

# Communicating Astronomy to Special Needs Audiences

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## Summary

Our team has developed a variety of astronomical activities specifically intended for people with special needs. In particular, we have created a series of interactive talks, software with astronomical content, hands-on activities, and a planetarium show, among others, to communicate astronomy to people with different kinds of physical and cognitive disabilities. The main goal of this work is to stress the fact that working with this kind of audience is not as difficult as it might seem *a priori*. Moreover, the experience is formative and very rewarding for everyone involved.

## Introduction

The International Year of Astronomy 2009 (IYA2009; Russo et al., 2009) was a great opportunity to offer astronomical activities to all kinds of audiences. It also gave the final impetus to our plans to bring astronomy closer to people with physical and/or intellectual disabilities. The IYA2009 motto, The Universe: Yours to Discover, was addressed to people everywhere, regardless of nationality, race and belief. And also regardless of physical or intellectual capacity: we all live in the same Universe, under the same sky, and therefore, we should all be given the chance to enjoy it, through our different sensory and physical abilities.

We have been arranging visits to the Astronomical Observatory of the University of Valencia (Spain) for small groups of people with cognitive problems since about 2005. These groups have helped us, along with their educators, to develop new educational material and strategies that could

also be useful to other outreach groups. IYA2009 was our opportunity to expand the range of activities and the kinds of audience that we were reaching out to.

### Storytelling, feeling, drawing and observing

The first activity that we planned for people with cognitive disabilities was a series of interactive talks.

*Sensaciones* (Sensations): A talk which links astronomical images to everyday sensations of temperature, textures or smells. We associated a sense with each slide: a radar image of the surface of Venus is viewed while touching balloons filled with warm water; images of Io are accompanied by the smell of incense, etc. Audiences usually became quite excited and really enjoyed the talk.

A second talk, *Solo Imagenes* (Just Images) is a series of slides about a journey through

the Universe, leaving Earth on the Space Shuttle (not very realistic, but very effective) and travelling out from the Sun to the cosmic microwave background. Soothing music is played throughout the trip, which is particularly appreciated by those affected by autism.

We usually complement the visit with some hands-on activities, like making a constellation on a piece of black cardboard with luminescent stars and golden pens, or building a simple sundial made out of cardboard (see Figure 1).

A somewhat different concept lies behind another talk/hands-on activity that we have called "The Life of Stars". Here we introduce the concepts associated with the formation and evolution of stars to people with intellectual disabilities. Each step of the evolution process is connected to some human experience, like being born, feeding, growing, etc., to establish a link to a common experience and the subject for the audience, making the topic more approachable.



Figure 1. Making constellations and sundials in the laboratory. Credit: The authors.

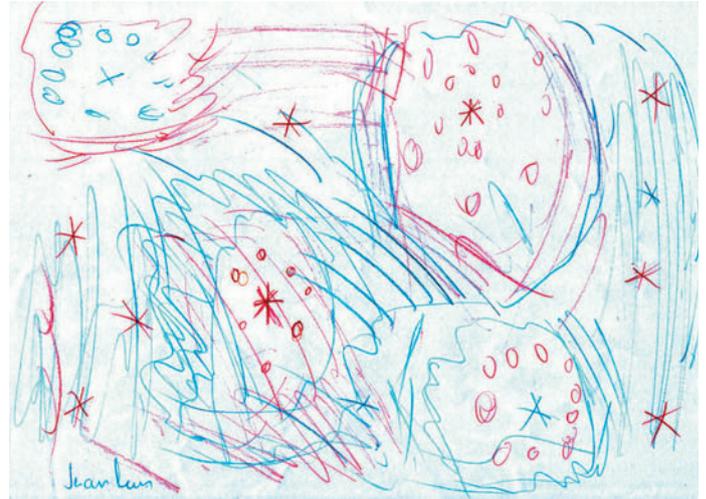


Figure 2. Stars forming in a cluster in cocoons of gas and dust. Credit: The authors.

The two main characters in the story are two stars, one a Sun-like star named *Estrellita* (little star) and the other a massive star named *Grandullona* (overgrown).

The talk is structured in two parts with a break in between. During the break the public go outside to observe our closest star: the Sun. We usually project the image of the Sun through a telescope, as it is much easier for the participants to watch it this way. Many of them also have physical problems added to their mental disabilities, so for some it can be tough to put an eye to the telescope's eyepiece.

During the break the audience draws their own interpretation of star formation and evolution from what they have heard so far in the talk. The complexity of the artwork has been really impressive in some cases, with protostars shining inside their gas and dust cocoons (see Figure 2).

After the break, the audience is shown the final stages in the evolution of the two stars, which proceed according to their initial masses: *Grandullona* explodes, while *Estrellita* just fades away.

A question and answer session follows, and some of the queries are truly difficult to answer. Taking the microphone and speaking in front of their peers is a lot of fun for the participants too.

The feedback that we have received from audiences and their teachers is extremely positive. As a next step, we plan to collect

this material into a little book that people can read at day-care centres or homes, using drawings from the sessions as the book's artwork.

### An astronomy book in Braille for the visually impaired

This initiative was started by the Astronomical Observatory of Padova in 2000 (see Benacchio et al., 2000), when they published a website with a comprehensive astronomy course for non-sighted people. The website<sup>1</sup> has a very clean layout, so that the text can be read by a computer's voice processor, and the drawings can be printed with thermoform or Braille printers. These drawings have been specially designed to take into account the way people with visual disabilities interpret images.

We contributed to the project by translating the website into Spanish, and printing about 50 copies of the contents as a Braille book, *Volver a ver las estrellas*. It has been distributed to the libraries of non-sighted associations and universities, as well as to astronomical outreach organisations and individuals, both in Spain and in the United States.

The book was also our little contribution to a fantastic exhibition organised by the University of Puerto Rico, where it received very good reviews, mainly because of the quality of the engraved images, and the clarity of the Braille employed.

### A planetarium show for the non-sighted

This is probably the "strangest" of our projects, as a planetarium show is largely a visual experience. But the pioneering work by Dr Sebastian Musso in Argentina had shown already that it can be done, and we started to develop the programme *El cielo en tus manos* (The Sky in your Hands), which could be shown at the Hemisferic, the planetarium at the Arts and Sciences City in Valencia, Spain<sup>2</sup>.

We developed an original script about a journey through the stars, visiting different regions of the sky with famous constellations and objects on the way. Each region of the sky was associated with a particular sound in the programme's soundtrack. The company Abac Estudios composed the soundtrack in five different channels to be fed into the multiple speaker system of the planetarium.

The projection of the night sky on the dome is scheduled so that when the narrator is talking about a particular constellation, the sound associated with that constellation is heard coming mainly from the speaker closest to the place where the constellation is being projected, thus giving information to the public about the relative positions of the objects in the sky above them.

Obviously, this method only helps to place the constellation on the sky, so how do we convey what the constellations look like? To help with this, we developed a hemisphere



Figure 3. Hemisphere used as a tactile support for the soundtrack of the show. Credit: The authors.

made of fibreglass, with different kinds of engravings (see Figure 3). Bumps represent stars, and they come in two different sizes, according to a star's brightness. Continuous lines delineate the shapes of the constellations, and the dashed lines guide the way from one constellation or object to the next, according to the show's script.

A prototype of the hemisphere was developed and then tested with the generous help of the Spanish Association for the Blind (ONCE), and we came up with the final, fully tested version that was used in the show. Each totally non-sighted person in the public held his or her own hemisphere, so they could easily explore it at will. We made sure during the tests that the system of using different kinds of engravings was also appropriate to guide the audience through the whole show, so that no one was "lost in space".

To combine the sounds and the sphere, the soundtrack had two different narrators, one for the astronomical content, the other to guide the public through the tactile hemisphere at the pace dictated by the astronomical script.

The show has been successfully presented twice at the Hemisferic. The audience was really excited by the experience. Some were deeply moved because they had never before been able to understand what a constellation was, and now they finally understood it. Others remembered that they had been able to see the stars long ago and the show brought back sweet memories.

The programme has also been shown at smaller planetariums with less sophisti-

cated sound systems, like the one at the Science Museum of Castilla-La Mancha in Cuenca (Spain). A very interesting experiment was conducted at the portable planetarium of the Principe Felipe Science Museum in Valencia, with the audience initially following the programme in complete darkness, with the only help of the hemispheres, and then afterwards with the usual projection of the sky turned on.

The hemisphere has been selected by the International Node of IYA2009 as one of the items that will be part of the IYA2009 Legacy at the Science Museum in London.

### Astroadapt: Astronomical software for people with motor impairment

In our on going collaboration with centres for the disabled, we met people with unimpaired intellectual capacity, but severe central nervous system damage that limited their mobility and ability to communicate verbally to a greater or lesser extent. Their usual method of communication with the external world is through a computer attached to their wheelchairs. This computer contains communication software, which essentially consists of a set of drawings or words that are sequentially highlighted in a coloured window. The user selects the currently highlighted image by stroking any key, or by making any other slight movement to activate the computer, as appropriate to their individual capacity. In this way the user can communicate hunger, thirst or readiness for a walk outside, for example. This software is also quite expensive and is too dear for many families.

After talking to these people and their carers, we began to develop a free source, Creative Commons Non-Commercial License code with similar characteristics, so it could be used both to communicate and to enjoy astronomical content.

The first version of Astroadapt is quite simple, and with limited astronomical content. This is largely deliberate, as we are still running tests with users. The software allows new content to be created easily, and therefore, the communication content, for example, can be created by the carer and tailored specifically for each particular user, as some prefer drawings, and some work

better with words. There are other settings that can be adapted to each user's individual needs, like the speed at which the sequential highlighting works, or the colours employed by the interface.

For the astronomical content, if the user selects a document, a few choices show up, indicated by large astronomical images related to their content. These images are highlighted sequentially by the software (see Figure 4). When one is selected, it pops up in a larger window, showing the image and an accompanying text. Audio material, such as a spoken version of the text, can be either pre-recorded or read directly by the computer's voice system.

The software has been written in Python, and versions in Spanish, English and Italian are already available. It has been tested so far in Spain and Italy. We would welcome hearing from anyone who wishes to collaborate by translating the existing content, or by incorporating new astronomical content, or improving the software.

### Sharing the material

The main goal of this project is to pave the way for other people involved in outreach and education to work with groups of people with special needs. We have created this set of tools to make the start a bit easier, and therefore all these materials are freely available under the conditions of the Creative Commons Non-Commercial License.

The slides from the talks *Sensaciones* (Sensations), *Solo Imagenes* (Just Images), and *La vida de las estrellas* (The Life of Stars, Spanish version only), and the Astroadapt software can be downloaded from [observatori.uv.es/](http://observatori.uv.es/) under *Divulgacion/Actividades divulgativas*.

The soundtrack of the planetarium show is freely available upon request from A. Ortiz-Gil, although only a Spanish version is available at the moment. We can also lend the hemispheres or provide any kind of help to those who wish to make their own.

The Touch the Sky website is online<sup>1</sup>, in several different language versions, and we can still provide interested parties with a copy of the book (only in Spanish).

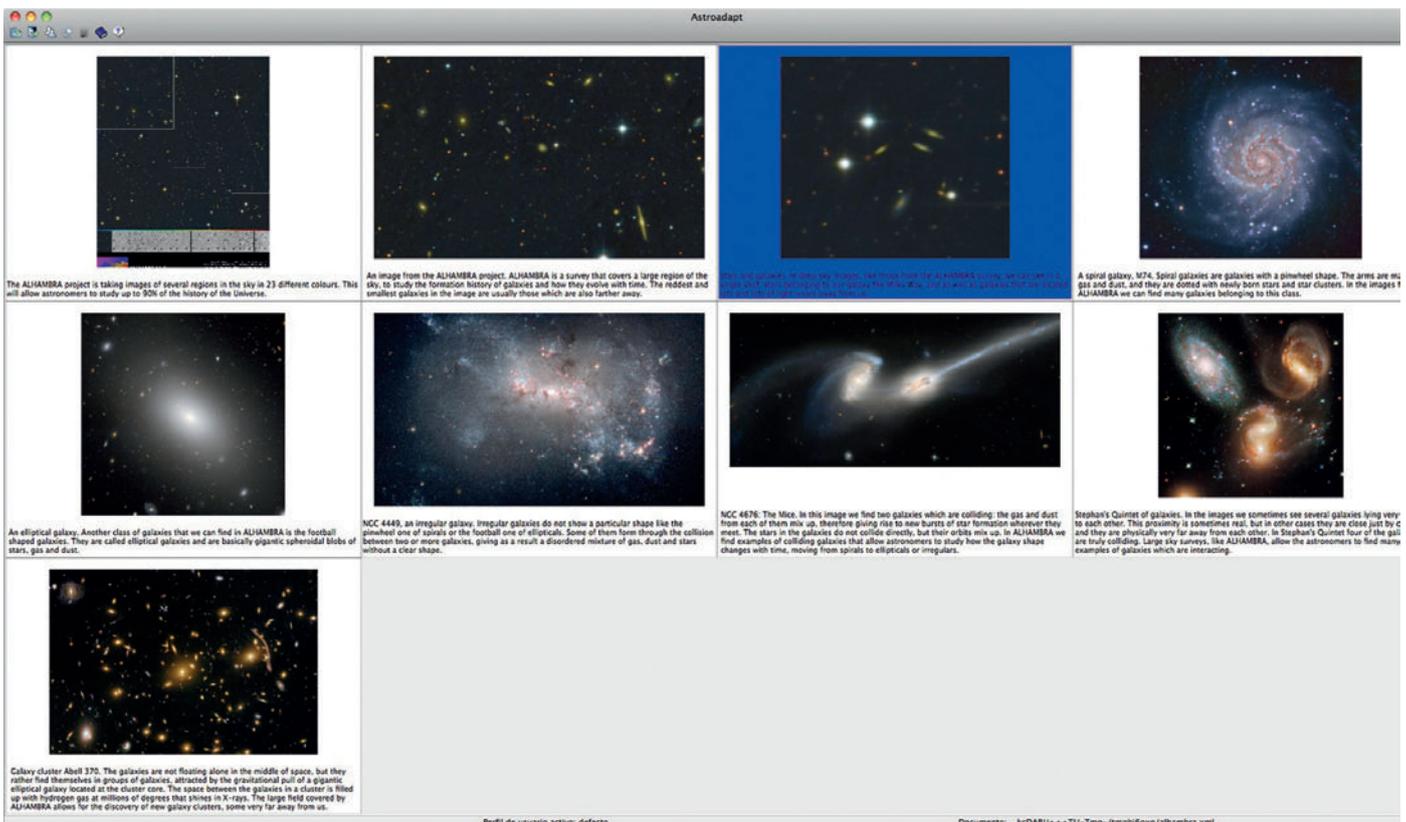


Figure 4. In the Astroadapt software the images are highlighted sequentially. When one of them is selected, it pops up in a larger window, showing the image and the accompanying text. Credit: The authors.

Pictures of the IYA2009 activities can be found at our flickr page<sup>3</sup> or the IYA2009 page<sup>4</sup>.

## Conclusions

With these few activities we want to show that we can bring the beauty and fascination of astronomy to people with various kinds of special needs. We hope that these examples will serve as a guide and inspiration for other educators and outreach agents to embark on this adventure.

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## Notes

- <sup>1</sup> <http://www.touchthesky.eu>
- <sup>2</sup> <http://www.cac.es>
- <sup>3</sup> <http://www.flickr.com/photos/iyaval09>
- <sup>4</sup> <http://www.flickr.com/groups/iyaval09/>

## Biography

Our team combined our separate efforts in developing activities addressed to people with disabilities in 2008, when the Spanish IYA2009 SPOC, Dr Montserrat Villar, asked us to create some activities and educational material specifically addressed to people with special needs to be used during IYA2009 in Spain.