

Accessible science

Kimberly Arcand, Media Coordinator for NASA's Chandra X-ray Observatory, conducts projects that aim to increase opportunities for public engagement with science. Here, she discusses how science exhibitions are becoming an important tool in communicating advances in space exploration



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What is your background? When did you first become interested in public science?

I focus on science communications, particularly public response to visualisation and multimedia in astronomy outreach. One specific area of interest to me is how people perceive and understand astronomy images, the effects of the scientific and artistic choices in processing astronomical data, and image and meaning across the novice-expert spectrum. In 2007, I became interested in the creation, distribution, and evaluation of large-scale science exhibitions in public spaces such as parks, libraries, malls, metros and prisons, as a direct result of working on a project for the International Year of Astronomy 2009. I had been inspired by the recent work of photographer and environmentalist Yann Arthus-Bertrand who was exhibiting large-scale aerial photographs of our home planet in his travelling 'Earth from Above' exhibition in the early 2000s.

Could you outline the role of public science in society? Is it similar to public art?

Similar to public art, public science efforts typically include collaboration, community

support and involvement, and even site specificity. These public science initiatives attempt to reach new audiences (particularly, non-experts who might not actively seek out science) by hosting events in alternative informal learning environments. The arts and humanities communities have been studying the role and impact of public art and public history for some time. There are many examples of public art, such as the Big Yellow Rabbit by Dutch artist Florentijn Hofman, which some argue establishes a loud visual way of not only questioning how we appoint public spaces, but also the importance of casting a critical eye on monuments in such spaces.

It occurred to me that there was no defined equivalent for public art or public history in science outreach practice or study. I feel that it is important that disciplines like science, mathematics and engineering reach out to the public in similar effective ways that art has. It's possibly one of many examples where there could be much learned from seemingly disparate areas of study.

From Earth to the Solar System (FETTSS) ran from October 2010 to August 2012. How was it received by the public? What kind of artefacts were on display?

As with its predecessor project, From Earth to the Universe (FETTU), the FETTSS organisational structure follows a grass-roots approach in which local organisers are provided with high-quality, accurate materials to print their own version of the exhibition for their selected venues. The FETTSS project supplies high-resolution electronic files that have been approved for non-commercial outreach use to be displayed in any way that makes sense for a given venue. The existing international FETTU network was leveraged for the FETTSS opportunity. As of spring 2013, about 100 venues from around the world have hosted

FETTSS events, from cafés in New Zealand to a mall in Texas. FETTSS content weaves together themes in multi-wavelength astrophysics, astrobiology and planetary science and includes images from amateur astronomers, field scientists, and ground and space-based missions.

From results obtained with the FETTU and FETTSS projects do you feel that it is possible to build long-term community partnerships that can enable science outreach at other public venues?

Our experiences with FETTU and FETTSS have shown us that public science events are 'win-win' situations for those involved. We can provide free content on an exciting topic at a very low cost to various venues and organisations in a community. They, in turn, can invite the local audiences that they know best to the most appropriate locations to enjoy and explore science. In the end, it is the public who benefits since they have additional opportunities to experience something new, either individually or with family and friends.

How do you balance making an image attractive without it being misleading or confusing?

As with many aspects of science and science communication, working on data and images involves making a series of choices. You have to weigh each decision carefully. What is the main science point or points this image is meant to convey? What will a non-expert take away from this image if, for example, we want to show a hotter region and use the colour blue instead of a 'heat' colour like red or orange? This may affect how members of the public perceive the image. It's critical that the process is transparent, that we are open about what was done to generate the image so we avoid being misleading or confusing, or causing viewers to feel distrustful.



Carina Nebula: An immense landscape of dark dust columns silhouetted against glowing gas clouds, about 7,500 light years away. © NASA

Bringing science to the masses

Outreach initiatives staged in public spaces are proving a useful method of communicating scientific discoveries. Two recent astronomy projects initiated by NASA's Chandra X-ray Observatory at the **Harvard-Smithsonian Center for Astrophysics** have attempted to reach people through unorthodox locations

UNLIKE PUBLIC ART, public science is yet to become a ubiquitous term. However, in recent years, it has proven a socially beneficial extension of its art-based counterpart. Science outreach projects or mediation events are staged in public areas, from parks to underground train stations, and aim to reach new audiences – specifically non-experts and casual visitors, many of whom may not have an immediate interest in science.

Kimberly Kowal Arcand, Media Coordinator for NASA's Chandra X-ray Observatory, is helping to drive public science initiatives that aim to raise understanding about astronomy. Her latest projects are two touring photography

exhibitions – From Earth to the Universe (FETTU) and, more recently, From Earth to the Solar System (FETTSS).

What makes these projects unique is their use of non-traditional locations and venues for science outreach (or public science), as Arcand explains: "FETTU is a project that places astronomy image exhibits in unusual locations for science outreach – public parks, metros, cafes, malls, etc. We have had about 1,000 different exhibit sites, in 40 languages worldwide, on every continent except Antarctica. The image collection contains about 125 images, some of the most dramatic views of our Universe, from NASA's multimillion dollar

satellites, to the most powerful ground based telescopes, and a host of astrophotographers' images, in many kinds of light". Indeed, curating of a web-based repository has allowed local organisers to capitalise on the public spaces in their areas, allowing the scope and reach of the project to dramatically increase. Where possible, these local organisers supplemented the exhibit with other activities such as 'tours' of the images led by volunteer guides, scavenger hunts and sky viewing events.

The subsequent project, FETTSS, continued the work of its predecessor, focusing on planetary science and astrobiology. Arcand's aim was to provide the right materials to organisers, so that existing FETTU sites could easily prep or revamp exhibits, as well as create new sites.

EFFECTIVENESS, KEY FINDINGS AND CHALLENGES

For these two public science projects, Arcand and her team carried out assessments, including surveys of participants and organisers. Their observations were unequivocal: the development and tightening of networks, often between disparate groups and organisations, was vital to the successful production of Science, Technology, Engineering and Mathematics (STEM) events, which are tailored to the local community. Both FETTSS and FETTU have shown that such subjects as astronomy, astrobiology, and planetary science appeal to a wide public audience – a notion compounded by the requests of many participating organisations to stage similar events in the future. It is evident that astronomy has touched a vast amount of people, either through the learning benefits of such events, or at the very least, the demand for further events.

The spectrum of people affected also ranges from the science-initiated to the less science-inclined. Indeed, even with events that do not offer guided tours of the exhibitions, the



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content has proven its relevance and appeal to the less-inclined. Furthermore, similar to FETTU, the data assessment conducted for FETTSS has demonstrated that public science programmes have a positive impact on the visitors' perception and their relationships with such events and with science topics.

There were several significant obstacles that were overcome during this research, including securing funding and having people understand the vision for these public science projects. "Now that we have demonstrated the potential success of this type of science outreach, it is a little easier, but of course it still remains a challenging time for many funding agencies and institutions," adds Arcand.

THE TROUBLE WITH COLOUR

One of Arcand's interests concerns how colour in imagery affects the way the public experiences, understands and reacts to science. This, according to Arcand, is because colour can both be confusing and controversial. Therefore, the team began a programme called Aesthetics and Astronomy (A&A), conducted in collaboration with the University of Otago, New Zealand. The group comprised psychologists, specialising in aesthetics, as well as astrophysicists and astronomy outreach experts. Findings have demonstrated that non-experts, or those less inclined toward science, have vastly differing responses to colour in an astronomical image.

Furthermore, key discoveries from the project indicated the need for clear narrative and textual context when presenting scientific images, as well as a good sense of physical scale, which helps form a basic understanding of the material being viewed. Ultimately, it means that the creators of such works and images need to account for this discrepancy and ensure their choices of colour and scale are clearly explained.

With the findings, the team has improved existing media, particularly websites, including the one most personal to Arcand – NASA's Chandra X-ray Observatory. "By adding interactive images, people can see more directly the colours and data being included in the image," she explains. "Also, by adding more descriptive links and transparent text, and other new features, we have been able to improve our communications. Our research gave us a much clearer picture on how to communicate the science results in an effective and engaging way." Indeed, the results have been used as a basis for other projects too, including Here, There, and Everywhere, which connects cross-cutting science content (in Earth and planetary

sciences and astrophysics) with everyday phenomena. This project helps explain to non-experts the ubiquitous nature of the physical laws and their relationship with the world and the Universe.

IMPLICATIONS AND THE FUTURE

The results of initiatives such as FETTU and FETTSS have implications for other public science programmes. Arcand and her colleagues hope to integrate the ideas and methodologies used in these projects with other, similar public science programmes, such as the International Year of Light in 2015. In addition, Arcand foresees this model being replicated for any kind of science programme, and she is keen to find potential collaborators, across other fields of science, in order to explore this avenue.

But methodologies will continue to be developed, with the team seeking new ways of staging public science in the future. Lines of enquiry that will be looked at include: to whom are science communicators actually communicating in such diverse venues and situations? Are there more incidental visitors than intentional visitors with public science events? Is it a less-science-initiated audience than might attend science centers and planetariums? Are public science events increasing attendees' interest in visiting traditional science outreach venues or reading about science in the library or in online spaces? Finally, is there the potential or desire for reshaping of the participant's identity (or non-identity) with science through public science?

Arcand believes that more extensive and longitudinal research of public science events will help to answer these questions. She also has plans to explore aesthetics and astronomy further. The aim is that the next phase of research will include eye-tracking studies, issues of false (or representative) colour, and topics involving images in motion/video. To achieve these ambitions the team is looking for new funding opportunities and partners. "We certainly hope to continue the research in this field, which we feel is incredibly important," Arcand explains. "After all, many resources are used to create astronomy and other science images and disseminate them."

Ultimately, these projects have provided an opportunity to disseminate scientific information to the general public. Although untraditional, the settings have nevertheless been inviting and play a key role in nurturing science literacy and a general interest in STEM subjects.

INTELLIGENCE

FROM EARTH TO THE UNIVERSE

OBJECTIVES

From Earth to the Universe (FETTU) is a public science project that showcases the most dramatic views of our Universe. The images represent the variety of astronomical objects that are known to exist – planets, comets, stars, nebulae, galaxies and the clusters in which they congregate. The collection has been exhibited in about 1,000 locations throughout the world since 2009. These exhibits, held in public parks, airports, community centres and at other unique sites, bring the Universe into everyday situations with the intent of making astronomy more accessible for non-experts.

KEY COLLABORATORS

Megan Watzke, co-investigator, Chandra X-ray Center, USA • **Lars Lindberg Christensen**, European Southern Observatory (ESO), International Astronomical Union, Germany • **Gary Evans**, Science Photo Library, UK • **Pedro Russo**, Leiden University, Netherlands • **Daniella Scalice**, Julie Fletcher, NASA Astrobiology Institute, USA • **Rick Fienberg**, American Astronomical Society, USA • **Henri Boffin**, ESO, Belgium • **Jean-Charles Cuillandre**, Canada-France-Hawaii Telescope Corporation, France • **Antonio Pedrosa**, Navegar Foundation, Portugal • **Manolis Zoulias**, National Observatory of Athens, Greece • **Thierry Botti**, OAMP, France • **Kathy Lestition**, Chandra X-ray Center

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CONTACT

Kimberly Arcand
Media Coordinator

Chandra X-ray Center
Smithsonian Astrophysical Observatory
60 Garden Street, MS 70
Cambridge, Massachusetts 02138
USA

T +1 617 218 7196
E kkowal@cfa.harvard.edu

www.fromearthtotheuniverse.org

KIMBERLY ARCAND is the Media Coordinator for NASA's Chandra X-ray Observatory, and Principal Investigator for the From Earth to the Universe, From Earth to the Solar System, and Aesthetics and Astronomy projects. She co-wrote *Your Ticket to the Universe: A Guide To Exploring the Cosmos* (2013).



FROM
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