materials	
14	Journalism	
15	The "good" story	
16	Core messages	
17	Science brands	
18	Individual – Organisation – Nation	
19	Organisation of science communication	
20	How to build a career in science communication	
21	Useful further reading	



INTRODUCTION

Science communication is a term that has been widely established since the early 2000s, but its meaning is often misunderstood. Who communicates with whom, and for what purpose?

The fact that science must communicate is rooted in its nature - its methodology. Without discourse, scientific knowledge does not emerge. Therefore, science has a long tradition of communicating its results and theories within the scientific community and putting them up for discussion. Only in this way can the quality of scientific statements be tested, established or refuted.

But is it necessary to actively inform wider society – even to legitimise research by scientific laymen? Does science need to "take society with it"? Does research need to "get across" and once and for all move out of its ivory tower?

The appropriate answers to these questions are rarely discussed. But the almost unanimous opinion is: Yes! Science must inform society about what it is doing. The reasons are manifold. And these include, not least, the need to communicate in order to bolster the social reputation of science and secure its funding. Science communication thus always has a political dimension. It is about education, about information, about reputation, about jobs and about budgets worth billions - every year. Science communication has thus developed into a highly complex and multifaceted form of communication, a discipline in its own right, with its own research, its own expertise, many jobs and its own budgets. Study programmes and numerous continuing education programmes are also offered internationally and are mostly taken up by escapees from science who are looking for and finding an alternative career on the fringes of science.

This Pocket Guide provides a brief overview of key aspects of the science communication course comprised in the Doctoral Education in Science Communication (DESCOM) project running at the University of Luxembourg.

It does not claim to be exhaustive, but merely provides a concise introduction to the basics and an aide-mémoire regarding certain essential aspects of the course. As well as being used by the doctoral candidates at the University of Luxembourg, the Pocket Guide also provides, in particular, scientists wishing to learn about science communication with an opportunity, for the first time and on a low-threshold basis, to come into contact with this discipline, which has grown steadily in importance.



WHAT IS SCIENCE COMMUNICATION?

A trivial question, you might think. Science communication is what happens when science communicates. But it is not quite that simple. Who communicates what, and with whom? Do scientists have to be involved, or is it enough if the content is scientific? Definitions remain inconsistent, but there is now a growing trend to use the term more broadly, in a general, literal sense.

Traditionally, the term "science communication" was and is mostly used in distinction to "science journalism" in the sense of "institutional science communication". It thus encompasses all communication measures taken by a scientific institution or organisation vis-à-vis the public. This includes communication by the scientists themselves as well as communication by the corresponding communications department or public relations department.

Currently, more and more experts are using the term "science PR" (public relations). In so doing, they are seeking to make the aspects of, in particular, interest-driven communication more transparent. The term "reputation communication" is often used in this context to emphasise a critical discourse aimed at institutional science communication. In contrast, the phrase "public good-oriented science communication", which encompasses noble goals for the benefit of society, is occasionally introduced as part of the relevant terminology. Particular exchanges within the science community, e.g. those taking place at a professional conference, are still rarely attributed to science communication. Science journalism, on the other hand, is readily integrated into science communication. For decades, science journalism has rightly insisted on its markedly different approach, namely independent reporting. Accordingly, lumping it in with interest-driven, institutional science PR gives rise to a certain amount of controversy and generates criticism amongst journalists.

In the context of teaching at the University of Luxembourg, we pragmatically focus on two criteria to frame the concept of science communication: (1) the group of recipients includes, at least in part, people from outside the science community; and (2) the content represents, at least in part, scientific knowledge. If both criteria are met, we speak of science communication.

PRACTICAL TIP:

When science communication is talked about in your own institution or department and expectations are placed on you, it is always worthwhile to first clarify whether everyone means the same thing. Within science, misunderstanding often arises from the fact that what is actually meant is internal science peer communication. When scientists indicate that they want to improve their science communication, they often mean that they wish to improve their presentation for the next professional conference. These aspects are explicitly not subsumed under the term "science communication." It is best to clear up this misunderstanding at the very outset of the discussion.



WHY DO WE ENGAGE IN SCIENCE COMMUNICATION?

The motivation for science communication can have many origins. First, it must be noted that science is a great cultural achievement that has given us a better understanding of our environment and the reality of life. In addition to our knowledge of natural phenomena, perception, and social interaction, science has given us vaccines, the Internet and the atomic bomb. So there are plenty of reasons to communicate about and from the standpoint of science, because science affects each and every one of us, all the time.

We can deduce from this that science is at least partly concerned with communicating findings and scientific theories. It thus pursues an educational mission. Science strives for knowledge and wants to share it - also with people outside the world of science. This is a very worthy goal and absolutely central to science communication: the utopia of an informed society that can make sovereign and wise decisions about the fate and development of its future.

It is also about the resilience of an educated society. When individual politicians claim that climate change is an invention of competing world powers designed to damage their own economies, people should be able to identify this statement as the expression of a conspiracy theory, and to consider instead the findings of the international climate research community. Only then can fact-based decisions be made.

Science itself has assumed enormous importance as a driver of innovation in highly industrialised societies. The "knowledge economy" is of central importance to countries such as the USA, Germany, China and many more. It is therefore not surprising that budgets in the billions are invested here – year after year – in research and development.

As a result, science has also become "big business", and the subject of strong international competition. It is no wonder, therefore, that the mechanisms of marketing and image cultivation have also long since arrived in science, even to the extent that they partially dominate science communication.

It follows that science not only wants to inform and educate, science also wants to be ahead in the competition for limited resources such as money and experts. This complex situation leads to multifaceted communication, the form of which has been the subject of increasingly critical debate among experts for many years. Thus, an ethic of science communication must also be established if a long-term strategy is to be pursued in science rather than just a scramble for short-term gains.

THE central goal of science communication should always be: to strengthen trust in science.

PRACTICAL TIP:

The question of the goals of science communication must be answered before any operational action is undertaken. This is the only way to ensure effective and efficient science communication.

Either answer it for yourself, or confront your management level with the often painful question: "Why?". Too often, science communication degenerates into a mere exercise with no measurable impact. It is always surprising how often, even at established institutions, the question of the "why" of science communication can only be answered with difficulty.



WHO ARE THE COMMUNICATORS ENGAGING IN SCIENCE COMMUNICATION?

Every one of us has done it: communicated science. Summarised the latest findings about the corona virus at the kitchen table or answered the question of why the sky is blue (at least to some extent) during a family outing. We all regularly become science communicators - from Nobel Prize winners to the cartoon character Lisa Simpson. Knowledge is often communicated without this process receiving special attention and/or without the communicators calling themselves science communicators. Nevertheless, such informal conversations about science make up the largest part of science communication.

Institutionalised science communication, i.e. the communication of scientific content that is specifically carried out by members of research centres and universities, has become increasingly important in recent decades. It is often conducted in a highly professional manner. While on the one hand scientists are best informed about their science, on the other hand they do not always have the talent or the leisure to get in touch with a more or less interested public. For this reason, science communication has established itself as a separate discipline with specific expertise.

Today, almost all larger research institutions have a communications department that acts at the interface between science and the public and

implements communication strategies and measures. These departments often employ people with careers in science who at some point discovered science communication for themselves and left the research field. These departments support and relieve the burden on science operations at many points and often have valuable expertise from the fields of communications, marketing and journalism.

However, only the active scientists themselves can communicate authentically about science. Their communication is therefore of particular importance. After all, who do you trust when a journalist, a politician, a university press officer and an epidemiologist are discussing the next pandemic on a TV talk show? Probably most likely the epidemiologist, even if the other people seem smart and sympathetic. Many institutions and organisations are therefore increasingly emphasising communication skills among their scientists and offering courses and training in science communication.

Science *journalism* occupies a special position. Often, a significant number of people can be reached through this interface to the science system. And if it is independent journalism, as is the case with many leading media in the democratically organised world, it offers enormous added value. Science journalism acts as a filter separating the essential from the non-essential and also subjects the experts it quotes to critical scrutiny. There are some science journalists who have been continuously reporting on the essential developments in certain scientific fields for several decades. Often, therefore, they have accumulated more knowledge and have a better overview of a discipline than some scientists in the relevant field. Truly good science journalism may therefore be considered the noblest form of science communication.

PRACTICAL TIP:

You are a scientist and you want to organise your science communication properly? Then first find out about the existing structures at your institution.

If there is a central communications department, pay it a visit. Find out what the department can do for you. You don't have to do everything yourself - let them help you! If need be, there are external service providers. Use the expertise that is already available to move forward efficiently.



STAKEHOLDERS IN SCIENCE

Stakeholders have a specific relationship with the company, organisation or institution in question. This does not have to be a close relationship. In some form, however, the stakeholders participate in the developments, statements and fortunes of the organisation under consideration. This relationship can be active or passive.

Stakeholders in science are, in the broadest sense, every human being, because every person is in some way related to expressions and outcomes of science.

The Corona pandemic is a good example of this. Through our political positions and choices, we directly influence the position of science in our society. Science is therefore heavily dependent on the society that sustains it. And it therefore also strives to establish a positive relationship with broad sections of society - for example, through science communication measures.

In addition to science as a whole, the question of its own individual stakeholders naturally arises for every scientific institution, every university and every research group at every research institution. Here, the designation of stakeholders is a much more subtle undertaking, because not all people are stakeholders of a research group on dinoflagellates (they really exist!) at the Institute of Oceanography. Stakeholders of almost every research group include, to name a few, the institute/university management, international peers, young scientists, journalists, the interested public, politicians, funding agencies and private sponsors, but also one's colleagues, i.e. members of one's own team. The list could be continued and differentiated at very great length.

It should be noted at this point that there are internal as well as external stakeholders. Some stakeholders are more powerful than others and the structure of stakeholders can change continuously. A key question for research management is: which stakeholders expect what?

In particular, powerful stakeholders must be taken very seriously in their demands, as the fate of one's own work often depends on their goodwill. Accordingly, stakeholder prioritisation is essential, and appropriate measures must be adopted from amongst the portfolio of scientific and political communication.

PRACTICAL TIP:

On closer examination, 20 stakeholder groups quickly come to mind, all of whom could and perhaps should be considered in terms of communication. It is not possible to satisfy all stakeholders equally, as time and money are limited. It is therefore essential to prioritise the stakeholders and rank them according to their current importance.

This prioritisation must be carried out and agreed upon by those responsible for communications together with executives at the management level. And then the resources must be divided accordingly. Prioritising, focusing and constantly readjusting - that is the path to efficient and effective science communication.



CHANNELS OF SCIENCE COMMUNICATION

Information can be transmitted in many different ways. People talk to each other, make phone calls and send e-mails. We read the newspaper or follow a person on Twitter. We do research on the Internet and watch a video. This variety of communication possibilities is also used by science communication. There is a wide range of channels to choose from. But which channel is the right one?

To answer that question, one must first identify and name the most important channels of science communication:

(1) personal, direct communication, (2) websites, (3) events, (4) social media channels, (5) multimedia, (6) print materials, and (7) via journalism.

One's initial impression that this is a bit of a wild mix and, in a sense, a case of putting apples and oranges together is not wholly misleading. Videos are presented on websites, and events are often merely an occasion for personal communication. So things get a bit mixed up, but this small list can prove very helpful in practice when one is considering which channel to choose to convey information.

An important prerequisite for choosing the right channel is knowing the information behaviour of the target group. This is another central concept

in science communication. The target group/groups always correspond to certain stakeholder groups that we want to reach via communication measures. The media behaviour displayed by a senior donor will differ from that of an 18-year-old school-leaver looking for a place at university. It is therefore important to choose the right channel depending on the objective (see also chapter 7). In addition, a research institution usually uses all channels in parallel, but not every piece of content has to appear in every channel.

Cross-media exploitation of content often occurs. This makes sense because content creation is usually the most troublesome and most costly element, and the content created is, of course, the real value in communication: the message, the story, the information.

It would be a gross mistake not to make a printed annual report available digitally on one's website. Events - promoted via social media channels and streamed on the web - can be made available to a much larger community than just the on-site audience. So the different channels don't compete with each other, they complement each other.

In the further course of this Pocket Guide, the individual channels will be described in more detail.

PRACTICAL TIP:

It is too often overlooked that a given content can not only be communicated on one channel, but with a little skill and planning can work on several channels at once. If you forget to hire a photographer for an event, you will have major problems afterwards documenting the event as an attractive item on the website or in an annual report. Spending a few hundred euros for professional photo documentation can be a real game changer.

The additional use of already existing information channels, operated for example by friendly institutions or even by governmental institutions (e.g. FNR), is also an option. Often there are well-established channels with a large audience whose editors are happy to promote the story from another house on their channel as well.

It's good to pause once in the run-up to a communication activity and ask yourself if perhaps even more target groups/stakeholders can be reached by smartly integrating additional channels. Creating content is work – but distributing it efficiently is cleverness!



THE RIGHT APPROACH: THE STAKEHOLDER-CHANNEL-MATRIX

It is immediately obvious that you have to adapt your communication to the appropriate target group. If you are speaking to an elementary school class, you will use different vocabulary and examples than if you are giving a presentation at a university.

Regardless of how you adapt your language, you also have to choose appropriate communication channels. A potential private supporter of science who has already reached the age of eighty uses different media than an 18-year-old school dropout.

If one wants to reach these different target groups with tailored information, one also has to choose the communication channels wisely. An event with a high proportion of personal communication can build the trust necessary for successful fundraising. Through Instagram, one is more likely to build enthusiasm among school graduates, some of whom may decide to study at university as a result.

Paper or digital? In person or via video? Elaborate or less elaborate? Expensive or cheap? All of these questions need to be answered for each target group at which the communication is aimed, i.e. for those stakeholders who are considered significant.

Resources such as money and time are limited. That's why science communication must also constantly think about its efficiency. Only those who, as managers of science communication, prioritise the target groups correctly and choose the communication channels wisely according to their effectiveness will get the best out of the various possibilities. This is the only way to optimise efficiency and effectiveness.

But back to language: it is of the utmost importance to adapt the vocabulary and the story to the appropriate target group. It is not only a matter of not overwhelming recipients with technical terms, but much more a matter of linking the information to the everyday life and knowledge of the target group and thus enabling a cognitive connectivity.

PRACTICAL TIP:

To visualise and present the topic of "target groups and communication channels", it is useful to prepare a simple two-axis table. On one axis, the stakeholders/target groups are listed according to their current importance ranking. On the second axis, the available communication channels are plotted.

According to a freely selectable evaluation system (traffic light, school grades, etc.), an evaluation of the effectiveness of all communication channels for the corresponding target group can now be made for each table field. The resulting stakeholder-channel matrix allows me to read off the currently most important communication measures and to derive work orders directly from them.

Since the prioritisation of, in particular, stakeholders changes continuously, whilst new communication channels are also added more or less frequently (especially in the case of social media channels), such a matrix must be regularly reviewed and adapted. It can then provide an excellent basis for discussions at management level and generate commitment for the allocation of resources.



PERSONAL COMMUNICATION

Nothing can take the place of a personal conversation involving faceto-face communication. If things are really important, we clarify them best directly. If we want to know whether someone is trustworthy, likeable, competent and honest, a personal conversation is pretty much indispensable. Too many examples of misunderstood communication via e-mail or messaging services prove the problems of information exchange where the communication is reduced to written form.

Even a telephone call or a video conference offers significant additional information of an affective nature, derived from such things as voice modulation and, in the case of video conferencing, facial expressions and gestures. These supplementary levels of information are highly important for a proper understanding of the relationship between the two communicators. Improved empathetic understanding can prevent misunderstandings and ultimately the failure of joint projects, and can also prevent mistakes.

In science communication, personal contact with people who from outside the world of science offers a particularly intensive exchange that is often highly valued, especially by those who are unfamiliar with science. This helps to create, even if only briefly, personal relationships that can have a lasting impact on people's view of science. The personal interaction can generate an enduring trust in science - because it makes it possible, through direct conversation, to personally test the trustworthiness of one or more representatives of science.

Of course, this kind of interaction can also backfire. Not every scientist is able to inspire and build trust - and not every science layperson enters into a personal exchange without reservations.

In any case there can, of course, be reasonable scepticism about science. As in other domains, not all that glitters is gold in the scientific world. On the other hand, having to engage in discussion with esoteric, irrational thinkers is often a step too far, even for level-headed scientists.

However, personal, direct, immediate communication always offers the chance of establishing a lasting, trusting relationship. This is why it is often used for exchanges with powerful stakeholders such as politicians, project partners or research sponsors.

Due, however, to the considerable effort involved, this form of communication can only be used selectively. Here, a clear prioritisation of target groups is necessary in order to make face-to-face communication efficient.

Video productions often offer a good surrogate for face-to-face communication, as they allow people to be depicted in words and images and represented authentically. By making internally produced videos available, science often succeeds very well in making a personally addressed message permanently accessible to many people.

PRACTICAL TIP:

As described, face-to-face communication is extremely time-consuming. Video may often offer an appropriate alternative.

For almost all target groups at which your communication is aimed, it's an excellent idea to include a small portrait video of you and your work. This could appear on the relevant page of the institution's website or could even be made available on YouTube.

The chances of meeting you in person are slight, but a video allows you to be present at all times. So, in a way, this practical tip is a cheat, being rather a recommendation for very personal video communication ...



WEBSITE

The website of a research institution or the webpage of a research group should always be the central information hub. Ideally, all news, videos, infographics, brochures, telephone directories, etc. can be found here.

Social media enthusiasts predicted the end of the World Wide Web more than a decade ago, but it continues to hold its own. Anyone interested in MIT or looking for the e-mail address of a colleague at the University can hardly avoid going through the website of the institution in question.

The website can therefore rightly be described as the most important, or at least the central, communication channel. However, it can often appear somewhat static and sluggish. It is therefore important to generate an appropriate throughput of news - in the form of text and images - on the homepage. This is also rewarded by the search engines with better rankings.

But apart from the content and the throughput of news, two elements play an overriding role when it comes to websites: functionality and design. The first impression you get of someone is often of great importance. It is the same with websites.

This is especially important for institutions and organisational units that do not have a history going back several centuries and boasting an impressive array of Nobel Prizes and a pantheon of scientific celebrities. If the University of Oxford's website does not look particularly modern, this will not diminish its reputation. However, if the website of a new research institute looks old-fashioned, then this can have a strongly damaging effect on its reputation.

The so-called "look and feel" of a website should always be kept up to date. This requires continuous maintenance, which costs time and money, but is a worthwhile investment.

Functionality is of equal importance to design. Websites whose search function does not work well, or which require dogged tenacity just to research the telephone number of a colleague, do not make for a positive user experience. Such shortcomings also damage the image of the institution.

In order to operate the website communication platform professionally, larger institutions, such as universities, have for many years had in place an editorial team of several people who are almost exclusively responsible for the website and the associated webpages, which can easily number several thousand.

PRACTICAL TIP:

In most cases, the framework conditions for your web presence are probably set by the institution to which you belong. The content management system (CMS), the possible page types and templates, and the corporate design are all fixed.

Often this situation is perceived as an annoying restriction. Many projects and working groups would like to gain additional freedom in this regard, and to be able to establish their own independent web presence.

This step is only recommended in the most dire emergencies, where the superordinate institution cannot provide a functional framework. Opting out and taking the initiative must in those circumstances be described as a last-resort act of self-defence.

In the vast majority of cases, cooperation with the internal structures and responsible parties is the better course to take: the reputation of the umbrella brand (university, research centre, etc.) usually supports, rather than weakens, the reputation of its own subordinate units.

In addition, as a "separatist" you naturally tend to make a number of enemies internally, so careful consideration is needed here. In any case, sound out the communications department before going ahead and taking any steps of your own!



EVENTS

What is an event? A narrow definition of the term is not a possible option here, because it has multiple potential meanings and can encompass a wide variety of event formats, large- or small-scale. One would usually expect more than two people to be present at an event. But an event may also include 50 million participants. Events can take place on-site or, as we have seen since the arrival of the Corona pandemic, across a wide spectrum in the digital sphere. Event formats may include such disparate get-togethers as award ceremonies, conferences or a fireside chat. In fact, the sky's the limit here.

The central aspect of many events, especially when they take place on-site, is the facilitation of personal communication. Meeting in person offers enormous advantages (see also Chapter 8), not least the opportunity to build up trust.

Successful events are status-laden: an institution that is able to stage outstanding events can rise sharply in the esteem of relevant stakeholders. Successful events are remembered for a long time. Sometimes people still talk years later about a wonderful and highly interesting evening that they have attended.

But where there is much to gain, there is usually also much to lose - and this is precisely so with events. First of all, there is an often significantly

underestimated amount of work involved in putting on a successful event. If everything runs smoothly, this effort is not very visible - after all, everything works out perfectly. The fallacy that it can't have been that difficult then is very obvious - to the chagrin of the event manager.

A failed event, on the other hand, can damage an institution's image for years to come. A minister who has to give a speech with defective sound equipment in front of a half-empty hall will probably show reduced commitment to supporting the institution in the future.

Another major danger also lurks in invitations: Forgetting people who are particularly important, or at least think they are particularly important, can lead to lasting diplomatic upheavals. Few things are as annoying, or even dangerous, as an offended VIP who wields power.

It is therefore essential to avoid the unintentional bypassing of individual stakeholders who have power. That's why it pays to spread the invitation process across the shoulders of several team members at once. The boss must give her/his/their "go ahead" at the end. This way, you protect yourself from the potential resentment that might come your way after the event.

And one thing to reassure you: at least one person has been forgotten every time...

PRACTICAL TIP:

Events are so extensive that event documentation should always be considered from the beginning. So never forget to hire a professional photographer or a video production team, or preferably both.

Live streaming but also recordings of special presentations are great ways to make an event accessible to people unable to attend or people on the other side of the world. On channels like the website, they can be documented in such a way as to be made permanently available.

And one more thing:

If you don't have the budget or energy to put on your own event, keep an eye out for larger community events in your area. It is often worthwhile to participate somewhere and reach the public this way, thereby saving energy and relieving your nerves.



SOCIAL MEDIA

Social media channels such as Twitter, YouTube and TikTok transport vast amounts of data to over four billion users worldwide. Communication via social media is a new standard. The exchange of information is so diverse that a summary description in terms of content focus and quality seems impossible.

But what is important to understand at the core of all this is the fact that, on social media, the individual or even the organisation itself is the immediate information provider. Everyone decides for themselves whether to publish something and is independent of various filters and hurdles. This is just as true in the private sphere as it is in the environment of science, its institutions and organisations. No press office or journalist takes a critical look in advance at your tweet or the next picture on Instagram. Every person - including every scientist - can communicate immediately and directly and build up their own community of followers. Some authors reach millions of people this way - quite directly.

The potential reach seems enticing and has led to a surge in social media use in the scientific community. Informal, international scientific communication is particularly widespread. However, the self-marketing factor comes into play. Reach maximisation is the – somewhat questionable – name of the game. Social media channels can do an outstanding job as communication channels, but they follow the basic mechanisms of attracting and retaining attention. Given today's information overload, it is very difficult to convince people to follow one's news and messages. Success only materialises if the given information offers relevant added value, for example if it reliably reports on all relevant developments in a key research area. Or if the way in which the selected information is presented is particularly creative and offers a high entertainment value. Then it can succeed. But this rarely happens.

It takes editorial skill, qualitative reliability and a high degree of stamina to build up one's own community. Only a few people summon up the necessary energy for this. And whether the effort expended would not have been better spent on one's own science is a question that can unfortunately only be speculated on afterwards.

With regard to science, Twitter, Facebook, Linkedln, ResearchGate and YouTube currently rank as the most important channels and platforms. However, universities and science organisations also occasionally use Instagram and TikTok to generate enthusiasm for themselves in a more entertaining way.

In view of the repeatedly discussed negative effects of social networks, it may be noted that individual actors and organisations also consciously decide against communicating via certain social networks in order not to support the mechanisms of the communication culture established there. Such a decision seems perfectly understandable.

PRACTICAL TIP:

Before establishing your own social media communication, do the following: learn from the best!

Look at best practice examples of science communication in the various channels and critically question whether you are in a position to make a similar effort in the future – in terms of time and technology. And even if you don't want to aim quite that high, never underestimate the effort. It is usually many times greater than you expect.

In addition, there is the focus of your content. What should it be about? Ask critically how many people are interested in your topics - and take a look at the competitive situation. If there are already well-established communicators in this field, it will be very difficult for you. So don't waste your precious time. Sometimes targeted communication is much more efficient than reach-optimised actions.



MULTIMEDIA: VIDEO

Moving image content is a standard feature of science communication. Research institutions that don't have decent video content today and aren't represented on YouTube have failed to recognise the signs of the times (that's perhaps a rather harsh way of putting it, but valid none the less).

The media behaviour of people with Internet access has changed significantly in the past decade. Basically, we nowadays expect to find helpful information on the Internet, regardless of the topic - ideally in video format.

This is not just about finding the best recipe for a yeast dough, but also about discovering how a large hadron collider works. If we want to gain a rudimentary understanding of how a particle accelerator works or how viruses can be held in check by an FFP2 mask, we look for information via the major search engines on the Internet - and occasionally also directly on the websites of relevant research institutions.

If a suitable video clip is found there, it is readily clicked on. It promises to summarise the most important information in just a few minutes, and to do so in a reasonably entertaining way. If the video is well made, i.e. if it contains the relevant information and has been prepared in a recipient-friendly way, then it will obviate the need for further research. The term edutainment, i.e. mixing education and entertainment, applies to video formats in a special way. Of course, there are not only good videos – one also comes across some terribly bad ones. And it gets worse: there are some videos that are very well made but which distort facts and deliberately disinform. These videos are highly problematic when they are viewed by an uncritical audience. As serious players in science communication, there is only one thing we can do, and that is to produce very good videos setting out the facts and countering the content of videos that distort and disinform.

It is often claimed that a video must not last longer than two minutes, otherwise no one would watch it - because times are so fast-moving and concentration spans are so short. This is arrant nonsense. If we're really interested in something, we may spend days reading a book about it, or may watch a one-hour documentary. Some listen intently to lectures lasting well over an hour. The idea that science communication must work in two-minute chunks is misleading.

Content must be presented appropriately and purposefully. Sometimes two minutes is enough for a good video clip. Other times, you need 45 minutes or more.

PRACTICAL TIP:

When it comes to video production quality control, one aspect beginners tend to neglect is sound. A video can be a little shaky in visual terms, and perhaps the cuts are not always particularly elegant. All of this can be tolerated, with some measure of goodwill. But if the sound is poor and you can hardly understand what is being said because the noise of the wind in the cell-phone microphone drowns out the accompanying voice information, the hoped-for image gain from a video production will be lost.

Those who want to start to become pros, and to produce video material internally, will sooner or later find that they have to purchase suitable equipment: before taking this step, you should either consult the Internet, with its countless tutorials, or ask a professional video production company for help. Equipment is expensive, and it is annoying needlessly to make bad purchases.



PRINT MATERIALS

Printed paper may seem, to many young people, like a technology from long ago. If you want to get students excited about research, you probably shouldn't hand out text-heavy, hundred-page brochures. But comic books about science, published in print format, are also popular with young people. Illustrated books about a research expedition or a brochure packed with high-quality images from a recognised research institution still find their fan base.

Nevertheless, a generational change is definitely under way. And it is doubtful whether printed annual reports from universities will still exist in ten years' time.

That said, paper has its own charm - there is particular quality associated with tangible media. Whenever a special signal of appreciation and value is needed, printed paper is also a popular medium in science communication.

Invitations to special events, information for private donors, newsletters for study participants, even the so-called image brochure – all these formats develop their own power by virtue of the fact that you can hold them in your hand. Print materials will retain their place in science communication – at least as a niche product.

That said, paper can also be annoying: conference bags stuffed with several kilograms of paper lead to overflowing trash cans. So it is important to weigh up wisely when and where paper is to be the target-oriented medium. Moreover, an art college may be able to develop a more direct approach to the medium and thus use it more meaningfully than an institute for the study of theoretical physics.

At the end of the day, the possibility of a revival like that experienced by the vinyl record cannot be ruled out for print materials.

Paper is dead - long live paper!

PRACTICAL TIP:

Print, yes - print too much, no.

This should nowadays be the mantra for the production of print materials. The curse afflicting numerous brochures and flyers printed in the professional off-set process is illustrated by the typical situation in which 1,000 brochures cost 2,000 euros and 2,000 brochures cost 2,400 euros. Many a customer will succumb to what is a false economy and order 2,000, considering the extra 400 euros to be a clever investment. After all, the end result is twice as many brochures.

But the fact that 1,200 of the 2,000 brochures end up in the waste-paper container during a clean-up campaign five years later casts the additional expense, which is not only financial in nature but also ecological, in a different light.



JOURNALISM

Journalism is the term used to describe independent media reporting in various formats. In articles, interviews and commentaries, journalists in newspapers, radio, television and the Internet make a selection of newsworthy topics. Journalism, also known as the fourth estate, thus performs an important filtering function. It relieves the burden on recipients of news and information, who cannot keep an eye on all world events. Of course, there is good and bad journalism. Or, to put it another way: the limits of the spectrum are illustrated by the existence of tabloid journalism on the one hand and science journalism on the other.

Journalism has a special significance among stakeholders: It may enable a message to reach millions of people through the multiplier effect linked to the media when it reports on a topic. Journalists therefore invariably form an essential target group of institutional science communication. Science would like to establish a good relationship with them.

The most frequent point of contact with journalists is the press release, which research uses to draw attention to itself by announcing current, particularly noteworthy developments. In the drafting of press releases, it is important to take into account the reading and writing habits of journalists: a succinct, catchy yet accurate headline, text focusing on the facts, most important things first and verbatim quotes are just a few stylistic devices to use when writing press releases.

That said, personal contact with media representatives and science journalists can also be of great importance. At the same time, however, it involves a challenging relationship which can be difficult to manage. Journalism wants to retain its independence, and should undoubtedly do so; yet at the same time the employee of the communications department of a research institution is hoping for wider coverage.

In this context, it is important that both sides should respectfully maintain their roles and keep expectations low. Only in this way can a professional, trusting relationship develop between representatives of institutional science communication and science journalists.

PRACTICAL TIP:

Media editorial offices are flooded with hundreds, even thousands of press releases every day. Only those who have mastered the craft of creating such releases, and who write in a way that is tailored to the needs of the media, will be noticed for their news. Good topic management is also essential. Not every award ceremony or medal of honour, not every professional publication, is worth a press release.

Observe the media yourself: what does the regional/local press report on? Which awards and honours make it into the national media or even the daily news? Reflect on the topics covered by your own research institution accordingly, and weigh up where you might be able to place your message.

Above all, if you do not consider a topic proposed from within the institution to be newsworthy, do not hesitate to say so. This carries with it the potential for conflict, and the boss may not appreciate it if you reject her/his/their topic suggestion. However, good contacts into the media landscape are your capital. If you are perceived as a mere generator of spam, you will certainly squander your capital – and that of your institution.

Many professional science communicators therefore publish the topics that are not relevant to the press as news items on the institute's website and thus disguise the press release that was not sent out, delivering it in a different format. This is quite a clever ruse ...



THE "GOOD" STORY

If you want to get the media excited about your research, you need to understand a few basic principles of journalistic topic selection and apply them accordingly. Not every research result is of interest to the public. And not every interesting research result is presented in an exciting enough way to attract the attention of the public or journalists. So, in addition to an appropriate selection of topics, form and storytelling also play crucial roles. Basically, one should first internalise four ingredients and keep them in mind when selecting and preparing topics. The "magic ingredients" of a "good" story are: 1 topicality, 2 proximity, 3 emotion and 4 production value. Ideally, these four ingredients can be considered and taken into account when we think about producing a press release.

First of all, the story must be current, that is to say, quite fresh. "Nothing is more boring than yesterday's news," as the popular saying goes. And that's exactly how the journalist sees it. Something must happen or have happened today - or it will take place tomorrow. If you have ever managed to sell a journalist a story that was topical three weeks ago, you can pat yourself on the back. You have achieved the impossible!

Being close to the lives of the recipients plays an equally important role. What does the story have to do with everyday life? One could also simply ask: So, what? If you can't answer this elementary question, you'll have trouble getting the story into the media. Wherever and whenever the research has a bearing on an aspect of everyday life, for example a pandemic, inflation, smartphones or the crime rate in one's city, then the reader's interest is piqued. The concept of proximity thus comprises at least two dimensions: content proximity (for example: diseases) and spatial proximity (for example: in one's city).

Emotions are a part of what it is to be human, like eating. Of course, we are sometimes more and sometimes less involved, but if a topic really grabs us because it touches us inside, then we want to know more. The media also know this, and so they always try to give stories an emotional charge. If your story also offers emotions, e.g. if it concerns therapy options for sick people, an exciting expedition or the rescue of baby animals, you don't have to worry about whether it will succeed. If the emotional element is missing, you should carefully consider whether the story can be told, at least in part, in a more emotive way.

Last but not least, production value helps. This usually concerns images that are difficult to produce and are of high aesthetic or informational value. For example, the first images of Jupiter's moon, lo, captured by Voyager 1 are an extreme example of high production value. Microscopic images or good portrait photos of the researchers also provide a certain production value. But those who do not have a chic laboratory or high-tech equipment need not fret. Successful infographics on exciting topics can be worth their weight in gold.

If a science story has elements of all four of the abovementioned "ingredients", then media success is virtually assured.

PRACTICAL TIP:

Actively search for your production values. You are sure to find interesting infographics in your Power Point presentations. Invest some additional time in graphic revision, or use internal or external graphic design expertise to create a value-added image. If you have spectacular photos, so much the better. Present these images on your webpage and enrich your press releases with this visual material. You will see that these images will significantly help you to place your topics and attract more attention.



CORE MESSAGES

We are all flooded with information and are grateful when our counterpart, be it a person or a newspaper, is able to get to the heart of things.

But getting to the heart of what the University of Cologne, MIT or LIST in Luxembourg are doing is not easy, because those institutions do a lot. Nevertheless, we cannot expect everyone who comes into contact with larger research institutions - however and for whatever reason - to have to undergo, first, a three-hour introductory lecture.

For this reason, it makes sense for facilities to formulate core messages summarising their most essential aspects, attributes and goals.

Core messages typically include three to five elements. These include the vision and characteristics of the mission concerned, i.e. information specifying how the vision will be achieved from a pragmatic standpoint. Where does the institution want to go? What does it do for society? How does it do it and what does it focus on? These questions must be answered in the core messages.

Formulating core messages is a challenging task: it requires a clearly defined strategy on the part of the institution in question. However, it is often surprisingly difficult for those at management level to identify and name

the essentials and thus to determine the real focal points. Why? Because this is often a source of heated controversy within the institution, inasmuch as there are inevitably going to be some people and departments that will feel downgraded and insufficiently valued when the focal points have been defined.

The urge to reel off an unexciting list of activities – "we do this, this, this and this and also this and this" – must be resisted when it comes to formulating core messages, and the true strategy of the institution must be revealed. This involves a degree of stress. Therefore, this elementary communicative process is often perceived as unpleasant and annoying by those at management level – and placed on the back burner.

Nevertheless, core messages derived from the strategy are essential. They very quickly enable outsiders to create an initial cognitive construct and thus anchor the institution in their memory. These processes play a fundamental role in establishing brands. From the communicative starting position of "core messages", the image of the facility can then be further circumscribed.

The often cited "elevator pitch" demands nothing less than getting to the heart of the matter in 30 seconds. And here it once again becomes apparent that short texts are often much more difficult to formulate than long texts, since the limitation thus imposed demands a focus and the omission of all but the most essential information. Especially among scientists, this is an art that, regrettably, tends seldom to be applied and is little valued.

PRACTICAL TIP:

Core messages are not about having these messages stored on one page of a 50,000-page website - and then forgetting about them. Rather, core messages should be reflected in all areas of communication and constantly disseminated through all channels of communication.

This applies not only to texts. Even when selecting illustrative images to feature on the website or in brochures, care should be taken to ensure that the images support or depict the core messages.

As regards an institution's homepage, it is not essential that all core messages should be readable, but they should be capable of being felt and experienced. If a core message is that the institution works closely with patient groups, then an appropriate image, news story or event announcement on the homepage should support that message. This principle applies to all communication channels.



SCIENCE BRANDS

Science locations, research institutions, and even individuals, i.e. researchers, can be viewed and analysed as brands from a marketing perspective. Silicon Valley, Harvard University, even Stephen Hawking, are all brands with reach and appeal.

For many people, the goal is to come into contact with these places and people, and in this way to connect with these brands at the same time. Simply mentioning casually at a conference reception that one is a Harvard graduate can greatly enhance one's reputation, regardless of whether one's interlocutors have any further knowledge of one's person or one's scientific work. Anyone who is good enough to have made it into Stephen Hawking's research group must be a person to be reckoned with.

So brands offer a promise of quality. They offer a cognitive shortcut, making life easier: where MIT is on the label, that means a quality product.

But developing an established brand and being perceived as an attractive brand by significant groups of people requires long-term effort and a good external image.

Modern science communication always includes essential aspects of this branding, because it carries the reputation of an institution, research group or individual researcher to the world. The core aspect of building a good science brand - and this is often underestimated by those at the management level - is the time factor. Because publicly funded research does not have large advertising budgets (unlike some soft drinks companies or sneaker manufacturers), brand development in science tends to be an arduous business.

Yet the trust aspect is of paramount importance. Few things are as fragile as trust. Built up over years, it can be destroyed in a very short time. If you try to build your brand on half-truths, you might just get away with it in the lemonade business. In science, on the other hand, there will be disastrous consequences and lasting reputational damage. The scientific system is extremely unforgiving in this respect - and this may well be recognised, in itself, as a sign of quality.

Establishing itself as a brand with a "built-in" promise of quality and reputation is precisely what can put a region, an institution or an individual researcher on the road to success: a self-reinforcing mechanism ensues. Good brands recruit better staff and attract more funding. And better personnel recruit even better personnel and attract even more funding.

So go for it!

PRACTICAL TIP:

Do good and talk about it! This imperative is the mantra of science communication with regard to reputation promotion. If you are internationally recognised in the field of your own research, you have fulfilled the most important criterion in brand building.

However, other important stakeholders may not be aware of this and may underestimate the significance and potential of the brand. This can happen quickly vis-à-vis politicians or even within one's own university.

In order to counteract this, you have to invest in continuous, appropriate and professional communication aimed at a particular target group or groups. In terms of strategy, it may be wise to employ one doctoral candidate fewer for a while and to invest the budget thus freed up in science communication – in order to be able to employ ten more doctoral candidates in the future, thanks to the fruits of successful communication.



INDIVIDUAL - ORGANISATION - NATION

Science communication always takes place in specific environments - just as researchers never conduct research entirely on their own, but in groups, at institutions and at locations. So you never bear responsibility only for yourself, but always for others as well. Most of the time, you have a boss, who in turn has a boss. And with a bit of luck, you are also a boss yourself. All of this has to be taken into account in your daily work and also in science communication.

If you gather together all the logos circulating within a large university, you are confronted with a horrible visual mess. Nearly every work group and project has its own creative name, funny acronyms and hand-painted logo. Colours and shapes are determined according to the taste of the people in charge, having been dreamed up over an evening beer. At least that's how it usually appears.

This chaotic scenario stands in the way of rigorous brand communication that can benefit everyone. All larger institutions therefore have a so-called corporate design. This determines which colours and shapes are allowed, what rules there are regarding logos, and what freedom is granted to work groups and projects.

As a team player, one tends to follow these guidelines – albeit sometimes rather grumpily – and thus to contribute to the brand reputation of the

umbrella brand, producing results that then in turn spill over into one's own work and projects.

As well as at an institutional level, there are also regional marketing and even nationwide branding processes. Those who are envisaging these processes should also support them when developing new brands and their own science communication.

This phenomenon is frequently observed in Luxembourg, where many institutions have appropriated the colours of the Luxembourg national flag with regard to their colour codes and thus appear in the context of "Research Luxembourg". In this way, they actively support Luxembourg as a science location and ensure that it is a focus of worldwide attention.

PRACTICAL TIP:

Don't forget that you are always part of a larger whole. When you start a new group or launch a new project, you are already part of an organisation, an initiative, and a region. Such entities usually have already established rules of communication.

Familiarise yourself with those rules. Often you will find professional communicators in your environment whose expertise you should take into account and utilise.

So before you stumble blindly from one faux pas to the next, please find out whether there are certain rules applying with regard to corporate design, forms of wording, etc.

Then decide, wisely and strategically, whether you will be more successful as a team player or as a loner.



ORGANISATION OF SCIENCE COMMUNICATION

Science communication can be organised and managed in very different ways. Good organisation requires that the strategy (that is, the vision and mission) plus the core messages must have been defined. Stakeholders must be prioritised and effective communication channels identified. Then, within the framework of the available human and financial resources, work packages for internal processing and external assistance must be determined and professionally implemented.

These organisational aspects of strategically driven science communication can be implemented by teams of different sizes or by a single person. Clearly, however, the results will differ considerably depending on whether one or twenty people, or whether ten thousand or two million euros per annum, are available.

Anyone who has read this Pocket Guide carefully will certainly have thought at some point about how all these aspects of science communication can be implemented within regular working hours and with the limited financial resources available. In addition, a wide range of expertise is needed: graphic design, video production, press release writing, event management and strategic branding. Hardly anyone is in a position to carry out all these activities on their own at a professional level. That's why universities and large research institutions nowadays have entire communications departments comprising ten to twenty employees and sometimes even more. In addition, many highly specialised activities, such as video production, are handled by external service providers. For these activities, many institutions seem to shy away from creating internal positions, preferring instead to increase the budget for external services, which are then purchased as needed.

However, professionalisation also extends beyond the boundaries of the individual research institution or university concerned: research networks are organising themselves more and more effectively in terms of communication. Together, they strengthen not only their umbrella brand, but ideally also the reputation of science within the country concerned, laying the foundations for future research funding and research work.

PRACTICAL TIP:

If you are not running a research centre yourself, then you have less to worry about in terms of the general organisation of science communication.

The important thing for you to know is that there is very likely a science communication department within your institution. And that is almost always good news.

So please take advantage of their expertise. Invite yourself in for a coffee and clarify how the department can usefully support your research, your communications, and your media outreach. Also, register your training needs so that your institution can promote you through core budgets and enable you to communicate more successfully.

Don't be afraid to contact them!



HOW TO BUILD A CAREER IN SCIENCE COMMUNICATION

The notion of diverting one's professional career from science towards science communication goes back a long way, and is an obvious and serious idea. Science communication offers proximity to one's beloved science without one having to be a small fish in the shark tank of science itself. This sounds attractive and has, indeed, prompted the author of these lines to adopt that very decision.

Over the past decades, science communication has developed to become a highly specialised field with its own competition.

To "stumble" from science into science communication without additional qualifications is still possible in some places, but is usually viewed as an outdated and inappropriate practice in more highly professionalised institutions.

Advanced training such as the one offered by DESCOM at the University of Luxembourg offer a first step in the right direction and help to develop the beginnings of a feel for the working world of science communication. Beyond that, however, there are entire degrees and continuing education programmes on offer which can make the difference between success and failure in the competition for limited jobs. Anyone seriously considering a move away from academia should ideally gain their own experience with science communication during their science career. It is not uncommon for institute directors to be very appreciative of individuals who show a particular commitment in this regard. Their own supervisor, however, is sometimes less taken with such displays of enthusiasm. Here, the loss of manpower in terms of scientific output is often placed at the forefront of the matters to be considered. But if you are sure anyway that a science career is not where your future lies, then you may well not be overly bothered by this.

At the beginning of a career, what often counts is, first of all, to "get your foot in the door." So don't be too picky when starting your career. The biggest hurdle initially is getting into the "science communication" system in the first place. Once you are inside the system, you will find many opportunities for career growth, because the turnover is amazingly high. Job opportunities are plentiful.

PRACTICAL TIP:

Take advantage of the freedom that the world of science offers in most cases, and try your hand.

If you encounter internal opposition, point out the generally recognised importance of science communication for the scientific community. Feel free to use official statements, such as those currently found in many programmes of European governments, or refer to policy papers of national academies and the available literature. Probably even your own institution has a positive commitment to science communication in its own strategy.

Get in touch with the SciCom community in your area and find out how and where you can get involved. Experience gained in this way can be worth its weight in gold when you start your new job.



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