

Science Diplomacy through Astronomy: Celebrating our Common Humanity

International Astronomical Union Office of Astronomy for Development

Introduction

Astronomy is a unique and cost-effective discipline for furthering sustainable global development because of its technological, scientific and cultural dimensions. For this reason, the International Astronomical Union set up an Office of Astronomy for Development (OAD), with its network of 10 regional offices throughout the world. Here, we outline an OAD global flagship project, designed to use astronomy to further several of the sustainable development goals (SDGs) under the general theme of *Science Diplomacy through Astronomy: Celebrating our Common Humanity*. It builds on special aspects of astronomy and space that are unique tools for stimulating internationalism and tolerance.

We first outline why the exploitation of astronomy and space is such a powerful way of stimulating those UN SDGs that are relevant for stimulating globalism. Next we describe the need for such a project to target several different segments of the population, including young children, teenagers and the general public. In each case the relevance to the SDGs, the needed approach, the various challenges and some practically achievable development goals are discussed. Finally, we outline the sub-projects that will be needed to achieve these goals.

Due to the nature of this project, it is important to clarify the difference between outreach and development. Outreach entails providing access to astronomical information while development aims at addressing specific UN Sustainable Development Goals. While there may well be overlaps, this project falls specifically under the latter and will not seek to promote astronomy but to use aspects of astronomy to achieve development goals.

Astronomy for Development

Astronomy is understood to have interdisciplinary, far-reaching impacts that extend beyond academia and the natural sciences. Historically, astronomy originated out of humankind's desire to understand our place in the Universe and with our fascination with the night sky. From our earliest records of human history, through multinational astronomical collaborations and telescopes (such as the Square Kilometer Array, with collaborators in every continent), to Carl Sagan's iconic *Cosmos* television series during the 1980s, astronomy and space have engendered a sense of wonder and awe among the public throughout the world.

Astronomy and space for stimulating globalism

A global citizen is someone who understands the wider world and their place in it. They take an active role in their community and work with others to make our planet more equal, fair and

sustainable¹. Astronomy embodies a combination of science, technology, culture and international collaboration and is therefore uniquely suited to encourage a sense of global citizenship. On the one hand, space science is a gateway to physics, chemistry, biology and mathematics and a driver of advanced developments in electronics, optics miniaturisation and information technology. On the other hand, the cultural roots of space science satisfy the deepest philosophical yearnings by observing far into our past history. Unravelling the history of the Universe has been one of the great human achievements of the last half century.

Astronomy pushes technological boundaries by studying extreme environments that are never within the reach of a laboratory on Earth. The need to probe the deepest part of the Universe has driven some of the most advanced technologies, as well as technologies that we all use in our daily lives. Space provides one of the most exciting and approachable gateways to science and engineering. The Universe is an excellent and exciting vehicle for introducing the scientific method and the concept that nature can be interrogated by rational means. But maybe more importantly, consideration of the vastness and beauty of the Universe and of our place within it provides a special perspective that can help broaden the mind and stimulate a sense of internationalism and global citizenship. Photos of Earth as a pale blue dot in space have impacted humankind in an unprecedented way. With the national boundaries gone, a feeling of oneness arises. And seeing our precious, but fragile, home planet stimulates people to safeguard it together.

Astronomy inherently needs international collaboration. Examples of global collaboration through astronomy have existed since its infancy, when early astronomers attempted to perform simultaneous measurements across distant parts of the Earth to measure its circumference. More recently, astronomers would be unable to produce such clear pictures of stars and galaxies in radio light, without linking together radio telescopes between countries and continents. With international collaborations such as the Square Kilometer Array², astronomers now transcend national borders and political differences with the goal of exploring our Universe.

Relevance to the SDGs

The goal of this flagship project is to use the inspirational themes of astronomy – namely, that we live under one sky and that we all have innate similarities on the basis of being human – to promote SDGs 4 (Quality Education), 13 (Climate Action), 10 (Reduced Inequalities) and 16 (Peace, Justice, and Strong Institutions).

SDG4, Quality Education: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

By inspiring people with the fascinating Universe, the projects under this flagship will attempt to increase the fraction of the population who are interested in following careers in science and

¹ <https://www.oxfam.org.uk/education/who-we-are/what-is-global-citizenship>

² <https://www.skatelescope.org/the-ska-project/>

technology and promote literacy in science and technology, particularly among the more vulnerable and disadvantaged communities.

SDG13, Climate Action: Take urgent action to prevent climate change and its impacts.

Introducing a global perspective of our continually-changing planet as part of a larger solar system, Milky Way Galaxy and an enormous Universe, promulgates the message of the vulnerability of the earth and the human race to climate change.

SDG10, Reducing Inequalities within and among countries

By encouraging a sense of global citizenship and unity we aim to shift people's consumption patterns, also increasing support for sustainable policies that promote equality. This flagship promotes the theme of acting beyond one's self interest in accordance with the greater good of humanity. Through using astronomy to highlight our common humanity,

SDG16, Peace, Justice, and Strong Institutions: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

Perhaps the most important problem that prohibits achieving peaceful and inclusive societies is conflicts between different ethnic groups within nations and nationalist-based conflicts between countries. In the age of sophisticated weaponry and climate change, such global conflicts not only impede sustainable development, but they also threaten the very survival of the human race. We therefore regard it crucial to promote a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and its contribution to sustainable development through the astronomical perspective.

The goal of this project is to use astronomy as a means to promote peace and acceptance. In doing so, it incorporates several Sustainable Development Goals. We intend for the themes pertaining to the fragility of our planet will initiate climate action (especially when the program draws special attention to our rapidly changing climate). We expect that teaching global citizenship and solidarity will have positive implications for the consideration and inclusion of the disenfranchised. Existing studies highlighting the general positive relationship between empathy and pro-social behavior motivate our confidence in the potential for this project to promote non-violence and acceptance.

Flagship as a Research Testbed

The IAU-OAD has already funded a number of projects that employ astronomy as a means of helping to build bridges in a divided world. *The Columba-Hypatia: Astronomy for Peace* initiative has been a force for promoting peace and a sense of global citizenship in Cyprus since 2017, focusing on primary school children and their families as well as hosting events for the public. Sentiments of peace and non-violence are incorporated through teaching that we all live under one sky and all share a common experience of being human and living on the same planet.

While not funded by the OAD, *Universe Awareness* is an educational program that employs astronomy education to instill a sense of global citizenship in young school children. To date, the project is enacted in 63 countries and has reached 106,419 children, although the organization has produced a series of online educational resources that can be accessed around the world.

Based on these and more projects run under the OAD flag in the past decade, we have come to the hypothesis that astronomy can be used as a tool to encourage global citizenship. The projects planned for the OAD flagship could serve as a testbed to investigate the effectiveness of using the perspective of astronomy to stimulate globalism. This will create an evidence base much needed for future projects in the field of astronomy for development.

In Peacetime

There exist a fair amount of studies which have measured the impact of empathy-based training on garnering empathy for outgroups (see Weisz and Zaki 2017 and Lam, Kolomitro and Alamparambil 2011 for meta-analyses of empathy training). For example, a study in 2009 entailed studying how medical students' capacity for empathy towards their patients changed by "putting themselves in the patients' shoes." This was done by having the students undergo auditory hallucinations so as to better understand how their patients feel when they undergo neuropsychological testing; the experimenters found that this increased the students' levels of empathy for individuals with mental illness (Weisz and Zaki 2017).

In 2005, a study by Levine and colleagues studied the malleability of in-group preference by changing peoples' perceptions of group boundaries (Ibid.). When they defined an in-group according to support of a particular soccer team, participants were less likely to offer help to individuals wearing shirts from a different soccer team. Though when they changed the definition of in-group according to being soccer fans in general, participants were more likely to offer help to anyone wearing a soccer shirt.

What is much less studied is the impact of astronomy as a tool for teaching empathy and solidarity.

In Conflict

The status of empathy and compassion in conflict zones, post-conflict societies, and during intractable conflicts is more complicated. Positive emotions such as empathy, compassion, and hope are often reduced, diminished, or even reversed as individuals are subjected to the atrocities of armed conflict or civil unrest. In light of this, however, researchers still have attempted to gauge the role of positive emotion in improving intergroup relations. For example, a group of academics in Israel measured the correlation between individuals' levels of empathy and hope with their tendency to support aggressive/militant policies towards Palestinians as well as their levels of support for conciliatory policies. It was found that empathy was negatively correlated with levels of support for implementing militant actions against the other side, but that hope (more so than empathy) was positively correlated with conciliatory attitudes. However, it is

important to note that the Palestinians were not interviewed, though it would be interesting to measure perceptions from individuals on either side of the intractable conflict. The OAD was unable to find literature on the impact of teaching empathy in refugee camps, or on the role of teaching empathy to children living in conflict zones. It should be noted that the World Health Organization produced a document in 1996 entitled “Mental Health of Refugees” that outlines the mental health needs and issues of refugees and internally displaced persons, going into the specific needs of children.

Guiding Questions and Research Framework

Empathy-based training has been frequently shown to have positive impacts on its targets. However, in some circumstances it has been shown to be ineffective or produce a counter-empathic response. What remains open-ended is whether astronomy, and the perspective it offers, has a role in mitigating narrow nationalism, intergroup bias, and xenophobia. In 2015, a study was carried out to measure the impact of the Pale Blue Dot image and message on promoting intergroup bias and empathy in South African primary school students (N=938). Unfortunately, the data analysis was not completed and the results on the impact of astronomical perspective on empathy and mitigating intergroup bias are currently inconclusive. This research project could serve as a potential basis for how to structure the research platform that will potentially accompany this flagship.

Measuring the impact of astronomy on pro-social behavior in a general context is outside the expertise of those at the OAD and we plan to develop academic collaborations with those well-versed in empathy, peace, and/or conflict studies. Thus, it could be said that the goal of this flagship is to *demonstrate whether or not* astronomy has a substantial role in promoting peace, empathy or universal solidarity. One promising study by Jennifer Stellar et. al in 2017 demonstrates that feelings of awe – defined as wonder and amazement brought on by experiencing something vast which transcends one’s current understanding, such as vast expanses of nature – leads to greater levels of humility and prosocial behavior.

The broad questions to be addressed in this study are:

- Do the themes of astronomy impact one's empathic tendencies? Are there differences in this effect based on age, gender, race or ethnicity, class, income, or other demographic status?
- If there is an impact on empathic tendencies, is it short-term, long term or both?
- How powerful can this effect potentially be? Does it have any role in conflict regions, or post-conflict regions?

The flagship will comprise different project formats, from a classroom setting for school children to an exhibition for the general public. Appropriate evaluation tools need to be devised tailored to each setting, but the foundation can be as follows. For example, measurements of empathy and global citizenship can be taken pre- and post-intervention. Additionally, impacts should be measured in the short and long term.

Measures of Empathy

As the theme of this flagship is empathy and global citizenship, one way the flagship projects can be evaluated is through measures of empathy, of which there are many. These include self-reported scales via surveys, behavioral-observational methods (evaluated by a practitioner or researcher), neuroscientific/physiological measures (such as f/MRIs, skin conductance, or pulse rate measures in response to viewing an interaction or pictures of strangers' facial expressions). The Focus on Emotions laboratory ([link](#)) has produced a substantial amount of emotion questionnaires that have been tested and used very widely, including several on empathy for different target age groups.

Implementation of the flagship

The sub-projects implemented under the flagship theme can take different shapes and need to be tailored to the needs of the target group and local culture. In this section, we describe the types of formats we envision for the flagship, although other suggestions are welcome.

General Points of Consideration

- Members of the community where the project is proposed should be leading the program or organising the leadership, as opposed to bringing in outside leaders to conduct the program.
- Empathy intergroup bias is defined as the tendency for individuals to preferentially demonstrate empathy towards individuals they already perceive as similar to themselves. Teaching universal empathy is essential to promoting a more peaceful world and addressing the UN SDGs, though special consideration must be taken to circumvent potential intergroup bias.

Relevant target groups

For different groups in society a different approach will be the most suited. Therefore, we define different target groups based on which we can tailor the flagship project.

1. Young children: inspiration, spark their interest in S&T; value systems forming so expected to have the most effect on global citizenship; form a cohesive and supportive school environment
2. Teenagers: starting to make decisions for themselves, so in this age group we could have the most impact for action against climate change; also stimulate interest in S&T; promote cohesive and supportive school environment
3. General public: spread the message of peace/globalism through the inspiring and non-threatening topic of astronomy
4. Conflict areas: emphasizing common humanity to ideally alleviate or address social barriers between groups due to conflict

As is the case for any development initiative, the project must be highly tailored to the local community's needs and resources. This is best done when project leaders and organizers are members of the community.

Implementation formats

Listed below is a short list of examples of how this flagship could be implemented.

1. [general public] A display or exhibit in science centers, observatories, and/or planetaria that includes a lesson about the scale of the Universe and our place in it, with a section on our common humanity. Before the visitors enter the exhibit, they could fill out a short empathy and global citizenship measure, which would be repeated when they exit the exhibit. The survey scores could be compared to survey scores from members of the public who do not experience the exhibit.
2. [young children/teenagers] A classroom lesson on astronomy, empathy and global citizenship. Students will learn about the scale of the Universe and our place in it, followed by a component on our similarities as humans. This will also entail an international pen-pal service or Skype sessions with students from other parts of the world.
3. [General public] A featured video with BBC's *Crossing Divides* on our common origins and place in the Universe, to be distributed to other platforms as well. This could begin and finish with a short anonymous online survey.
4. [between cultures/groups in conflict or tension] A cross-cultural lesson about local or indigenous astronomy and cosmology that emphasizes our common humanity. This could be performed between two cultures in person or remotely through Skype or another video chat service.

[Click here to see a more in-depth sample implementation.](#) Once again, this is simply a template to provide a more thorough example and is not a set of definite instructions.

References

- Fukushima, K., Venugopal, R. First Step to Understand Intergroup Bias and Cohesion from the One World Experiment: A Pilot Project to Evaluate the Effect of the 'Pale Blue Dot' Hypothesis. *Communicating Astronomy with the Public*, Issue 23, 2018, pp. 26-33.
- Kodai Fukushima. 'One World Experiment' on the Astronomy Outreach: Difference in Response to Ingroup and Outgroup. Master's thesis, Hosei University, 2016.
- Stellar, J. E., Gordon, A., Anderson, C. L., Piff, P. K., McNeil, G. D., & Keltner, D. (2018). Awe and humility. *Journal of Personality and Social Psychology*, 114(2), 258-269.
- Weisz, E. & Zaki, J. (2018). Motivated empathy: A social neuroscience perspective. *Current Opinion in Psychology*, 24, 67-71.
- Seppälä, E., Simon-Thomas, E., Brown, S., Worline, M., Cameron, C., Doty, J., Weisz, E., &

- Zaki, J. Empathy-Building Interventions: A Review of Existing Work and Suggestions for Future Directions. *Oxford Handbook of Compassion Science: Oxford University Press*. 2017.
- Lam, Tony, Klodiana Kolomitro, & Flanny C. Alamparambil. "Empathy Training: Methods, Evaluation Practices, and Validity." *Journal of MultiDisciplinary Evaluation*, 7.16 (2011): 162-200.
- Vincent van Grondelle. Rorty's Concept of Sentimental Education: Empathy As The Key To Legitimate And Inclusive Human Rights. Master's thesis, Pompeu Fabra University, 2017.
- Fourie, Melike Marethe et al. "Empathy and moral emotions in post-apartheid South Africa: an fMRI investigation." *Social cognitive and affective neuroscience* (2017).
- Overgaauw, Sandy et al. "Assessing Empathy across Childhood and Adolescence: Validation of the Empathy Questionnaire for Children and Adolescents (EmQue-CA)." *Frontiers in Psychology*, Vol. 8 870. 29 May. 2017.
- Lor, Kajua B et al. "A randomized prospective study on outcomes of an empathy intervention among second-year student pharmacists." *American journal of pharmaceutical education* vol. 79,2 (2015): 18.
- David. L. Neumann, Raymond C.K. Chan, Gregory. J. Boyle, Yi Wang, H. Rae Westbury. Measures of Empathy: Self-Report, Behavioral, and Neuroscientific Approaches, *Measures of Personality and Social Psychological Constructs*, 2015, Pages 257-289.
- UN High Commissioner for Refugees (UNHCR), *Mental Health of Refugees*, 1996.
- Brown, D. and Neale, N. "A Global Citizen of the skies." *Educational Futures*, Vol. 2(2). 2010.
- Leslie Mullen. "Reverence for the Heavens: How Astronomy and Religion Intersect." *Space.com*, January 20, 2011. Op-ed.
- Fourie, Melike & Subramoney, Sivenesi & Gobodo-madikizela, Pumla. "A Less Attractive Feature of Empathy: Intergroup Empathy Bias." *Intech*, Ch. 3. 2017.
- Mealy, Marisa and Walter G. Stephan. "Intergroup Empathy." *Encyclopedia of Group Processes & Intergroup Relations*. 2010. 476-478.
- Gerdes, Karen E., et al. "Measuring Empathy in the 21st Century: Development of an Empathy Index Rooted in Social Cognitive Neuroscience and Social Justice." *Social Work Research*, vol. 35, no. 2, 2011, pp. 83–93.