

How to Do a Presentation

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An integral part of being a scientist is publishing and promoting your work, The end point that we normally work towards is acceptance for publication in a peer reviewed journal. (That is, fellow scientists will examine the work and judge that it has be carried out competently and that the results are worthy of wider consideration by other scientists.) In practice, however, most scientists will also spend a good deal of time presenting their work in person at meetings with fellow researchers, often before formal publication, both to promote wider knowledge of their achievements but also to get constructive feedback and idea. Things are not really all that different if you work in an industrial environment: we all need to promote our ideas and make them widely visible and understood.

The skill of being a good communicator is therefore important, and it is worth spending time learning how to do it well. Please note, while there seem to be variations is natural ability most of us need to acquire the skill in the same way we might acquire the skill of playing a musical instrument: we need to gain understanding of fundamental techniques and then *practice*. In fact, many of those who *seem* to do communication easily and naturally have just realised that it is a skill to which they need to pay attention, and deserving of hard work.

All I can do here is give some basic tips, but one very good way of developing your own abilities is watching lectures (say on YouTube) by people who are known to do this type of thing very well. Academic distinction is, however, no guarantee of competence: I can think of Nobel Laureates who are almost incoherent when on their feet talking to an audience; there are also those who can explain their work clearly and competently but manage to lull you to sleep even when talking about important discoveries. I have, however, also encountered junior researchers who will rivet you to your seat with their small, but fully engaging story.

Did I just say story? Yes! A good presentation tells a story. It has a beginning, a middle and a satisfying end, and rather like a classic short story from literature, it first grabs the attention, then explains challenges overcome and finally draws together a conclusion - perhaps surprising - that ultimately leaves the audience satisfied. (Readers of detective stories may recognise a pattern.)

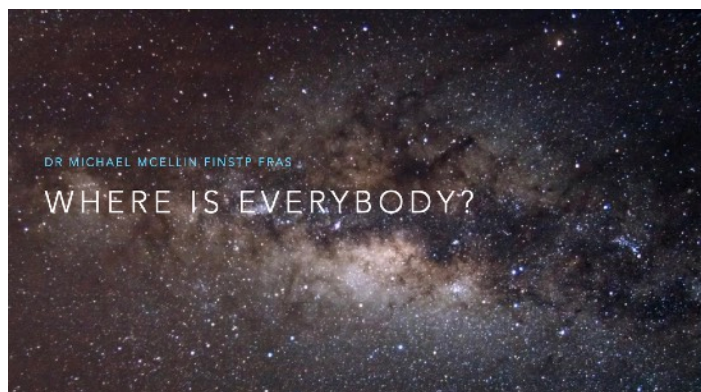
So, let us go through some tips and examples from *my* way of giving talks. (I have copied and adapted much of my style from speakers who impressed me and did thing with their approach that I though I might be able to do. Other people have different styles that work equally well for them - but I did not think I could make them work for me.)

Introduce yourself and claim credibility

The audience need to know who you are and why they should listen to you.

My first slide would normally contain the title of my talk my name and any relevant qualifications that I claim which increase my credibility in this context.

On the right is an example from one of my lectures, which dealt with the chance of detecting intelligent extra terrestrial life. The title is intended to intrigue by laying out an apparent paradox, reinforced by the image: vast numbers of stars but no credible signs of signals or visitations. (Yes, I did say *credible*.)



Introduce the topic of your presentation

In the example that I gave, I would explain the paradox verbally both while the initial slide is visible, and with a small number of subsequent slides (this depends on the complexity of the subject matter).

In this case my second slide is a video (downloaded from a professional observatory) that “zooms” in to a star field grabbing audience visual attention and reinforcing the point that there are utterly vast number of stars. Meanwhile I am explaining the history of the so-called “Fermi Paradox” (named after the scientist Enrico Fermi, who first posed the question in this way) finishing with a picture of Fermi because personalities make connections with an audience.

During this phase the only text that appears on the screen is the name “Enrico Fermi” underneath his picture.

★ *You want the audience to **look** at the screen, but **listen** to you.* Minimise the amount of text on the screen, but maximise relevant visual interest.

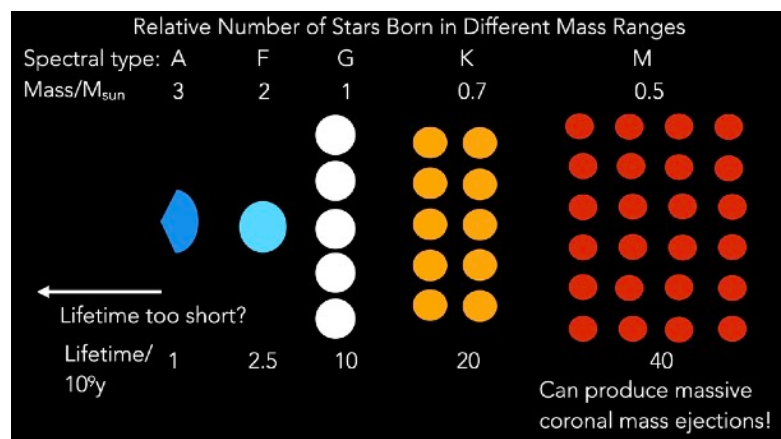
Develop your ideas

You should introduce relevant background information. The slide on the right, for example, illustrates the accompanying explanation that our Sun happens to be placed in an optimum position for the evolution of life. (Note minimal text.)



This slide contains a relatively small amount of visual information but is sufficiently visually attractive that the audience will not get bored while I explain the concept of a galactic habitable zone.

Some slides, however, need to contain a lot more information. The slide on the right provides a visual representation of the relative numbers of stars of different masses (which also have different lifetimes), but also has relevant numbers.



I will keep this slide on the screen for longer than average and talk about it more, because understanding the information presented here is crucial to following later parts of the talk.

- ★ *Vary the pace of the talk.* Some slides will require only a few seconds on the screen, others may be up there for five minutes.
- ★ *Present important information in several different ways.* You can use graphs and numbers together, as well as verbal explanations.
- ★ **DON'T just put a list of bullet points on the screen and then read them out.** This is a waste of an opportunity to employ multiple channels of communication. It is not often that I find it too difficult to illustrate my points non-verbally.

Having said that, here is an example where I have used bullet points. I am presenting the “Drake Equation” whose terms are essentially a table of contents for the topics I will deal with on later

slides. This is also the only equation that I display in this lecture because this talk was aimed at a general audience. A talk to my professional peers would probably include more maths, because it is a better way to communicate precise information to those who are comfortable with equations.

I use bullet points because, I *have* to refer to this famous equation that forms a basis for much research in this area, and I have to say something about each of the terms because these are signposts to later sections of the talk. I also want to keep the entire equation visible while I am talking and so need to keep the meaning of each of the terms also in front of the audience while they are looking at the slide.

I actually feel guilty if I find I am using a bullet point list more than once in an hour-long lecture. I feel am just not working hard enough on relevant visuals - but it does sometimes happen that you really need to tell an audience that there is an important list that needs to be understood as a list.


The Drake Equation (1961)

$$N = R_* \cdot f_p \cdot n_e \cdot f_l \cdot f_i \cdot f_c \cdot L$$

N = Number of communicative civilisations now in our galaxy (other than ourselves).

- R_* = Rate of star formation
- f_p = Fraction of stars with planets
- n_e = Fraction potentially life supporting
- f_l = Fraction that develop life
- f_i = Fraction that produce intelligence
- f_c = Fraction that are communicative
- L = Lifetime of a civilisation.

A research programme, not a prediction!



Use of Humour

It's great if you can do it, but you need to be able to carry it off: jokes that fall flat are worse than no humour. Gratuitous humour - a joke for the sake of a joke may also go badly because it is easy to cause offence with certain audiences. The humour also needs to move the story forwards.

I don't do jokes, but I wanted to make a point that if we encounter extra terrestrial life it may well be in the form of Artificial Intelligence, because while organic life is highly vulnerable in space possibly sort-lived compared to the time required for interstellar travel, robots could indeed possibly survive such journeys. Note that I have cited the source of the image from Hitchhikers Guide to the Galaxy.



I also wanted to make a point that our ideas of life and where it might be encountered are often very Earth-biology centric and are almost certainly wildly wrong, should we encounter alien life forms. I also, therefore, included a cartoon that data back to the time of one of the early NASA missions to Mars. (In this case the image is signed.) I was using it to make the point that scientists were well aware even in 1976 that life was unlikely to be found on the surface of Mars, and the same might be true elsewhere. It helped my make my point.

In general you should pay attention to proper citation of sources and not infringe copyright provisions. I do not give my talks outside educational context and do not charge fees. I believe I am within the scope of the "Fair Use" provisions of the law - but I did think about it.



Telling the Story

There are people who say that all stories tend to fall into a small number of patterns. (The “Hero’s Journey” is for example a widely discussed pattern.) Some science presenters deliberately plan their talks in one of the conventional patterns: e.g. overcoming adversity to achieve triumph. It works surprisingly often, especially when strong personalities are involved in the tale, where there is often more than enough material to create tension, excitement and reach a joyful resolution.

There are a few lessons here. Firstly personalities do often help the audience to connect with the science perhaps by imagining themselves in the context: what would they do? Secondly, detective stories are perennially popular and much of science can be presented as a detective story: puzzling clues sometimes leading to wrong inference, but then we get the final reveal by the great detective when everything is explained. Thirdly, good stories need tension and good story-tellers know about varying pace and voice pitch to convey excitement and emotion. Finally, you need resolution.

So the first part of my talk is mainly about difficulties in identifying extra-terrestrial life (“creating tension”) but also how modern instruments have revealed new clues, while nevertheless leaving big gaps in our knowledge (small resolutions to more tension). However, when moving into the last third of the talk I point out that we are very close to having new telescopes that will very likely resolve some of the big outstanding questions. (“Inspiration and opportunity”: I want to encourage young people to think about careers in science.)

Here are my final two slides from the “Where is everybody?” lecture. The penultimate slide is a summary of everything I have talked about in the previous 40 minutes, using a table to give high and low estimates of all the terms in the Drake Equation (see above). It contains the punch line: that the present data is consistent with us being alone in our galaxy, and our intuitions could be wrong. It also shows where we have to look in order to reduce the present large uncertainties.

My very final slide is actually just

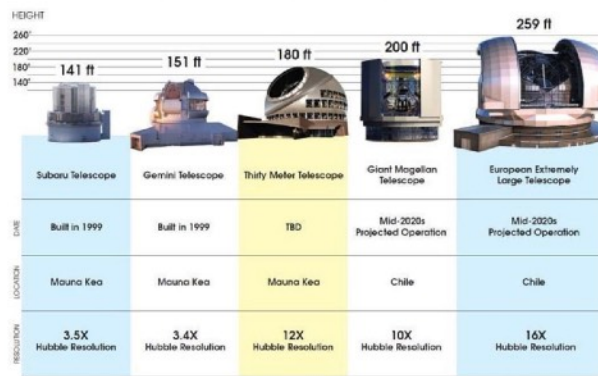


Figure 6

Next Generation Telescopes

We should soon be able to get more information about atmosphere composition, and perhaps detect bio signatures.

FACTOR	LOW	HIGH
RATE OF STAR FORMATION	1	3
FRACTION OF STARS WITH PLANETS	1	1
FRACTION ON WHICH LIFE IS POSSIBLE	0.001	0.1
FRACTION DEVELOPING LIFE	0.001	1
FRACTION PRODUCING INTELLIGENCE	0.001	1
FRACTION COMMUNICATIVE	0.1	1
LIFETIME OF A CIVILISATION	200	10,000
NUMBER OF COMMUNICATING CIVILISATIONS NOW	2×10^{-8}	3000



almost duplicate of my first slide, asking whether we have reached a conclusion. Well, no, but we *can* see the end point, and just possibly some of the people in the audience may be inspired to become part of the journey and make the final steps.

Even before I start assembling the slides of a presentation I often imagine myself verbally telling the story to a member of my target audience, and sometimes I write it down often as a two-page summary. (If I need more than that I worry that the story is possibly too complicated for 50 minutes of talks with images.) Only then do I start looking for images to illustrate my story.

Practice, Practice Practice

I do not always use this particular story structure: but my style always tends to involve lots of visual information and I work hard at finding relevant images.

I tend to write myself a full script to go with the presentation, usually on the “Notes” pages of Powerpoint (so I always have the original script whenever I revive the presentation). A Notes page does not allow you to put too much text in your script for each slide, and sometimes you just want to list points you want to make (yes, this is where you put your bullet points!) and leave it to the inspiration of the moment just how you express them. These days, most Powerpoint shows are done with the aide of projectors and laptops, so you can arrange to have the Notes page visible to you while the slide is visible on the audience screen. Learn to use this facility: it can really help, especially because it also reminds you what the next slide is going to look like.

Nevertheless, I do practice: I *speak* the script because what looks good as written English often sounds stilted if simply read off the page. You want to sound spontaneous, so you should read what you have written (silently) *then* put the script away and speak what you remember. *Then* modify your script to be closer to what it feels natural to say. Before I give a talk I read my script very closely - but I may not refer to the Notes once the lecture starts - only if I lose the thread of my ideas, possibly because of a question from the audience.

Do you take questions while the lecture is in progress? If you are really confident in your material it can help with communication - or it can disrupt a carefully constructed chain of logic. I once gave an astronomy talk to year 6s and got to about slide 6 before the questions started, but it was great: the kids were showing real enthusiasm and curiosity, which is what I wanted.

You need to vary your pace. Some points require more thought from the audience. Many inexperienced presenters speak too quickly having memorised what they intend to say or reading it from a page and then just read it off as quickly as possible. It does not sound spontaneous. Give a little pause after an important or non-intuitive point. It may seem long to you but probably not to your audience. (OK, I have seen this overdone, with the speaker coming across as portentous, investing unwarranted significance in minor statements. Moderation in all things!)

Excitement tends to raise the pitch of your voice, but control it! You want to convey emotion, but not too much.

A very good tip is to film yourself giving the presentation. It will seem sobering to start with, but you will learn to get better very quickly. (Zoom can be set up to record talks solo. I find it easier to do this rather than trying to set up an iPhone or iPad to record video.) You may well find that you need to edit your talk to remove material in order to keep it within the allowed time frame. (This can be as short as a couple of minutes in some science communication competitions, maybe as long as 15 minutes for CREST presentations, or often 50 minutes for a typical “outreach” lecture. **Don't overrun.** The audience gets bored and the organisers get upset. As a matter of personal experience you can often cut 30% of the originally planned words without much impact on the information content - in fact your words will probably have more impact because better expressed.

Look at the audience, what how they are responding and adjust to what you see. (It is very off-putting when you actually seem someone nodding off the sleep, but it has happened to me.)

Other Information Sources on Science Communication

Greg Foot's YouTube channel is an excellent source of information about presenting science. In fact, he has put together a free short course on the topic. See <https://www.gregfoot.com/> and <https://www.youtube.com/@GregFoot/videos> and particularly the link on the right. It does not take very long to watch the full course and it is full of very good advice from someone who makes a living out of science presentation. I strongly recommend spending a couple of hours watch these ten videos.



Yes, you can make a living these days just presenting science. The RGO Presenters Network (<https://www.rmg.co.uk/schools-communities/presenter-network>) links together anyone who want to take the practice seriously, whether they are getting paid or not, to share information, ideas and good practice.

A final piece of advice

Learn to enjoy presenting!

There are lots of people who fear making presentations, so they avoid it and never learn how to do it properly, and then, of course, make a hash of it when it cannot be avoided because they have not acquired and practiced the skills.

Yes, some people are naturally better than others, but anyone can learn to be entirely competent and will then stand out from their peer, who have not take this trouble. Act on the guidance of those who have learned how to do it well, practice, take any opportunity to present before an audience in a relatively safe zone and you will soon find that you can really enjoy the experience and be ready to take on a larger stage.

I am not a natural, but I started to really enjoy presenting after attending a course that was taught by a professional actress - a tutor at Bristol Old Vic Theatre School. A lot of the course was about how to look natural, relaxed and confident when you do not feel that way including how to stand and move and how to control your voice. Practice looking confident and you will start to *feel* confident (it really works). Our tutor also taught us a valuable trick known to all professional actors who have stage nerves (and all the good one do): just before going on, take ten deep breaths: slow in, slow out. Your pulse will slow down and you will feel more relaxed - then you go out and slay them. I have used this and it does work.

The general standard of presentations is often so low that anyone who makes a serious effort to do a little better will quickly find themselves on the right side with their audience: they feel that you are giving them respect and are therefore prepared to listen - even if you really know that things did not go quite as well as planned.