CAP journal
issue 4 | August 2008

Communicating Astronomy with the Public

Finding the Real Media Stars
How to achieve high media coverage!

Harry Potter and the Planets
The upcoming Venus–Jupiter conjunction

Science Journalists Speak Their Minds
What do they really think about scientists?

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Colophon

Published by
IAU DIVISION XII Commission 55: Communicating Astronomy with the Public

Sponsored by
ESA/ST-ECF, ESO, Fundação para a Ciência e a Tecnologia, Portugal and Navegar Foundation, Portugal.

CAPjournal
Communicating Astronomy with the Public Journal
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ISSN 1996-5621 (Print)
ISSN 1996-563X (Web)

Contents

Cover: After a rainy day the sky becomes crystal clear on a pleasant spring evening, while diligent skygazers wait to seek the treasures of the night. The bright point just below the telescope tube is the dazzling planet Venus. Credit: Babak Tafreshi/twanight.org.

Editorial

HERE AT THE CAPJOURNAL we are always keen to find new ways of disseminating available astronomy education and public outreach (EPO) resources.

Wearing my International Year of Astronomy 2009 hat, I need to find new ways of re-using the resources available to our IYA2009 partners and ensure that they are available to other nations and organisations. We see IYA2009 as a huge opportunity to empower networks and to exploit all available material.

If we could count the number of astronomy EPO resources available on the web, our minds would be blown by the enormous number of terabytes out there — many more than the data from the Hubble Space Telescope.

Unfortunately, these resources are not easy to translate or adapt to different languages and cultures. Principally because, either the original materials were not developed with portability in mind, or the source files are simply not available.

Imagine a website where anyone can download, access, reuse, recycle and adapt content to different languages and cultures. The first steps torwards this have come from Spain, where a group of aficionados are translating and adapting electronic EPO content into Spanish using professionally minded volunteers. The network astroseti.org translates and adapts news, documents, brochures, educational material and presentations, specifically to promote and disseminate astronomy. This group are setting an example to follow! The IYA2009 Cornerstone, the Portal to the Universe, hopes to continue their efforts and is attempting to fill this niche.

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In this issue, Mathew McCool, professor of writing at the Southern Polytechnic SU (Atlanta, USA) provides tips on how to avoid cultural and linguistic tangles in astronomy communication. Also be sure to check out the articles on achieving high levels of media coverage, the upcoming Venus-Jupiter conjunction and what journalists really think about scientists...

Between issues you can stay in touch through our website, www.capjournal.org, where you will find the current issue in PDF format, a job bank, submission guidelines and back issues. You can also post anything you have to say on the site or e-mail me at editor@capjournal.org. I'd like to know what you think!

Happy reading,

Pedro Russo
Editor-in-Chief

Explained in 60 Seconds

A collaboration with *Symmetry* magazine, a Fermilab/SLAC publication

Standard Model

The Standard Model is the best theory that physicists currently have to describe the building blocks of the Universe and it is one of the greatest achievements of 20th century science. According to the theory, everything around us is made of particles called quarks and leptons, and four kinds of forces influence their interactions.

The most familiar of these four forces are electromagnetism and gravity; the other two, the so-called strong and weak forces, are less well known. The strong force binds atomic nuclei together, making them stable. Without it, there would be no atoms other than hydrogen: no carbon, no oxygen and no possibility for life. The weak force drives the nuclear reactions that have kept the Sun shining for billions of years. As a result of these reactions, trillions of neutrinos are released from the Sun every second. Some of these neutrinos reach Earth, but pass unnoticed through our bodies, as the weak force is so feeble.

Despite its incredible success, the Standard Model has serious deficiencies. For example, if these four forces and the familiar matter particles are all there are, the theory says all particles must travel at the speed of light — but that is obviously not what is happening. To slow matter down, theorists have proposed a mysterious, Universe-filling, not-yet-seen "liquid" called the Higgs field. Also, physicists now understand that 96 percent of the Universe is not made of matter as we know it, and which does not fit into the Standard Model. How the Standard Model might be extended to account for these mysteries is an open question for current and future experiments.

Key Words

Written Communication
Case Study

Hitoshi Murayama
University of California Berkeley and Lawrence Berkeley National Laboratory

Colour-composite image of the startling spiral galaxy Messier 83, made using data from the Wide Field Imager on the ESO/MPG 2.2-m telescope at La Silla. The WFI stared at M83 for four periods of 25 minutes through different filters (B, V, R, Hα). The data were extracted from the ESO Science Archive and processed by Davide De Martin (SkyFactory). The field of view covered by the image is about 17 x 17 arcminutes. Credit: http://www.eso.org

Finding the Real Media Stars: Analysis of Media Coverage of the UK's National Astronomy Meeting

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Key Words

Astronomy in the Media
Astronomy Meetings
Best Practice

Summary

We present an analysis of the level of media coverage of the Royal Astronomical Society's National Astronomy Meeting (NAM) over the period 2005–08.

The study aims to provide quantitative information to assist press officers, both of future NAMs and of other astronomy meetings, in identifying talks that are most likely to achieve high media coverage and to look at whether the distribution of releases can be improved or changed to optimise media attention. We find that the increase in the total number of pieces of coverage exhibits a roughly exponential trend over the period 2005–2008, mainly due to a large increase in online general and specialist science news sites seen to be picking up NAM stories. Print and broadcast coverage has also increased over the period, but shows a more complex dependence on the nature of the story and the interest of local media. For all four meetings, approximately 50% of the coverage is derived from the top three releases.

NAM runs over four or five days, from Monday or Tuesday to Friday. The peak of releases issued and the resulting coverage is on Tuesday and Wednesday. However, for this four-year sample, the ratio of pieces of coverage to the number of releases appears to be highest for Monday.

1. Introduction

The National Astronomy Meeting (NAM) in the UK is the annual out-of-town meeting of the Royal Astronomical Society (RAS). It has taken place in April each year since 1992 and is hosted by university departments of physics and astronomy around the UK, and in one case (2003) in the Republic of Ireland. The meeting is the largest annual gathering of astronomers in the UK and covers a wide range of astronomical topics including astrobiology, astronomical technology, cosmology and planetary exploration. Most years the meetings are held in conjunction with the UK Solar Physics (UKSP) and the Magnetosphere Ionosphere and Solar–Terrestrial (MIST) meetings and the young Astronomers Meeting (YAM). NAM is sponsored by the university hosting the meeting, the Royal Astronomical Society and the Science and Technology Facilities Council (STFC, formerly PPARC). The largest meeting to date was held at Queen's University Belfast in 2008 and was attended by 650 astronomers .

NAM meeting sessions traditionally run from Tuesday morning to mid-afternoon on Friday, with the Thursday afternoon devoted to the RAS lecture and the conferment of RAS medals, followed by the STFC and UK astronomical community forum. On rare occasions, as in 2007, some sessions are held on the Monday afternoon; this decision depends on the size of the meeting and the capacity of the venue.

NAM provides an important media opportunity for both the RAS and the UK's astronomical community. Registrations are invited from the UK and global science me-

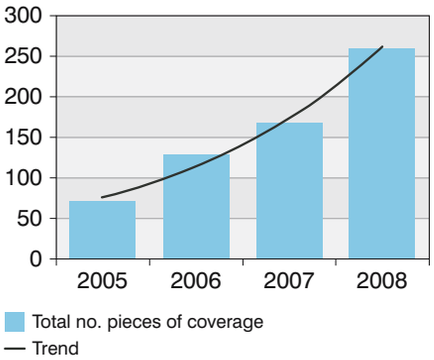

Figure 1. Total number of pieces of coverage resulting in press releases issued by the Royal Astronomical Society for the National Astronomy Meetings in 2005-08. Credit: The authors.

dia; however, in recent years, cuts to travel budgets (and a reluctance to travel to locations far from London) have meant that fewer journalists have attended in person. Each year the RAS press officers select around 20 talks to feature in press releases, which are sent out under embargo the week before the meeting. The embargoes expire at 00:01 local time on the day that the talk is given, aiming to maximise coverage over the week that the meeting takes place. We send the releases directly to an RAS e-mail list covering approximately 300 print, online and broadcast media contacts.

This list includes the press officers from the American Astronomical Society, who forward the releases to their own mailing list. We also post the releases on AlphaGalileo, Eurekalert, the RAS website and on an embargoed section of the relevant NAM website.

Prior to the advent of online news aggregator services such as Google News, the ability to measure quantitatively the worldwide media impact from press releases was limited to those organisations with the budget to employ a clippings service. As a charity, the RAS did not have the funds available for this, so our assessment of coverage was limited to a superficial trawl through papers, magazines and online sites, and information from the scientists featured in the releases regarding interviews that they had given.

Some news aggregator services now allow us to follow the spread of a story worldwide, free of charge, over 30 days following the issue of a release. The Google News service came out of beta-testing in January 2006 and we have compiled the coverage for meetings held in 2006 onwards using this tool. The coverage for 2005 was compiled by using normal search engines and manually searching known general news and specialist science news sites.

2.Data Selection and Analysis

In total, we have issued 84 releases relating to talks given at National Astronomy Meetings held between 2005 and 2008. We issued 23 releases in 2007 and 24 in 2008. In 2006, only 17 releases were sent out; however, this was a stand-alone NAM, i.e. not held in conjunction with the UKSP and MIST meetings, so the number of abstracts submitted was lower. The 2005 NAM was a combined meeting with UKSP, but not MIST, and we sent out 20 releases.

For the purposes of this study, we have not included coverage resulting from non-scientific releases relating to the meeting (e.g. media announcements) or additional coverage not relating to one of the releases (e.g. stories resulting from journalists on site attending talks or interviewing scientists not featured in the releases), although we have included releases issued by other organisations but linked to talks at NAM.

Each year, over the period of the conference and in the following days, we have compiled an initial spreadsheet listing, for each release, the date on which any item of coverage appeared, the publication/website/broadcaster, the article/broadcast title and a web link (where appropriate).

For this study, we have classified the coverage by type: whether it has appeared online, in print, on TV or radio and then subdivided those categories into online science news, online general news, online IT news site; broadsheet, tabloid, local newspapers and magazines; regional/web TV and national TV; and finally local radio and national/international radio. The audience for new media is expanding rapidly — in the past two years, we have found that stories are being featured increasingly in blogs and online discussions — so we have also included categories for blogs and podcasts.

We have also tried to classify the coverage by the country hosting the publisher/broadcaster/ website, although for online news services the country of origin — and indeed the relevance of this — is not always completely clear.

Where more than one release has been combined into a single story, it is only included in the data for the release that received most attention in that story although the number of times each release is featured as a combined story is noted.

The distribution of releases issued and the resulting coverage over the week of the meeting have significant implications for planning future releases, so we have produced breakdowns of these both for individual years and on average over the four years.

We have also broken down the releases and coverage by subject area to identify the themes most likely to be picked up. In fitting the releases into subject categories, there are some elements of overlap and the focus of the story is not always on the same theme as the session in which the talk is given. In general, we have chosen categories relating to the phenomenon being studied e.g. stars or black holes, rather than the method of investigation e.g. radio or X-ray astronomy. Exceptions are made in the case of future technology e.g. stories on the Extremely Large Telescope (ELT). We have chosen to include separate categories for astronomical technology, which includes releases on the X-ray Slew Survey and ELT, and space technology, which includes releases such as "Smart dust for planetary exploration" and "Small satellites offer PC access for space". This is because the latter examples have an appeal to the IT media that the purely astronomical technology stories may lack.

3.Results

Overall, coverage of the NAM has increased with a close to an exponential trend (Figure 1) over the period 2005-08. In each year, there have been one or two "top stories" (Figure 2) that have received the most coverage by quite a significant amount, spread across all forms of media outlet, followed by up to six or seven "secondary stories", which have also been reported in a range of online, print and broadcast. Coverage for the remaining ten or so releases appeared mainly on specialist online science or space news sites. For each year, the top three stories account for approximately 50% of the total coverage (see Table 1).

However, a rise in the number of items of coverage alone is not necessarily a reliable indicator that press coverage is improving. Whilst we believe that all coverage is useful, it is clear that some types of coverage have more intrinsic value than others. It is as much of a priority to achieve consistent coverage in key media (e.g. BBC2's *Newsnight*, Radio 4's *Today* programme, national newspapers, magazines such as *New Scientist* and *Nature*'s news section, and prestigious online sites such as the BBC News Online, Space.com) as to expand our audience worldwide via the internet.

3.1 Coverage by Type

The exponential trend in the number of pieces of coverage resulting from NAM releases is largely due to expansion in the online sec-

Table 1. Breakdown of releases and coverage per year for the three releases resulting in the highest amount of coverage.

Year	Total no. releases	Total no. pieces of coverage	No. pieces of coverage for top story	No. pieces of coverage for 2nd story	No. pieces of coverage for 3rd story	% of total coverage for top story	% of total coverage for top 2 stories	% of total coverage for top 3 stories
2005	20	71	21	7	7	29.58	39.44	49.30
2006	17	127	27	18	15	21.26	35.43	47.24
2007	23	167	38	34	12	22.75	43.11	50.30
2008	23	256	62	53	19	24.22	44.92	52.34

tor. The number of general news websites and the number of science news websites that we have found to be picking up NAM releases have both doubled from 2007 to 2008.

The number of journalists attending has been more or less constant for the period, so we conclude that the physical location of the meeting (Birmingham in 2005, Leicester in 2006, Preston in 2007 and Belfast in 2008) has no significant effect on the media impact of the meeting, except in terms of local coverage. The journalists attending were from BBC News Online and *Astronomy Now*, as well as a handful of freelance writers. The RAS media e-mail list currently comprises 297 e-mail addresses for journalists, agencies press officers and science communicators worldwide. We receive on average ten requests for additions to the list per year (it has increased from 258 addresses in 2005 - mostly from UK journalists. Whilst there has been a steady annual increase in the UK coverage, expansion of the mailing list does not explain the exponential increase in coverage worldwide, particularly in the US, India, South-East Asia and Australasia.

Without some further research it is therefore difficult to pinpoint the reasons for this dramatic rise; a brief investigation of the "new" sites reporting from NAM releases shows that most of the sites have been established for some time. The most likely explanation is that there has been a surge in sites registering as news sites with Google, in which case sites may well have posted NAM stories in the past that we have not picked up in our search for coverage. Alternative explanations include: that existing news sites have expanded allowing them to cover a broader range of topics including astronomy, that news sites have perceived a growth in interest in astronomy and are therefore more inclined to cover RAS press releases, and/or that sites had a pre-existing interest in astronomy but have now developed a new route into RAS press releases, e.g. by registering with AlphaGalileo or are starting to pick up stories from other news sites such as BBC Online or Space.com.

The technical nature of the top releases in 2007 ("Shields for the Starship Enterprise" and "Smart dust for planetary exploration") meant that the stories were picked up by online IT news sites, for which most NAM stories do not lie within the sphere of interest. Coverage from this sector reduced to a minimal level in 2008.

It should be noted that many of the non-specialist internet news sites are linked to regional newspapers. As we have not, at this point, been able to access these printed publications and assess how likely it is that the online stories will appear in the print copies, we have not included them in our analysis of the print media. However, it is possible that the print coverage described below is significantly higher worldwide.

Whilst up overall, the trend in print and broadcast media coverage is much less clearly defined and is much more dependent on the nature of the stories. Coverage in the broadsheet newspapers has been roughly stable throughout the period (Table 2.) with

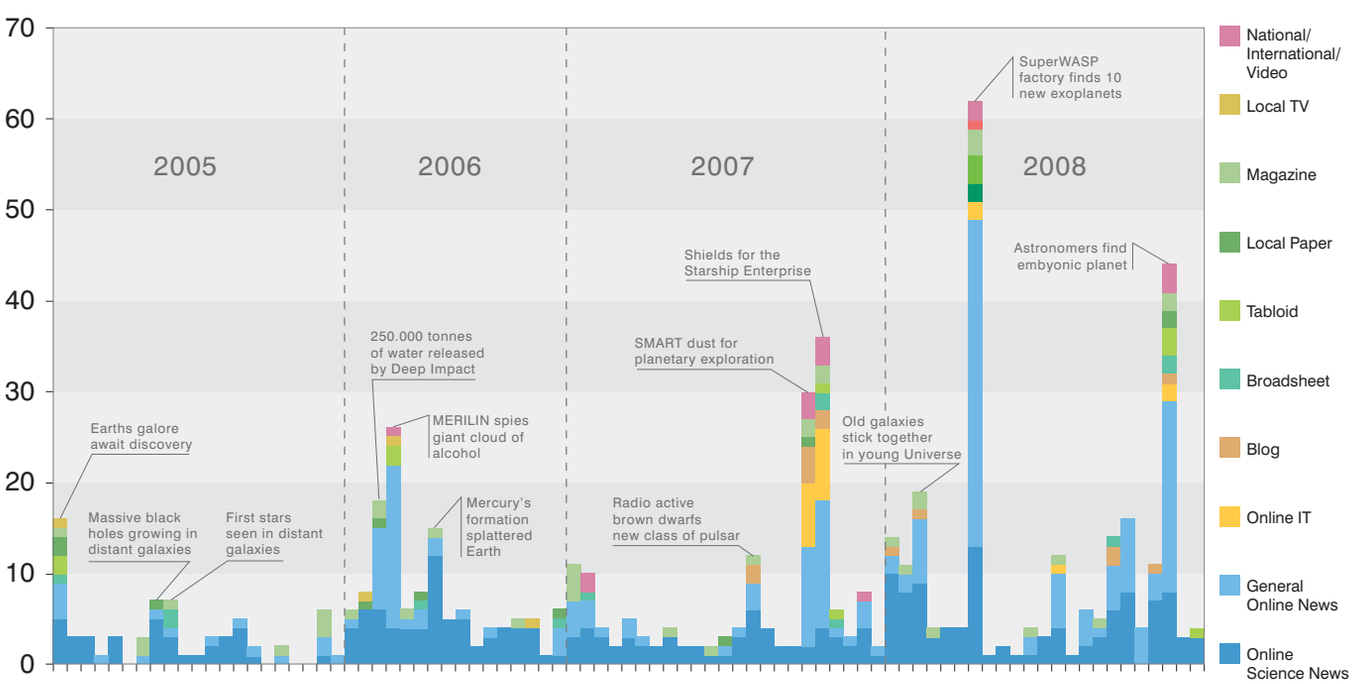

Figure 2. Summary of all coverage for press releases issued in 2005-08, highlighting "top stories" for each year. Credit: The authors.

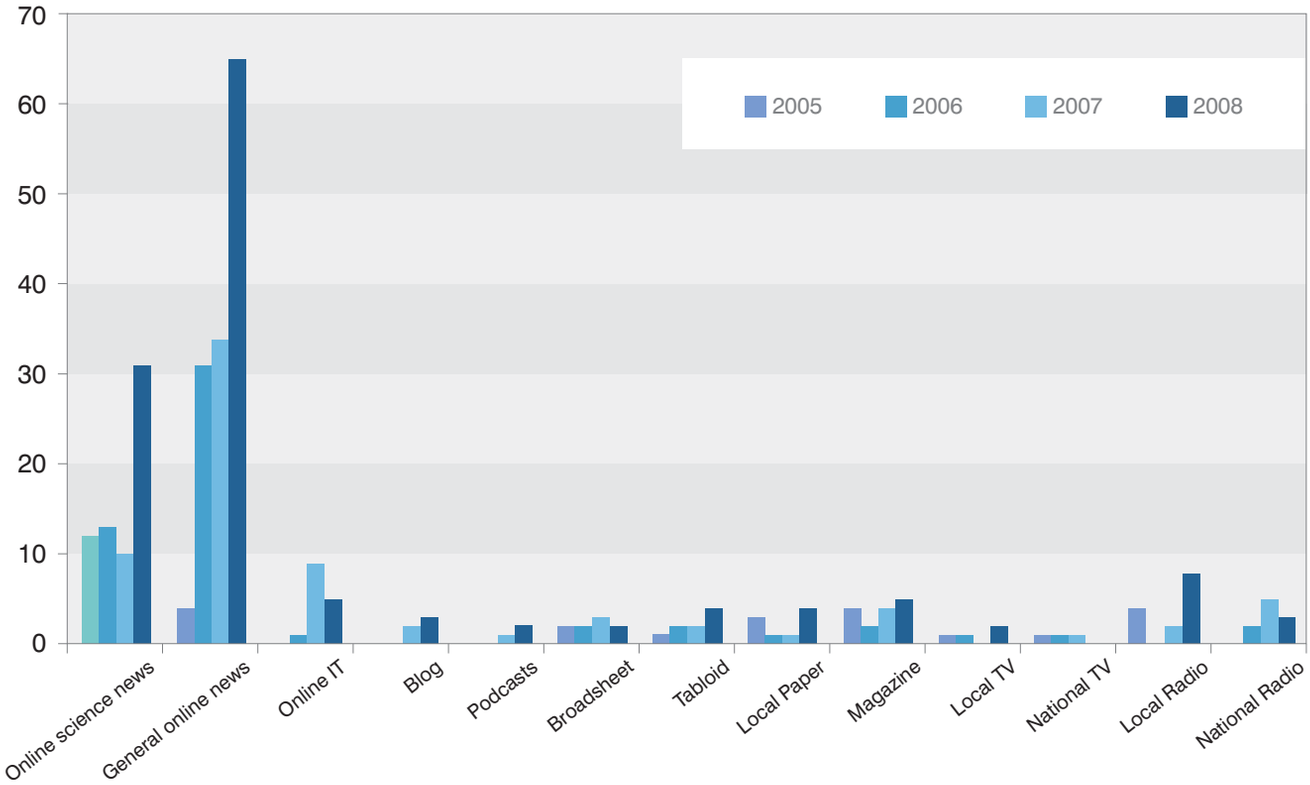

Figure 3. Number of media organisations picking up NAM stories 2005–08 classified by type. Credit: The authors.

stories appearing in most of the "serious" UK papers (*The Times*, *The Daily Telegraph*, *The Guardian* and *The Independent)*. Tabloid coverage was consistent in 2005–07, with two articles appearing, and increased to four in 2008, which could suggest an upward trend; however, it is worth noting that, in terms of square inches of coverage, the peak is in 2005 when the *Daily Mail* published a full-page article on exoplanets and the Goldilocks Zone and a full-page interview the following day with Professor Barrie Jones, who gave the featured talk.

There was particularly good local coverage in 2006 and 2008. Leicester, which hosted the 2006 meeting, is home to the National Space Centre, the UK's largest space-themed visitor attraction; the *Leicester Mercury* takes pride in both this and the University of Leicester's Physics and Astronomy Department and has a long tradition of publishing space and astronomy themed stories. The first NAM to be held in Northern Ireland, hosted by Queen's University Belfast in 2008, had a strong regional identity and attracted a lot of interest from the print, radio and TV sectors of the Northern Irish media, which has the characteristics of a national service elsewhere.

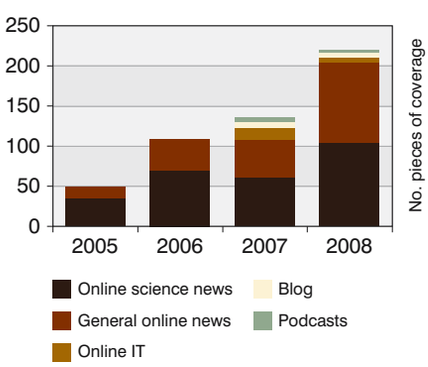

Figure 4. Online news coverage for all stories 2005–08. Credit: The authors.

Television coverage reaches potentially the widest audience and we have had reasonably consistent success over the period. *British Satellite News* attended the meeting in 2006 and scientists featured in our releases were interviewed by *Sky News* in 2005 and *BBC News 24* in 2006. In 2007, *Newsnight* closed with a *Hubble* image of galaxies forming in the young Universe. *Newsnight* filmed the STFC and Astronomy Community forum in 2008, but this is not directly related to a release and therefore has not been included in this study.

3.2 Coverage by Day

For every NAM in the period 2005–08, most releases were issued on the Tuesday and Wednesday of the week and those days also achieved the peak coverage. Tuesday and Wednesday are the only full days of scientific sessions and, historically, conference organisers have chosen to programme the high-profile sessions mid-week to attract the biggest number of attendees.

Unsurprisingly, fewest releases were issued on Mondays, as sessions were only held on Monday afternoon in 2007. In 2008, ESO issued a joint release with NAM on a *Hubble* image of an exploding star in NGC 2397, which was the subject of a talk by Professor Stephen Smartt, one of the NAM Local Organising Committee for 2008. In order to avoid a clash with another release they were issuing later in the week, ESO sent out the release on the Monday and it was the fifth highest ranking story in terms of coverage that year.

Despite the small number of releases issued on Mondays, it is worth noting that the overall ratio of pieces of coverage to number of releases is highest for Monday, with an average of more than nine pieces of coverage per release. This is marginally higher than for Tuesday or Wednesday (Table 2).

On average, Thursdays has the lowest average for pieces of coverage and, like Friday, has an average ratio of pieces of coverage to releases of 3:1. As the journals *Nature* and *Science* are published on Thursday, there is a lot of competition for science stories at the end of the week and that, together with the smaller number of talks on those days, possibly accounts for the lower success rate.

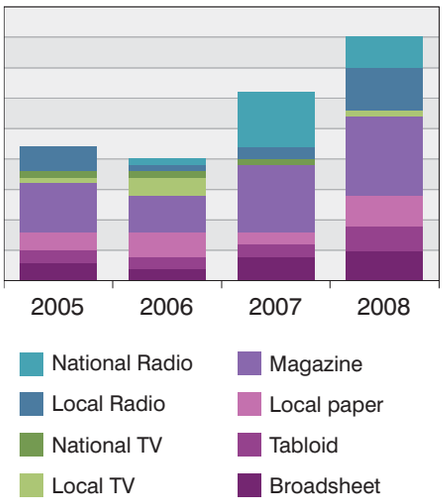

Figure 5. Print and broadcast news coverage for all stories 2005–08. Credit: The authors.

3.3 Coverage by Country

There has been a steady increase in UK coverage over the period 2005–08. Coverage in Europe in 2008 was down overall, possibly because AlphaGalileo was offline from the Friday before the meeting until the Tuesday after the meeting closed, so that releases were not posted during this period. However, looking at the Google News results for the previous years, NAM "top stories" are finding their way into high-profile European publications such as *Der Spiegel* and *Le Monde*. The majority of the coverage is in the US, where most of the online science, space and astronomy news sites are registered. In the past two years, there has been significant growth in the uptake of NAM stories in India, South-East Asia and Australasia (Figure 8).

3.4 Coverage by Subject Area

Exoplanets and the search for life in the Universe are by far the most successful topics in achieving mass coverage. The ratio of pieces of coverage to releases issued is 31:1, nearly twice that of the next most successful topics (space technology and solar terrestrial, both with a ratio of coverage to releases of 18:1), shown in Figure 9.
Exoplanet stories account for a quarter of all the coverage resulting from NAM releases over the period 2005–08 and the public interest in this topic seems to be insatiable, even when the findings are not particularly new. For instance, at the 2008 conference BBC News Online published a further exoplanet story, about a solar system with Saturn- and Jupiter-like planets, which was picked up in several other places, including the *Mail on Sunday*. We had chosen not to issue a release on this abstract during our selection process as the finding had already been publicised on 14 February in press releases from the University of Ohio and STFC/Jodrell Bank and this coverage has not been included in the study.

The success of the space technology stories is boosted by coverage from the IT media. The high-ranking solar–terrestrial stories are linked to protecting astronauts from solar storms, so have a human interest element that many astronomical stories lack.

The subject areas that have generated the most releases are stars, a category which includes binaries, supernovae, pulsars and brown dwarfs and has generated 15 releases, and solar science and galaxies (13 releases each). The stars category has a ratio of pieces of coverage to releases of 4:1; galaxies and solar science both have a success ratio of 6:1.

The subjects with the lowest success rate in attracting coverage are astronomy outreach (3:2), groups and clusters of galaxies and gamma-ray bursts (both 5:2).

Planetary science came surprisingly low down the list, below astronomical history. This may be because most years NAM is held the same week as the European Geophysical Union, which attracts many planetary scientists. Good planetary stories also

Table 2. Comparison of number of releases with the number of pieces of coverage generated by day over the period 2005–08.

Day	Number of releases				Total number of releases	Number of pieces of coverage				Total number of pieces of coverage	Ratio no. coverage/ no. releases
	2005	2006	2007	2008		2005	2006	2007	2008		
Monday		0	3	1	**4**			26	11	**37**	**9.25**
Tuesday	6	6	9	8	**29**	31	73	28	109	**241**	**8.31**
Wednesday	6	6	9	12	**33**	22	36	103	129	**290**	**8.79**
Thursday	4	2	1	0	**7**	10	5	8	0	**23**	**3.29**
Friday	4	3	1	2	**10**	8	13	2	10	**33**	**3.30**

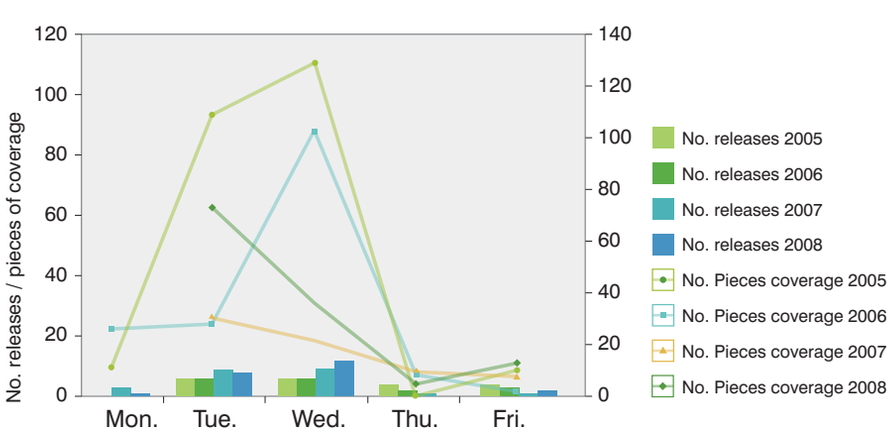

Figure 6. Breakdown of no. releases/pieces of coverage by day for NAM meetings 2005-2008. Credit: The authors.

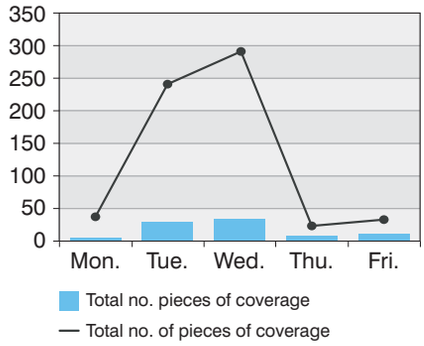

Figure 7. Total no. of releases issued and resulting coverage by day for all NAMs 2005–08. Credit: The authors.

tend to be submitted to the journals *Science* and *Nature* and are therefore subject to their embargoes and cannot be featured in releases prior to publication.

4. Discussion

In studying the patterns in coverage over the past four years, certain questions are raised. With 50% of the coverage coming consistently from just three stories, is it worth sending out twenty or so releases? Is there any point in sending out releases on the more "difficult" subjects? Is there a balance to be addressed between quality and quantity?

In answering these questions, we need to look at the aims of the press office for the National Astronomy Meeting. These are to raise the profile of astronomy, and the UK astronomical community in particular, as well as to promote the Royal Astronomical Society and the meeting itself. The priority of these aims depends very much on the audience reached; for instance, in placing an article in the tabloids the emphasis is on generating interest and enthusiasm in astronomy generally rather than making the man in the street more aware of the RAS. For decision makers, the role that the RAS plays in the astronomical community and the prestige in which NAM is held worldwide are equally important. It is also vital for the long-term growth of the meeting that the scientific community recognises that interesting and significant work is being presented at the meeting (and that NAM presents an opportunity to communicate research to the wider public through the media). It is rare that a single story will have the qualities to fulfil all these aims.

For example, despite the public appeal of extrasolar planets and their success in generating coverage in the tabloid media, many of these stories do not represent major leaps forward in our understanding of other solar systems and are therefore not particularly newsworthy in the scientific sense or widely reported in the science media, e.g. *Nature*. Conversely, stories on dark matter or Modified Newtonian Dynamics (MOND) will never reach a large public audience, but may be picked up by *Nature*, *Science NOW* and *New Scientist*.

In sending out around 20 releases, we are able to ensure that the full range of topics presented at NAM is reported by the science and specialist space and astronomy news websites.

Steve Maran and Lynn Cominsky of the AAS, who give us vital assistance in forwarding the releases to their own list, have expressed some concerns about the volume of the NAM releases in such a short space of time. As part-time volunteers, they have limited time and resources and, this year have only forwarded a selection of the releases. In future we will ask the AAS to distribute the initial press registration release and the username and password for secure access to the media area of the NAM website, rather than our full suite of releases, as the key priority for the AAS remains their two annual conferences and issues relating to their Society.

As three exoplanet stories, three releases on *Hinode* results and two releases on the UK Infrared Telescope (UKIRT) results were, on several occasions, combined by journalists into three stories, we also need to ensure that we are not sending out too many releases on one subject at the expense of another.

In the past, we have issued releases that combine information on several talks, but this requires additional time. For practical reasons, NAM is a fixture of the universities' spring break and, in three of the past four years, Easter has fallen in the fortnight before the meeting. The abstract deadline tends to be a month before the meeting and we have to allow time for the abstracts to be collated, so usually we have three weeks to contact authors and write the releases. When Easter falls in this period and many of the authors are away on holiday, this is a very tight timescale. In 2008, several authors only made contact at the end of the week before the meeting and there was therefore no time to assess similarities and produce combined releases. As this appears to be an important issue, we need to work with future conference organisers to ensure an early abstract deadline, particularly when there are holidays in the run-up period to the meeting.

As a final point, although not directly linked to coverage, we noted with interest that nearly 20% of the releases issued had lead authors that were PhD students. NAM has traditionally had a large attendance by young scientists and it is often the first opportunity that they have to present their work at this scale of meeting. We believe that the experience of working on a press release about their research at such an early stage of their career should assist these young scientists in understanding the importance of communicating their work and finding the right level at which to pitch information. This must have benefits for astronomy communication in the future.

Conclusions

In the period 2005–08 NAM press releases have resulted in consistent coverage in key

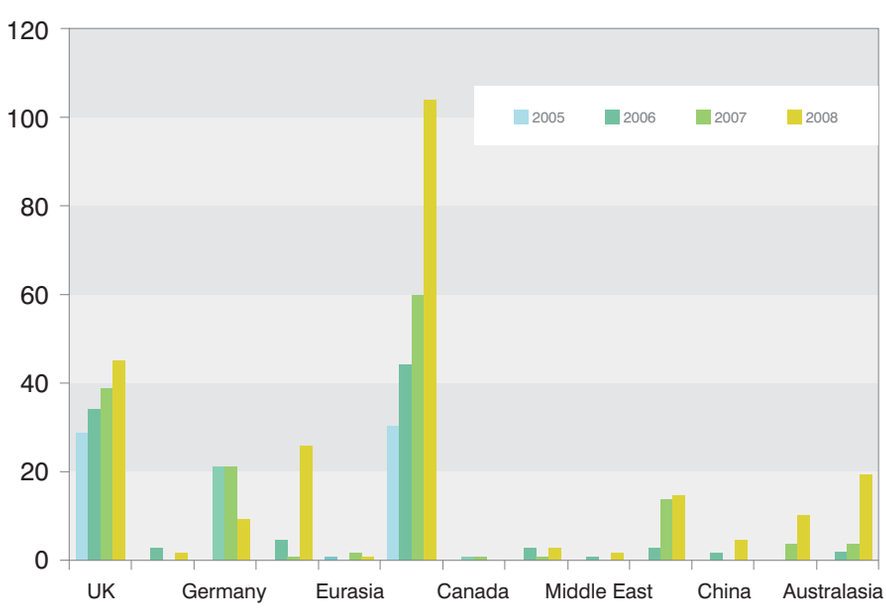

Figure 8. Total number of pieces of coverage by region for period 2005–08. Credit: The authors.

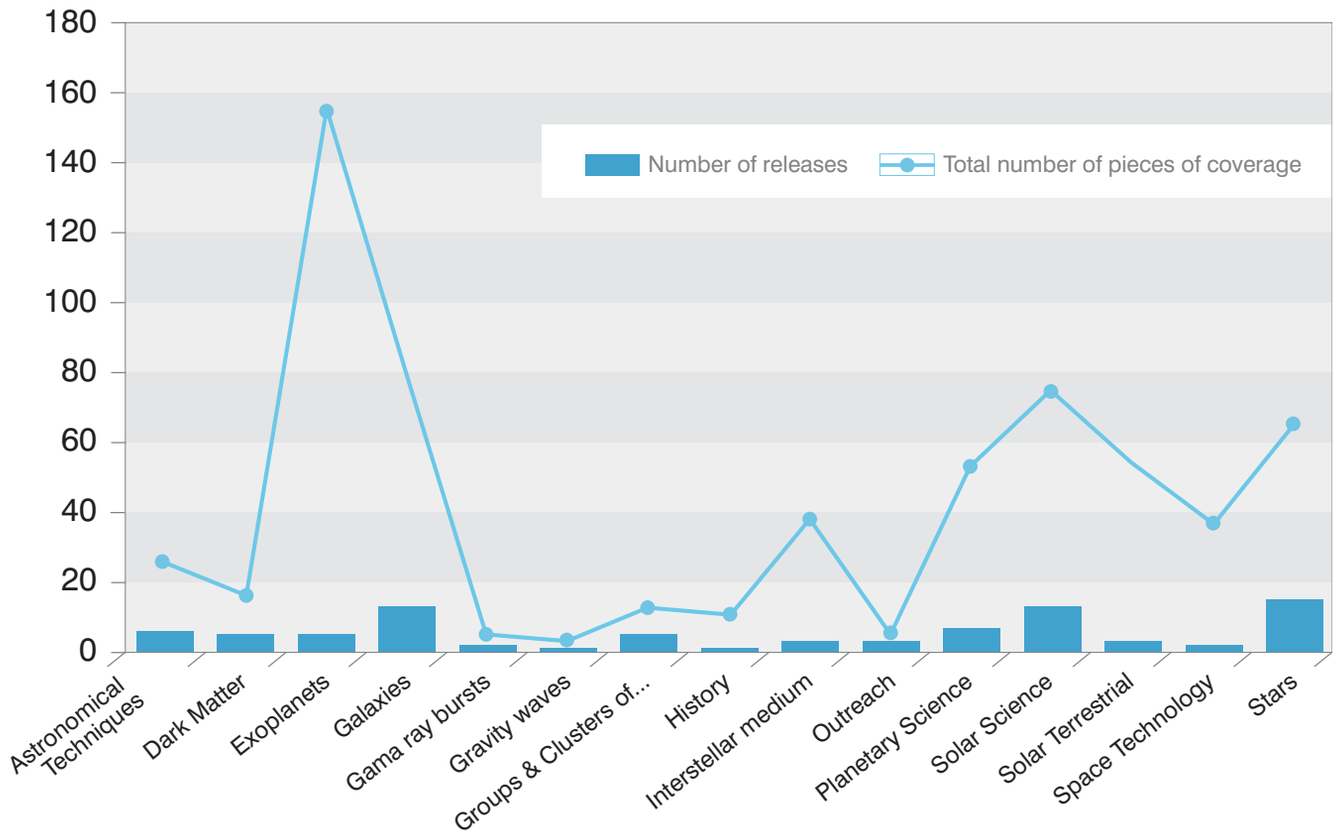

Figure 9. Average number releases and pieces of coverage by subject area over the period 2005–08. Credit: The authors.

publications and we are reaching an increasing audience via the internet on both general and specialist science news sites.

Although our findings result from an analysis of media coverage of NAM, we believe that the themes and trends may apply to other astronomy meetings. We have therefore formulated the following general conclusions:

- With half the coverage being generated by three releases, it is important to make sure prior to the meeting that the scientists featured in the "top" stories are fully prepared for the potential media attention and the time that they may need to spend in talking to journalists.

- Stories about exoplanets and the search for life in the Universe are by far the most successful in attracting coverage. Other topics of high media interest are solar terrestrial relations and space technology. However, press officers should produce a range of releases to represent the wider spread of research presented at the meeting.

- Stories on similar themes should be consolidated into a single combined release. If public holidays fall in the run-up to the meeting, an earlier abstract deadline should be set to give press officers time to carry out this work.

- AlphaGalileo and the AAS provide important dissemination services; however, their manpower is limited. Press officers should appreciate this and provide embargoed material as far in advance of the meeting as possible.

- Particular effort should be made to find stories that relate to the first day of the meeting week, even if few sessions are scheduled, as the tentative results of this four-year sample suggest that they have a higher chance of being picked up than stories issued at the end of the week.

Notes

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Acknowledgements

We would like to thank Peter Bond, Press Officer for the RAS during 1995–2005, for his comments.

Biographies

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Robert Massey is Press and Policy Officer at the Royal Astronomical Society, where he works to raise the profile of astronomy with the public at large. Robert started his career with a PhD from Manchester University and then worked for several years as a teacher in a further education college. From 1998 to 2006 he was Public Astronomer at the Royal Observatory Greenwich.

The International Year of Astronomy 2009 — Products

The IYA2009's aims include increasing scientific awareness and promoting widespread access to educational materials. To help achieve this, we are making a range of resources supporting these goals available. These materials have been designed with versatility in mind. Innovative, original and entertaining, the resources are adaptable and easily translated into other languages. They are excellent ways of promoting IYA2009, and will help involve the public at large. And, best of all, bulk discounts are available to IYA2009 partners and IYA2009 Single Points of Contact! For more information, please contact the IYA2009 Secretariat by e-mailing iya2009@eso.org or telephoning +49 89 320 06 195.

Astronomical Pictures at an Exhibition

An Adler Planetarium video suite, produced and directed by Jose Francisco Salgado, with music by Mussorgsky and orchestrated by Rave. In addition to presenting these inspirational and educational works, a lecture or Q&A session is usually offered as a pre- or post-concert event, and educational materials are distributed to audience members.

More information: http://svl.adlerplanetarium.org/videosuites

The Lives of Galileo, a journey through the history of Astronomy

The official IYA2009 cosmic comic book by Fiami. Astronomy and Galileo are presented in an historical, accessible and humerous comic book for the first time. In 40 colour-filled pages, organised into six stunning chapters, Galileo plays different roles through the ages as great astronomical discoveries are made.

More information: http://www.fiami.ch

Eyes on the Skies, 400 years of telescopic discovery

The International Astronomical Union's official book and movie celebrating the 400th anniversary of the telescope. The invention of the telescope is the single most revolutionary development in the history of astronomy. For thousands of years, astronomers had to rely on their eyes to unravel the mysteries of the Universe. The telescope unveiled an embarrassment of astronomical riches, and led to a dramatic increase in knowledge about the wider world we live in. The Eyes on the Skies DVD movie and accompanying book explore the many facets of the telescope — historical development, scientific importance, technological breakthroughs, and the people behind this ground-breaking invention, their triumphs and failures.

More information: http://www.eyesontheskies.org

IYA2009 Planispheres

Standard and customised planispheres or starfinders. Language, latitude, colours, design, size and number are yours to choose. The perfect planisphere for your IYA2009 activities.

More information: http://www.walrecht.nl

Contrary to Belief

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Key Words

Written Science Communication
Belief
Scientific Evidence

Put it before them briefly so they will read it, clearly so they will appreciate it, picturesquely so they will remember it and, above all, accurately so they will be guided by its light. Joseph Pulitzer

One of the primary goals of communicating science to the public is to capture the excitement of scientific discoveries while trying to follow the advice of Joseph Pulitzer. Writers and speakers often fall short of this goal and say too much, use too much jargon, or use picturesque language carelessly, as in saying that a neutron star is "incredibly dense", when the data have shown that the density is credible.

More problematic is the use of the word "believe", as in: "Astronomers believe that most galaxies harbour massive black holes at their centres", or: "Scientists believe that elements such as oxygen, silicon and sulphur are dispersed into the galaxy primarily by the explosion of massive stars."

In most cases, to paraphrase Helen Quinn (Quinn, 2007), these statements mean something like: "Based on the evidence at hand, this is what most scientists think is going on, and there is no good evidence to indicate otherwise." It is much briefer to say: "Scientists believe…", but not nearly as accurate.

For many readers, the word "believe" could indicate a statement of faith, as in: "He believes in God." Or it could be a statement that involves an educated guess, as in: "I believe the Red Sox will win the World Series again this year."

The latter is closer to what is meant when we say scientists believe, but does not reflect the state of scientific knowledge, which is well beyond an educated guess. In the example above, the evidence is strong that supernovae play a critical role in the dispersal of heavy elements and that supermassive black holes exist at the centres of most galaxies. It is healthy to maintain a little scepticism, but not to the point of describing the state of understanding inaccurately.

To say that: "The evidence indicates that most galaxies harbour massive black holes…" would seem to be a good compromise that satisfies both the brevity and accuracy criteria.

The search for knowledge using the scientific method proceeds in a random walk, with steps that can be forward, backward or sideways. It moves along a broad path, beginning with having an idea, to thinking something might be true, to being so sure as to say that we know it is true. For example, we know that gravity acts throughout the Universe, and that we can use our knowledge of the law of gravity to launch satellites and send them to planets in the outer reaches of the Solar System.

Progress along the path from ideas to knowledge is driven by applying the steps of the scientific method – observation, hypothesis and testing with more observations or experiments. Several hypotheses are almost always proposed to explain initial observations and further observations are undertaken to distinguish between the hypotheses.

For scientists who formulate hypotheses, the sobering fact is that most of their hypotheses will turn out to be wrong. But that's not necessarily a bad thing. As Nobel laureate Frank Wilczek said, "If you don't make mistakes, you are not working on hard enough problems."

The process of developing an idea into a working hypothesis and building models to test the hypothesis can take years or even decades before it finally becomes an accepted theory. In the meantime, the evidence indicates that we should be more careful and use phrases like "The evidence indicates…" instead of "Scientists believe…" when describing the state of scientific understanding.

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Biography

Wallace Tucker, an astrophysicist, is science spokesman for the Chandra X-ray Center at the Harvard-Smithsonian Center for Astrophysics. He has authored or co-authored several non-technical books on astronomy, the latest of which is *Revealing the Universe*, written with Karen Tucker.

The Universe in a Single Atom: Communicating Astronomy through Metaphor

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Key Words

Astronomy Communication
Metaphor

Imagination is more important than knowledge. – Albert Einstein

Effective science communication requires a return to the mind of a beginner. This is a critical detail to remember because astronomy is, above all else, a remarkably complex subject. Since astronomy is initially a study of the abstract, observations of mysterious targets in the archives of time, we slowly but surely forget our initial self. Novelty gives way to expertise. The problem is that effective astronomy communication requires a kind of scientific translation, a process made possible only by understanding the novice stargazer. And one of the best ways to accomplish this goal is communicating through analogy and metaphor.

We often think of metaphor as a tool for authors and poets. This, no doubt, is true. Delivering one idea through a separate, but more tractable idea goes back at least to the days of Aristotle, who studied its importance in epic verse. The modern use of metaphor has changed little in the 2000 years since its analysis among the ancient Greeks, and this is certainly true for astronomy. The Big Bang, dark matter, black holes, shooting stars and event horizons are all — at least in some respect — conceptual metaphors designed to wrap our heads around big ideas. While it may turn out that some of these descriptions are true (e.g. dark matter really is dark), much of this metaphorical work is used to satisfy the mind's insatiable appetite for concrete images. And this is precisely how we can find the Universe in a single atom.

Consider the relationship between atoms and the cosmos. Electrons whirling around an atomic core are a lot like planetary orbits, or so we have been told. Conversely, the parabolic paths of moving bodies turn out to be a nice analogy for zipping electrons. But astronomical metaphors have not always been so vivid. Consider Johannes Kepler's "music of the spheres", an attempt to connect music with motion in the Universe. As a result of his new understanding of the cosmos, the night's starry skies were no longer conceptualised as a perfectly aligned clock. Rather, Kepler's Universe fused a series of apparently unrelated dimensions (arithmetic, geometry and music), all of which contributed to a sublime understanding of the cosmos. Yet there is a sense that Kepler is after something far deeper than is revealed from the surface. For Kepler, astronomy could be neatly captured in a quirk of language based on analogy and metaphor. Beautiful as Kepler's music may have been, such metaphors have never been confined to astronomy.

A computer program, for instance, is neatly understood through the metaphor of branches in a tree. The mind, it has long been said, is like a computer. More recently, culture has been likened to a kind of mental software. Modern bridges, equipped with fibre optic cables and sensors, are analogous to structural nervous systems. Even cities are conceptualised in terms of living organisms, complete with proportionally scaled metabolisms. Our Universe, it seems, is ruled by mechanical properties best conveyed through elegant verse. There is poetry in the stars.

Such is the case with metaphor, my standard operating tool for explaining fundamental concepts in astronomy. Take Einstein's general theory of relativity, not only one of the most popularised ideas in all of science but also one of the least understood. The general theory has a profound impact on our lives, affecting everything from global positioning systems to mobile phones. And while the general theory continues to impact every corner of the planet, its basic principles are understood by few people. This is

why, during the course of explaining Einstein's general theory to a novice, metaphor remains my most reliable tool.

Consider the difference between tables and cubes. Instead of jumping into a complex 4-dimensional cube, I use an ordinary mental image of 2-dimensional flat space. This is the same planar geometry with which everyone is familiar, to which I add just a dash of complexity. Such layering requires one to imagine that their hard surface 2-dimensional plane is now a sheet of tensile fabric, such as a trampoline. And resting at the centre of the trampoline is a rather dense sphere which causes the spatial fabric to warp and stretch. The final phase asks one to envision the sphere spinning in place, its rapid revolutions causing the spatial fabric to warp and twist. And encompassing the entire process is a constant return to the original image, a hint of 2-dimensional space. If properly unveiled, the new example provides a vivid and practical visualisation that is rarely forgotten. The novice takes away a vivid mental model of Einstein's general theory of relativity.

But of course, this metaphor is old news. It is the same strategy used by one of astronomy's most ardent popularisers, Carl Sagan. Because of its effectiveness, it continues to be invoked by modern luminaries such as Brian Greene and Neil deGrasse Tyson. Yet it survives despite its imperfection, which is precisely the point. When lost in downtown Tokyo, the last thing one needs is a perfectly designed map. Instead, the greatest navigational aid is a simplified depiction of Tokyo illustrating only its key landmarks and structures. The same holds true for effective astronomy communication. Since graphic images are sometimes not at our disposal, as is often the case in public astronomy, the creative use of language becomes our strongest ally. And at the root of this strategy is analogy and metaphor.

All of this brings us back to the beginner's mind, which is the state of our initial understanding of a complex problem. Grasping difficult astronomical concepts requires dedication and focus, qualities that usually lead to an intensely narrow perspective. Such are the requirements for grasping basic astronomical principles. But with a little help, we can learn to recall our first glimpse into the night sky and then transfer that knowledge on to others. Fortunately, the vehicle of analogy and metaphor can help take us there.

Biography

Matthew McCool teaches writing at Southern Polytechnic SU (Atlanta Georgia, USA). He studied intercultural communication at New Mexico SU (USA), literature and philosophy at the U of Illinois at Springfield (USA), and neuroscience at the SIU School of Medicine. He is finishing a book about intercultural writing called *Writing around the World* (Continuum).

Harry Potter and the upcoming Venus–Jupiter Conjunction: a Unique Outreach Opportunity

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Key Words

Astronomy Outreach
International Year of Astronomy 2009
Children
Arts and Entertainment

Summary

As we prepare for the International Year of Astronomy 2009 (IYA2009), we should be on the lookout for celestial events which we can use not only to popularise the IYA2009 and practise our outreach skills, but which also have natural connections to popular culture. The Venus–Jupiter conjunction this fall is such an opportunity, given several direct connections to the use of astronomy in J. K. Rowling's famous Harry Potter universe.

One of the most beloved children's book series of our day is J. K. Rowling's Harry Potter universe. Comprising seven thick tomes published between 1997 and 2007, Rowling's works have shattered publishing records worldwide. Individual books have been included on numerous "favourite books of all times" polls taken in several countries, and the series is commonly mentioned in the same breath as classic fantasy series such as J. R. R. Tolkien's *The Lord of the Rings* and C. S. Lewis's *The Chronicles of Narnia*. Books 1–5 have already been made into motion pictures, which have also set new box office records, with *Harry Potter and the Half-Blood Prince* to appear on movie screens in July 2009, and two films based on the series' final book, *Harry Potter and the Deathly Hallows* set for release in 2010 and 2011. Although the pure literary value of her works has been debated, some have argued for her inclusion in the official "canon" of children's classics based on the ability her works to turn millions of children (and adults) into voracious readers (Allsobrook 2003).

Readers quickly find themselves completely immersed in Rowling's secondary world, and characters, both major and minor, become personal friends. Some of these characters have names easily recognised from history and mythology (such as Ptolemy), while others are named after heavenly bodies (Heckert 2008; James 2007). From Hogwarts astronomy teacher Aurora Sinistra to students Luna Lovegood and Draco Malfoy, to the Death Eater Bellatrix LeStrange and witch Merope Gaunt (mother of Harry's arch-enemy, Lord Voldemort), astronomical names are common in the Potterverse. Indeed, in the Black family alone we find names such as Sirius, Alphard, Cygnus, Cassiopeia, Orion, Pollux, and Regulus. As C. Renee James (2007) noted, Rowling's works provide a "vast new avenue for astronomy outreach". For example, the New Jersey Astronomy Center for Education developed a planetarium show entitled "The Skies Over Hogwarts" based on these and other astronomical references in the Potterverse. In his popular-level book, *The Science of Harry Potter*, Roger Highfield (2002) engaged readers by comparing the antigravity properties of flying broomsticks to dark energy, and Harry and Hermione's travels in time and location to wormholes and parallel universes.

Rowling herself seems to understand the value of an astronomy education, as demonstrated in numerous passages in Book 5, *Harry Potter and the Order of the Phoenix*. As part of their Hogwarts curriculum, Harry, Ron and Hermione are required to write an essay on the characteristics of the Galilean moons of Jupiter, and Rowling gets the science right. As Hermione explains to Ron, "Jupiter's biggest moon is Ganymede" and "it's Io that's got the volcanoes" (Rowling 2003). Science@NASA production editor Tony Phillips took advantage of this passage soon after the publication of the book by writing a feature article to interest children visiting the NASA website in learning more about these fascinating moons (Phillips 2003). One of the culminating events of the Hogwarts curriculum each June is the OWL exam (Ordinary Wizard Level), which includes both a written astronomy exam and a practicum involving observing the night sky with a telescope. Readers follow along as Harry carefully plots the positions of various celestial objects on his star map, including the planet Venus, which he locates and views through his telescope near midnight. More than one astronomically-minded reader has initially thought: "View Venus near midnight? Impossible!" However, as Kevin Krisciunas (2003) pointed out in a letter to *Sky and Telescope*, it is possible in some years for Venus to remain above the horizon that late at night in England.

However, as is the case with many writers, Rowling's astronomy is far from perfect. For example, one of the objects Harry and friends supposedly view during their June practicum is Orion, which as several authors have noted is clearly impossible (Pasachoff 2003; Weinstein 2007). In the first book, *Harry Potter and the Philosopher's Stone* (1997), much is made of Mars's "unusual brightness", at odds with the actual appearance of Mars at the time of the book's events (May 1992), according to the timeline of the series (Weinstein 2007). In book 3, *Harry Potter and the Prisoner of Azkaban* (1999), werewolf Lupin notes that he was suspiciously ill at the times of full Moon, but the dates of his "episodes" did not follow a 29.5 day cycle (Weinstein 2007). But with a little creativity, all astronomical references, regardless of scientific accuracy, can be turned into valuable lessons on astronomical concepts (Larsen & Bednarski 2008).

One of the most common Harry Potter-themed astronomy outreach activities has been the star party held in conjunction with the release of individual books in the series. Such activities have been held at bookstores to entertain devoted fans waiting in line for the midnight release of the book (Jones 2003) or larger scale events held at science centres such as the Jodrell Bank Visitors Centre (Lowe 2007a,b,c). Such events are of interest as we gear up for the International Year of Astronomy in 2009, since they align with the goal of increasing opportunities for the general public to look through a telescope, as well as the IYA2009 USA National Node's "Arts and Entertainment" programe.

Although there are no further books planned in the Potterverse, the mid-2009 release of *Harry Potter* and the Half-*Blood Prince* offers an ideal opportunity for us to flex our outreach muscles in preparation for IYA2009 and also publicise IYA2009 itself to the general public. Besides the astronomical references already listed, there is another class of astronomical events that is prominent in *Harry Potter and the Order of the Phoenix* — planetary conjunctions. On 30th of November and 1st of December, Jupiter and Venus pass within 2 degrees of each other, with the crescent Moon joining in on the second night. Given the importance of Venus and Jupiter in the OWL examination and its preparation, and the numerous references to conjunctions in the same book, Potter fans would be delighted to follow in the footsteps of their idol and view these objects in a telescope with their own eyes. Since sunset is approximately 4:30 p.m. (at mid-latitudes) on these nights, and the planets are visible for about three hours afterwards, even the youngest Potter fans can easily attend special events at local science centres, planetariums and observatories.

Due to the brightness of the planets, light pollution is not an issue, making sidewalk observing sessions at local movie theatres another realistic possibility. Attendees can be given their own OWL certificates for completing telescopic observations, and special Harry Potter starwheels can be distributed (Larsen 2008). Since the phases of Venus and Jupiter's moons were among Galileo's initial telescopic observations, important links can be made to the upcoming IYA, and attendees can be made aware of the historical importance of 2009 and local plans for celebrating the IYA. If these references aren't enough reason for celebrating this celestial alignment with muggles and wizards alike, consider this final fact: the planets are gathering in Sagittarius, and as any Potter fan knows, centaurs are stargazers at heart, having "unravelled the mysteries of these movements over centuries" (Rowling 2003: 531).

As philologist and fantasy writer J. R. R. Tolkien noted, "Fantasy is a natural human activity. It certainly does not destroy or even insult Reason; and it does not either blunt the appetite for, nor obscure the perception of scientific verity" (1997). Thanks to Rowling's fantasy series, young people around the world have had their astronomical appetites whetted. We should not waste this opportunity to feed their fascination further and turn it toward astronomical reason.

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Biography

Kristine Larsen is Professor of Physics and Astronomy, and Director of the University Honours Program, at Central Connecticut State University. The author of two popular level books, *Cosmology 101* and *Stephen Hawking: A Biography*, she has widely published and presented on connections between astronomy and the works of J. R. R. Tolkien.

Science Journalists Speak Their Minds

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Key Words

Journalism
Questionnaires
Media

Summary

Science journalists are a vital link in the process of communicating science to the public, and yet their personal opinions are rarely taken into account. This paper documents a small-scale attempt to rectify this situation, by asking journalists to complete questionnaires designed to provide an insight into their working practices.

Since journalists play a central mediating role in the dissemination and communication of science to the public, often translating scientific jargon into more accessible language, it is important to know their views on the process. It also is also important to identify the nature of any barriers that can prevent European research from reaching the news headlines, as far as journalists are concerned.

The questionnaire

A questionnaire was produced and sent to science journalists working in different areas of the media throughout Europe. The questionnaire was designed to gather general information about the way science journalists work, their educational backgrounds, their sources and their view of the kind and quality of information that reaches them or that they are able to acquire. These results should be seen purely as an informal survey — a sort of "vox pop" of opinions on the subject of science communication from a small number of European journalists. Too few journalists in too few European countries were contacted to give the data any real statistical validity, but the results are an indication of possible trends among professionals working in the European media.

The questionnaire was divided into two sections to allow us to gather both quantitative and qualitative data. The first part consisted of questions with closed answer options and the information gathered was intended to frame and characterise both the journalists and their work in terms of quantities and percentages.

The second part of the questionnaire allowed the respondents to express their views in a less restricted manner and was designed to obtain qualitative and personalised information.

The questionnaire form, designed in Microsoft Word, used check boxes and text fields to make it as quick and easy to complete as possible. The form was protected to ensure that both the formatting and the text of the questions remained unchanged. It was then sent by e-mail as an attachment, accompanied by a short explanation of the purpose and aim of the research. A Portuguese version was also produced.

Table 1. Types of Media

- Newspapers
  - » Daily
  - » Weekly
  - » Online
- Weekly Magazines
  - » Specialised
  - » General Interest
- Monthly Magazines
  - » Specialised
  - » General Interest
- Television
- Radio
- Science website
- Science blog

The results

Framing the information

The following results are based on a sample of 28 questionnaires received from science journalists from the UK (14), Portugal (8), Germany (2), France (2), Romania (1) and the Netherlands (1).

The responses came from journalists working in all the types of media referred to in Table 1.

Most of the journalists work for several types of media simultaneously. In this particular sample, 50% were freelancers and 61% write exclusively on scientific topics. Only 50% of the journalists who responded to the questionnaire have an academic background in science, most of them in physics, astrophysics or mathematics.

Figure 1 shows the sources most frequently used for science news by the respondents.

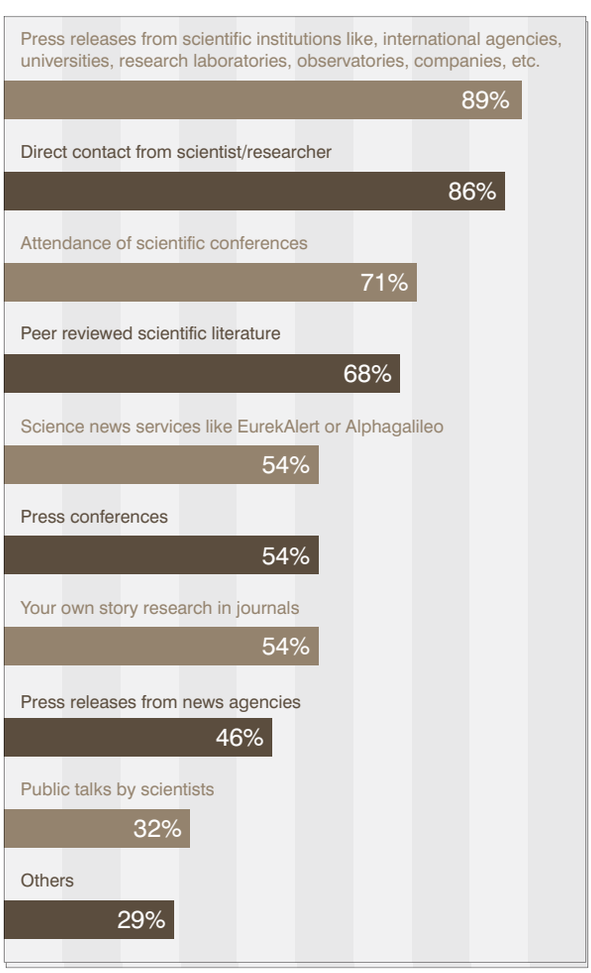

Figure 1. Most frequent sources for science news. Credit: Authors.

The journalists were also asked what was important for them in this form of communication, with "Subject" and "Credibility" coming first in the responses. The complete results are shown Figure 2.

In this group of journalists, 46% always contact the principal scientist or someone directly involved in the scientific research/discovery when they research a topic, while the remaining 54% only do so sometimes. The majority (79%) consider it "easy" to contact the scientists.

The analysis of answers to this questionnaire show us that science stories are not often passed over by editors in favour of more popular subjects. In fact, 43% of the interviewees state that this "never" happens to them while 46% say this only happens "sometimes".

The results seem to confirm the popularity of astronomy and space sciences with the media and the public. 64% of our interviewees state that these subjects are "very important" in their work when compared to other sciences and 25% consider it "of some importance". Only 11% regard it as "not important".

In the first eight months of 2007, most of these journalists (93%) had already completed stories, features or programmes on astronomy and space sciences.

Speaking their minds

In questions 14 and 15 of the questionnaire, interviewees were asked to list the things that made their work as a science journalist difficult and things that would make it easier. By allowing journalists total freedom in their answers, this part of the questionnaire produced some quite interesting comments and insights into what journalists think about their relationship with scientists, science institutions, press officers and news agencies. The results seem to confirm a certain climate of suspicion and friction between the journalistic and scientific communities (Gregory & Miller, 1998) and indicate that there is still much to do in finding a common language and work methods that suit both journalists and scientists. The following comments reflect the journalists' points of view and may provide clues as to why the presence of science topics is unsatisfactory in the European media when compared, for instance, with what happens in the USA.

To avoid wrongful or misleading interpretations, we have opted to transcribe unedited the most significant comments from the respondents (the answers written in Portuguese were translated). As this questionnaire was anonymous, the names of the interviewees are omitted. The views and opinions presented are those of the respondents and not of the authors. Although all the following comments are unique and reflect personal views, we have chosen to group them in similar categories, in order to facilitate the organisation and understanding of the information.

Things that make the work of a science journalist hard

"Time to prepare and write the texts."

"*Not enough space to explain certain things.*"

"*Time differences between UK and US.*"

"*Quickly finding experts for interviews.*"

"*Balancing the need to meet tight deadlines, yet understanding the topic in question well enough to write a factually sound piece.*"

"*Lack of sympathy from TV schedulers to science programmes.*"

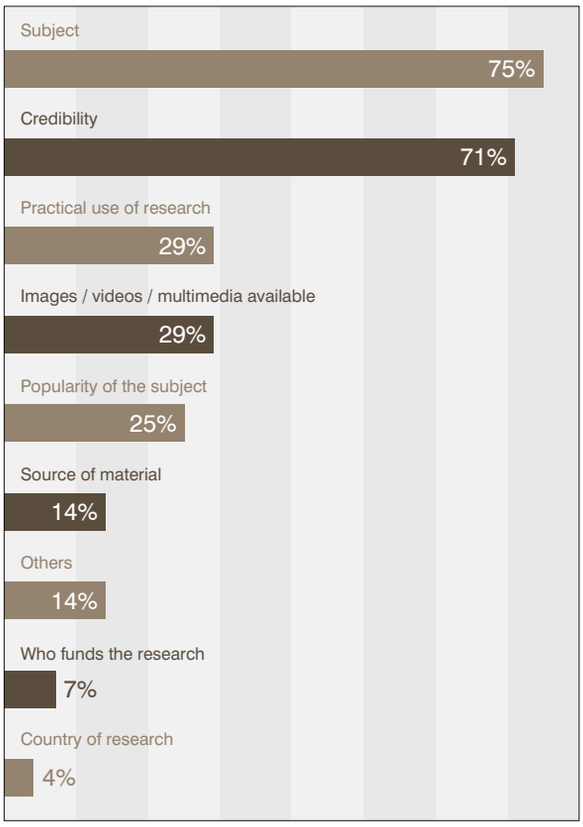

Figure 2: Most relevant aspects for choosing a press release. Credit: Authors.

"*Convincing TV commissioners to show programmes about science.*"

The different meanings of "news value" for different professional groups

"*PRs that waste my time trying to sell pointless surveys.*"

"*Convincing editors that science doesn't need to have an immediate application to make a good story.*"

"*When press officers present bland research as major 'breakthroughs' in press releases.*"

"*Selling stories to editors.*"

"*Stories about new images that have lousy images.*"

"*Making sure the images are all available and at high resolution.*"

"*Better definition of news value and credibility of the scientific paper, as every researcher seems to think they are doing groundbreaking research.*"

Language and communication problems that affect the work of journalists

"*Bad reporting or inaccurate reporting of science stories makes the scientific community and the public distrust all science journalists and it makes my life more difficult, it should stop.*"

"*Responding to, or clarifying, stories appearing in mainstream news outlets that sometimes confuse the prevailing scientific data.*"

"*Making science/scientists easily understood by general audience.*"

"Stimulate scientists to help me find metaphors that are accurate and appealing at the same time."

"*Scientists are not always skilled in translating their often specialised language into ideas that can be understood even by the specialised press.*"

"*Encouraging scientists to make their work accessible/easily understood.*"

"*Obscure press releases [this is a very minor hardship, but sometimes releases are pitched at such a low-level that it's hard to work out what's new; sometimes they merely bury the news].*"

"*Scientists' difficulties in expressing themselves and in communicating.*"

"*When scientists back away from their grandiose claims once you go on record.*"

"*Researchers being unavailable, especially during conferences.*"

"*Poor number of releases for European science missions.*"

Uneasiness in the relationship between the media and scientific institutes, scientists and journals

"*PRs that are over-controlling (the ones that basically don't trust their own scientists).*"

"*The fear of God put into researchers by the journals (which makes them dither about whether they can talk to you).*"

"*Organisations are sometimes overly bureaucratic and defensive in nature with respect to journalists.*"

"*Lack of centralised EPO responsibility within ESA and ESA member-states.*"

"*Restricted access to some journals on the internet.*"

"*Embargoes.*"

"*Scientists are sometimes overly wary of journalists' intentions.*"

"*Locations of scientists.*"

"Release of papers when key researchers are on holiday."

Things that would make the work of a science journalist easier

"*More time!*" (x2)

"*More broadcasting time.*"

"*Greater appreciation by TV schedulers of science programmes.*"

"*More time to investigate the issue.*"

"*More space in newspapers.*"

"*More resources to allow in-depth coverage of stories of note.*"

"*More thought given to image availability.*"

"*Available footage.*"

"*Available animations.*"

"*Better images, videos and graphics for online content.*"

"*For press releases about science to be written by the scientists themselves or rather to at least be checked for accuracy by the scientists, rather than being written by a press person trying to 'sell' a story and getting facts wrong or playing up one area that they think has more popular appeal. As a science journalist, I can generally work out for myself what the merits of a piece of science are.*"

Language and communication problems that affect the work of journalists

"*If scientists realised that journalists are not scientists, and that they write science divulgation articles, not papers.*"

"*Mandatory communication training for scientists ;).*"

"*More scientists who are able to talk simply and clearly about complicated subjects.*"

"*Well thought out press releases and background information for journalists wishing to delve into the material, perhaps as a supplement to the main press release that must be written for a wider number of less-interested people.*"

Uneasiness in the relationship between the media and scientific institutions, scientists and journals

"*A better understanding of the role of the media by the scientists.*"

"*For the popular science journals (Science & Nature etc.) to make sure the scientists are not away when they decide to publish their paper.*"

"*Greater professionalism from the scientific institutions in communicating results.*"

"*For ESA and its member states to have a centralised contact or department for outreach, etc.*"

"*Open access journals.*"

"*Better availability of scientists (x2).*"

"*That more scientists look at journalists as allies and not a necessary evil… and stop asking to read the articles before they are published.*"

"*Better attitude from scientists to the media.*"

"*More notice of forthcoming stories.*"

"Less liaison by public relations agencies that often know little about the work."

"*Direct access to principal researchers once the material is public.*"

"*If some scientists stopped thinking of us as a parasitic subspecies.*"

What have we learned from these results?

Previous media studies have underlined that the two professional groups are dissimilar in working practices and professional values (Dunwoody & Ryan, 1983). After reading these comments we are left with the impression that the scientific community needs a better understanding, working knowledge and "culture appreciation" of the media and how they operate.

Also, Peters (1995) showed that scientists and journalists act within different value-systems, following interviews with German scientists and journalists to identify differences in perception of what constitutes "good" science communication in the media. Peters notes that scientific papers, for example, seek to legitimate specific research by referring to a more general, commonly perceived research with a strong focus on presenting results and proving their validity. On the other hand, for journalists, important issues are: who performed the work, what the results mean and what the likely impact of the research is.

As Fahnestock (1986) notes, in public communication the purpose is to celebrate, not to validate. Also, the communication must be explicit about the value of the results, discoveries, etc. This makes the rhetorical genre of journalism very different from that of the scientific paper.

It may be necessary for journalists to understand the way the scientific community operates in terms of communication. To quote Nelkin (1995), "scientists and journalists must accept and come to terms with an uneasy and often adversarial relationship".

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Biographies

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Lee Pullen puts his astronomy degree and science communication master's to good use, engaging a wide range of hard-to-reach audiences. He specialises in science education and journalism, having taught several thousand people about the cosmos and regularly writing for NASA's astrobiology webmagazine. His website can be viewed at www.leepullen.co.uk.

Communicating Astronomy around the World

Opinion

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Key Words

Cooperation
Cultures
Multilingualism

As with any complex topic, communicating astronomy to a diverse audience is a multipart process. One must distil not only the most important pieces of an idea, but also effectively deliver its main points to a novice. Effective astronomy communication is difficult because one never truly knows the reader's limitations. As a result, the best strategies tend to use a series of simple and accumulative analogies and metaphors. The final result, hopefully, is a vivid, clear and concrete image. While effective, this strategy regularly fails among readers from many of the world's cultures.

Communicating Astronomy

Effective astronomy communication requires one to refine the simple from the complex. Distilling core concepts from a sea of complexity is often difficult, as in the case of brain science. Imagine walking into a room full of neuroscientists talking about the inner workings of the brain. The conversation centres on exotic brain modules, strange neuronal systems and obscure Latin terms. Without a training in neuroscience, the discussion sweeps over a world that might as well be fiction. The key in this instance is to translate the technical ideas of neuroscience for a general audience properly. This is an easy process when first learning a complex topic, but increases in difficulty with greater knowledge.

Although astronomy communication is a difficult task in itself, culture adds an additional layer of complexity to an already thorny process. And one of the best ways for understanding these cultural complications is through two different communication strate-

gies — writer responsibility and reader responsibility (Table 1).

Some cultures rely on what is called writer responsibility. Writer responsibility is characterised by something called parallel progression, which means that the topic of one sentence overlaps the topic of the next sentence. Parallel progression also means that a reader's failure to understand a passage is usually thought to be the writer's responsibility. Most astronomers who speak English as a native language are accustomed to writer responsibility. And perhaps unsurprisingly, this is also why most popular advocates of astronomy come from writer-responsible cultures.

Table 1. Primary differences between writer responsibility and reader responsibility.

Writer responsibility	Reader responsibility
Parallel progression *AB* to *BC* to *CD*	Sequential progression *AB* to *CD* to *EF*
Wide audience	Narrow audience

At the other end of the spectrum is reader responsibility. As the name suggests, when miscommunication arises the responsibility is usually placed on the reader. Reader responsibility is characterised by something called sequential progression. This means that the topic of one sentence is closed and followed by another topic in the next sentence. Many cultures subscribe to reader responsibility, but Japan is possibly the most important for the field of astronomy.

Writer responsibility and reader responsibility are just two conceptualisations of how culture affects communication. While no culture is purely writer responsible or reader responsible, most lean toward one of these two strategies. The best way to see this difference is through an example of how the contrasting strategies affect communicating the cosmos.

Culture, Communication and the Cosmos

Although intercultural writing is far more complex than the distinction between writer responsibility and reader responsibility, awareness of this basic polarisation is a useful strategy for increasing the effectiveness of astronomy communication. Consider a writer-responsible passage on the redshift phenomenon, which is used for inferring the motion, speed and direction of moving astronomical objects.

The term redshift means that electromagnetic energy in the form of visible light has shifted toward the red end of the spectrum. Objects at the red end of the spectrum are moving away from our point of observation. From our point of observation, many astronomical objects express redshift signatures as a result of our expanding Universe.

The first sentence ends with a comment on light at the red end of the spectrum, which is immediately picked up by the beginning of the second sentence. The second sentence takes the idea of red light and applies it to our point of observation. The third and final sentence continues the process by carrying our point of observation to the expanding Universe. Each sentence overlaps the next sentence. As with most forms of writer responsibility, this passage may be expressed symbolically as *AB* to *BC* to *CD*.

The purpose of writer responsibility is to make sure an idea is clear for many different readers. Arguably, it is easier to capture and retain a reader who is constantly aware of the scope and location of a main idea. Because writer responsibility is a highly effective form of communication, it is perhaps unsurprising that most scientific journals, astronomy websites and even podcasts follow writer responsibility.

In contrast, reader responsibility places the onus of communication on the reader. Consider a similar passage on the redshift phenomenon from a reader-responsible perspective.

The term redshift means that electromagnetic energy in the form of visible light has shifted toward the red end of the spectrum. Astronomical objects with blueshift signatures are moving toward our point of observation. The galaxy Abell 1835 IR1916 has a redshift signature.

The first sentence begins in precisely the same way as the writer-responsible paragraph. The difference, however, is immediately obvious at the beginning of sentence two. Instead of picking up on the final section of sentence one (redshift), sentence two immediately begins explaining the blueshift phenomenon. Clearly, the red light at the end of sentence one and the blue light at the beginning of sentence two are not the same topic. A similar occurrence is found in the final sentence. Instead of discussing our point of observation in relation to visible light, the final sentence provides an example of a galaxy with redshift properties.

Although all three sentences are related to electromagnetic radiation, visible light and the shifting of objects in relation to that light, they demonstrate three separate topics. Each sentence feeds into a related, but separate sentence. As with most forms of reader responsibility, this passage may be expressed symbolically as AB to CD to EF.
The primary purpose of reader responsibility is to convey a message without insulting the reader, if only the right kind of reader. The idea of reaching out to a wide audience is foreign among reader-responsible cultures. And as a result, reader responsibility seeks to please by offering what may seem to be unnecessary details. Stating the obvious is not only perceived as unnecessary, but ridiculous.

Summary

Cultures use different strategies for communicating the cosmos. At one end of the spectrum is writer responsibility, which carries the reader through each step of the process. The main strategy for this approach is called parallel progression, in which the topic of one sentence overlaps the topic of the next sentence. The sequential progression of reader responsibility is found on the other end of the spectrum, which demands more of the reader. Instead of overlapping ideas across sentences, reader responsibility covers distinct, but related topics in successive sentences.

Both reader responsibility and writer responsibility are effective forms of communication, but only within a given cultural context. A problem arises, however, when scientists and astronomy enthusiasts communicate with different values and beliefs. This is unfortunate because pondering our place in the cosmos is one of the few areas of universal human enquiry. And this is why culture should never interfere with communicating astronomy around the world.

Biography

Matthew McCool teaches writing at Southern Polytechnic SU (Atlanta GA, USA). He studied intercultural communication at New Mexico SU (USA), literature and philosophy at the University of Illinois at Springfield (USA) and neuroscience at the SIU School of Medicine. He is finishing a book about intercultural writing called *Writing around the World* (Continuum).

Neighbourhood Watch: Solar System Exploration during 2009

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Key Words

Solar System Missions
Public Involvement
Engagement

Summary

For the Planetary Society, the International Year of Astronomy 2009 is simply a continuation of our mission since 1980 of directly involving the public with space exploration. It provides us with the opportunity to extend our message to people around the world and to involve them in the increasingly international planetary exploration missions.

This article will highlight some of the important planetary missions due to take place throughout 2009, as well as explaining methods of engaging the public with these events and highlighting the need for international cooperation.

Overview of Upcoming Planetary Exploration Missions

The frontier days of space exploration, once a battle for bragging rights between two super-powers, are history. Although national pride is still unquestionably an important reason that governments fund missions, space research is an increasingly international activity. Many of the next steps in the exploration of our neighbourhood in the Solar System are so daunting that they seem unlikely to succeed without the commitment and cooperation of many (if not all) of Earth's space-faring nations. Establishing a permanent presence on the Moon; advancing the scientific study of the mini-solar systems and ocean-filled moons of Jupiter, Saturn, and beyond; returning scientifically useful samples of rocks from the surface of Mars; extending the presence of humans beyond Earth orbit to the Moon, asteroids, and Mars - all of these will require billions of dollars and the kind of effort that only seems to be sustainable when departments of state, not just space agencies, commit to working together toward common goals.

As 2009 opens, more than 20 spacecraft are set to explore the planets and smaller bodies of our Solar System or to continue their lengthy journeys, and three more launches toward Mars are planned. A selection of significant events is outlined in the following two tables.
Every one of these spacecraft has been funded by the taxpayers of space-faring nations, not only Americans and Europeans, but increasingly Asians as well.

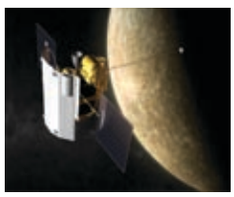
One of the most interesting missions in Table 1, overleaf, is the Russian *Phobos-Grunt* sample return. It will contain the Living Interplanetary Flight Experiment (LIFE) "bio-module" that will carry a collection of living organisms on a three-year trip to the Martian moon Phobos and back, aboard the capsule. This journey will test the hypothesis that life can move between planets inside rocks blasted off one planetary surface by impacts, to land on the surface of another world. For example, if a rock on Earth contained life and were blasted off, could it survive until it reached Mars? Or, if life existed on Mars, could it have been transported to Earth?

Inviting the Public to Participate in Space Exploration

The Planetary Society (TPS) strongly believes that the public should not only be told about the lessons learned from these missions, but also be invited to ride along for the adventure.

Table 1. Planetary exploration missions active in 2009.

Inner Solar System



MESSENGER (NASA)
En route to Mercury orbit insertion in 2011, *MESSENGER* will fly by Mercury for the third time on September 29. Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington.

Venus Express (ESA)
Venus Express' nominal mission will have ended in September 2008, after two Venus sidereal days in orbit, but with the spacecraft in good health its mission is expected to be extended. Credit: ESA

The Moon

Kaguya (JAXA)
Kaguya will have finished its primary mission in October 2008, but is expected to continue mapping the gravity field of the Moon and capturing high-resolution stereo images into 2009. Credit: JAXA.

Chang'e 1 (China)
Shortly after the lunar orbit insertion of *Chang'e 1*, Chinese officials announced that the fuel margin should permit them to double the length of its science mission to two years. Credit: CNSA.

Chandrayaan-1 (India)
Expected to launch in autumn 2008, *Chandrayaan-1's* lunar mapping mission will continue through 2009. Credit: ISRO.

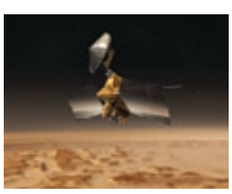
Lunar Reconnaissance Orbiter (NASA)
Expected to launch in November or December 2008, *Lunar Reconnaissance Orbiter's* mapping mission will continue through 2009, after which it will serve as a communications satellite. Credit: NASA

LCROSS (NASA)
Launching with *Lunar Reconnaissance Orbiter, LCROSS* will impact the lunar south pole in January or February 2009, an event that will be watched by Earth-based astronomers including a worldwide amateur community. Credit: NASA

Mars

2001 Mars Odyssey (NASA)
Although long past the end of its primary mission, 2001 *Mars Odyssey* shows no signs of faltering and will likely still be mapping Mars and serving as a communications relay for the rovers. Credit: NASA/JPL

Mars Express (ESA)
In orbit since 2003, *Mars Express'* mission will likely be extended again to continue its mapping of the surface and subsurface of Mars. Credit: ESA.



Mars Reconnaissance Orbiter (NASA)
Mars Reconnaissance Orbiter's primary function in its extended mission will be to serve as a communications relay, but throughout 2009 the *Phoenix* mission will be over and the *Mars Science Laboratory* not yet arrived, so its Mars mapping should continue. Credit: JPL/NASA.

Mars Exploration Rovers (NASA)
Although both *Spirit* and *Opportunity* are showing signs of their advanced age, there is no reason to expect that they will not survive until 2009, when spring and summer in Mars's southern hemisphere should bring them warmer temperatures and more solar power than they enjoyed in 2008. Credit: NASA/JPL/Cornell University/Maas Digital.

Mars Science Laboratory (NASA)
The *MSL* rover is currently scheduled to launch toward Mars in September 2009 for a summer 2010 landing. Credit: NASA/JPL-Caltech.

Phobos-Grunt (Russia)
Phobos-Grunt is currently scheduled to launch toward Mars in October 2009 to collect samples from Mars's moon Phobos and return them to Earth. Credit: Paolo Ulivi.

Yinghuo-1 (China)
China's first mission beyond Earth orbit will hitch a ride to Mars with the *Phobos-Grunt* spacecraft, launching in 2009. Image credit: CNSA.

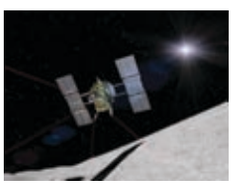
Table 1. Planetary exploration missions active in 2009 (Cont.).

Saturn

Cassini-Huygens (NASA/ESA/ASI)
Throughout 2009 the *Cassini* orbiter will be in its first extended mission, continuing studies of Saturn, its rings and its moons; highlights will be three exceptionally close flybys of the geyser moon Enceladus, and witnessing the arrival of Saturn's equinox in August. Credit: NASA/JPL.

Deep Space / Cruise

Dawn (NASA)
Throughout 2009 the ion-powered *Dawn* spacecraft will be en route to a 2011 arrival at the asteroid Vesta. Credit: McREL.

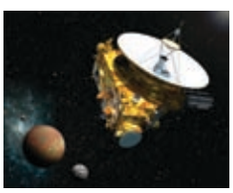


Hayabusa (JAXA)
Although seriously injured during its dramatic touchdown on asteroid Itokawa in 2005, *Hayabusa* continues to persist in its attempt to return its sample capsule (which may or may not contain a sample) to Earth in 2010. Credit: LiVE Company Ltd.

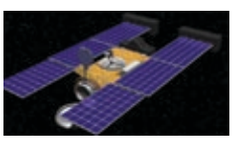
Rosetta (ESA)
ESA's flagship mission to a comet will fly by Earth for the third time on November 13, en route to its planned May 2014 arrival at comet Churyumov-Gerasimenko. Credit: ESA - C. Carreau.

Voyager 1 and 2 (NASA)
The two long-lived spacecraft will hopefully still be returning data from the interstellar medium beyond the Solar System. Credit: NASA/JPL.

Deep Impact (NASA)
The *Deep Impact* spacecraft will be continuing its follow-up studies of extrasolar planets as it travels toward a 2010 rendezvous with Jupiter-family comet 103P/Hartley 2. Credit: NASA/JPL/UMD.



New Horizons (NASA)
New Horizons will spend most of 2009 hibernating, as it will not reach Pluto until 2015. Credit: Johns Hopkins University Applied Physics Laboratory/Southwest Research Institute (JHUAPL/SwRI).



Stardust (NASA)
Throughout 2009, *Stardust* will be cruising toward a February 2011 encounter with Tempel 1. Credit: NASA/JPL.

One method of helping people to feel a sense of ownership over various space missions is to facilitate "Messages from Earth" opportunities . These allow the public to send their names and, sometimes, well wishes along with planetary missions. The oldest example is still in orbit around Saturn: *Cassini* carries a DVD with 616 400 handwritten signatures from people living in 81 countries, scanned to digital format. The advent of the internet has made collecting names easier, so two DVDs each containing four million names were sent with the Mars Exploration Rovers. With *Phoenix*, a DVD was included containing "Visions of Mars", a collection of Mars-inspired literature, art and personal greetings from leading space visionaries of our time.

Another example of involving people is the SETI@Home project where members of the public share idle time on their computers to analyse radio signals from space. TPS is continuing this method of encouraging participation through the Stardust@home project . After completing a short online training session, members of the public can help examine more than 700 000 microscopic scans of the *Stardust* spacecraft's interstellar dust collection plates, searching for a few dozen micron-sized grains of dust. To date, only a quarter of the collection plates have been scanned, so plenty more work remains for 2009.

Advancing International Cooperation

Space exploration is no longer just NASA, ESA and Russia. More and more nations are seeking to participate in the exploration of the Solar System, and particularly of our nearest neighbour, the Moon. Japan, China, India, the United States, Germany, the United Kingdom and Russia are all now planning or operating missions on the Moon, a confluence of effort that inspired TPS to declare

Table 2. Calendar of Planetary Events in 2009. The year starts with Mars in early northern autumn; Saturn in late northern winter; Uranus in early northern spring; Neptune in early northern winter.

	Astronomical Events	Spacecraft Events
January	4: Earth at perihelion 11: Full Moon 24: Jupiter at conjunction 26: Annular solar eclipse	??: *LCROSS* lunar impact 14: *Stardust*: Earth flyby (en route to Tempel 1 rendezvous in 2011) 22: *Venus Express*: End of extended mission
February	9: Full Moon 9: Penumbral lunar eclipse 13: Neptune at conjunction 20: Venus at maximum brightness	2: Cassini: distant Rhea flyby 7: *Cassini* Titan flyby 13: *Dawn*: Mars flyby (en route to Vesta rendezvous in 2011) 16: *Kepler*: Launch
March	8: Saturn at opposition 11: Full Moon 13: Uranus at conjunction 20: Earth at equinox 28: Venus at conjunction	27: *Cassini* Titan flyby
April	9: Full Moon 29: Venus at maximum brightness	4: *Cassini* Titan flyby, first of 10 straight with 16-day orbit matching Titan's 20: *Cassini* Titan flyby
May	9: Full Moon 22: Mars at solstice (northern winter)	5: *Cassini* Titan flyby 21: *Cassini* Titan flyby
June	6: Full Moon 20: Earth at solstice	6: *Cassini* Titan flyby 22: *Cassini* Titan flyby
July	4: Earth at aphelion 7: Full Moon 7: Penumbral lunar eclipse 22: Total solar eclipse in Asia	8: *Cassini* Titan flyby 11: *Cassini*: distant Dione flyby 24: *Cassini* Titan flyby 26: *Cassini*: distant Tethys flyby
August	6: Full Moon 6: Penumbral lunar eclipse 11: Saturn at equinox (northern spring) 15: Jupiter at opposition 18: Neptune at opposition	9: *Cassini* Titan flyby 11: *Cassini* observes Saturn at equinox! 25: *Cassini* Titan flyby, last of 10 straight
September	4: Full Moon 5: Earth crosses Saturn's ring plane 17: Uranus at opposition 18: Saturn at conjunction 22: Earth at equinox	15: M*ars Science Laboratory*: launch period opens 20: *Cassini*: distant Dione flyby 29: *MESSENGER* Mercury flyby #3
October	4: Full Moon 27: Mars equinox (northern spring)	??: *Phobos-Grunt* and *Yinghuo-1*: launch 12: *Cassini* Titan flyby 13-14: *Cassini*: distant Rhea, Mimas, and Tethys flybys
November	2: Full Moon	2: *Cassini*: Targeted Enceladus flyby (1 of 2 this month) 13: *Rosetta*: Earth flyby #3 (en route to comet rendezvous May 2014) 21: *Cassini*: Targeted Enceladus flyby and distant Rhea flyby
December	2: Full Moon 21: Earth at solstice 31: Full Moon (blue moon!) 31: Partial lunar eclipse	12: *Cassini* Titan flyby 26: *Cassini*: distant Tethys flyby 28: *Cassini* Titan flyby

the "International Lunar Decade" beginning with the launch of Japan's Kaguya orbiter in 2007. We hope that the Decade will serve as a framework for cooperation among the international organisations and nations conducting lunar missions, and also that it will provide a mechanism for scientists and engineers from developing nations and other countries not directly involved in space missions to participate in science programmes or smaller engineering developments.

To advance international cooperation further, TPS is supporting the development of the Global Exploration Strategy . Fourteen space agencies (including ESA, NASA, and the agencies of Italy, the UK, France, China, Canada, Australia, Germany, India, Japan, South Korea, the Ukraine and Russia) have signed on to the first Global Exploration Strategy document, published by ESA in 2007. It presents a broad global consensus and concise rationale for human exploration of the Solar System, beginning with our nearest neighbour, the Moon. We hope that by the end of the International Lunar Decade, humans will have returned to the Moon and be looking outward, to asteroids or Mars.

It's certainly a dynamic time for planetary exploration. We hope that the worldwide events of the International Year of Astronomy in 2009 will focus public attention not only on distant stars and galaxies, but also on our own Solar System. Space is not just what we see at the other end of a telescope; we live in space, too, and it is as important to study our own neighbourhood as it is to examine the Universe beyond.

Notes

1. http://www.planetary.org/
2. http://www.esa.int/SPECIALS/ESA_Permanent_Mission_in_Russia/SEMIJFW4QWD_0.html
3. http://www.planetary.org/programs/projects/life/
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Biography

Emily Lakdawalla is the Science and Technology Coordinator for The Planetary Society. She received a Bachelor's degree in geology from Amherst College and then taught science to fifth- and sixth-grade children in Chicago. She went on to Brown University to study planetary geology. Lakdawalla came to The Planetary Society in 2001, and she now writes for the website and weblog, records the "Q and A" segment on the weekly Planetary Radio show and occasionally contributes to the Society's bimonthly magazine, *The Planetary Report*.

Brief Status Report on the International Year of Astronomy 2009

Reproduced, with minor editorial changes, from IAU Information Bulletin n° 102

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Key Words

International Year of Astronomy 2009
IYA2009 Cornerstone projects
IYA2009 Network

Summary

The International Year of Astronomy 2009 (IYA2009) is a global collaboration between nations and organisations for peaceful purposes – the search for our cosmic origin, a common heritage that connects everyone. The science of astronomy represents millennia of collaborations across all boundaries: geographic, gender, age, culture and race, in accordance with the principles of the UN Charter. This report outlines the status of the principal projects and activities that make up the Year..

IYA2009 Network

As of 12 August 2008, an impressive 122 National Nodes, representing 118 countries and 26 organisations, have signed up to participate in the IYA2009. This is an unprecedented network of engaged astronomy communicators and educators. A total of around 140 nations are expected to join the IYA2009 before the Year starts. Astronomy, education and science outreach related organisations are also welcome to participate in the IYA2009. So far 26 such organisations have signed up.

The IAU welcomes suggestions for so-called "Single Points of Contact" from countries that are not as yet involved. The IYA2009 Secretariat is particularly keen to establish contact with the following countries, based on the report on the state of astronomy development by country, compiled by John Hearnshaw (IAU Commission 46: Worldwide Development of Astronomy Programme Group[1]): Albania, Andorra, Azerbaijan, Brunei, Barbados, Korea DPR, Lebanon, Liechtenstein, Mauritius, Monaco and San Marino.

Resources

Over the past few months the Secretariat has generated an abundance of resources to spread word of the IYA2009 among members of the general population. These include everything from trailers to brochures to presentations, many of which are easily accessible through the astronomy2009 website. Some of these online resources include: IYA2009 Trailer, IYA2009 Brochures, IYA2009 Power Point Presentations and IYA2009 Logo and Branding.

IYA2009 Cornerstone Projects

The International Year of Astronomy 2009 is supported by eleven Cornerstone projects. These global programmes are based on specific themes that collectively represent the means to achieve the IYA2009's primary goals. The Cornerstone projects are key to the success of IYA2009. Several Cornerstones are underway and have dedicated websites.

- 100 Hours of Astronomy: www.100hoursofastronomy.org;
- The Galileoscope: www.galileoscope.org
- Cosmic Diary: www.cosmicdiary.org;
- Portal to the Universe : www.portaltotheuniverse.org;
- She is an Astronomer : www.sheisanastronomer.org;
- Dark Skies Awareness : www.darkskiesawareness.org;
- Astronomy and World Heritage: http://whc.unesco.org
- Galileo Teacher Training Program: www.galileoteachers.org;
- Universe Awareness: www.unawe.org;
- From Earth to the Universe: www.fromearthtotheuniverse.org;
- Developing Astronomy Globally: www.developingastronomy.org.

Conclusion

1 January 2009 will mark the beginning of the IYA2009 in the eyes of the public. However this immense worldwide science outreach and education event began more than six years earlier, with IAU's initiative in 2003. The IYA2009 aims to unite nations under the umbrella of astronomy and science, while at the same time acknowledging cultural differences and national and regional particularities. Never before has such a network of scientists, amateur astronomers, educators, journalists and scientific institutions come together. When the IYA2009 officially kicks off in Paris on 15 January 2009, it is estimated that more than 5000 people will be directly involved in the organisation of IYA2009 activities across the globe.

Notes

1. http://iau46.obspm.fr/spip.php?article53&lang=enspip.php?article53&artsuite=0#sommaire_1

Visualising Astronomy: The Astronomical Image, Part Two

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Key Words

Visual Communication
Astronomical Images

A quick recap. In my previous column, I offered my two bits on the aesthetics of what I called the Astronomical Image: those sumptuous products of the great observatories that have migrated from the newspaper to the art gallery, capturing people's imagination along the way.

Since my last piece appeared, no less an authoritative source than *The Onion* has weighed in on almost the same topic: in the article "Hubble Kaleidoscope Finds Evidence Of Space Looking All Crazy", the American satirical publication describes how researchers using the instrument have "acquired the first concrete evidence that the Universe is in a constant state of total weirdness". Of course, the text is accompanied by an image[1]. Stories in *The Onion* are often formed around a kernel of truth, and I don't think it's much of a stretch to recognise the perception of Hubble images as abstract, garish and fundamentally meaningless (or at least possessing a meaning beyond the ken of the casual observer).

Figure 1. J.M.W. Turner's The Burning of the Houses of Lords and Commons (1835) represents the Romantic image as it relates to the sublime — in this case, rooted in a sense of terror, à la Edmund Burke.

Let's return for a moment to Elizabeth Kessler's idea that Hubble imagery resonates with the Romantic landscape tradition[2]. In my first "Visualising Astronomy" column, I referred to Immanuel Kant's idea of the sublime[3], and indeed, conceptions of the sublime informed the development of the Romantic landscape. In particular, J.M.W. Turner's paintings were firmly rooted in 18th-century ideas of the sublime, although strongly linked to Edmund Burke's darker thoughts on terror: "Whatever is fitted in any sort to excite the ideas of pain and danger, that is to say, whatever is in any sort terrible, or is conversant about terrible objects, or operates in a manner analogous to terror, is a source of the sublime; that is, it is productive of the strongest emotion which the mind is capable of feeling[4]." Fun guy, Eddie. For Kant, the infinite and vast also inspired a sense of the sublime.

A friend and I recently toured the J.M.W. Turner exhibit at the Metropolitan Museum of Art in New York City. As we gazed at one of the several watercolour studies depicting the immolation of the British Parliament, my friend asked me, "So, is this any good?" I looked at the brightly coloured streaks and splotches of paint, fiery reds and yellows butting up against cool blocks of purple and blue representing the burning buildings. And I replied in the affirmative. "Yeah, these are good, but mostly because they led to that," and I pointed to the large oil canvas nearby, *The Burning of the Houses of Lords and*

Figure 2. The structures in the star-forming region W5, as imaged by the Spitzer Space Telescope, may resemble Turner's abstractions, but these ''flames'' signal the birth of thermonuclear furnaces dozens of times as massive as our Sun.

Commons, 16th October, 1834[5] (Figures 1 and 2). Art demands context.

When you choose to read the little card next to a painting at a typical art museum you see things listed such as the artist, the name of the work, the date it was painted, and the medium (oil on canvas, tempera on board). It's all about context! How do I relate this artwork to other work I've seen? For the most part, the curators of an art exhibit presume that a viewer will know the difference between gouache and oil, between Cézanne and Monet, between Renaissance and Baroque.

Similarly, it seems that an astronomical image featured in one of the "art" exhibits described in my previous column should list the observatory or instrument, the name of the object, the distance to the object, the wavelengths represented, and other relevant information. Of course, no curator of an art exhibit would expect a visitor to know [OIII] from H-α, light years from parsecs, *Gemini* from *Spitzer.* But I would hope, in such a setting, to take advantage of the opportunity to convey the source of the work and give viewers a sense of what they're looking at — in the same way an audio guide at the Met might describe how Turner was influenced by Burke.

A *Spitzer* image of the star-forming region W5 (Figure 2) may evoke the aesthetics of Turner's abstract flames, but how much more evocative to realise that these burning towers lie 6,500 light-years away?

Or consider the recent images of Enceladus that *Cassini* sent back (Figure 3). I can imagine a context in which these images could appear as an abstract work, or perhaps that the rough surface could be interpreted as terrestrial in origin. But if we further invest the image with its meaning as scientific data transmitted home by a remote probe some billion miles from Earth, then we provide a much more impressive aesthetic.

Of course, this is not written without bias. I have thrown in my lot with an ambitious bunch, the talented people behind the Astronomical Virtual Metadata (AVM) standard and FITS Liberator. We have started shaking the trees to establish the Virtual Astronomy Multimedia Project (VAMP)[6], which proposes to associate astronomy's voluptuous visuals with metadata that will facilitate their interpretation. Perhaps we can make the Astronomical Image more meaningful and more accessible.

1. The Onion, *"Hubble Kaleidoscope Finds Evidence Of Space Looking All Crazy"*, Issue 44•29, July 16, 2008, at http://www.theonion.com/content/news/hubble_kaleidoscope_finds_evidence
2. Astronomers interpret Hubble images in same majestic light as early painters of America's western landscapes, University of Chicago Press Release, available at http://chronicle.uchicago.edu/050303/hubble.shtml
3. Kant, I., 1790,*The Critique of Judgment, Book Two* (1790), available online at http://ebooks.adelaide.edu.au/k/kant/immanuel/k16j/
4. Burke, E. 1757, *A Philosophical Enquiry Into the Origin of Our Ideas of the Sublime and Beautiful*, available online at http://www.bartleby.com/24/2/
5. Some of the works in the exhibition can be seen at http://www.metmuseum.org/special/jmw_turner/images.asp
6. See http://www.virtualastronomy.org/ for more information.

Biography

Ryan Wyatt is the Director of Morrison Planetarium and Science Visualization at the California Academy of Sciences in San Francisco, California, USA. He writes a quasi-regular blog, Visualizing Science, available online at http://visualizingscience.ryanwyatt.net/.

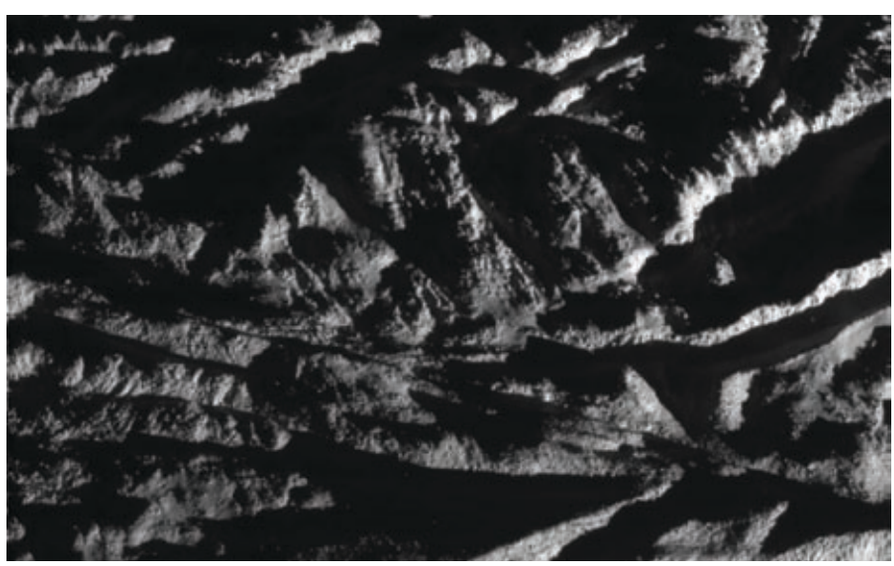

Figure 3. Cassini's *image of Enceladus can operate on numerous aesthetic levels, but it gains particular and important meaning when recognised it for what it is — data that has travelled a billion miles from a spacecraft in orbit around another world. Credit: NASA/ESA/ASI Cassini.*

INTERNATIONAL YEAR OF ASTRONOMY 2009

www.astronomy2009.org

United Nations Educational, Scientific and Cultural Organization

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THE UNIVERSE YOURS TO DISCOVER

INTERNATIONAL YEAR OF ASTRONOMY 2009

The vision of the International Year of Astronomy 2009 is to help citizens of the world rediscover their place in the Universe through the day and night sky, thereby engaging a personal sense of wonder and discovery.

All humans should realise the impact astronomy and basic sciences have on our daily lives, and understand how scientific knowledge can contribute to a more equitable and peaceful society.

The IYA2009 represents an excellent opportunity for science communicators and educators to further their activities and improve their techniques. The IYA2009 is constantly growing not only in the number of people and organisations involved but also in the quantity of resources it makes available. For example, easily accessible are PowerPoint presentations about the IYA2009, an introduction to astronomy, and the history of telescopes. All these are valuable tools for communicators and educators.

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