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Conveying astronomy to the public

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Abstract. The International Year of Astronomy offers us a unique chance to carry out outreach projects in great scale and, to think about new ways to improve our efforts. In this paper I present a few considerations on my activity as a popularisation person. I address its importance and I will emphasize on radio, television and public lectures. I also stress certain ingredients I believe popularisation must include; it must be interesting, diverse, simple, pertinent, and be peer reviewed.

Keywords. Outreach, teaching, public, mass media

1. Introduction

Outreach is the way adults learn about topics outside their main activity, it is also how most people get to know about astronomy since it is not included in several countries' education system. I believe popularisation must be taken seriously; it is a creative activity that must be carried out with passion.

In places where science is generally considered a subject that only a few people can understand, astronomy is nevertheless a popular subject, making it ideal for outreach. Astronomy is multi-disciplinary and has a particular appeal due to the beauty of its objects. Besides it addresses fundamental questions, an outstanding example is the evolution of the universe.

Internet has had an enormous impact on the way the public accesses information, so it important to consider its availability when engaging in popularisation. In order to have a successful outreach program it is important to combine a wide variety of media and ways of conveying knowledge: written materials, web sites, radio, television, workshops, public lectures, museums, planetariums, plays, etc. In my opinion a characteristic of a good outreach program includes knowing the public. The public should have a way to contact the spoke person; phone and email during live radio and television programs and time allocated for questions during public lectures and definitely during workshops. The public in general has a true curiosity about nature and sincerely wants to understand, and feels a sense of relief doing so.

For young people hands-on experiences are generally more effective, than a speech, especially if they take something they have created home after the activity. Adults feel more at ease with public lectures or panel discussions and written materials. Almost every group enjoys television.

I like to imagine outreach like a map. A map of France is not the country but it comes in handy. So popularisation is not science but it can be conveyed in such a way that it can transmit meaningful information, skepticism and a tool for decision-making.

In this paper I shall address my experience in Mexico concerning public understanding of science. I will present my ideas about popularisation and later comment on the way the way radio, television, written materials, and public talks can be used. I will also comment on fund-raising, planning an activity, and assessing popularisation.

2. Local culture

In developing nations there is the general belief that science is something that is done abroad. Usually textbooks and television documentaries present great discoveries as something that only happens in wealthy nations.

Part of the problem for understanding science is that many of the examples come from different cultures and environments; typical examples are the seasons and tides that have to be explained in tropical, inland countries.

Places such as Mexico had a rich culture prior to the colonisation, and astronomical examples from the past make sense to the public. All the archeological sites were created not only for commerce and religious purposes but also for time keeping. For instance the ball game courts are usually oriented with the equinoxes, and there are many observatories over the large territory to watch the zenith pass of the sun. For the general public the pride of the past can be quite significant and a vehicle to explain naked eye observations. Giving a talk, prior to a star party with the public seated on the steps of a great pyramid can be a moving experience.

3. Radio

Radio is a great medium for outreach. One-minute programs can be prerecorded with ease, on the phone at home or office. Interesting information is available in magazines and is generated at research institutes that update their web pages. With practice one can improvise.

There is an interesting public prejudice among the public concerning radio conductors. They have a reputation of being witty, upper middle class, open minded and trustworthy people. Due to this general idea and the relative ease of producing radio programs compared to television gives a popularisation person a great medium. In Mexico City people spend at least 2 hours per day in public transportation and radio is company. Some listeners prefer interesting productions to music, and that is when we can give science a chance. One has to prepare with care, freshness is appreciated in radio broadcasting. I suggest a beginner to write down the main ideas, as with a formal presentation. One must keep in mind to include a small introduction and conclusion, and address the subject concisely; the attention gap of listeners is small if they are doing some other activity while they stayed tuned.

I have broadcasted a science an hour-long evening radio program for over ten years. It usually is interviewing a guest researcher and once a month only science topics I talk about. The program reaches a wide variety of people, elderly bed stricken, adults, students that have to listen to it as part as their assignment, and workers on a night shift. The phone is open to the public and I always bring in books to give out upon request. I believe it is a very good media to convey astronomy to the public. Topics tend to be very interesting.

I am also interviewed periodically. My advice is to give the radio production its importance. The freedom of speech must not be an excuse not to take it seriously. The audience senses one's mood and if one came in ill prepared. It is like teaching, one can tell a good lesson from a last minute improvisation. I usually bring in written material for teachers and the general audience since I am convinced that a few minute long outreach presentation is usually is not enough for long term general understanding of the physical reality.

4. Television

Television is ideal for public outreach since it reaches millions. The problem is that it takes up lots of time, the image is important, so one must learn to be patient and listen to what the experts in the media have to say.

One of the common practices in several stations is to interview a scientist. Unfortunately communication schools usually do not teach science, so the conductors do not necessarily ask interesting questions. One of the ways in which researchers can better public understanding of science is lecturing at schools where professional journalists are trained.

At present I have two three-minute long television spaces. I believe my success comes from the fact that I have been on TV hundreds of times so I feel at ease, I talk about what I want with total freedom and I always include some kind of demonstration. This is important, it is easier just to talk, but television is best when it includes a moving image; if there is some kind of activity with changes of color and movement the viewer's attention increases.

I usually purchase objects for demonstrations at airport toyshops and science centre stores. Recently I have commissioned small theaters, the size of the average television screen, where different puppets can explain particular topics. For instance *The Little Prince* talks about asteroids and exoplanets, or I have the Greek gods tell constellations stories.

I have learned to put a limit on what I am able to do comfortably. For instance I use a small amount of makeup and do not participate in more than three television programs per week, when I get tired it shows.

5. Books and magazines

A public lecture, a television or radio program are ideal for talking about recent scientific discovery; in the case the public wants to acquire knowledge further study is necessary. When one can express correctly in ones own language a scientific phenomenon we know it has been understood. So it is wise to provide books and magazines and good Internet sites references whenever one participates in a popularisation activity in order to provide lasting understanding.

I have written several astronomy books for different levels. I usually take a few to distribute by tossing them at the audience. Since I am such a poor pitcher the printed materials are given out randomly. By the way, I also distribute Galileo scopes in this fashion and give out books and magazines for teacher to the organisers if they are part of a school staff.

During the last decades economist have being carrying out multidisciplinary research on happiness since its quest is the great motor for economic growth. Some of the results can be used for outreach. Two characteristics of happiness are its short time span and its relativity; hence its search never ceases. It has also been found that happiness can be achieved through family, friends, altruism, status, discovery and work.

Popularisation should include items that lead to happiness like the pleasure of understanding, of conveying knowledge to others or even the status of attending a great workshop.

6. Demonstrations

I believe demonstrations are crucial for good outreach. Specially now with the prevalence of Internet people need a grasp of reality. There are many fine experiments that can be found on line.

The experiment I enjoy most is one on free fall. One needs a flat pan, a glass, water, and a flat surface covered with a towel. One has to fill the glass with water, cover it with the pan's flat surface, and turn the pan and glass upside down at the same time. Release the glass and move it to the edge of the pan. Stand next to the flat surface covered by the towel and pull the pan towards oneself swiftly and keeping it parallel to the ground. The glass and water will fall at the same time. For large crowds several this demonstrations should be carried out at the same time, at different places of the auditorium. This free fall experiment usually needs to be practiced, nevertheless I suggest the public should carry it out, even if the performer fails the first few times. Once they do it right it becomes a meaningful experience not only for the performer but also for the crowd. During this experiment one discovers one of the characteristics of science, its prediction capabilities.

I try to keep all my demonstrations simple and that can be done with materials people own, so their duplication is easy and teacher can repeat them in their classrooms.

7. Outreach at special settings

There is a lot to carry out for popularisation for children at hospitals. Several of the patients are tired, sad, bored and anxious. So an outreach program for them is a plus. In my experience if astronomy is included time keeping and small telescopes are ideal topics. Time is something the children have at large and they can usually handle Galileo scopes with easy even if they are lying down. They also appreciate books, magazines and science television programs.

As with other activities outreach brings experience. Taking a small amount of risk can bring success. For instance by doing demonstrations on television one learns how to work with a cameraman; and this comes in handy when giving lectures at mass events like those held in plazas or bullfight rings with audiences of tens of thousands watching giant screens and that are being broadcasted on national television.

When one is at loss as to how to handle a new project I believe the following items can come in handy. First, one must write down two lists, the reason is to focus on the project. The first one must include the formal purposes and the second one's personal goals. This seems an easy task but is important to keep it constantly in one's mind. Later on, one should pick the medium, TV, radio, web, museum, public lecture, article, book, workshop, and a play. And finally one must worry about funds. If one has good ideas and a convenient media to convey them, passion and work are what one needs to achieve the goal.

Something I have included lately in my lectures and television programs is dance. I have two different amateur companies that I can use upon request. One is a mambo group, its music is well-known supermarket music, but rarely danced due to is vigorous movements. I commissioned a mambo called "*... and yet it moves*" to honor Galileo.

During the international year of planet Earth the Institute of Geography at Mexico's National University took several sensitive seismographers to a large plaza and projected the graphs on giant screens. I gave a standard lecture on the Earth and then danced with my group to honor Galileo. After I taught a few steps to the public. And then divided the crowd of several thousands in two groups to see which could cause the largest tremor by dancing mambo; the response is fantastic.

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I have danced in all the public lectures on Galileo I have given during the International Year of Astronomy. When I address the topic of Galileo's fame and mention, space crafts, monuments, bills, stamps I play the music and have people come up to the presidium and dance, my greatest success was when some clearly religious monks did the mambo with me.

The other group I do outreach with dances ballet. Several physical laws can be explained using toe shoes. I can use the ballerinas to help me with demonstrations and they can simulate constellations, rotating objects, story characters.

8. Informal learning

In order to grasp the way in which informal learning is conveyed, so it can be applied to outreach, and to other subjects, one can observe how gifted teachers from a completely different discipline work, for instance ballet.

What are some of the characteristics of such lessons? Dance is a voluntary activity, people are happy to participate, even if they feel tired or clumsy; teaching is done in sequences: basic positions, steps, and choreography; there is always enough time for lots of practice, it is all right to learn from one's mistakes; and finally pears help each other. This strategy can be applied to other disciplines such as reading in a foreign tongue, such as English for Mexicans. Reading science has to be appealing, one has to undertake reading following every step: read words and understand their meaning, practice reading sentences, paragraphs and finally texts. One of the reasons reading can be difficult is that it requires an internal dialog. When one speaks or dances with another person one receives immediate feedback; reading science in silence requires internal feedback, one has to figure out if one is understanding the text and what it makes us relate to and think about.

Astronomy books are great to encourage adults to read, since they usually carry beautiful pictures and fascinating topics. (One must keep in mind that the literacy is far from complete in developing nations).

9. Assessment

Assessment is necessary for all academic activities including popularisation. As scientists we are well aware of the ways in which we are evaluated but for outreach new criteria are needed.

My experience has taught me that it is wise to invite a colleague in to my public performances and listen to his/her suggestions. And needless to say one must reciprocate.

It is not easy to select the proper referee. For instance when evaluating a text, some colleagues say it is all right without having carefully revised the manuscript and others tend to write it over again. Neither works. What I do is write a draft of, let's say, a book and then ask a colleague to be a coauthor. This guarantees that he will look at the material carefully and bring in new ideas.

One of the most important things I have learned during my dance lessons is the way continuous assessment helps learning. During a ballet class mirrors, other students and the teacher's incessant scrutiny surround one. So whatever work we do it must be and is judged by others.

It is important to create rules to evaluate outreach. Some are relatively simple, number of reprinted books, invitations to public lectures or TV programs. But for outreach these tend to measure popularity, not necessarily quality.

10. Fund raising

Usually outreach activities have scarce funding so one has to obtain extra resources in order to carry it out in an effective way. Fund raising has not been part of Mexico's culture.

My suggestion is to hire a professional fundraiser, he knows where the resources are, how to ask efficiently –fill out forms, produce appropriate DVDs– and what to give in exchange, depending on the donor, usually status. The fundraiser requires a fixed salary and pertinent information. One must keep in mind that he takes several months to obtain the first resources.

The donor expects his resources to be used wisely, recognition such as prestige, and is not interested in a project that is about to fail. There are many worthy needy causes, so one must find convincing arguments that express the urgency of the money and ways to talk to the heart of the giver. Informal education is a good project to obtain resources for.

11. Conclusion

Outreach is a fulfilling activity. It can bring happiness to millions of people if done with care and passion. It is a great complement of formal education.

Popularisation is a space to explore, create and to be free.

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† see `http://www.traditionsofthesun.org/ViewerYucatan`

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