

A Tactile Voyage Through the Solar System: Venus

Amelia Ortiz-Gil (1), Jordi Burguet-Castell (2), Enrique Pérez-Montero (3), **Fernando Ballesteros** (1), Lina Canas (4), Alberto Fernández-Soto (5), Andrés Gálvez (6), Thilina Heenatigala (7), Mariana Lanzara (1), M. Jesús Moya (1), Mónica Pallardó (1) and João Retrê (8)

(1) University of Valencia Astronomical Observatory, Spain (amelia.ortiz@uv.es), (2) Universidad Autónoma de Madrid, Spain, (3) Instituto de Astrofísica de Andalucía-CSIC, Spain, (4) National Astronomical Observatory of Japan, Japan, (5) Instituto de Física de Cantabria - CSIC - UC, Spain, (6) European Space Agency, ESA-HQ, France, (7) Tokyo Institute of Technology, Japan, (8) Instituto de Astrofísica e Ciências do Espaço, Portugal

Abstract

"A Touch of Venus" is a project funded by the International Astronomical Union's Office of Astronomy for Development (OAD) with the goal of developing educational tactile resources focused on the planet Venus. The project has developed a three-dimensional (3D) tactile model of Venus and a series of related educational activities for the general public, including people with low vision and blind. The model was created from the topographic map obtained by NASA's Magellan spacecraft by using a novel software specifically developed for this project (Mapelia). The educational activities to use the tactile globe will be freely downloadable from the project's website and from IAU's online peer review educational repository AstroEDU [1]. The funding allowed the project to print 20 globes and activity books that will be sent to educators/science communicators around the world that work with groups of blind persons mainly in developing countries or underserved communities. Social media will be used to reach to a wider community and will allow for the exchange of ideas and experiences among all those who wish to be involved in this project of tactile astronomy.

The resources in the kit of "A Touch of the Universe" were developed according to the Universal Design for Learning (UDL, a learning framework which allows to reach to the general public as well as to audiences which might be regarded as "special" because they have some disability.

In 2017 we applied again for funding to the OAD for the project "A Touch of Venus" which intends to be an addition to the materials that were part of the initial kit of "A Touch of the Universe". In this case we intended to build a 3D tactile model of the planet Venus supporting the users with a related activity book and some video tutorials.

1. Introduction

The project "A Touch of the Universe" [3] was funded in 2013 by the IAU's Office of Astronomy for Development (OAD) with the goal of developing a kit of educational tactile astronomy materials that educators/science communicators could use with the general public, including blind or visually impaired persons. A total of 30 kits were distributed among educators and teachers in underdeveloped countries in the Americas, Asia and Africa. Among the materials included in the kit there was a tactile globe of the Moon [5] and a half-sphere with some relevant constellations of the northern sky engraved on it that was part of the planetarium show for the blind "The sky in your hands" [2].

2. From the 2D map to the 3D globe

We started with the topographical map that was created from radar data obtained by NASA's Magellan space probe during its exploration from orbit of the planet Venus between 1990 and 1994. Magellan employed a radar technique to create topographical maps of the surface below the thick atmosphere that makes it impossible to probe the surface in optical wavelengths from orbit.

The next step was to enhance the contrast of the most relevant features and to smooth out the smallest structures to simplify the model and get rid of details that could lead to confusion when touching the globe without seeing it.

When the image was ready for our purposes we processed it with Mapelia [4], a software which produces digital 3D tactile globes from 2D maps in an easy and fast way. It works with many different map projections and the output is a ready-to-print 3D file in several digital formats. An example of the Venus 3D file created by Mapelia is shown in Fig. 1, and can be downloaded

from the “A Touch of the Universe” website.

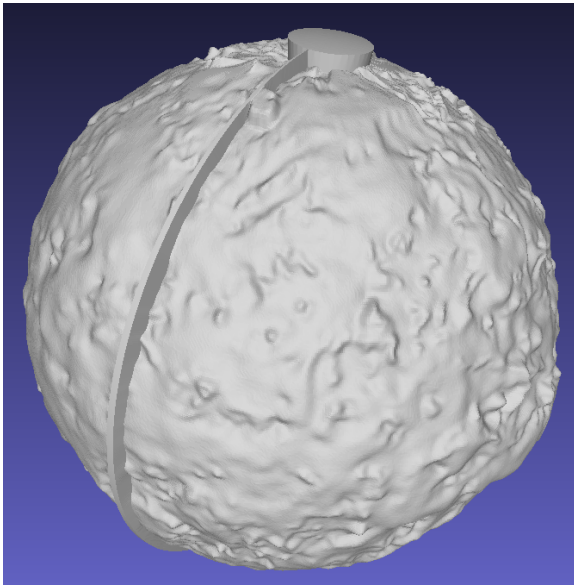


Figure 1: 3D rendered tactile models of Venus obtained with Mapelia. Credit: A. Ortiz-Gil & J. Burguet-Castell.

A series of educational activities to be carried out with the Venus globe have been developed teaching the user how to identify craters, volcanos, mountains, plains and highlands by touching the model (Fig. 2) Other activities reflect on Venus retrograde motion, phases and global warming. Finally one activity has been devoted to the nomenclature of Venus features, which are mostly named after female characters, both real and fictional or legendary. In the activity we highlight the particular achievements of some of them.

3. Summary and Conclusions

We have developed a 3D tactile model of the planet Venus along with an activity book to be used as educational resources for publics including visually impaired or blind persons. This is part of the project “A Touch of the Universe” that includes also tactile 3D models of the Moon and Mars, and a tactile planetarium show. The project is very successful among educators and we have received many requests for the materials that we share freely through the project’s website.

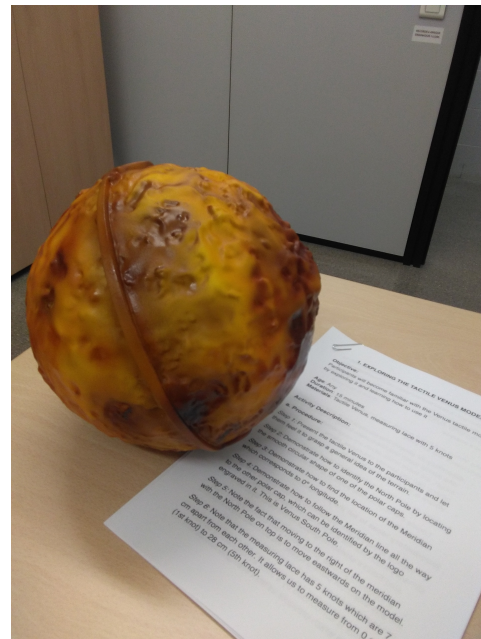


Figure 2: Venus 3D printed globe with the plain text version of the activity book. Credit: A. Ortiz-Gil.

Acknowledgements

This project has been possible thanks to the grant scheme of the IAU’s Office of Astronomy for Development (OAD). Amelia Ortiz-Gil, Fernando Ballesteros and Alberto Fernández-Soto were supported by the Spanish Ministry of Science project AYA2016-81065-C2-2.

References

- [1] AstroEDU, Peer-reviewed Astronomy Education Activities, <http://astroedu.iau.org/>
- [2] Canas, L., Borges, I., & Ortiz-Gil, A. 2013. Proceedings of the European Planetary Science Congress 2013, 2013EPSC....8..716C
- [3] Project “A Touch of the Universe” website, Ortiz-Gil, A. 2013, <https://astrokit.uv.es>
- [4] Ortiz-Gil, A., & Burguet-Castell, J. 2018, Journal of Open Source Software, 3(25),660
- [5] Ortiz-Gil, A. 2018. Proceedings of the European Planetary Science Congress 2018, in press