CAP journal

Communicating Astronomy with the Public

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Video Podcasting

Do It Yourself!

The World at Night

A New IYA2009 Project

A Short Guide to EU Grants for Science Communication

Is *FP7* a new type of organic smoothie drink?

Is *eContentPlus* a new ecological laundry detergent?

Is *MEDIA 2007* the latest type of computer storage?

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Cover: Moonlight illuminates Alborz Mountain Range in northern Iran. The winter sky above Alborz is filled with the dazzling stars of Orion and Canis Major, including Sirius, the brightest star in Earth's night sky. The eerie glow in the Haraz valley in the foreground from the headlights of cars travelling the road that leads from Tehran to the Caspian Sea. Credit: B.Tafreshi/twanight.org

Editorial

ON 25 AUGUST 1609, Galileo demonstrated his telescope to Venetian lawmakers. This was the first astronomical outreach activity using the new instrument. It is curious how this simple "star party" will be celebrated in the biggest educational and public outreach initiative ever. The International Year of Astronomy 2009 was proclaimed at the highest level by the United Nations, in recognition of the major impact that astronomy has on our daily lives and its contribution to a more equitable and peaceful society. So far, the International Year of Astronomy 2009 is supported by 104 National Nodes, 15 Organisational Nodes, 9 Organisational Associates, 11 Global Cornerstone Projects and 7 Task Groups. This event is the perfect opportunity to raise the profile of astronomy in society and to further develop our community.

The CAP conference (CAP2007) was a good example of how the astronomy education and public outreach community is becoming ever more professional. Over 200 participants attended four days of talks, meetings and lively discussions. These community-building initiatives enhance our activities and, most importantly, provide a forum for the discussion of problems and prospects in the field.

As an example of commitment, we would like to take this opportunity to congratulate CAPjournal working group member Andrew Fraknoi, for the Award of 2007 California Professor of the Year and the American Institute of Physics Andrew Gemant Award. These prizes reflect Andrew's sustained commitment and dedication to astronomy education and public outreach for over 30 years.

In this issue we marvel at the breathtaking images taken by astrophotographers from The World at Night project, get insider tips from authors of the two most popular astronomy vodcasts available on the web, learn how to navigate the labyrinth of European Commission grants for education/outreach and much more.

We'd also like to welcome Ryan Wyatt as the author of our first regular column, "Visualising Astronomy". Ryan will give us his opinions and perspectives about the growing field of graphical science communication.

CAPjournal is a newcomer to the field, but we are extremely happy with the community feedback, which gives us an added incentive to continue. Between editions you can stay in touch through our website, www.capjournal.org, where we have comments on featured papers, a job bank, back issues and the current issue of CAPjournal. You can also post anything you have to say on the site or e-mail me at editor@capjournal.org. I'd love 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

Best Practices

Dark Energy

Dark energy is the weirdest and most abundant stuff in the Universe. It is causing the expansion of the Universe to speed up, and the destiny of our Universe rests in its hands. However, we don't know much about dark energy.

Dark energy is everywhere and is extremely diffuse — a cubic metre of dark energy contains only as much energy as a hydrogen atom — and it is not made of particles. Dark energy is like a continuous, extraordinarily elastic medium. Its elasticity leads to its defining and most spectacular feature: its gravity repels rather than attracts. For the first nine billion years after the Big Bang, the attractive gravity of matter caused the expansion of the Universe to slow down. Five billion years ago, dark energy's repulsive gravity overcame matter's attractive gravity, leading to the accelerating Universe.

Figuring out dark energy is high on the to-do lists of both astronomers and physicists. During the next 20 years, ground- and space-based telescopes will shed new light on dark energy and perhaps bring a few surprises too. I, for one, believe that dark energy is the most profound mystery in all of science and that cracking the dark energy puzzle will lead to advances elsewhere, from understanding the birth of the Universe to illuminating string theory.

Michael S. Turner
University of Chicago

Key Words

Written Communication
Case Study

News

As MESSENGER sped by Mercury on 14 January, 2008, it captured this shot looking toward Mercury's north pole. The surface shown in this image is from the side of Mercury not previously seen by spacecraft. Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington.

A Hands-on Guide to Video Podcasting[1]

Research & Applications

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Key Words

Audiovisuals and multimedia
New Media
Case Study
Best Practices
Distribution
Evaluation

Summary

Video podcasting, or vodcasting, is the latest evolution of the podcast revolution. The market for on demand multimedia content spans the gamut, ranging from portable media players to computers, and increasingly to televisions through home media centres. This new mode of accessing content is rapidly growing in popularity, particularly among younger audiences. Vodcasting allows a direct link between consumer and content producer, bypassing traditional media networks, making it ideal for EPO efforts. Even modest budgets can yield compelling astronomy vodcasts that will appeal to a large audience. Gateways like the iTunes Store and video community websites such as Veoh and YouTube have created new content markets where none existed before. This paper highlights the key steps for producing a vodcast and shows some statistics from two leading astronomy vodcasts. The reader will see how to make (or improve) a science video podcast and learn about some of the latest developments in this rapidly-evolving field.

Pod•cast

n. [backronym] P(ersonal) O(n) D(emand) (broad)CAST

Vod•cast

n. (1) stylish contraction for "video podcast";

(2) the next revolution in multimedia delivery to the public;

(3) visual content virtually any tech savvy Education and Public Outreach person can produce.

1. Introduction

Right up through the 1970s virtually all video content in the United States and Europe was produced by a few national networks, and could only be seen during specific time slots. During the 1980s and 1990s this "TV 1.0" era gave way to a fundamentally new paradigm of flexibility and choice. In the "TV 2.0" era viewers now had dozens, even hundreds, of niche-market networks, driven by a shift from broadcast to satellite and cable subscription, offering a much broader variety of programming. At the same time, the advent of the VCR, and more recently the Digital Video Recorder (DVR), has also increased flexibility by "time-shifting" content from its broadcast time to an individually convenient viewing time.

Figure 1. Apple iPods are not necessary for viewing video pod-casts, nor even necessarily optimal. The range of portable audiovisual playback devices continues to increase both in performance and in popularity. Seen here is a range of popular playback devices from computers to iPod Video products. Credit: ESA/Hubble (Raquel Shida) & Apple/ Microsoft.

Widespread broadband internet access is enabling a new revolution, commonly referred to as "TV 3.0". Viewers now have the option of bypassing networks and schedules altogether and downloading content on demand for viewing on their computer, portable media player, or television. This has an interesting side effect. There is no longer necessarily a network executive and programming schedule standing between the content producer and the audience; it has become a direct relationship!

One of the instruments of change is the podcast[2]. The "Personal on demand broadCAST" is really no more than an online media file posted alongside an XML file (Extensible Markup Language), known as an "RSS feed" (Really Simple Syndication, see Gay et al., 2007, for more background and a timeline of the early days of podcasting), that is updated as new content becomes available. Media portals or aggregators (such as Apple's *iTunes*) allow subscriptions to the feed and will automatically download new content in the background to their computers as it becomes available.

While the roots of podcasting are in the audio MP3 format, video, often delivered in the popular MPEG4 format, has become increasingly popular in recent years. As quoted in Glaser (2007) the results of the "Arbitron/Edison Internet and Multimedia 2007" study showed that 13% of Americans have listened to a podcast, and 11% have watched a vodcast, up from 11% and 10% the year before respectively.

The video podcast, or vodcast, has become a competitor for traditional television, thus defining the TV 3.0 revolution. Due to the plethora of video formats and download metrics it is not easy to estimate the use of on demand videos. Kirsner (2007) quotes eMarketer that about 107 million Americans watched web video at least once a month in 2006. Vodcast shows such as Lonelygirl15 are now attracting millions of viewers[3], surpassing small niche television shows.

2. Why Vodcast?

Vodcasting allows producers with the ability to tell a compelling story to generate some interesting visuals to connect directly to an audience. This opens up incredible opportunities for public astronomy communication. There are a number of compelling reasons why science communicators should consider vodcasting. The subsections below outline some of the most convincing arguments.

2.1 Astronomy is Visual

Of all the sciences, astronomy is arguably the most visual and is responsible for some of the most memorable images of our time. Video is a natural medium for astronomy communication because of the readily available image, illustration, and animation resources for production. This is illustrated by the fact that three of four vodcasts in the iTunes Science podcast/vodcast top 10 are about astronomy. Astronomy-themed vodcast content is highly appealing to audiences (Gay et al., 2007) and is a natural fit to the medium (Price, 2007).

2.2 Easy to Produce

The standards for online video content are dramatically more forgiving than for broadcast television. The reason for this is partly that a good fraction of the viewers watch on demand content on small and low resolution viewing devices (although the fraction of these may be decreasing if our experience from Hubblecast and Hidden Universe can be taken as an indication of the general trend, see Figure 12). Also, the "Do-It-Yourself style" of many of the established vodcasts lowers the technical expectations among the audience, and puts an emphasis on the content — the idea and the messages. For an example of this different "function, not form"-type content, see the excellent, very low-tech, but remarkably thought-provoking "Pinky Show's Ant's perspective on light pollution"[4]. While a broadcast documentary can cost tens of thousands of dollars or more to produce, effective vodcasts can be made on a shoestring and thus are within reach of even the smallest Education and Public Outreach groups.

It is to be expected that production values will go up with time as the resolution and viewing size increase. For tips on pod- and vodcasting production see Apple (2008b) and Apple (2008c).

Table 1. Top 10 of the iTunes Store Science podcasts/vodcasts. 3 of 10 podcasts/vodcasts are about astronomy, and these are all vodcasts (three out of four vodcasts in total in top 10).

Rank	Title	Type	Published by	Topic
1.	Wild Chronicles	Vodcast	National Geographic	General science
2.	NPR: Science Friday	Podcast	NPR	General science
3.	WNYC's Radio Lab	Podcast	WNYC public radio	General science
4.	Hidden Universe	Vodcast	NASA/Spitzer Science Center	Astronomy
5.	Science Talk	Podcast	Scientific American	General science
6.	Time's GreenCast	Podcast	TIME	General Science
7.	HD – NASA's JPL	Vodcast	NASA/JPL	Astronomy
8.	Second Opinion – PBS	Podcast	PBS	Health
9.	Hubblecast HD	Vodcast	ESA/Hubble	Astronomy
10.	60-Second Science	Podcast	Scientific American	General science

Figure 2. Who needs convincing? After introducing a High Definition format, the Hidden Universe (see below) briefy reached the top spot in the US rankings of all podcasts and vodcasts in September 2007, ahead of major players such as National Geographic, ESPN and HBO. New episodes of this vodcast are routinely downloaded 150,000 times in their first month online. Credit: Authors & iTunes Store

2.3 It's The Future, Not Just a Fad

The explosion of downloaded content over recent years (see for instance Kirsner, 2007) makes it clear that vodcasting is an inescapable trend, not just a fad of the moment.

Vodcasting is supported by powerful industries such as Apple, Google, and video community websites such as Veoh and YouTube. It is also claimed by some that vodcasts may be more effective in instructional situations. Cann (2007) found that the response rate to vodcast was nearly three times higher than to podcasts. The video on demand world of vodcasting is a permanent feature in the multimedia landscape.

2.4 Connect to Large Audiences

Increasing numbers of people are actively searching for compelling online content. The *iTunes* Store now offers over 100,000 podcast episodes (Apple, 2008a). This is particularly true for younger audiences, including children, who are growing up online rather than in front of the TV. Astronomy vodcasts can attract large audiences simply by existing. On 11 February 2007 three of the top 10 science podcasts in the iTunes Store were astronomy shows (see Table 1). Often viewers will find the content without having to be told about it. This is called "pull" distribution as opposed to "push" distribution (where the producer actively promotes and distributes material).

2.5 Online Distribution

The online distribution of video podcasts offers significant advantages over the shipping of more traditional physical audiovisual products like CD-ROMS, DVDs or magnetic tapes such as Betacam. It requires fewer human resources to distribute digital material once an online distribution platform has been constructed and, perhaps most importantly, digital products are available on demand, i.e. when the user needs them.

3. Vodcasting Case Studies

As examples of vodcasts we will look more closely at the production of two successful video podcast series: Hidden Universe and Hubblecast.

Figure 3 The Hidden Universe HD logo.

3.1 Hidden Universe

The Hidden Universe of the Spitzer Space Telescope, produced by NASA's Spitzer Science Center, was the first astronomy video podcast. The first episode went online in May 2006, and one year later it became the first astronomy vodcast to offer a high definition (HD) version. The focus is science, not human interest stories, with new episodes released at roughly monthly intervals.

Figure 4. Two different green screen studios. To the left is the Hidden Universe studio and to the right the Hubblecast studio with narrator Bob Fosbury and host Dr. J. The green screens in the background are used to create a combination of real footage and computer graphics. Credit: ESA/Hubble (Bob Fosbury/ Martin Kornmesser)

Figure 6. Impressions from the recording of the Hubblecast. To the left Dr. J is being styled. To the right the narration is being recorded. Credit: ESA/Hubble (Bob Fosbury/ Martin Kornmesser)

Hidden Universe uses two show formats: Showcase episodes are mini-documentaries (~5 min) featuring a host, rich visuals, and interviews, and Gallery Explorer episodes (~2 min) that display one or more related images with simple overlay text for background. A full Showcase feature takes about a full week of production time to complete, while a Gallery Explorer episode can be produced in about a day. As of February 2008, total downloads above 1.8 million, with recent subscriber surges reaching about 100,000 downloads per month (the HD version accounts for 90% of this traffic).

Figure 5 The Hubblecast logo.

3.2 Hubblecast

The Hubblecast is produced by the European Space Agency's Hubble Space Telescope group and started in March 2007 after the results from Hidden Universe and the Chandra X-Ray Observatory Podcast were presented at conferences. It features the latest news and images from the NASA/ESA Hubble Space Telescope. The host is Dr. Joe Liske, a.k.a. "Dr. J.", from ESO. Dr. J. was selected from ten other very promising scientists at a screening session by a panel in a casting session slightly reminiscent of reality television. Despite the undoubted ability of many of the candidates, there could only be one host, and the ESO astronomer Dr. Joe Liske had the best combination of talents (ability to memorise text, English accent, presence etc.). His on-screen alias is "Dr. J" and he now receives fan mail on a daily basis via his MySpace page showing that the audience sees Dr. J. as a resource and wants to communicate with.

The production time for an episode is two to five working days, and up to 10 person-days are spent from concept to online vodcast in total. The duration of an episode is five to six minutes. Hubblecast has three channels: SD (Standard Definition), HD (from June 2007) and Full HD (possibly the first Full HD Vodcast in the world, from June 2007). Eight other on demand video formats are also made available online at spacetelescope.org.

More than a 1.8 million Hubblecasts were distributed in the first 11 months of operation (12 episodes). The download numbers seen in Figure 7 were derived from the web access log. Note that duplicate entries for same IP numbers were removed in the Hubblecast stats.

Further information about the Hubblecast is available in Christensen et al. (2007) and on the Hubblecast web page[5].

3.3 Other Astronomy Vodcasts

A number of other astronomy-themed vodcasts have entered the market since the premiere of Hidden Universe in May 2006. See Gay et al. (2007b) for a list of some of the astronomy vodcasts currently available.

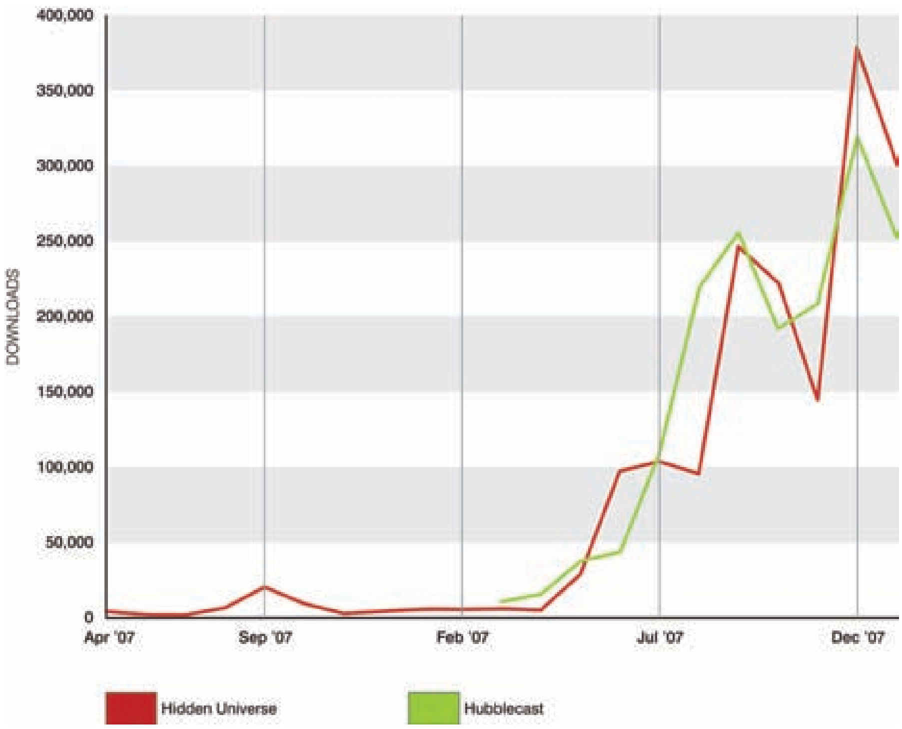

Figure 7. A popular vodcast can attract considerable interest. Here are the numbers of vodcast downloads per month for the Hidden Universe and Hubblecast accumulated over a period of 21 months. Despite being independent vodcasts there is a clear correlation between the two sets of download numbers. Note that Hubblecast started in March 2007. Credit: The authors & ESA/Hubble (Nuno Marques/Raquel Shida)

4. Production Design

In designing a new astronomy vodcast it is worth starting by considering where it should fit into the overall podcast mediascape. Identify the specialty or niche that will make the podcast stand out. What is its intended audience and level of engagement? What is the scope of the topics to be covered? What is its signature graphical look, or style of the host or hosts? Although the aspirations in this initial brainstorming phase may be high, be realistic and make sure that the concept is feasible in terms of production time and costs. A steady stream of fresh and interesting episodes is one of the most difficult things to achieve in podcasting.
A typical production has three phases:

Pre-production

1. Concept development
2. Storyboard writing

Production

3. Filming of host and scientist interviews
4. Audio recording
5. 2D and 3D Animation

Post-production

6. Green screening/keying
7. Video editing
8. Music selection/composition
9. Encoding
10. Distribution

Most of these topics are discussed in greater detail below. Note that the some of the steps of the production process tend to interweave organically and the list above should not be seen as a strictly linear timeline. One of the advantages of the relatively small production teams involved in podcasting, as compared with television or movie production, is that the different steps can more easily interact with each other.

4.1 Production Resources

In a vodcast production where human resources are often restricted, it is vital to manage these resources and make the best of existing assets. These assets include (but are not limited to) images, animations, a host and scientists. In designing a vodcast, one should identify which assets are available and develop a show format to use as much in-hand material as possible. Minimising time-consuming custom production needs is critical for maintaining a sustainable production.

4.1.1 Images

Astronomy images are abundant and are a key resource for any vodcast. Most of the third-party astronomy images on the web are free for use in educational and communication purposes. Even static images can be fantastic for video if slow zoom and/or pan effects are added. This effect is also known as the "Ken Burns" effect after the American director who uses pans and zooms heavily on stills in his productions.

4.1.2 Animations

One or two well-chosen animations, either artistic or derived from science data/simulations, can help communicate a difficult science concept. While they can be time-consuming or expensive to produce, many institutions have broadcast-quality content available online that may eliminate the need for custom work.

Figure 8. The different steps of the keying process. The first image shows the scene as taped in the studio. Next, the parts of the image corresponding to specific colours are made transparent, allowing a digital backdrop to be substituted. Other parts of the studio beyond the green screen backdrop can be removed with a "garbage" matte drawn by hand in the compositing software (here the corners of the matte are numbered). The final composite allows the host to reside within a virtual environment that can be much more compelling than a static set. Note that with the careful application of a garbage matte, the videographer need only ensure that the host remain in front of the well-illuminated green screen. The rest of the background is irrelevant. Credit: Robert Hurt

4.1.3 Host

A regular host can give a personal touch and can help establish an identity for a vodcast. A host can also provide a visual focus when images or animations are not available to illustrate a point. He or she can even make low resolution content less obvious if it is presented as a "newscaster" style insert (limiting the number of on-screen pixels visible). It is critical to cast someone with clear speech patterns and good presentation skills with technical material; it is even better if they can memorise material rather than rely on cue cards.

4.1.4 Interviews

Scientists can bring a personal angle to technical results, and can be a great resource for video. By interviewing them several times on the same subject it is often possible to get a good, clear "take" that gets across key ideas. Plus, anything covered in an interview does not have to be written into the script, simplifying production. Note that not all scientists are equally suited to appear in front of a camera and it is good to screen a potential scientist guest in advance for his or her ability to present the material in a lively and concise way.

4.1.5 Production Time

Both Hidden Universe and Hubblecast use all four of these assets in their productions. Typical end-to-end production times are of the order of a week. However, the Hidden Universe Gallery Explorer format was specifically designed to include only readily available images and animations to provide a rapid-production option (about a day) to assure timely updates to the feed when a full Showcase production is not possible.

The average episode duration of both these vodcasts is on the order of five minutes. Our own experience shows that this is a suitable duration for this type of vodcast. There is a correlation between the size of the viewing device and the acceptable duration of video, as well as between the viewing distance and the acceptable duration (Rocketboom, 2007 and Cann, 2007). A viewer tends to watch shorter videos on small mobile devices with a short viewing distance, and longer videos on TVs or in the cinema with larger distance and a more comfortable viewing position and more suitable surroundings (darkness, acoustics etc.).

5. The Storyboard

Vodcasting is a very "light" medium; the format is short and it is essential to focus on key facts and make them as engaging as possible. The storyboard can make or break a production. It must encompass both the narrative and the visual content and effectively link them.

The first step is to identify the target audience. Is the product intended for children, laypeople, or the informed public? This determines the number of ideas and the level of background information needed to explain them. Traditional news criteria can help to determine the elements that make interesting stories (see for instance Christensen, 2007).

Adapting pre-existing material, such as a news release, can be a shortcut to researching and writing on a new topic. However, spoken dialogue has a significantly different character from written text, and it is important to carefully rewrite such material so it sounds right to an audience. It is also critical to make adjustments to the content if the source material was intended for a different level of audience.

6. Audiovisual Production

Once the storyboard is ready, the visuals for the vodcast must be assessed. Raw material for image and animation segments needs to be found online or developed using animation software. This process can start even before audio and video footage has been acquired if the timings for the storyboard are recorded; this can be done with timed read-throughs or even by using text-to-speech software.

6.1 Shooting Video

Any production with host or interview segments will need to shoot video. There are many options, ranging from on-location in an office, working in a controlled studio setting, or even using substituted backgrounds by shooting against a green screen.

Real footage is recorded with a camcorder either in-house or with the assistance of a small hired camera team, depending on the budget. Naturally, the better the real footage is, the more "cinema-like" the final result, and so using the best equipment that fits the budget is helpful. High definition video cameras today start at just a few hundred dollars (US), but the better quality equipment starts in the thousands of dollars. Advanced prosumer cameras such as the Panasonic HVX200 cost from 6000 US$ MSRP or the Sony HDR-FX1HDV from 4000 US$ MSRP.

6.2 Background Removal & Virtual Sets

It is not too difficult to create a completely imaginary set for your host or interview subjects. The backdrop can be as simple as an image, an animated background pattern, or even a "virtual set" constructed in image and 3D graphics editing programs.

The technique requires shooting the subject against a distinctively coloured backdrop that can be digitally removed, or "keyed" out. Typically these are bright blue or green screens; green is more commonly used as it is less likely to match common clothing or skin tones. Note that these green screen studio installations need not be permanent, but can be set up in about an hour or so, and prices for the backdrop starts below 100 US$/70 EUR. Common editing applications have tools for removing these backgrounds (see Figures 8 and 9).

Shooting green screen footage does place stronger technical requirements on the video equipment. The least expensive digital video cameras will tend to blur out colours, making it difficult to separate the subject from the background cleanly. This leaves an unnatural border that can ruin the effect. A good compromise is to look for video cameras that employ a 4:2:2 colour compression format (with a single colour sample for every 2x2 grid of luminance pixels). Note that colour sampling of 4:0:0 makes keying almost impossible.

It is useful to check online forums to see what results filmmakers have had with specific video equipment before committing to a particular camera.

6.3 Recording Audio

Audio quality is dramatically increased by using an external microphone. The camera's built-in system tends to be omni-directional, pulling in unwanted environmental noise, and even internal camera vibrations. Better options include highly directional shotgun/boom microphones near the camera or lavaliere microphones that clip onto the shirt. Wireless systems allow more freedom of movement, but even wired microphones with long cords can be used flexibly. A high quality microphone will make a big difference to how professional the production feels as audio problems are difficult or impossible to fix after the fact.

Figure 9. An example of the final product of a keying process: Dr. J, a.k.a. Dr. Joe Liske, from ESO, interacting with a globular cluster. ESA/Hubble (Martin Kornmesser)

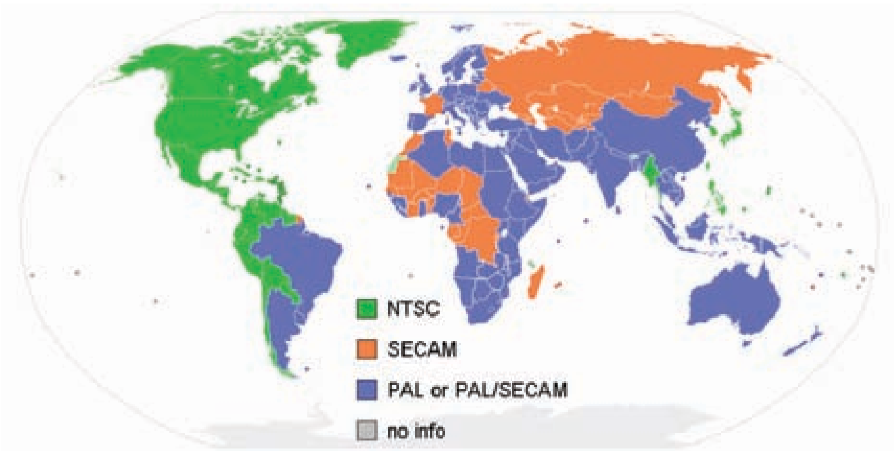

Figure 10. The global distribution of the PAL, NTSC and SECAM formats. From Wikipedia[8].

Clarity and diction are critical for any host or narrator. Very strong accents can be distracting. If a speaker is important to a story but difficult to understand, try to use her/him in shorter segments, and allow her/him to reinforce established points rather than introduce new material.

6.4 Music and Sound Effects

Music and sound effects can dramatically improve the impact of a video. Free sound tracks and effects from the web, as well as copyrighted "pay-per-use" stock music are available for the sound. Many so-called "net labels" exist and have favourable conditions for the use of the music. See Testtube[7] for an example. However, it may be interesting to collaborate with artists who can compose music and sound effects that will fit the specific needs of the project better. Often up and coming musicians will be willing to work for little or no payment in order to gain exposure and professional credits.

7. Editing

The post-production stage follows the recording of the audio and video. At this point the video footage is transferred to the editing system (digitally captured or directly transferred). The various "takes" are screened and the best are chosen and trimmed to remove unwanted parts. If shots are taken at different distances from the subject it is possible to edit a more dynamic sequence by cutting between wide and narrow shots. The remaining video, animation, image, and audio assets are assembled.

The storyboard serves as a template as the project is pieced together like a jigsaw puzzle in the editing software. Video and audio clips are added to the timeline to tell the story. Audio levels are adjusted to be consistent, video colours are corrected, and transitions are added where they improve the storytelling. Finally, extras like music and sound effects are laid into the timeline for the final polish.
Software and hardware that, only a few years ago, would have been considered inaccessibly expensive, is today surprisingly affordable. Mac and Windows computers now come standard with incredible computing power and data input/output rates, and almost any new high-end computer can be used for video editing. Key considerations are lots of storage space (7200 rpm drives, internal or Firewire, but not USB). High definition editing is particularly demanding and requires larger monitors and high performance video cards (this technology changes rapidly; it is worth consulting computer experts to find the best current video card options).

There are many powerful options for video editing software today. Industry standards now include suites like Final Cut Studio and Adobe® Premiere®, but even entry-level products like iMovie can produce a solid vodcast.

Hubblecast, for example, is produced on a high-end dual CPU (dual-core) Dell PC with 4 GB of RAM, Discreet's RTX-2 video card (for live previewing of Full HD footage), a 50-inch Pioneer 5070 plasma screen and a large external firewire RAID hard disk array. Hidden Universe is produced on a quad 2.5 GHz G5 Macintosh with 4 GB of RAM with a colour-calibrated 30" Cinema Display; Final Cut Studio and Adobe After Effects are the primary editing tools.

8. Video Formats

The broadcaster is faced with a dizzying array of image sizes and formats. Traditional US (NTSC) and European (PAL) formats have different frame rates and dimensions that have made production for the global market more difficult (a third format, the French SECAM, also exists). They do, however, share a common aspect ratio (4:3 in width:height).

High definition (HD) formats are quickly becoming the new international broadcast standard. While this makes the market more united and global, there are, unfortunately, an equally dizzying array of formats in these new standards as well. There are two image sizes (both with widescreen 16:9 aspect ratios) and a variety of frame rates and interlacing options.

Interlacing is a workaround to compensate for limited signal bandwidth that allows a complete video frame to be rendered in two separate passes. Alternate lines of an image

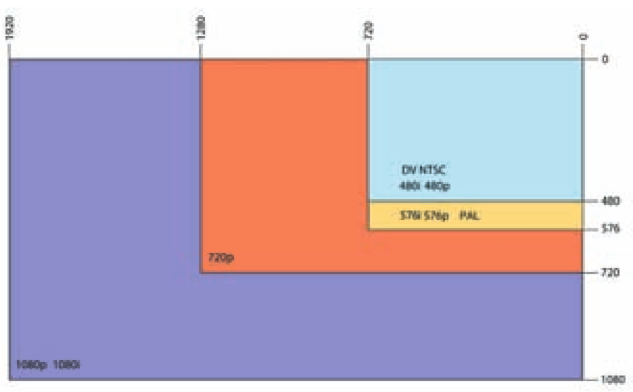

Figure 11. The difference in video format sizes. Credit: Wikipedia[9] & ESA/Hubble (Raquel Shida)

Table 2. Summary of video formats.

Format	Dimensions [pixels]	Interlacing	Field/Frame Rate [fps]
NTSC (broadcast)	640 [720] x 480	Interlaced	60 (fields)
NTSC	640 [720] x 480	Progressive	24, 30
PAL	720 [768] x 576	Progressive	25
HD (720p)	1280 x 720	Progressive	24, 25, 30, 50, 60
HD (1080i)	1920 x 1080	Interlaced	50, 60 (fields)
HD (1080p, "Full HD")	1920 x 1080	Progressive	24, 25, 30

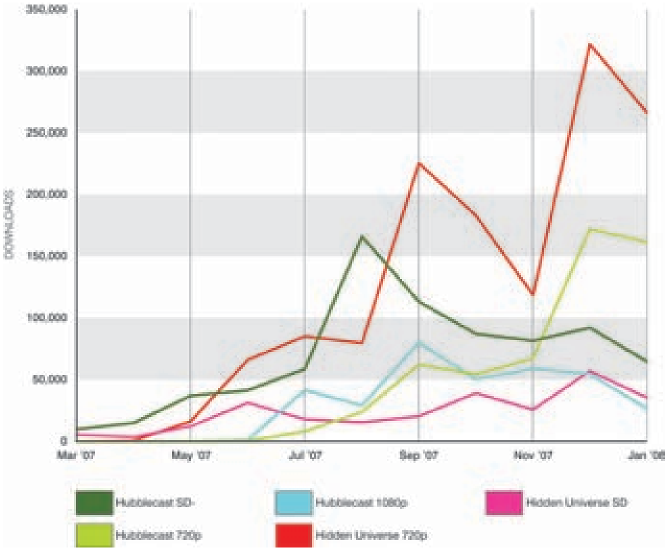

Figure 12. When plotting the number of vodcasts distributed decomposed into format groups, SD (Standard Definition, SD- denotes formats smaller than or equal to SD), 720p and 1080p (full HD, only Hubblecast) it is clear that HD, especially 720p, formats are on the rise and have started to dominate. For Hidden Universe the 720p format is extremely popular and outperformed SD a few months after launching Hidden Universe. Credit: The authors and ESA/Hubble (Nuno Marques/ Raquel Shida)

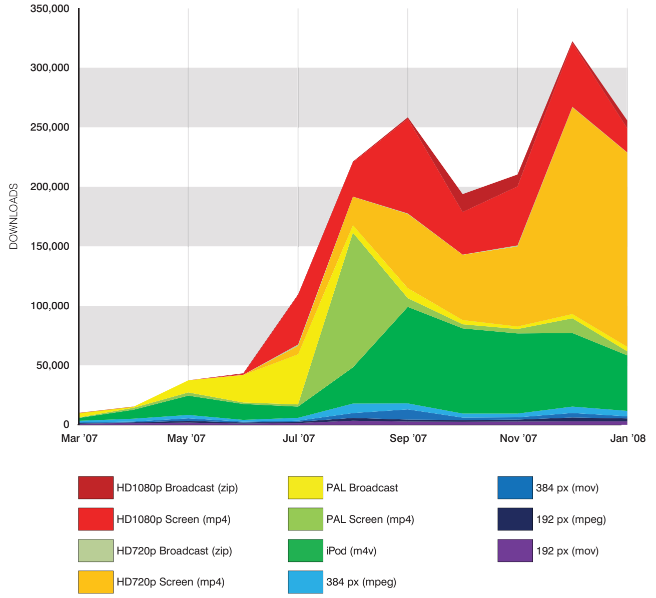

Figure 13. What formats do users choose? This download chart for the Hubblecast shows the increasing resolutions arranged vertically with the Full HD format on top and the smallest available format at the bottom. Credit: The authors and ESA/Hubble (Nuno Marques/Raquel Shida)

(a field) are sent in one pass, and the complementary interlaced field is filled in on the next pass. While this does create a faster-refreshing screen, the resulting interlace artefacts can create an unpleasant effect for computer/online viewing in various broadcast situations. It also makes the footage difficult to rescale to other sizes and formats. These factors make interlaced formats unappealing for vodcast work.

Table 2 and Figure 11 summarise the major video formats. Vodcasters may find it advantageous to produce their projects in a standard television broadcast format even if it is not going to be the final distribution format.

What is the best format for vodcasting? There is no easy answer. Lower resolution formats and lower frame rates make for smaller files and faster download speeds that match to a wider cross section of hardware. For longer format shows (half-hour or more) this may be a practical distribution limitation.

However, modern computers are now easily able to play back and display HD material on computer screens. Many consumers already have HD or Full HD plasma or LCD screens in their home, and media centres and HD players such as Apple TV are becoming increasingly common. Paradoxically, most normal consumers are not able to find much HD content to display on computers or TVs today and this is definitely a niche that can be exploited for science communication purposes.

Choice of aspect ratio is the most significant production consideration when deciding between SD and HD formats. The traditional 4:3 aspect ratio follows the dimensions of older televisions and monitors. The HD 16:9 widescreen format is quickly becoming the universal standard for new televisions as well as many laptops and monitors and is arguably the more forward-looking choice today.

The other consideration for the distribution format is the target hardware platform. For instance, video iPods can handle footage up to 640 x 480 pixels at frame rates of up to 30 fps (frames per second). The newer Apple TVs have an added potential to handle 1280 x 720 frames at up to 25 fps (720p/25). Most new computers can display 1920 x 1080 pixels at up to 25 or 30 fps. Of course once a master video file has been created, it is easy to downsample it to lower resolutions using encoding tools. Flicker is visible at 720/25p

Table 3. Overview of the 11 different distribution sizes and codecs available for the Hubblecast. This overview can be used to interpret Figure 13.

Name	**Size**	**Encoding**	**Compression**	**Colour in Figure 13**
1080p Broadcast	1920 x 1080	HDV Mode-2 (m2t format, MPEG2 transport stream)	Light	Crimson
1080p Screen	1920 x 1080	H.264	Hard	Red
720p Broadcast	1280 x 720	HDV Mode-1 (m2t format, MPEG2 transport stream)	Light	Pale green
720p Screen	1280 x 720	H.264	Hard	Orange
PAL Broadcast	720 x 576	AVI DV	Light	Yellow
PAL Screen	720 x 576	H.264	Hard	Leaf green
iPod	640 x 480	H.264	Hard	Green
384 px	384 x 288	MPEG1 encoded	Hard	Blue
384 px	384 x 288	Quicktime Sorensen-3	Hard	Dark blue
192 px	192 x 144	MPEG1 encoded	Hard	Indigo
192 px	192 x 144	Quicktime Sorensen-3	Hard	Violet

Figure 14. The iTunes page for Hidden Universe. The SD Format (before May '07) had typical 3-month downloads of 3,000 and a cumulative 1-year download of 12,000 per episode. With the arrival of the HD Format (May '07), the typical 3-month download per episode exceeded 100,000 (!) and has pulled the typical SD 3-month download to 6,500 per episode. Even SD gets a bump in attention from the HD channel! Credit: Apple Store

and 1080/25p due to the large frames and the relatively slow refresh rate.

If one were to distribute and play raw, uncompressed footage, it would be highly impractical and extremely strenuous for the hardware. For the final distribution it is necessary to "encode" the videos into a compressed format designed for easy playback and with a smaller file size. One of the best video "codecs" now in use is H.264 (MPEG4 part 10). Within the limits stated above, this format is compatible with iPods, many other portable media players, and computers running Apple Quicktime. It is also Adobe's newly-adopted standard for flash video. However, offering vodcasts in multiple formats can reach audiences with older hardware; common choices are MPEG1 and Sorenson 3 Quicktime. In addition, posting minimally-compressed high-quality formats makes it easy for television broadcasters to include the content in news and documentary programming. The path from conceiving a vodcast idea to seeing it appear in a TV programme has never been shorter.

A good batch compression tool can simplify the creation of media files. Once this has been set up for the desired formats/codecs and sizes it is simple to take a final source file and create multiple versions of it. Naturally it makes sense to produce a vodcast at the highest desired dimension and frame rate, and then downsample to lower quality as needed. Compressor — part of Final Cut Studio — is used by many Mac users. ProCoder is a good tool for PCs to batch compress many different formats from the largest format in the workflow.

For Hidden Universe the original production format was designed to be 4:3 (640x480) at 30fps. When it moved to a HD format the production was redesigned to a 720p frame at 24 fps. This was aimed to match the hardware capabilities of the Apple TV system, but also offered advantages on HD production. Mastering to a film frame rate of 24 fps cuts down on the number of rendered frames per second, and working with the smaller HD 720p framesize creates edit files that are more that a factor of two smaller than 1080p. This has made HD production more time and resource efficient.

Hubblecast is, in contrast, produced at a full 1080/25p resolution.

In a time of rapidly advancing technology and consumer interests there is no simple answer to the seemingly simple question: "What is the best format to use for vodcasting?" But with the rapidly increasing market for HD televisions and related hardware, there is already a surprisingly strong trend towards large-format content. Since introducing both the 720p and 1080p formats for Hubblecast, download statistics for recent months have shown these HD options account for at least half of the total downloads

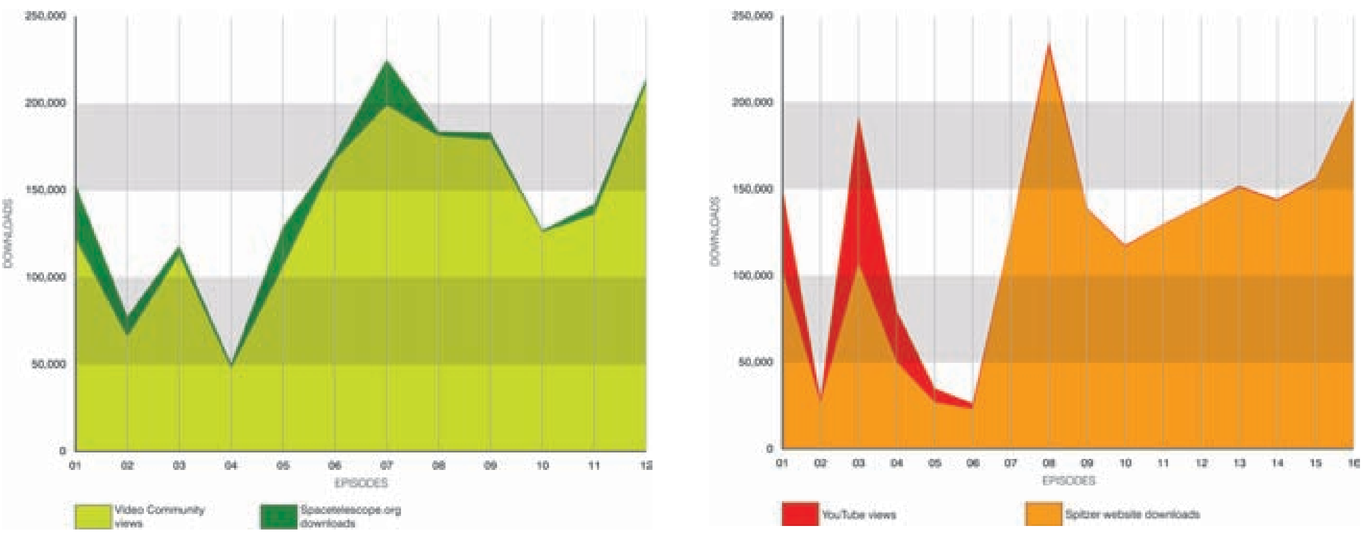

Figure 15. Hubblecast and Hidden Universe downloads per episode. The weak bimodal structure seen (a bump in the beginning, and also a bump for the more recent episodes) may be due to two different interacting effects: the longer any podcast episode is available, the more downloads it will have and the user base is still on the increase, giving more downloads of the later episodes. Video community downloads (in red) make up a maximum of 5 - 20% of the total. Credit: The authors and ESA/Hubble (Nuno Marques/Raquel Shida)

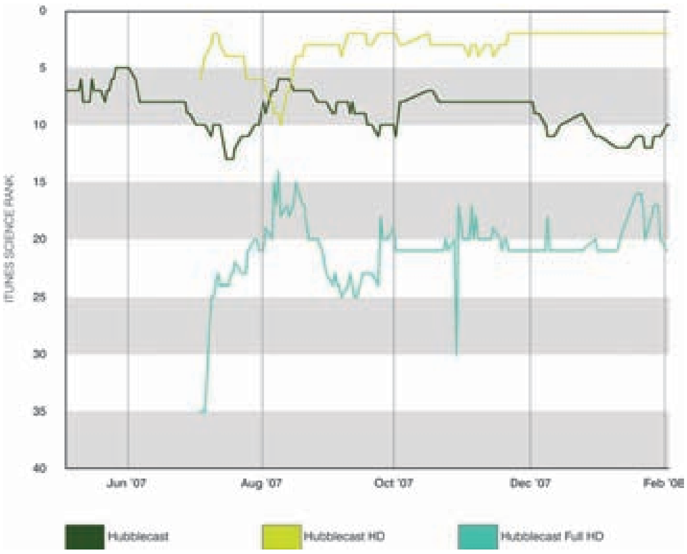

Figure 16. The US iTunes rank in the Science section for the three different Hubblecast channels: SD, HD and Full HD. The HD version (720p/25) is the most popular in iTunes and Full HD is the least popular of the three. Credit: The authors and ESA/Hubble (Nuno Marques/Raquel Shida)

Figure 17. Special iTunes features, such as this Outer Space feature, can boost downloads significantly. Features promote different podcasts across many interest areas and formats. Credit: iTunes Store

and, in January 2008 as much as 75% (see Figure 12). For Hidden Universe the 720p format is even more dominant and is downloaded almost 10 times more frequently than SD.

By analysing the 11 different sizes and codecs available for the Hubblecasts it is possible to obtain even more fine grained information about user download behaviour. Figure 13 shows a further decomposition of the download data into the 11 different codecs/sizes (an overview is seen in Table 3).

Although the user's selection of formats is heavily influenced by small scale fluctuations created by individual files being promoted at different times by different sites (the "slash-dot effect"), some conclusions can be drawn from Figure 13 and 12.

- 720p downloads are increasing with time, indicating that the format is getting a larger user base.
- Full HD downloads seems not to be increasing.
- Total HD (720p + 1080p) started to dominate in October 2007.
- Formats aimed at on-screen viewing with smaller file sizes are especially popular.

The HD format is also extremely popular for Hidden Universe and has begun to outperform SD.

9. Distribution — All about the Ratings!

The final important step in a vodcast production is the distribution and promotion of the video. The primary distribution of vodcasts today is through the iTunes Store. The ITunes page for Hidden Universe is seen in Figure 14.

As the XML feed at the iTunes Store is updated with information on new episodes, this information is displayed for casual browsers looking through the podcast section. As with TV, better visibility will give higher ratings. A good name to the vodcast channel, a "sexy" description and a recognisable icon are critical elements for success. Learn from other vodcasts — what looks interesting and why? Episode titles and descriptions are important

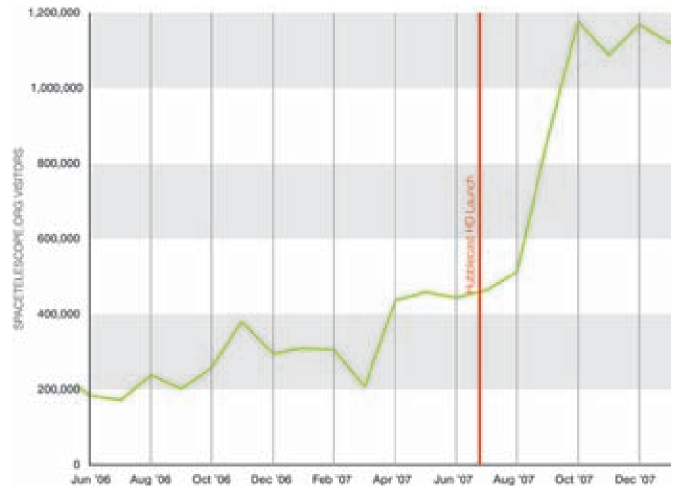

Figure 18. Web visitors on spacetelescope.org as function of time. A dramatic increase seems to coincide with the launch of the Hubblecast in March 2007. Credit: The authors and ESA/Hubble (Nuno Marques/Raquel Shida)

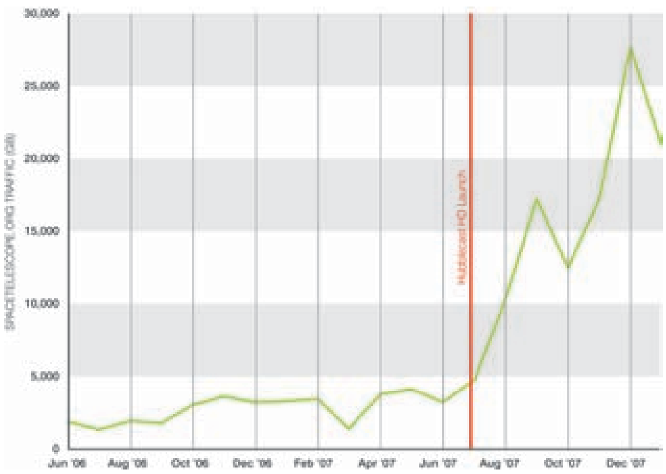

Figure 19. The distribution of HD material may make you more popular, but certainly puts a strain on web servers. The jump in overall (all products) web traffic from spacetelescope.org since the introduction of the HD formats June 2007 (marked by the line) is shown. Credit: The authors and ESA/Hubble (Nuno Marques/Raquel Shida)

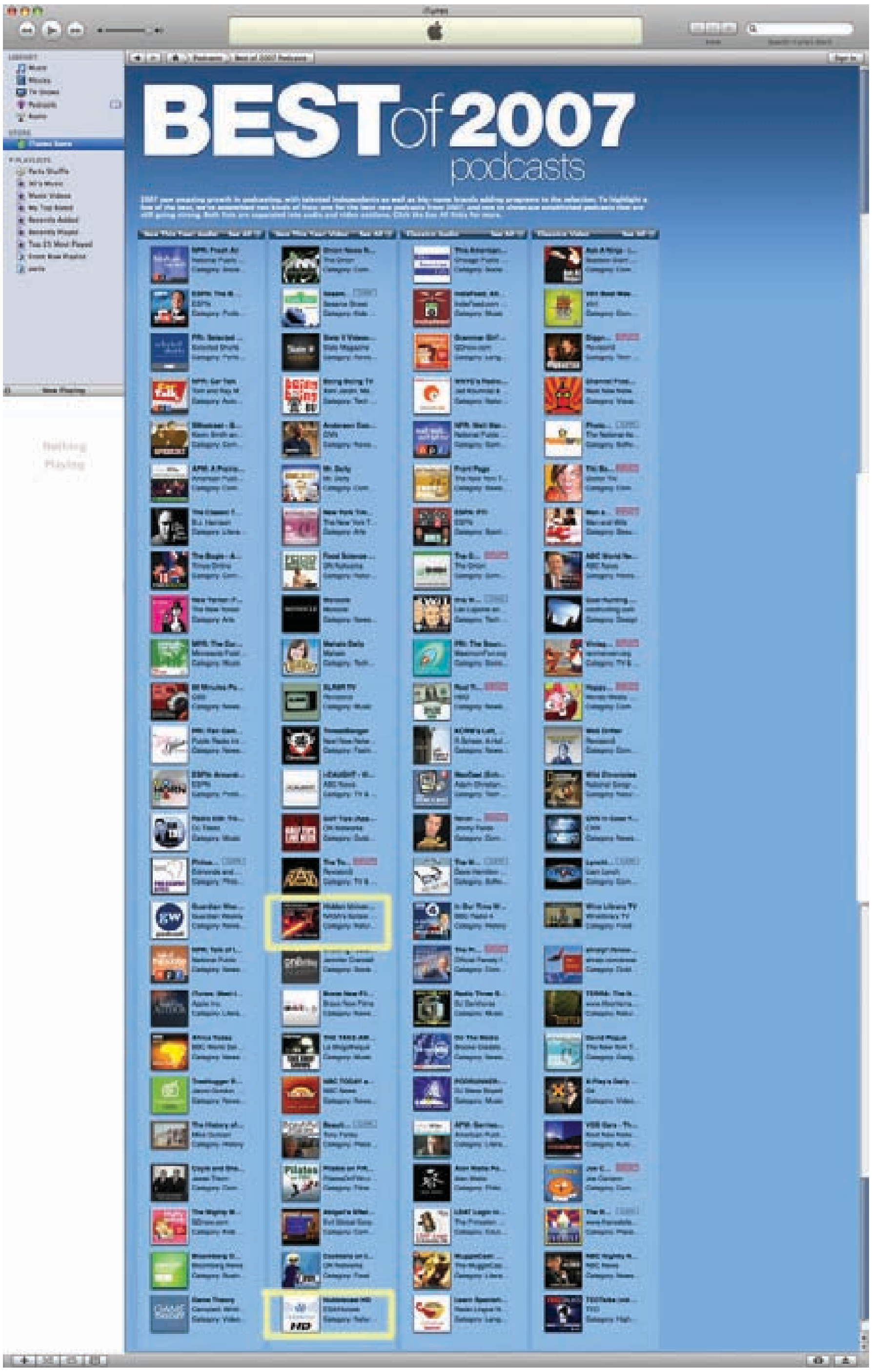

Figure 20. Two astronomy vodcasts actually made it into the Top 25 for New Vodcasts of the year 2007: Hidden Universe and Hubblecast. Credit: iTunes Store

since casual browsers often sample an episode before subscribing. Waste nothing in your description; the first few words can be pivotal in capturing a potential subscriber's interest!

Video community sites such as YouTube, DailyMotion, blip.tv and Veoh can be good additional channels for promoting a vodcast. Download numbers from these pages can be substantial (up to 20% of the total, see Figure 15).

9.1 Webstats

It is interesting to look at a vodcast's potential influence on web statistics. It is perhaps surprising that a single product, such as a vodcast, can have a dramatic effect on the overall web statistics for an EPO office. Figure 18 shows the jump in web visitors to spacetelescope.org after Hubblecast launched in March 2007 and more dramtically after Hubblecast HD launched in June '07 (marked with a line). It is impossible to disentangle the effect of the vodcasts from that of other products and campaigns, but the increase in visitors is striking and is likely mainly due to the vodcasts.

However no measurable effect on the number of web hits was seen. This is not unexpected as every vodcast only accounts for one hit (compared to hundreds of hits per "real" visit). As expected, the Hubblecast HD launch also gave rise to a surge in web traffic (seen in Figure 19). This has become quite dramatic in the most recent months as the HD downloads have increased (see the discussion above).

10. Conclusion

Based on the experience drawn from the two successful vodcasts, Hidden Universe and Hubblecast, we feel confident in saying that vodcasts are here to stay. Delivering content in multiple formats to appease both the desires of instant gratification and of premium viewing quality seems to maximise the potential audience. Our experiences show that being one of the first providers of a new format can pay off, so watch out for new trends, platforms and formats! Whereas the HD formats seem to be on the way to dominate the market a note of concern may be appropriate. The largest part of the population on Earth do not have access to high speed networks and computers. In order not to make the digital divide[10] wider it is advised to maintain some formats in lower resolution.

At the time of writing, 12 episodes of Hubblecast and 16 episodes of Hidden Universe have been released and both vodcasts have been downloaded more than 1.8 million times each. The two vodcasts are — at least for the time being — regularly ranked among the 10 most-viewed podcasts in the science category in the US iTunes, and among the US Top 100 podcasts in total. In 2007 the two vodcasts were even ranked among the best 25 new vodcasts of the year (see Figure 20). Not bad for science communication products!

We plan to keep up with the steady stream of exciting space images seen through the eyes of Hubble and Spitzer, presenting the latest science to the younger generation for as long as this segment of viewers enjoys our work. Who knows what the next trend will be? Vodcasts in 3D HD? Or will there be another even more exciting medium that can help us bring the stars to everyone on Earth? Only the future can tell…

Acknowledgements

The authors would like to acknowledge the two vodcast teams from Hidden Universe and the Hubblecast, as well as Will Gater and Anne Rhodes for their editorial contributions to the paper. The comments from the referee improved the paper significantly.

Notes

1. Parts of this paper have appeared in the proceedings from the 2007 ASP EPO meeting and the proceedings from the Communicating Astronomy with the Public 2007 conference.
2. See for instance http://en.wikipedia.org/wiki/Video_podcast and http://en.wikipedia.org/wiki/Podcast
3. According to Wikipedia (accessed 11 February 2008) the LonelyGirl15 series had more than 70 million combined views as of September 2007.
4. http://www.pinkyshow.org/archives/episodes-/070118/ (accessed 11 February 2008).
5. http://www.spacetelescope.org/videos/hubblecast.html
6. Averaged over October, November, December 2007.
7. http://testtube.monocromatica.com
8. http://en.wikipedia.org/wiki/Image:PAL-NTSC-SECAM.svg (accessed 11 February 2008).
9. http://en.wikipedia.org/wiki/Image:Common_Video_Resolutions.svg (accessed 11 February 2008).
10. See for instance http://en.wikipedia.org/wiki/Digital_divide

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Bios

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The World At Night: A New International Year of Astronomy 2009 Project

Annoucement

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Key Words

International Year of Astronomy 2009
Astrophotography
Photo Exhibition
Dark Skies Awareness
UNESCO World Heritage

Summary

The World At Night (TWAN) is a new programme founded in 2007 with the goal of creating a collection of stunning photographs of the world's most beautiful and historic sites against the night-time backdrop of stars, planets, and celestial events. The eternally peaceful sky looks the same above all the symbols of different nations and regions, a testament to the truly unified nature of Earth as a planet rather than an amalgam of human-designated territories. Those involved in global programmes learn to see humanity as a family living together on a single planet amidst the vast ocean of our Universe. This global perspective motivates us to work for a better, more peaceful planet for all the world's inhabitants. TWAN is an innovative approach to expanding this global perspective. TWAN's primary goal is to present the public with a new and enlightening view of the wonders of our planet by revealing the unified nature of Earth's people as one family and our world as a living planet that we must all care for together.

Figure 1. Trails of stars in a multi-hour exposure from a high point in Yosemite National Park (Credit: Stefan Seip).

The brainchild of the Iranian photographer, science journalist, and co-author Babak A. Tafreshi, TWAN existed in concept only until Astronomers Without Borders (AWB) was formed in 2007. Designated as an IYA2009 Organisational Node in 2007, AWB is a US-based non-profit initiative dedicated to promoting understanding and peace between peoples worldwide through a common interest in astronomy. AWB serves as an umbrella for projects that connect astronomy enthusiasts around the world. Tafreshi, editor of Iran's Nojum (Astronomy) Magazine (the Middle East's only astronomy magazine) has practised his photographic art at historic and natural sites throughout his home country and around the world, publishing many spectacular images in international publications and on important websites. He had entertained the idea of creating TWAN for years, but accepted the challenge after TWAN became a project of AWB, whose global reach and greater resources made the logistic and financial needs of the project feasible. Tafreshi is assembling a team of dedicated, world-renowned photographers who excel at the specialty of landscape astrophotography. Many not only travel the globe to capture unique landscape astrophotos, several are well-known astronomy lecturers and educators with astronomy books and TV appearances to their credit. The collection of images has already begun, primarily with pre-existing images but also with new images specific to TWAN's needs. The 20 photographers invited to join the TWAN team have contributed approximately 200 images to the collection and online gallery as of mid-February 2008. The carefully selected image collection already portrays celebrated sites on all continents — from the planet's most remote locations like Chile's Atacama desert and Antarctica to some of the world's most visited sites such as the Taj Mahal, the Acropolis, and the Great Wall of China — all pictured beneath the splendour of the night sky. With TWAN's goal of photographing important sites worldwide, dedicated wide-field photographers in more regions will be selected and invited to join the effort. Only well-published specialists in wide-field landscape astrophotography are being considered, in keeping with the high quality of the cadre of photographers recruited to date.

As image collection continues, a comprehensive list of all potential TWAN sites around the world is being prepared, with more than 100 candidate sites already included. The 851 UNESCO World Heritage Sites are given the highest priority and as many as possible will be visited. But there are many other outstanding sites throughout the world that will also be included. Only with the broadest survey of the nature, culture, and history that the Earth offers can TWAN and AWB present their ultimate message — that we all share the same sky regardless of our location, our culture, or our beliefs.

The inventory of candidate TWAN sites will begin with World Heritage Sites and other well-known locations and monuments and be augmented by input from around the world. Each site must be scrutinised for suitability for use in the TWAN project, including not only the site's uniqueness and appearance but also the potential to include suitable sections of the sky in images and the local visibility of celestial events. Some remote sites present particular difficulties in access while others may suffer from poor climatic conditions for astrophotography. Sites will be rated according to their suitability for inclusion in TWAN, with greater weight given to the most important sites. Thus, some sites will deserve the expenditure of greater resources to ensure their inclusion in the collection. TWAN will include many unique astronomical sites as well, from the modern world's greatest telescopes to the ruins of ancient observatories. Presenting the starry sky above the greatest monuments of ancient astronomy, such as Stonehenge and Mayan observatories, is a TWAN goal shared with the IAU/UNESCO Astronomy and World Heritage Initiative.

To achieve its ambitious goal of surveying and including the world's most important sites in its collection, TWAN seeks funding for a broad programme of travel by TWAN photographers to candidate TWAN sites. TWAN will seek support from UNESCO for visits to World Heritage Sites, national tourist ministries and bureaux, national air carriers, and other institutions with a stake in seeing the sites of their countries included in the resulting high-profile exhibitions and materials. At many good sites, access and

photography is restricted, and many are not available for night-time visits. This has been a particular problem for many TWAN photographers in their own work. AWB's international nature and the credibility the global TWAN effort bring should encourage greater cooperation and access. UNESCO and national, regional, and local governments will be approached for assistance.

Along with surveying potential TWAN sites worldwide, the potential for capturing special celestial events at each site must also be considered. Eclipses, conjunctions, and unexpected events such as the appearance of a bright comet present opportunities for unique images from many TWAN locations. Determining the best sites for these images includes consideration of geographic location and altitude, local topography, light pollution, accessibility and local circumstances including government restrictions and political conditions. The knowledge of local citizens is often invaluable here, as many TWAN photographers have found many times in their own work.

Images from TWAN sites worldwide will be selected for a major international travelling exhibition that will first be shown in 2008. A schedule of exhibits worldwide is being prepared for IYA2009, perhaps including the IAU General Assembly in Rio de Janeiro, Brazil. TWAN has approached organisatios in various countries to discuss hosting this world-class exhibition, which will be accompanied by unique presentations and educational workshops. Companion books and DVDs based on TWAN images will also be published.

A major part of TWAN is time-lapse digital photography showing celestial motion over the planet's most important sites, with breathtaking videos of sky motion above splendid mountains and historic monuments. A high-quality documentary film of images will also be produced for large screens, which will also be the basis for the first presentations at conferences at public venues worldwide. Presentations for live display and television following TWAN photographers in their quest to obtain these unique but challenging images are also being considered. Tours to TWAN sites, as part of AWB's programme of astro-tourism, will give photographers, astronomers, and others the opportunity to visit sites they've seen in the image collection, where they can also try their hand at taking their own images. Tours will be led by TWAN project leaders and local TWAN photographers.

Because the TWAN team is composed of individual photographers with their own interests, image ownership and copyright issues must also be addressed. All photographers retain rights to their images, with licence given to TWAN to include them in TWAN presentations. TWAN is already receiving requests for use of TWAN images in other publications, and the TWAN project

Figure 2. Aurora Borealis over the World Heritage Site of Denali National Park, Alaska, USA (Credit: Dennis Mammana)

Figure 3. Stars of the Summer Triangle in the last hour of a winter night near the village of Mesr, a remote unspoiled area in the central desert of Iran. (Credit: BabakTafreshi)

and individual photographers work together on copyright and photo credit issues. With many decades of combined experience in publishing images, the TWAN team itself has emerged as an expert body for discussion and decisions regarding these issues.

TWAN has enjoyed an auspicious beginning. The public first learned of TWAN with the launch of its web site in December 2007. NASA's Astronomy Picture of the Day (APOD) web site featured a TWAN image on Christmas Day, 2007 — an image taken the same month by TWAN photographer Wally Pacholka in the USA's famous Monument Valley — with an announcement of TWAN's creation and a link to the TWAN website. The venue for this public announcement was fitting given the dozens of previously published APOD images created by photographers who have joined TWAN. Spaceweather.com, a Sky and Telescope weblog, and others quickly followed suit with news of the new initiative to bring innovative and inspiring views of the night sky to the public. Traffic on the TWAN web site was high and feedback has been very encouraging.

This success suggests an important role that "TWAN-style" photography can play in reaching the public and sparking the imagination of viewers. The inclusion of known or recognisable terrestrial landmarks in these images of the night sky provides a context to the images that many people can relate to. While deep-sky images present unparalleled beauty in the processes they portray and the science they represent, sparking the imaginations of all, the views from Earth exhibited in TWAN images communicate with viewers on a more basic level. Even city dwellers who have never experienced the beauty of the Milky Way in a dark sky can relate to the images with familiar landmarks included. The opportunities that TWAN's image collection represent are yet to be fully explored. But the response to TWAN so far demonstrates the tremendous potential such images have to communicate astronomy to the public in new and exciting ways. TWAN photos emphasise how fascinating the science is that explores the many beauties of the night sky, but they also motivate the public to gaze at stars even with the un-aided eye.

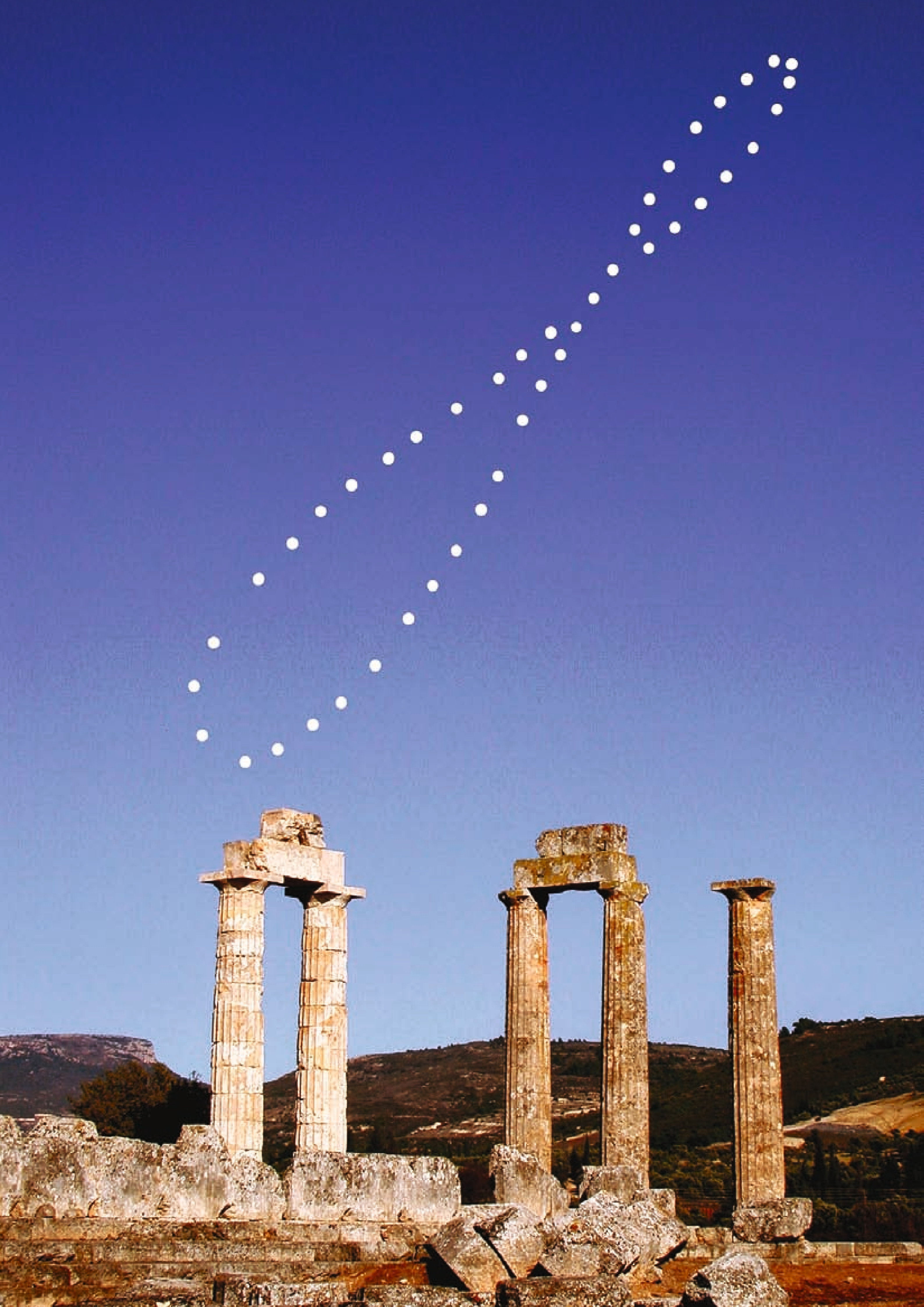
While the joy of astronomy and the importance of dark skies are inseparable messages of TWAN, the cultural depth of the photos builds bridges through the sky to connect the civilisations of our planet. Wars are fought over boundaries that have been created in the name of politics, religion, race, and beliefs. But the view from space reveals the true nature of our cosmic home — a borderless planet divided only into land and sea. While few will experience that view first-hand, the same is also true in reverse; the night sky above us — a view that is accessible to everyone on the planet — also has no visible borders. This common view is a bridge that connects us, creating understanding and friendship. When borders vanish, political and cultural differences become irrelevant. We all live under the same eternally peaceful sky. And the Earth we inhabit under it belongs to us all. This is the message that Astronomers Without Borders was created to spread. TWAN conveys this message in a profound and enthralling way. The measure of success of TWAN is simple — if it brings this message to the public, then it has succeeded.

Bios

Mike Simmons is the founder and President of Astronomers Without Borders, an IYA2009 Organisational Node. He is the Vice President of the Mount Wilson Observatory Association. He has been involved in education and public outreach in astronomy for 35 years.

Babak A. Tafreshi is the Director of The World At Night (TWAN) Project and board member of Astronomers Without Borders, is a science journalist, astronomy communicator and photographer. He was editor of Astronomy Magazine of Iran from 1997 to 2007. He has traveled to every continent, including Antarctica, in pursuit of celestial events, unique astrophotographs and interesting astronomy stories.

Figure 4. (next page). Analemma with the Temple of Zeus (340-330 BC), Ancient Nemea, Greece (Credit: Anthony Ayiomamitis)



The Pitfalls and Perils of Communicating Science

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Key Words

Communicating Scientists
Scientists and Communicators
Best Practices

It's hard to say when scientists realised that policy makers were not always going to make the best decisions regarding science funding, but a safe bet would be somewhere before 3000 BC. In the intervening 5000 years, not a lot has changed in how well scientists, politicians and the public really understand each other. A week doesn't go by when there isn't an article lamenting that one project or another doesn't get funding, or that one government bureau is over-zealous or too conservative. Scientists learned early that the best way to get the message across to the people who can truly influence policy makers was to consult them directly. In past ages it was advisers to kings. Later it became the voters themselves.

Yet along the way something changed in the science approach to communication. Science became more insular, more demanding, and the perception was that the public was not qualified to understand. The concept of the "citizen scientist" went the way of the homing pigeon. In the 20th century specialty journals written by scientists for peers became the norm. "Popular" science was still popular but scientists were no longer the folk heroes of yesteryear.

The internet changed that, along with a number of other things in our culture. A subset of scientists, frustrated with journalism in the general publications or lack of exposure in peer-reviewed journals, took to communicating science directly to the people. Other groups followed and, today, NASA and the National Institutes of Health are the most visited science sites on the internet.

As the age of the "citizen scientist" dawns again, some science topics, like global warming, have become part of the international lexicon and are ingrained in our culture while others, such as space exploration, that once held the public's imagination have lost their way and are only seriously discussed by the most devoted advocates in the general population. Why and how does that happen?

Instant Access to the World Gives Us a Unique Ability — along with Everyone Else

Instant communication opportunities mean there is a true confluence of science, culture and policy in the world today, and that means the opportunity for scientists to get their message out to the public in a way that delivers the most accuracy with the least amount of delay. Yet instant access by the public can be a blessing or a curse.

I don't think readers of a medium like this need to have it explained philosophically why communicating science with the public is essential. Most scientists are in the field because they care, and as science has improved society the social consequences of the science and the technologies that have resulted fall back on the general population. Yet often it seems as if the onus of communicating science should fall on someone else. Not only is there no one else to do it, there are reasons why you shouldn't want anyone else to do it.

The Pitfalls of Science Communication

If you're going to communicate science effectively, there are a few pitfalls you should avoid:

1. Avoid the belief that the public is uneducated and that you will correct it. This seems like common sense, yet we can all recall examples of scientists using that sort of "deficit" thinking about the general public and believing that nothing except their force of will and the right information will "correct" it. We may believe that data speaks for itself, but data is also subject to interpretations, including by laypeople, that are completely valid though not in line with the conclusions of scientists. Few aspects of science are so simple that data is impervious to perception.
2. Avoid the belief that science and society do not need each other. In my favourite movie, The Right Stuff, the astronauts know something the semi-fictional NASA heads do not: *"No bucks, no Buck Rogers."* The space programme of the 1960s was an aggressive vision that appealed to society to such an extent that even rocket

failures and a Gemini I disaster did not deter people. The success of that vision inspired an entire generation of young men and women who are now in positions to impact science policy in important ways. They remember the magic of the stars, but scientists need to reach them on a level that is practical to society as well.

3. Avoid advocacy. No one is trusted less than politicians. "Framing" was a big topic in 2007, mostly among scientists who regard the public as educationally defective, as in item 1, and simply need to be corrected. If scientists "frame" too much, they become advocates and the public is far too savvy to not look for suspicious motivation, even if there is none. No matter how you portray it, people will regard framing as either "spin" or an insult to their intelligence. Show respect for your readers. If you're successful, you will have a cross-section of readers of varying education levels but they're all important.

The Perils of Science Communication

1. It's not publish or perish, it's publicise or perish. No matter which country you are in, you have competitors and you will be in a constant struggle to defend your science during times of increased budget competition. You can privately ridicule scientists who do more successful self-promotion but they will set the agenda for the public if you do not. Open access and peer-reviewed journals are an increasingly effective measure to get the word out to the public about your work.

2. Avoid looking like a political mouthpiece. If you're communicating science in a detailed, effective way and it's remotely controversial, someone is going to attribute an agenda to you but the only alternative is to not be in the public at all. However, the higher your profile the greater the potential to look like an advocate. Using the global warming example, again, both Richard Lindzen and James Hansen have impeccable credentials and valid expertise on the subject yet each is dismissed by one side of the global warming debate or the other because of financial ties to Exxon and George Soros. Is either of them paid to speak out? Not at all, they are both honest professionals with differing views, but their value in the discussion is limited because they polarise the population due to their political exposure. When the world is a mix of politics and culture and science, it's best to let people know where you are. If your science is most often political, your value in science discussions is marginalised by a large chunk of the population. Politicians engage in polemic, not scientists.

3. Avoid thinking that promotion is unethical. It happens on occasion that the best work doesn't get drowned out in a sea of noise but it's rare. Every day I read science press releases, at least 40 of them, and they run the gamut from the ridiculous to the understated. Not every news outlet is devoted to science so some will go with the most outrageous headline, some will think in terms of "what sells" to their audience, most will not sift through elaborate jargon or subtle nuance to find out what makes your finding spectacular. If you have a study that you want publicised, work with the marketing department to make sure it gets the point across clearly, but also has enough sizzle to make the steak appealing.

Communication Is One of Your Tools

Scientists use tools to learn things about the world. Some tools are physical, like observations through a telescope, and some are numerical, like simulations that tell us about objects in space we can't detect in ordinary ways. Communication should be considered another tool of the scientist. Like all other tools of science, communication should be used for the best possible reasons and it should adhere to the scepticism and objectivity that is foremost in science.

Most people know less about your discipline than you do, but everyone gets a say with policy makers so their opinion counts. Online open access and peer-reviewed journals are excellent tools for reaching the public in a way that gets the information out quickly. I wrote an article, "Sharing Research Leads To Good Citations"[1] and the most interesting factoid to me was that in an examination of 85 cancer microarray clinical trial publications, 48% percent of the trials with publicly available data accounted for 85% of the aggregate citations — so most of those citations were due to its easy availability. Lots of citations means your work has value in the science community and that's an excellent source of credibility for reviews and proposals. The public, and fellow scientists, are catching on to the value of science communication and it's something our ancient ancestors knew as well. The second age of the "citizen scientist" is here and as long as we avoid some of these perils and pitfalls of communication, that will be a good thing for everyone.

Notes

1. Sharing Research Leads To Good Citations, Scientificblogging.com, 20 August 2007, http://www.scientificblogging.com/hank/sharing_research_leads_to_good_citations

Bio

Hank Campbell is a long-time physics software industry veteran, including direct accountability in taking one company from $6 to $60 million in annual revenue and an IPO. Currently he is CEO of ScientificBlogging.com, the world's largest Science 2.0 community and one of the top 25 science sites on the internet.

Astrobiology for the 21st Century

Opinion

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Key Words

Astrobiology Communication
Scientific Knowledge
Evolution
Non-Science Majors

We live in a scientific world. Science is all around us. We take scientific principles for granted every time we use a piece of technological apparatus, such as a car, a computer, or a cellphone. In today's world, citizens frequently have to make decisions that require them to have some basic scientific knowledge. To be a contributing citizen in a modern democracy, a person needs to understand the general principles of science.

Non-Science Majors

A major challenge in this scientific world, however, is that most people are not scientists; neither should they be, since the human endeavour shouldn't start and end in science. Thus, most of the people in our world are not as scientifically knowledgeable as we would like them to be in order to understand the world that surrounds them. These people, who comprise the majority of the population, have great power in the world, and some are involved in decision-making — politicians, businessmen, judges, CEOs, and so on. These are the ones who decide the funding and policy of scientific research. This segment of the population might be called "non-science majors".

It is therefore in the interest of society that non-science majors understand the basics of science in order to make informed decisions. Unfortunately, most people do not have the most basic scientific notions and do not understand the nature of science.

Evolution

A few months ago, in a Republican Debate, three candidates to the Presidency of the United States of America stated that they do not believe in evolution. This is scary! And it is especially surprising, since they clearly are very knowledgeable and intelligent persons. One reason for this belief may be that the three candidates do not have a very sophisticated understanding of the nature of science. And the biggest problem is that many other American citizens share the same belief — several millions of them according to some polls. It is troubling to consider that these individuals may be in a position to make decisions that will profoundly affect the future of science in our society.

The solution to this problem should not be to take a passive attitude, or to blame religion, and expect that things will magically turn out right. Neither should it be to turn this into a "holy war" between science and other aspects of human life. The solution has to lie in educating people. Knowledge is humanity's most important weapon.

Scientists, educators, and communicators of science often disagree about the methods to achieve their goal. But it is the same goal for all: scientific literacy.

There are many misconceptions about the nature of science among the population, and these, to me, are the ones we need to focus on. For non-science majors, in formal or informal learning environments, the scientific details are practically irrelevant. According to Carl Sagan, the "big picture" is the best knowledge to transmit to persons who are uninterested in the scientific nitty-gritty. The details are vital in scientific research but hide the essential points from the majority of the population.

Misconceptions about the Nature of Science

With evolution, there are clearly several misconceptions about the nature of science. One is that the population thinks that science is a question of belief. This happens most probably because science is usually transmitted in schools and also in informal environments, such as science centres, books, articles, and so on, as being "the truth", something that must be believed instead of understood. Science is viewed as a belief! On the other hand, people don't recognise all the science around them — there appears to be a disconnect between science and the general population. By saying that they don't believe in evolution, they are not only saying that they don't understand science, but they are also saying that they do not believe in the scientific process. This is shocking, since they enthusiastically use televisions, aircraft, and cellphones, all of which work on scientific principles and were developed using the scientific process. It's as if I said that I do not believe that my car works while I'm driving it; or writing in a blog that I do not believe the internet or computers exist! It makes no sense for people to fully trust science in certain areas — like when their life depends on it in a hospital — but not in others that follow the same scientific principles; and it makes even less sense for people to state that they do not believe in science (evolution, for example) while using and trusting it (example: on television).

Neither do most people have any idea of the meaning of a scientific theory. They assume a theory is just an idea that someone had. They don't realise that a proper scientific theory, like evolution, was and continues to be, tested repeatedly, and that the results of these tests create a bulk of evidence supporting the theory, making it as close to "fact" as it can be. Furthermore, people have difficulty comprehending that the gaps in our understanding are minor details that do not bring the overall theory into question. We send probes to other planets, we have computers, we deal with science daily, even though we do not fully know how the Universe works; and we don't need to! Science is work in progress; it is an ongoing human endeavour. It will never be fully complete, otherwise curiosity, and thus part of what it is to be human, would die. The communication of science needs to emphasise this point.

Maybe these popular misconceptions come from formal teaching or informal communication, which is presented as if everything were already known. For instance, in science classes, the current news is rarely emphasised. Science is taught as something complete, a finished endeavour. On the other hand, in TV news reports, only new, possibly still unconfirmed discoveries at the frontier of science are emphasised. This can give people the mistaken impression that all scientific results are as shaky and as vulnerable to revision as the latest discoveries. But this is not the case: most science is not vulnerable at all. We don't hear much about it, because is not newsworthy. It is important that people know where the boundaries lie. Science education needs to focus on this too.

Finally, there is also the popular perception that a scientific theory is limited to one area of science. Evolution is perceived as being about biology. But that's not the case. The theory of evolution is, as with most scientific theories, an interdisciplinary theory, with strong footholds not just in biology, but also in geology, physics, chemistry, astronomy, paleontology, and other disciplines. Therefore, not to support the theory of evolution is not to support several sciences or science in general, which, of course, is absurd — especially taking in consideration the examples of driving a car or writing a blog, mentioned above.

We can't blame the general population for these misconceptions. If people don't understand the nature of science, that's probably because the agents of transmission of science to the population are not communicating effectively. A change is imperative!

Astrobiology is the Answer

My solution is directly related to astrobiology. If taught appropriately, using critical thinking and scientific speculation, astrobiology can be an excellent vehicle for teaching the nature of science.

Astrobiology, as defined by the NASA Astrobiology Institute, is: "*The scientific study of the living Universe: its past, present, and future. It starts with investigating life on Earth, the only place where life is known to exist, and extends into the farthest reaches of the cosmos. It ranges in time from the Big Bang and continues on into the future*". It studies the origin, evolution and distribution of life in the Universe; thus, it studies life on Earth, and searches for life beyond our planet. Astrobiology covers many questions, of which the best known is: "*Are we alone in the Universe?*"

From the misconceptions mentioned earlier, we can see that astrobiology, especially with respect to extraterrestrial beings shown everywhere, has already incorporated a belief system. Instead of ignoring it, the teaching and communication of astrobiology can use this belief in its favour, by clearly demonstrating the line separating beliefs from scientific knowledge. Useful issues in this regard may be science fiction and ufology. A critical analysis of these subjects helps to distinguish scientific knowledge from scientific speculation and from plain beliefs.

Additionally, astrobiology is an interdisciplinary science, with concepts from natural sciences like astronomy, biology, chemistry, geology, ecology, and so on, and also from social sciences like history, sociology, psychology, etc. It's a perfect combination of sciences, which, when integrated, will not be perceived as "island-sciences" with no relation among themselves — as is usually perceived in science classes. At the same time, it will allow people — and most importantly, non-science majors — to have a basic knowledge of many sciences, how they relate to one another, and how scientific knowledge is intrinsically multidisciplinary. Moreover, the incorporation of social sciences connects astrobiology with the society in which it is embedded. Furthermore, almost daily we have news related to one of the sciences spanned by astrobiology, which gives the notion that science is work in progress. All these factors are advantages provided by astrobiology that may help to diminish the misconceptions many people have about the nature of science.

On top of all this, there is a public fascination for the possibility of life in the Universe (and UFOs — where the social sciences enter). In the last ten years, Gallup, Roper, ABC, CNN, and many other polls, have clearly shown that most Americans (and the same happens with Europeans) believe in alien life. In addition, there are several science fiction movies with extraterrestrial life that have been great box-office successes. This shows the interest that people have in astrobiology-related issues. Basically, it enhances the inherent motivation of the general population for this subject. And this makes astrobiology the perfect hook with which to attract people to study science, the nature of science, and the interdisciplinary aspect of science.

Following in the steps of Carl Sagan and others, the teaching and communication of science needs to relate more with the general population; it needs to be engaging, to have an inherent motivation, and to be multidisciplinary. Astrobiology can be the answer to all this!

Bio

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A Short Guide to EU Grants for Science Communication

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Key Words

Funding
European Union
Transnational Projects

Summary

"The importance of communicating science to the general public cannot be overestimated. Science cannot live isolated from society." As the words of Janez Potocnik, EU Science and Research Commissioner, clearly demonstrate, there is a political call to the European Union (EU) for supporting science communication. But as we all know, the reality lies in the implementation and not in the mission statements. So let's see what the EU can offer to science communicators.

Introduction

We can definitely describe science communication as one of the most innovation-needy fields. Why is that? The new tools of general communication catch the attention of people — especially youngsters — easily, not leaving too much space for traditional communication tools, which can seem to be boring compared to the new innovative and interactive eye- and ear-catching tools. Another important factor is the demand for quick and up-to-date information, which sets the requirement of easy access to information from everywhere, at any time. Science communication has to live up to this challenge dictated by the needs of the target group. Like all fields with these characteristics, science communication is often in critical need of funding for its innovative projects.

The traditional way to get funding for a project is to approach the national research-funding agency. However, in the case of international and intercontinental projects, the national funding option is not applicable in most cases. This is the point where the words of Janez Potocnik come into context. The European Union (EU) also provides support for projects communicating science to the general public!

Figure 1. Is FP7 a new type of organic smoothie drink? Credit: ESA/Hubble (Martin Kornmesser)

In order to provide a fair picture, it is necessary to emphasise that the EU should not just be considered a money distributor. There are other important actions where the EU influences the general appreciation of science communicators and science communication itself. The EU sets policy principles that aim to impact national legislation and the national budgets to improve the situation for science and science communication. It organises Europe-wide science communication conferences and public debates, and harmonises national projects and actions in order to build space for Europe-wide joint projects. And indeed the EU provides grants for international projects, which serve the interest of European research, and which are not eligible for funding at national level.

But what are these grants?

1. 7th Research and Development Framework Programme

The 7th Research and Development Framework Programme[1] (FP7) is the EU's main instrument to provide funding for European research and technological development projects. FP7 will run for seven years (until 2013), with an overall budget of 50,521 MEUR. FP7 provides grants through open competitive Calls for tenders (Call).

SEVENTH FRAMEWORK PROGRAMME

Figure 2. European Comission Seventh Framework Programme logo.

FP7 is divided into four basic blocks, the so-called Specific Programmes (SP):

1. Cooperation (32.413 MEUR)
2. Ideas (7510 MEUR)
3. People (4750 MEUR)
4. Capacities (4097 MEUR)

Each Specific Programme is further divided into parts or themes. What is relevant to science communicators is the Capacities Specific Programme, and inside that Programme the Science in Society (SiS) theme and the International Cooperation (INCO) theme.

1.1. Science in Society

The aim of the Science in Society theme is to stimulate the harmonious integration of scientific and technological endeavour and associated research policies into European society[2].

The SiS has an overall budget of 330 MEUR for the seven years, and support for one project varies from between ten and a hundred thousand EUR to one or two million EUR. Of course not all the Calls submitted under the SiS programme can be used for science communication, especially for astronomy science communication. There are some Calls to be published in 2008 that can be of use to *CAPjournal* readers:

- 5.1.1.4[3] The role and image of scientists.
- 5.2.1 Gender and research.
- 5.2.2 Young people and science.
- 5.3.0.1 The provision of reliable and timely scientific information for the press and media.
- 5.3.0.2 Training actions to bridge the gap between the media and the scientific community.
- 5.3.0.3 Encouraging a European dimension at science events targeting the public.
- 5.3.0.4 Promoting science by audiovisual means in European co-production and the circulation of science programmes.
- 5.3.0.5 Promotion of excellent transnational research and science communication by means of popular prizes.

It is worthwhile to devote some time to the details of the last Call. The European Science Awards, in particular the Science Communication Prize (former Descartes Prize), which is unique.

Recognition is a strong driver for research and innovation. The EU, in parallel with its political decision to strengthen European scientific research, established a prestigious international prize to give emphasis to this important decision. The Descartes Prize supported international research themes with 1,150,000 EUR anually since 2000, and science communicators with 275,000 EUR anually, since 2004. The history of the communication prize is clearly not a long one, but the initiative certainly demonstrates dedication. On a national level almost every EU member state grants science communication prizes, but on a Europe-wide level this is the only one.

During the last three years five winners and five finalists were awarded the recognition and reward of the Descartes science communication prize for their high quality work of communicating to the general public each year. In 2007 some changes were made to the Descartes Prize structure. In parallel with the launch of FP7 the two main parts of the Descartes prize were separated. The prize for excellence in transnational and collaborative research kept the Descartes label, but the prize for excellence in science communication was simply renamed as the "Prize for Science Communication". One could argue that for a science communication prize a more appealing name might have been chosen, but the prestige of the prize remains.

In parallel with the name change the budget and conditions have been changed as well. In 2007 a maximum of three Laureates receive an award of 60,000 EUR each and up to three Finalists receive 5,000 EUR each. "The Prize targets individuals and organisations having achieved outstanding results in science communication and having been selected as winners by European and/or national organisations which carry out existing science communication prizes of any kind. This implies that prize organisers can send their winners as candidates to the EU prize..."[4] Who knows, maybe one day the *CAPjournal*, or one of its readers, will be among the Laureates? More information for all candidates can be found on the new website of the European Science Awards[5].

1.2. International Cooperation

Although not obviously targeting science communication projects, the International Cooperation[6] (INCO) theme of the Capacities programme also contains some possibilities to exploit with a bit of imagination and flexibility while defining a new science communication project. Astronomy science communicators often work in international teams connecting people from different countries and continents. The INCO can be a solution for these cross-continental projects, with its overall budget of 108 MEUR for the seven years. Next round of INCO calls is expected in the first half of 2008. More information can be gathered from the FP7 website.

1.3. HELP!

It is not easy to find your way in the jungle of FP7 rules. Brussels knows this as well, so they have tried to make all the information easily accessible. The main website of the FP7 programme is the door to the different parts of the programme: http://cordis.europa.eu/fp7/home_en.html. The updated information about open Calls can be found on the "Find a Call" page of the website: (http://cordis.europa.eu/fp7/dc/index.cfm).

However, it would be understandable if you were to shut down the computer after an hour of desperate attempts to understand the structure, the procedures and the meanings of FP7 Calls. It would then perhaps the right time to approach a National Contact Point or the organisational equivalent. The EU Commission, in collaboration with its Member States and Associated States, has established the system of National Contact Points (NCP); a network of professional EU FP7 officers whose main task is to help people to understand FP7, find Calls and write applications. A list of the NCPs can be found on the "Get support" page: (http://cordis.europa.eu/fp7/get-support_en.html) of the FP7 website.

2. The eContentPlus Programme

Nowadays science communication, in particular in the field of astronomy, relies on and contributes to the evolution of new technological developments such as Internet-based innovative applications managing digital contents. For these projects the eContentPlus programme offers lots of possibilities in a framework that is less complicated than FP7.

The aim of this multi-annual programme is to make the digital content in Europe more accessible, usable and exploitable using the available 149 MEUR overall budget of the programme. The programme addresses areas of public interest, and that would not develop (or would develop at a slower pace) if left to market forces[7].

The projects financed under this scheme have to be based on a proven state-of-the-art technical solution, so this grant cannot be used for technological innovation, but for innovation in organisation and in deployment.

The programme supports educational digital content and digital libraries among other target areas. For the purpose of the programme educational content means digital content that can be used for learning in different contexts, both in formal and informal education. Digital libraries have a very broad definition in the eContentPlus framework: organised collections of digital content made available for the public by cultural and scientific institutions and private content holders in the EU Member States and the other participating countries of the programme[8].

There are three eContentPlus project types that are eligible for funding:

1. Targeted projects (TPs): Targeted projects are open in the areas "educational content" and "digital libraries". The projects should aim to solve specific known problems by pooling together the resources of interested and affected participants in a consortium.
2. Thematic Networks (TNs): Thematic Networks are open for the area "reinforcing cooperation between digital content stakeholders". The aim of bringing the stakeholders together is to define best practices, building consensus in order to better coordinate the availability and usability of digital content.
3. Best Practice Networks (BPNs): Lastly, the Best Practice Networks are designed to serve the areas "geographic information", "educational content" and "digital libraries". The expected outcome of these formations is the adoption of standards and specifications that could enable users to access and use the digital content of certain areas. This type of activity would implement the "Thematic Networks" in practice.

A common eligibility criterion of all the three types of activity is the requirement to have a European dimension to the activity. The current eContentPlus programme runs until the end of 2008. The last Calls will be published during the course of 2008. The new eContentPlus multi-annual programme will be published in the second part of 2008.

So, digital content stakeholders: please do not be discouraged by this very dry text. Go to the main website of eContentPlus for more information: http://ec.europa.eu/econtentplus.

Figure 3. European Comission MEDIA Programme logo.

3. MEDIA 2007

I believe all movie-lovers (at least the European ones) remember that some years ago a strange text appeared on the cinema screen before the start of certain famous movies, such as Goodbye Lenin, Secrets and Lies and the Fabuleux destin d'Amélie Poulain. I myself watched the film Breaking the Waves on DVD and skipped the seemingly unimportant parts and text stating that the movie was produced with the help of the MEDIA programme. Little did I know then that one day I would write about this programme to promote it!

The MEDIA programme already has a long history. The series of four MEDIA programme terms has provided support for the European audiovisual industry since 1991. MEDIA 2007 is the successor of the former MEDIA programmes, covering the years 2007-13, providing the European audiovisual industry with an overall budget of 755 MEUR.

The programme supports different activities of the pre- and post-production phases of filmmaking:

- Training (scriptwriting techniques, digital technologies, economic and financial management).
- Development.
- Distribution.
- Promotion and festivals.
- Horizontal actions and pilot projects.

Calls are submitted on a yearly basis. More information about the programme can be found on the webpage of MEDIA 2007: http://ec.europa.eu/information_society/media/overview/index_en.htm.

Checking the list of the MEDIA programme supported movies I could not find any science-related one, but at least a science movie festival was there. I hope this can change in the future and that the audiovisual industry will be more encouraged to apply to make more science movies.

Conclusions

As one can see after reading this inventory of EU grants, there are some opportunities to obtain funding from EU for science communication projects. It is, undeniably, not a smooth path to get the funding. EU projects require hard work at all levels. Project preparation, application, management and reporting are demanding, but it pays well in the case of a successful project. But keep in mind that professional help to get the EU information and to prepare an application is available from public bodies and also from the private sector, giving everyone the chance to choose according to the size of his wallet. And don't forget:

"The importance of communicating science to the general public cannot be overestimated. Science cannot live isolated from society."

Notes

1. http://cordis.europa.eu/fp7/home_en.html.
2. Capacities, part 5, Science in Society Work Programme 2007, C(2007)563, page 4.
3. Call identification number.
4. http://ec.europa.eu/research/science-awards/communication_en.htm.
5. http://ec.europa.eu/research/science-awards/index_en.htm.
6. http://cordis.europa.eu/fp7/capacities/international-cooperation_en.html.
7. eContent*Plus* — A multi-annual Community programme to make digital content in Europe more accessible, usable and exploitable (2005 - 08); Work Programme 2007, page 3.
8. For all areas, the following countries are eligible for funding: 27 EU Member States and Norway, Iceland and Lichtenstein, Croatia, Turkey, the Former Yugoslav Republic of Macedonia. Other countries can also participate in consortia, but without financial support from the EU. Up-to-date information about the participating countries can be found on http://ec.europa.eu/econtentplus.

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Bio

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Important for Good Press Relations: Accessibility

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Key Words

Press Relations
Mass Media
Accessibility
Press Office Best Practices

Why do the European media often favour American results and institutions, for instance by using results from NASA instead of ESA? Is it just habit or is there a better relationship between editorial departments and NASA? Are NASA's stories more accessible for the media, more digestible or of a higher standard than those of ESA?

Accessibility of information is, in my opinion, a very important factor when cooperating with the mass media, as I will try to show. For the past year I have been an online editor and author for the Südwestrundfunk, one of Germany's major public broadcasters. My target audience has a fairly limited knowledge of spaceflight, the ISS, and of astronomy in general. When we write articles or produce commented image galleries we cannot do in-depth reporting, but have to focus on overview and comprehensibility.

I admit that I have learned to prefer NASA material. My reason is that we mainly do our journalistic research (What kinds of pictures and texts are available? Who might be an interview partner? What could be the focus of our story? etc.) on the web and with limited time. When one of my colleagues or I visit the NASA website it is easy to find the media and press section. It does not take long to find out that their pictures, video and audio material are available for use. So we can quickly assemble what we would like to use and start producing our web articles — perfect conditions for my hectic guild! ESA's website also has a "media centre" and a multimedia gallery. So, everything looks fine at first glance. But when I needed pictures for an article about the Perseid meteor shower of 2006 I could not find any terms of use concerning ESA's pictures (neither could I find them when writing this text in November 2007). So I asked ESA's media relations department for permission by e-mail. The deadline for my article was only a few hours away, but usually press offices of major organisations handle this kind of query quickly or are prompt in telling the journalist that permission cannot be granted. ESA's reply and the permission came exactly 14 days later. The meteor shower had been over for many days, and the article I had finally produced with the help of NASA's pictures was already offline again.

If major institutions establish a press office, it must be in a position to serve the media's needs. In this case I would have needed the information within the hour; news agencies may need information within minutes. So somebody should be available during usual office hours to answer e-mails and calls. This sounds obvious — and it is — but it is still lacking in some press offices.

Journalists — who have to write about a new drug one day and about an archaeological discovery the next — need to find accessible information and good interview partners quickly. If a useful and reliable source is identified (for the journalist, "reliable" means, among other things, that he or she can rely on getting an answer quickly) most journalists will contact the source again, for example when writing a follow-up of a story. In contrast, if journalists have had a bad experience like the one described above it may be quite some time before they contact such an institution again. Such poor press relations could be very damaging in the long run. All too often, it is just a handful of media-savvy scientists who dominate certain topics in the media, and such opinion monopolies threaten the balanced representation of science in the media.

Accessibility of information is crucial to good press relations and should not be underestimated by scientists and press information officers.

Bio

Diane Scherzler, MA, works as an editor for a major German Public Broadcasting Company. She has been concerned with the subject area "science, the media, and the public". Diane Scherzler gives media training to academics and advises scientific organisations who want to improve their collaboration with journalists.

Why Should We Bother to Communicate Astronomy?

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I once attended a lecture on science communication by a prominent BBC radio producer. At the end of the lecture questions were taken by the producer on the ways in which science is communicated in the media and a lively discussion quickly arose. After covering the in and outs of target audiences, pitching articles and news pieces at the right level, the debate settled. Finally one postgraduate promptly raised his hand and proceeded to ask the producer something along the lines of: "*Why should we even bother with science communication?*" He then continued, emotively and quite genuinely, to argue that to try and explain his complex work would simplify it and, ultimately, belittle it. As he went on the room became quieter and quieter.

At the end of the lecture, as I picked up my pen and paper to leave, I tried to understand where my colleague was coming from. As someone who has a passion for communicating science and astronomy to other people I began to question whether I had really taken for granted that mine was a job that needed to be done. Maybe it was because the question was posed without a hint of jest and with complete genuineness that I was jolted. Did my postgraduate colleague have a point — surely not? Was he just being narrow-minded, not seeing the bigger picture and if so how many other scientists shared such a hard-line view? As science communicators these are questions we need to be able to respond to with clarity and strength.

One of the observations which arose in my mind from the lecture hall experience was that here was a young man just starting out in his research career in some field of astronomy; someone of similar age to myself who had grown up in a much more media-orientated world than today's more experienced researchers. A world where research grants, project funds and big name backing are all linked by the potent ability to communicate, enthuse and convey your own innate passion for your work to someone else. Yet before even starting his career he had already perceived the communication of his work as something that can have a detrimental effect, not a positive one. How so?

It's no secret that many scientists today feel that communicating their work is not the most important item on their agenda. But nevertheless many appreciate its value. Some scientists commendably approach outreach with a passion, whilst others take the view of the postgraduate in the lecture hall. Now this may ultimately depend on the individual's communication abilities but everyone, communicators and scientists alike, can always improve their skills. It's the perception within the scientific community of outreach as damaging that we have to shed. If we are to reduce or even reverse this attitude then we must continue to ensure that as science communicators we produce the best work we can.

Our work should maintain credibility at all costs. We should strive to be factually correct whilst conveying the theory, message and science. We should inform not hype, simplify but not patronise and explain without confusion or ambiguity. It's quite a difficult but — crucially — not an impossible task. These issues have already been widely discussed so I will not explore them much further here. We need simply to make sure that credibility is ingrained in our work so that the interface between scientists and the media is as smooth as possible and is as beneficial to the researcher as it is to us communicators.

The central question is still why we should communicate not how. The discoveries of science and astronomy need to be communicated. Astronomy represents one of the oldest, most captivating sciences there are. Today many laypeople yearn, as they have always done, to understand more about the Universe they live in. As astronomers and scientists we too covet every new major discovery almost with a veneration for progress that has lasted for centuries; it's our job to disseminate this vital information. I doubt that many people, academic and lay alike, would disagree.

We should communicate astronomy because it is important. It's important to many people, on a multitude of levels. Take the images from the various space agencies around the world. Millions of people have marvelled at the exquisite detail of the spirals in distant galaxies thanks to the Hubble Space Telescope, or the view of a Saturnian moon they had never even heard of thanks to Cassini. Whilst these images may not be heavily laden with scientific prose, they are incredibly important keys to communicating the science. If even a small percentage of the millions who see the pictures from space take an interest in what the image actually shows then thousands will be educated in the astronomical workings of the Universe. What would have happened if Vivaldi had decided to show only a few friends the sheet-music to The Four Seasons before filing it away? With good communication our lives, our culture and, most importantly for us, our work is so much richer. Astronomy is a stimulating, mystifying, often baffling and immense subject that brings pleasure and intrigue to young and old, experienced and inexperienced all over the world. Not to communicate the wonders of the Universe would be an outrage.

Culturally, the advancement of astronomy has gone hand in hand with the expansion of some of the most vibrant and diverse cultures the world has ever seen. Similarly, those countries which have embraced science throughout history (especially astronomy and space sciences) have also witnessed a growth in the skills of their populace, employment opportunities arise and numerous economic benefits. Without outreach and education few laypeople would know anything about the workings of the Universe, let alone the workings of a research scientist! If we were to stop communicating astronomy how could we ever hope to inspire and bring forward the next generation of astronomers?

In everyday life we communicate because we must do so to survive. It is a central foundation of our human existence; it has been so since our ancestors wandered the dusty plains of Africa. Today, many millennia later, there is absolutely no difference. Astronomy (and science in general) must communicate to survive. If astronomy is to evolve and progress in the burgeoning manner that it has done since it began, then we must not only bother to communicate we must also excel at it.

Bio

Will Gater is a science writer and astronomer based in the UK, currently working for the BBC Sky At Night magazine. His latest popular astronomy book is due to be published in the near future. Visit his website at www.willgater.com.

Visualising Astronomy: Comics, Kant and *KAGUYA*

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Key Words

Visual Communication
Science Visualization

Although I grew up reading comic books, I always hesitate before using superhero references. That said, I admire the moment in Spiderman when Uncle Ben tells Peter Parker: "*With great power comes great responsibility*". Actually, that's the concise, film version; the original line appeared in a caption and read: "With great power there must also come — great responsibility!" (Lee 1962) But I'm not one to nitpick.

Ben (or the omniscient narrator) had a point, and with my tongue only slightly in cheek, I would suggest that the great power of astronomical imagery should be executed responsibly. Immanuel Kant describes the kind of power I'm talking about: his idea of the sublime encompasses both the aesthetic and the intellectual to generate a potentially overwhelming emotional experience (Kant 1790). As purveyors of beautiful images coupled with complex and compelling scientific concepts, astronomy communicators have an opportunity to impart a sense of the sublime. Thus, the topic of imagery and its associated content merits discussion, which is what prompts me to talk about visualising astronomy.

For a little over a year, I have tried my hand at blogging about scientific imagery and the way in which it can help support (or sometimes detract from) a story. We learn from our mistakes, and we also learn from each others' successes; thus, I try to mix constructive criticism with explicit praise, but the appropriate blend of honey and vinegar can prove tricky to achieve. In this column, I shall confine my comments to astronomical imagery and visuals produced for public consumption, but of course, things get stickier when moved from the blogosphere into

Figure 1. West side of Oceanus Procellarum as imaged by the SELENE/KAGUYA spacecraft.

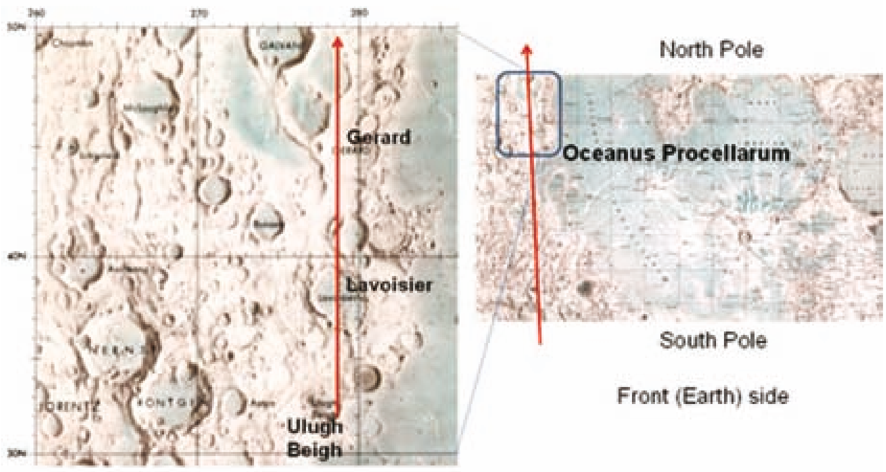

Figure 2. Lunar map showing the trajectory (red) of the SELENE/KAGUYA spacecraft and indicating the region (blue) depicted in a portion of the video released. (JAXA/USRA).

print, so… I ask for your charity even when my comments seem uncharitable.

Let's get the ball rolling with a particularly striking series of visuals from the SELenological & ENgineering Explorer (SELENE or KAGUYA) launched by JAXA earlier this year. In collaboration with the Japan Broadcasting Corporation (NHK), the spacecraft has sent back high-definition (and we're talking 1080p here) imagery from lunar orbit. The frame above comes from one such video sequence. On the JAXA website, you can watch streaming video of the orbits; in addition, you can find maps such as Figure 2.

Watching the video and using the little map, I can say with some confidence that the feature in the centre left foreground of the still image is Ulugh Beigh with the crater Lavoisier in the middle distance. Seems like a great map-reading exercise for, well, university students, given some of the cognitive studies on map-reading I've heard about (Taylor & Rapp 2006). But it also works as a blueprint for an interactive tool, showing the location of the spacecraft on an inset map in coordination with the video (a little like a heads-up display in a computer game).

I appreciate that level of detail in the information made available online. It surprises me, however, that the actual high-definition video is nowhere to be found on the JAXA website; in fact, you can't download any of the video, since it's available only as streams. Heck, you can't even get single frames at full resolution! In an era when several groups (e.g. Spitzer Space Telescope and ESA/Hubble) release regular high-definition video podcasts, the unavailability of such content seems particularly unfortunate.

Detailed images sent back from the other side of the Moon? A sublime concept, when one really allows the idea to sink in. But the experience of that particular epiphany relies on our ability to communicate effectively and responsibly about the amazing discoveries in astronomy.

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Bio

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 somewhat regular blog, *Visualizing Science*, available online at http://visualizingscience.ryanwyatt.net/.

From Earth to the Universe: Image Exhibitions in the International Year of Astronomy 2009

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Key Words

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Summary

The fantastic images of the Universe are largely responsible for the magical appeal that astronomy has for lay people. Indeed, popular images of the cosmos can engage the general public not only in the aesthetics of the visual realm, but also in the science of the knowledge and understanding behind them. The International Year of Astronomy 2009 (IYA2009) is an unprecedented opportunity to present astronomy to the global community. *From Earth to the Universe* (www.fromearthtotheuniverse.org) endeavours to bring these images to a wider audience in non-traditional venues, such as art museums, public galleries, shopping malls and public gardens.

As we plan for IYA 2009, there remain many unknown factors. Issues such as funding, location availability, and other major planning elements are still waiting to be determined. Therefore, we suggest that this concept has the greatest likelihood for success if we can create a flexible plan that can accommodate a wide range of support in a host of different settings. Below we outline the basic categories we have designed. These "levels", however, should not be seen as absolutes. Rather, a particular exhibit may incorporate various elements based on the sensibility of that location and the local interest and support.

Platinum Exhibit

As the name suggests, this is the most ambitious and, of course, expensive outline. We envision a semi-permanent outdoor exhibit in a prominent location such as the National Mall in Washington, DC, or the Champs Elysee in Paris. Such "under the sky" installations would require proper illumination at night and high-quality weather-proofing treatments. The core exhibit of images could be enhanced with such features as interac-

Figure 1. The Universe from the Earth — An Exhibit of Astronomical Images. Credit: The authors

Figure 2. The Universe from the Earth — An Exhibit of Astronomical Images. Credit: The authors

tive kiosks, large-scale sky maps, and alternatives for visually-impaired and other challenged visitors.

Gold Exhibit

As with the platinum level, the gold exhibit would consist of up to 100 astronomical images in large printed format, roughly 120 cm x 90 cm (4 ft x 3 ft) in size, with appropriate captions. In order to keep costs to a minimum, these images could be directly mounted on pre-existing walls or less expensive stands with less sophisticated or no additional lighting. Simple packaging could be developed so that it would be relatively inexpensive to ship these images to multiple locations. Or, depending on printing costs in a particular location, the exhibit could alternatively be duplicated.

Silver Exhibit

This is the "do-it-yourself" version of the image exhibit for science centres, planetariums, and other interested groups. The images would be available for "off the shelf" or pre-existing technologies such as light boxes, large-scale prints, or other formats already being used at any given location.

Call for images

Individuals, organisations and observatories that missed the last call for images, now have a last opportunity to submit their images. Submit one image that will print well at 120 cm x 90 cm (4 ft x 3 ft) and ideally is colour corrected for printing. Upload to ftp://cxc.harvard.edu/incoming (anonymous, use E-mail for password). It will be difficult to accept new images after this call.

Financing

As a recognised Cornerstone project for both the international and US IYA efforts, the image exhibition concept is acknowledged as a worthwhile project to proceed for 2009. However, at this point, it is not obvious that any significant funding can be obtained from the major agencies (NASA, ESA, IAU, etc.). Therefore, in order for this project to succeed, financial backing must be found.

We propose that corporations, foundations, and other entities be approached and asked for their support. Each individual location will most likely need to obtain its own funding. Hence, if there is interest in having an image exhibit come to a location, the organiser for that location must take the responsibility to secure the funding for this to be possible. (See more details in the "How to Participate" section.)

It is difficult to supply specific costs for each level of the image exhibition concept because many of the expenses will vary from location to location. For example, the costs of printing — which will be done as locally as possible — will change. Also, if there are fees to use a particular site, this will have to be factored in as well. There are many other details that may also affect the ultimate cost. But, in order to begin planning, we provide a very loose estimate below.

- Platinum: $250,000—$500,000
- Gold: $25,000—$50,000
- Silver: $2,000—$10,000

Again, these numbers encompass a very wide range and should only be used in general planning. We hope to expand upon these numbers and other details of planning soon.

How to Participate

If you would like to see an image exhibition in your area in 2009, please consider the following responsibilities.

1. *Serve as Point of Contact*: A lot of logistical planning will be necessary to secure locations. We need people who are willing to pursue and coordinate with all of the necessary local officials and act as an intermediary with the IYA Image Exhibit Task Group.
2. *Scout locations*: Suggest a public space with room to house large format images (wall mounted or on stands)

with high traffic — parks, metro stations, art museums, etc.

3. *Find local printing and related companies.* We would like to have these images printed locally, when it makes sense. Therefore, the local organiser would need to find suitable companies that could provide the quality required (details will be forthcoming). Also, lighting, mounting and other elements of the exhibit — again, to be determined by the specific location — will also need to be solved.
4. *Find funding*: As mentioned above, it is imperative to the success of this project to identify and secure funding from outside entities: corporations, foundations, etc. The local organisers of the host country or region must take responsibility for acquiring funding for the scope of the exhibit they would like to see go forth in their area.

Conclusion

We believe that exhibitions of astronomical images across the world in 2009 will serve as a powerful way to engage potentially millions of people in the wonders of astronomy. It is a large project that could involve many agencies, companies, governments, and of course individuals. We hope to serve as a catalyst for this project, providing core materials that can be used freely and openly in a multitude of ways. The success of this project will depend on the combined efforts of the local organisers, the Image Exhibition Task Group, and many more. If you are interested in serving as a local organiser, please contact us as soon as possible. We look forward to working on this exciting project.

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Bios

Kimberly Kowal Arcand is the visualisation & media production coordinator for NASA's Chandra X-ray Observatory. Along with Megan Watzke, she is co-chair for the IYA2009 "From Earth to the Universe" Task Group.

Megan Watzke is the press officer for NASA's Chandra X-ray Observatory, a position she has held since 2000. Both she and Kim Arcand are based at the Chandra X-ray Center at the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass., USA.

Lars Lindberg Christensen is a science communication specialist heading ESA/Hubble EPO group in Munich, Germany. He is IAU Press officer and Secretary for the IAU Executive Committee IYA2009 Working Group.

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Technological and esoteric language should be either avoided or used with a footnoted explanation if absolutely required. British and American English are both acceptable, although one system of punctuation (British) will be imposed. Figures and tables should be referred to 'Figure n' and 'Table n' respectively. Acronyms should be spelt in full once and then parenthesized; henceforth they can then be used as lettered acronyms. Numerals should be used for numbers greater than two words and always for numbers greater than ten.

Manuscripts should be delivered in MS Word or text (.txt) format, with no formatting apart from bold, italics, super- and subscripts. Hard carriage returns after each line should be avoided, as should double spacing between sentences. If the contribution contains figures, these may — just for the sake of overview — be pasted inline in the Word manuscript along with the caption (Word files below 4 MB are encouraged). However, images must also be delivered individually as Tiff, PDFs, vector-files (e.g. .ai, .eps) in as high a resolution as possible (minimum 1000 pixels along the longest edge).

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