Here, There, and Everywhere: A Case Study of Science through Analogy, Near and Far

Megan Watzke and Kimberly Arcand

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

Abstract. Here, There, and Everywhere (HTE) is a program that consists of a series of exhibitions, posters, and supporting hands-on activities that utilize analogies in the teaching of science, technology, engineering, and mathematics (STEM) to provide multi-generational and family-friendly content in English and Spanish to small community centers, libraries, and under-resourced small science centers. The purpose of the program is to connect crosscutting science content (in earth, atmospheric, and planetary sciences, and astrophysics) with everyday phenomena. By using different modes of content delivery (physical exhibits and handouts, interpretive stations, facilitated activities for educators, and online resources), HTE helps to demonstrate the universality of physical laws and the connection between our everyday world and the universe as a whole to members of the public who may not identify strongly with science. HTE is part of a series of so-called public science projects created and developed by the Education and Public Outreach (EPO) group at the Chandra X-ray Center (CXC). This paper will outline how HTE fits into the lineage of this particular type of science outreach that aims to engage the greater public in non-traditional venues for science learning and appreciation.

1. Overview

Here, There, and Everywhere (HTE) is a NASA-funded program from the Education and Public Outreach (EPO) group at the Chandra X-ray Center (CXC) that consists of a series of exhibitions, posters, and supporting hands-on activities, utilizing analogies in teaching science, technology, engineering and math (STEM). The content features topics in earth, atmospheric science, planetary science and astrophysics, and presents them in context to one another. The purpose is to help demonstrate how everyday phenomena relate to those found on larger and larger scales on a physics-based level. HTE does this through a series of exhibits, activities, interpretative stations, information for educators, and online resources that have been distributed free of charge in both English and Spanish to community centers, libraries, schools, and under-resourced or small science centers.

HTE builds on the legacy of two previous projects that fall into the relatively newly defined science outreach category known as “public science.” In 2009, the CXC EPO group created, developed, and oversaw “From Earth to the Universe” (FETTU) that placed large-scale astronomical images in over 1,000 locations around the world in conjunction with the International Year of Astronomy. In 2010, the same team produced “From Earth to the Solar System” (FETTSS) to help support NASA’s Year of the Solar
System, which ran from October 2010 through August 2012. During this time, FETTSS appeared in over 100 locations around the United States.

Both FETTU and FETTSS demonstrated the power of putting astronomical and space science content into venues that fall outside traditional science learning environments, such as schools, science centers, and planetariums. Dubbed “Public Science,” this type of science outreach seeks to mirror the success of public art in reaching audiences where they already visit rather relying on their entrance into an art gallery or museum.

HTE takes public science in a new direction by incorporating different types of content than FETTU and FETTSS. The underlying goal behind HTE is to dispel the common misperception that astronomy and space science only relate to distant objects and foreign cosmic landscapes. To do this, HTE compares—through visual representation and short text descriptions—various phenomena that are shared in everyday experiences on Earth as well as on much larger scales across the Universe.

To develop the content of HTE, the CXC EPO group enlisted three astrophysicists with extensive public communication and formal education experience. During the iterative process of selecting the topics, choosing the images, and developing the accompanying text, we also utilized the Science Education Department at the Harvard-Smithsonian Center for Astrophysics for formative and summative evaluations. A brief summary of the preliminary evaluation data is provided below.

2. HTE Topics

Six topics were selected to be included in the full exhibit, which meant that each would have its own tri-paneled display with introductory text and descriptions of the phenomenon on three different scales. The six that were selected were carefully vetted both within the HTE team as well as through feedback from the Science Education Department. The primary topics that were selected are entitled: When Atoms Collide; Light That Does not Pass; Where the Wind Blows; The Flow of Electric Charge; The Shape of Speed; and Bending of Light.

In addition to these six, we also selected a second tier of topics, which were covered somewhat less extensively. These topics were included collectively in one exhibit panel (as opposed to one panel per topic of the primary six). We have included these second-tier topics on the HTE website and continue to expand their content as much as possible.

Because of the nature of all of the topics (both the primary and second-tier), we are able to feature content from a variety of NASA missions and programs, thus highlighting the vast range of science that the agency performs. In addition to data from the Chandra X-ray Observatory, HTE features content from Hubble, Cassini, GOES-11, GOES-12, and other missions spanning a suite of NASA science research.

3. Networks and Content Distribution

For distribution of HTE, we utilized some of the local (U.S.-based) existing network out of the hundreds of organizers who worked on the FETTU project. We then made use of a new opportunity to work with the American Library Association (ALA), which resulted in an expansion of the existing informal science education network to include
a number of U.S. libraries. The ALA advertised the HTE opportunity on their blog and, as a result, applications to host the exhibit exceeded the available dates by 225%. To help address this demonstrated need, we extended the exhibit travel end date for an additional nine months from the one originally planned, through May of 2015.

For those sites that were not selected to receive the full HTE exhibit, we provided sets of HTE posters, activities, and handout materials. We also took advantage of other partnership opportunities that developed during the creation and implementation of HTE, including NASA’s “astro4girls” to expand the reach of the project.

4. Preliminary Evaluation Data

This preliminary dataset examines 71 randomly selected visitors across three institutions (EcoTarium, Worcester, Massachusetts; Christiansburg Library, Christiansburg, Virginia; and Radford University and Planetarium, Radford, Virginia) surveyed between Oct–Nov 2012. Visitors were asked to complete a paper-and-pencil survey upon exiting the exhibit.

The results include some of the following: visitors were asked how much they liked the exhibit, using a rating scale from 1–5. The average rating was 4.4 with 55% percent of respondents rating the exhibit a 5. When asked how much they learned from the exhibit, 77% percent indicated that they learned quite a bit or a great deal. With regard to interest, 59% of visitors reported that the exhibit was very interesting, and an additional 16% found the exhibit interesting. Visitors were additionally asked about their experience with the interactive components of the exhibit. 54% percent of survey participants indicated that the activities were interesting and also reported that they learned a great deal. All indicated that the interactive activities helped them understand the main idea of the exhibit.

Visitors were also asked to what extent viewing the exhibit increased or decreased their interest in astronomy. Over 60% indicated that the exhibit increased their interest in astronomy. 72% reported that they would be interested in attending another science event, and 40% commented that they would now be interested in reading about science online.

Staff members of host institutions were also surveyed about their experience with the exhibit. Their responses were overwhelmingly positive, and they reported new benefits for their interactions with the public on these topics as well as increased understanding and appreciation themselves.

5. Conclusion

The Here, There, and Everywhere project is the latest example of how public science can positively impact science awareness and science literacy in casual audiences. HTE helps realize the important goal of allowing participants to discover how scientific knowledge relates to everyday experiences and familiar phenomena. By providing science content to important physical topics in a unique way, HTE shows promise in increasing understanding and interest in large segments of the greater public. In short, HTE can establish unusual and memorable connections between exciting topics and provide the base for future learning. Preliminary evaluation shows that these connections help ignite excitement and an appetite to learn more among lay audiences.
Public science projects, including HTE, can help open the pipeline to empower more non-experts to engage in deeper learning opportunities in informal and formal STEM education.

6. Notes and References

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References

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