

How Do We Know What Works?¹

Oli Usher

ESO education and Outreach Department/ESA Hubble, Germany
E-mail: ousher@eso.org

Oana Sandu

ESO education and Outreach Department, Germany
E-mail: osandu@eso.org

Lars Lindberg Christensen

ESO education and Outreach Department, Germany
E-mail: lars@eso.org

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Summary

There are many reasons why communicating science with the public is a good idea. There are also many views on how this is best done. This article will not focus directly on these questions, but rather on: how do we know that we are reaching our target audiences, how do we know whether our output is well received — in short, how do we know what works?

Introduction

This article presents experiences from the press and outreach activities for the European Space Agency's share of the Hubble Space Telescope (ESA/Hubble) — an integrated part of ESO's education and Outreach Department (ESO ePOD), for which the methods described here also apply. While astronomy is in some respects atypical in the broader field of science communication (there is a ready, supportive and enthusiastic public, which is not the case for numerous other sciences), the methods of gathering data and feedback which inform ESA/Hubble's work are broadly applicable.

ESA/Hubble's outreach straddles several different forms of communication — interaction with the media (which inevitably takes a top-down approach), direct communication with the public via information and videos on the web (similarly top-down), and a growing effort to engage with audiences-as-stakeholders via blogs and social media (a bottom-up approach). In this respect, ESA/Hubble bridges the divide between the traditional "public understanding of science" models of science communication and contemporary "public engagement with science" models. As such, its operations could be of broad interest in the science communication community.

The Hubble Space Telescope is a programme of international co-operation be-

tween NASA and the European Space Agency (ESA). Since 1999, the well-established and highly successful Office of Public Outreach (OPO) at NASA's Space Telescope Science Institute has been complemented by a European outreach office, ESA/Hubble, based at the European Southern Observatory (ESO) in Germany. While there is extensive cooperation between OPO and ESA/Hubble, they remain quite separate operations.

Outreach for ESA/Hubble takes a number of forms. The primary channels are press releases (both of new science results and of newly processed images), the [space-telescope.org](http://spacetelescope.org) website (which is updated several times a week with pictures, news and videos), video podcasts, and engagement with the community via social networks. Due to the complexity of the information flow in modern day society, the dividing lines between these are of course not always clear-cut — press releases are read by the public on our website; videos from our podcasts are widely used by broadcasters; social media reach opinion leaders and journalists.

Different types of communication have to be assessed in different ways, and it's important to understand that it is not an exact science. The purpose of monitoring output is not to write up the results in a scientific journal, but rather to inform and direct the work of the organisation towards what is most effective. The impact of a web page can easily be measured through vis-

itor numbers, while a video podcast which is shared and re-posted virally is much harder to assess — this is not a weakness, but simply a recognition that we have to do our job with imperfect information at our disposal. Nevertheless, with this broad range of indicative data we can get a good handle on what works and what doesn't.

Effectiveness

Monitoring the effectiveness of the ESA/Hubble website² using Google Analytics is arguably the most straightforward element of our evaluation strategy (which is just one part of the larger departmental strategy). This gives a wealth of information, not just about reader numbers for individual pages but also on the paths readers take through the website, geographical location, technical info, and many other metrics. As would be expected, the readership fluctuates considerably depending on how much Hubble appears in the news, but there is a constant baseline thanks to the sizeable archive of news stories, images and videos. Note that the materials on the site are made available for reproduction with very open licensing conditions (Creative Commons 3.0 Attribution), which encourages dissemination of Hubble science and images to a wide audience, but inevitably makes any analysis of how broadly it is used incomplete. In 2010, we ran a competition asking members of the public to identify cases of Hubble imagery in popular culture, which brought many to



Figure 1. *The Hubblecast, presented by Dr Joe Liske (aka Dr J) is one of the most popular science vodcasts on iTunes. It is also widely shared on YouTube, where success is harder to quantify. Credit: ESA/Hubble.*

our attention, but this was only scratching the surface.

We monitor the impact of press releases both quantitatively and qualitatively. The quantitative approach is essentially bibliometric — the number of times a story's keywords appear in Meltwater, an online news monitoring service (this figure, although admittedly only a small part of the total media coverage, is our proxy for how many times a story has been picked up in the media); combined with page views on our website as measured by Google Analytics (a proxy for public interest); and hits in EurekAlert, a science press release service (a proxy for journalists' interest in a story).

These figures vary considerably between press releases, and the impact is not necessarily immediate or predictable. While interest typically peaks in the few days following a release date, it can sometimes have a second burst of life — we are regularly contacted by people who use images in commercial products, TV programmes, books, etc, years after they are first published. A broad approach combining qualitative and even anecdotal evidence with quantitative data helps see this broader picture.

Press releases vary in their immediate impact too — certain “sexy topics” (exoplanets, black holes, record holders such as most distant galaxies or most massive stars) are naturally more media-friendly than others (such as cosmology). Pictures and illustrations, of course, help a great deal, particularly in the general interest press — we have a small team of graphic designers and image processing experts to provide world-class visuals with our press releases. But regardless of how good a press release is and how well processed the graphics are, some topics will inevitably have a bigger or smaller impact than others simply because of how intrin-

sically interesting they are. In general our experience shows that the most important and intrinsically interesting stories or images make the press releases with the most impact and penetration.

Qualitative monitoring of press release impacts is by its nature less complete, but it gives a complementary view of press coverage. We use Meltwater's online news and monitoring of magazines and newspapers in print to build up a library of press clippings. This serves as an archive — a form of feedback on the effectiveness of our press releases.

Since 2007, ESA/Hubble has produced the Hubblecast, one of the first HD video podcasts (see Christensen & Hurt, 2008). It has since established itself as one of the most popular sources of audiovisual science

store's subject areas. Hubblecast HD is consistently in the top ten video podcast series in the science and medicine category in the UK, US and Germany, alongside Hidden Universe, the Spitzer Space Telescope's official podcast, PBS Nova and NASAcast. Note that these statistics are for the 720p HD version of the Hubblecast alone — our standard definition and 1080p Full HD videos are listed separately and do not count towards Hubblecast HD's rankings. These also perform well, with the Full HD edition frequently in the top ten too. This means the true position of the Hubblecast (all versions combined) is higher than it appears — it may be the most popular science video podcast in the world — but impossible to measure quantitatively since iTunes provides only relative rankings rather than absolute viewing figures.

Charts of individual episodes are obviously more volatile and we do not keep a regular tab on these — *ad hoc* checks suggest we frequently have episodes in the top ten, but not always. We have elected not to monitor these charts systematically; there are simply too many variables at work. Nonetheless, anecdotal evidence suggests that, if anything, our longer episodes (six to ten minutes) are more popular than the shorter ones (three to five minutes). Dire warnings of the short attention spans of internet users seem not to be justified in this case.

While these iTunes statistics give an idea of how successful our video podcasts are relative to other comparable ones, they don't offer any absolute numbers. While we can, in principle, track subscribers to the podcast (both those who subscribe through iTunes and those who do so directly from spacetelescope.org) via Google Feedburner, it is in fact very hard to gain any meaningful insight from these figures. Our total of around 30 000 subscribers is based on the number of users whose client software checks our feed every day, which is not a particularly useful number. More meaningful, but still problematic, is Feedburner's measurement of “reach” — the number of downloads initiated per day through the feed. This figure of around 2500 per day is more useful, but a small caveat needs to be mentioned: subscribing to a podcast in software like iTunes automatically downloads new episodes regardless of whether they are ever watched.



Figure 2. *The Hubble website, spacetelescope.org. Google Analytics produces detailed statistics about readership, traffic sources and popularity of content. Credit: ESA/Hubble.*

news on the internet. Each issue focuses on a single topic, for example a new discovery, or a presentation of Hubble observations of a particular object, or a certain type of observation. To use some science communication buzzwords, they cover both downstream (scientific results, observations) and upstream (methods, technology, etc) topics.

Hubblecasts are distributed through the iTunes store and on dozens of video sharing websites including YouTube and Vimeo. Rankings from iTunes are easy to get hold of — the software offers a “most popular” selection both for podcast series and for individual podcast episodes in any of the

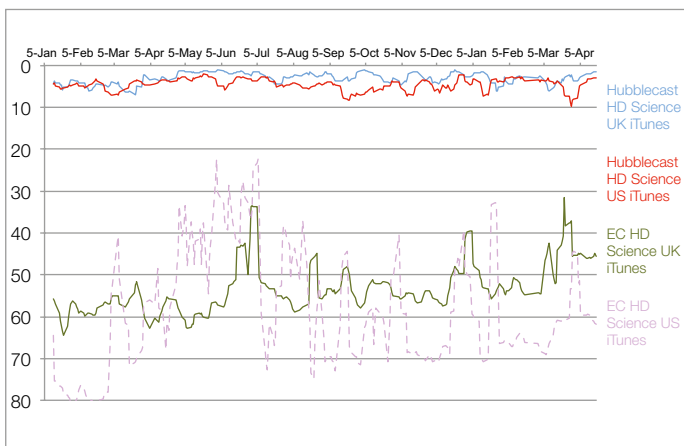


Figure 3. This graph shows the five day rolling average position of the HD edition of the Hubblecast, in the US and UK stores. Equivalent figures for the ESOcast are included for context. Credit: ESA/Hubble.

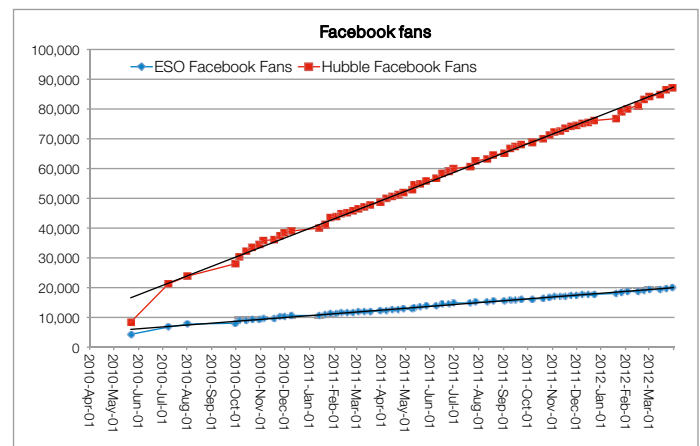


Figure 4. This graph shows the progression in Facebook fans for Hubble since January 2010. Equivalent figures for ESO are included for context. Credit: The authors.

Performance of the Hubblecast on YouTube can give a clearer idea of public reception than subscriber or download statistics — partly through viewing figures, which are publicly available, but also through user comments. Here again, though, our copyright policy, which is such a help at disseminating Hubble science and images, is a hindrance to evaluating precisely the success of our science communication strategies: the vast majority of views of Hubblecasts on YouTube are actually not through the official channel at youtube.com/hubbleesa, but through users who legally upload the video to their own accounts and share the videos themselves.

It is quite common for these re-uploaded videos each to have hundreds of thousands of views and hundreds of user comments. While the quality of user comments on YouTube is far from being legendary, it can at least give some idea of public interest and appreciation.

The complex interaction with users, as well as instant (if ambiguous or throwaway) feedback on YouTube is typical of the fourth major aspect of Hubble outreach (after press work, web content and audiovisual) — community interaction, primarily through social media. This is the primary mechanism for public dialogue in our outreach operations, ensuring that we carry out best practice in science communication.

Engaging with online communities has rapidly grown into one of ESA/Hubble's main outreach methods in recent years: the social media are experiencing an explosion in their journey from new media to main-

stream media. Social media have opened a door for science communicators into a fascinating territory — one where “the public” is made up of individuals with personal opinions, ideas and preferences that make them opinion leaders in their own online community. Each individual connects with hundreds of other individuals and creates their own sphere of influence. It is in this complex landscape that information spreads, traveling from one group to another. The power of socially fuelled word of mouth is incredible, but also incredibly hard to monitor.

The main channels ESA/Hubble uses to engage with its online communities are Facebook and Twitter. We also use YouTube and Vimeo for sharing our videos and Flickr for our photos, but most of the interaction between ESA/Hubble and its community happens on the ESA/Hubble Facebook Fan Page and on its Twitter feed.

We use both channels for two main purposes

Firstly, we share all our scientific results and images, drawing more attention to our science and photo releases and we also promote our Pictures of the Week and Hubblecast episodes when they are published. This helps us to communicate our output to the online community and directs them to where they can find further information. Social media messages have to be concise and appealing, so these channels are not suitable for explaining science — they serve instead to stimulate interest, engagement and curiosity. There's only a lim-

ited amount of information that can fit into fewer than 140 characters!

Secondly, in addition to disseminating information we also try to encourage people to engage in a dialogue with other Hubble and astronomy fans. This makes people more enthusiastic about our discoveries so that they want to learn more, and also share the information with their friends. Our goal is to transform passive consumers of information into active, engaged ambassadors in their own online communities, helping us take Hubble from one sphere to another in this vast social universe. This enthusiastic and engaged audience can be used to feed back into other areas of our work: for instance, requests and questions from our fans on Facebook and Twitter formed the basis of the 50th episode of the Hubblecast, which took the form of a question and answer session.

The potential of viral information is enormous and hard to keep track of, but not completely obscure. Even if the impact of social media is hard to grasp, there are still a number of indicators that tell us whether our input has brought results and how many resources we should continue to invest in social media.

For our Facebook page we do a quantitative evaluation that focuses on the number of fans we have. This number has been constantly growing — to more than 75 000 at the time of writing (December 2011), which makes ESA/Hubble the most popular Facebook page among astronomical observatories.

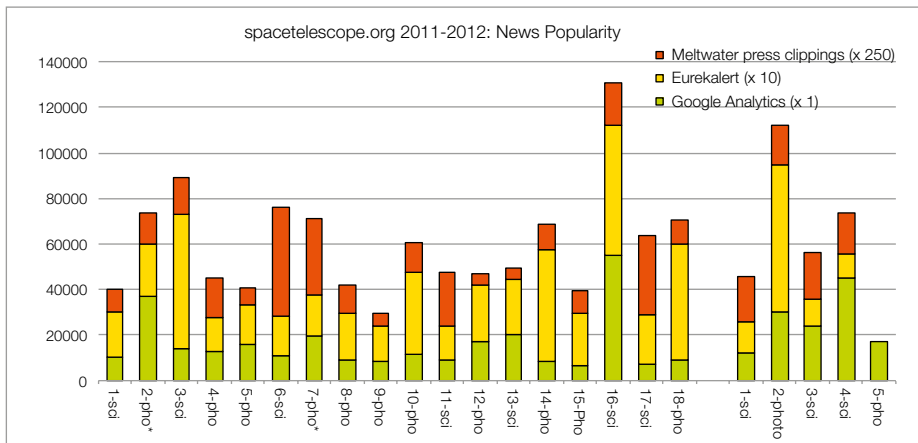


Figure 5. Popularity of the news releases published 2011 and 2012 on spacetelescope.org. The news releases are identified by their release number and type. Credit: The authors.

However, since everything we post on our page is publicly available to everyone, not only to our fans, people do not necessarily have to “Like” our page in order to see the contents. For this reason, there are several more relevant indicators that show some very impressive numbers. Facebook offers page administrators a service called Insights, which provides interesting statistics.

In November 2011 we had 1.25 million post views — the number of times people have viewed a news feed story — which is almost twice the number of website pageviews for that month. A narrower view of user interaction is the number of people who have commented on, liked or shared one of our posts, which gives a more modest figure of around 10 000 per month.

Another interesting factor to take into account is that if we look at Google Analytics we see that among traffic sources, Facebook is number two in most months, right after Google’s search engine. This means that we have a large community reading our news on Facebook and many of these people go on to look at our website. This number varies a lot, depending on factors such as the topic of the story, the day or the hour when it was posted. Luckily, it is possible to drill down in these statistics and see which posts have had the most views and thus which topics are of more interest for fans.

Facebook also collects data about the gender and age of Facebook friends, as well as the countries and cities where the accounts are most popular, which can be an important variable if it’s necessary to justify a local impact.

In the case of Twitter, evaluation is even harder because the platform does not have a well-established monitoring service. Until recently, all we could do was to keep track of the number of followers (around 6000 as of December 2011) which shows a steady increase over time. We then looked at Google Analytics and saw that Twitter was also bringing more and more people to the website, which was reason enough to believe that we were reaching and engaging with more Twitter users. However, we had no other data and we could not analyse what worked best.

In spring 2011, HootSuite, a software platform used to manage social media accounts launched an evaluation tool that generates reports on individual account activity and its impact. As we gather data from this, we should be able to gain new insights and spot new trends in our social media use.

Conclusions

Analysing the success of outreach efforts is not a simple matter of clean, unambiguous statistics. It relies on educated guesses and common sense too, because we function with an imperfect dataset.

However the purpose of evaluating scientific outreach is not to come up with detailed, accurate statistics which can be published, but rather to assess whether what we do actually works. Effective evaluation holds a paradoxical position, in that it should be both tightly integrated with science communication work, and clearly secondary to it. If there is one thing worse than not measuring output at all, it is to

cripple the output (for example by enforcing strict copyright terms) in the name of measuring it properly.

References

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Notes

¹ This is an extended and updated version of an article that was published on EuroScientist.com in April 2011

² www.spacetelescope.org

Biographies

Oli Usher studied History and Philosophy of Science at University College London and the University of Cambridge, and has written widely about science, technology and their place in society. At Cambridge, he became interested in science communication when he studied how flawed government decisions about how to communicate scientific information led to public mistrust of medical science. Before coming to ESO, he worked as a journalist, writing science stories for a range of publications in print and online, including *The Guardian* and the London-based political magazine *Tribune*.

Oana Sandu works as community coordinator for ESO’s education and Public Outreach Department (ePOD). She is responsible for the promotion of outreach products or events and the social media presence of both ESO and ESA/Hubble. With a degree in Communication and Public Relations and a Master’s Degree in Marketing, she worked for two years in a leading PR agency from Eastern Europe. As a volunteer, she was involved in projects such as Global Astronomy Month, the Space Generation Congress and World Space Week. She keeps a blog on astronomy communication at www.astronomycommunication.wordpress.com. To get in touch with Oana you can connect on Twitter (twitter.com/oanasandu) or Facebook (facebook.com/oana.sandu).

Lars Lindberg Christensen is a science communication specialist heading the ESO education and Public Outreach Department (ePOD) in Munich, Germany. He is responsible for public outreach and education for the La Silla-Paranal Observatory, for ESO’s part of ALMA and APEX, for the European Extremely Large Telescope (the largest optical telescope in planning), for ESA’s part of the Hubble Space Telescope and for the International Astronomical Union Press Office. Lars has more than 100 publications to his credit, most of them in popular science communication and in its theory.