

Impact of language, culture and heritage on the way we learn and communicate Astronomy

Basilio Solís-Castillo 

Escuela de Ingeniería, Universidad Central de Chile, Avda. Francisco de Aguirre 0405,
La Serena, Chile.
email: basilio.solis@ucentral.cl

Abstract. The language we speak, the culture in which we grew up and where we come from have a tremendous impact on the way we learn astronomy. Additionally, the historical predominance of Western culture has influenced the way our modern society sees the world, and of course, the sky. In this work, we will share author's experience working as science advisor in an outreach institution, where he explored different strategies to reach diverse communities and bring astronomy closer to broader audiences.

Even though the construction of world-renowned astronomical observatories in Chile has boosted the interest in astronomy on the community, many challenges have not yet been addressed. One of them is to raise awareness about the ancestral heritage of Chilean's first nations. Finally, we would like to highlight the importance of learning astronomy in our own language and therefore assure inclusion, diversity, and equity in our countries.

Keywords. Science education, Science communication, Astronomy outreach, Cultural astronomy

1. Introduction

Speaking a language different than English was, and sometimes still is, a disadvantage to learn astronomy. High impact science magazines, world-known science institutions and best-sellers books are predominantly produced and written in English, meanwhile other languages from comparable speaking population are left to play a secondary role. This is not only because English is the most spoken language with around 1.268 billion speakers around the world (according to *Ethnologue**) but also due to most authors believe that the language of science is and should continue to be English.

In the past, main interests of developing countries like Chile were focused only on economy, leaving education and science behind for decades. Additionally, that someone decided to study astronomy and become an astronomer was something considered to be very far from the Chilean standard and more often related to foreigners from Northern Hemisphere and first-world countries.

The present work will detail the author's experience as an astronomer and science communicator in Chile, how the current situation have changed during the last decades and what are the perspectives for the future of astronomy.

* <https://www.ethnologue.com/guides/ethnologue200>

2. Learning astronomy from the South of the world.

Looking through a standard astronomy textbook it is not a surprise to find that most references in the sky are related to Northern Hemisphere stars, constellations and visible to naked-eye objects like: Polaris, Vega, the Big Dipper, Cassiopeia and Andromeda galaxy. Their use to connect the reader to the night sky, is of course, very appropriate for the ~90% of world population living in the Northern Hemisphere (according to *Worldometer*†), but the lack of references of Southern stars and constellations it is something that it was not considered.

Growing up with a night sky that is different from standard textbooks break the link between astronomy and the community. Even something normally considered to be very simple like finding Orion constellation can be a bit tricky for the untrained eye. One of the things we must have in mind is that the great hunter is seen up-side down from the Southern Hemisphere. Other Southern constellations such as Microscopium and Ara lack the easiness of recognition in the sky.

In the 60s, the construction of two observatories: Cerro Tololo Interamerican observatory‡ in 1967 (from National Optical Astronomy Observatory, hereafter NOAO§ and Association of Universities for Research in Astronomy, hereafter AURA¶) and Cerro La Silla observatory|| in 1969 (from European Southern Observatory, hereafter ESO**) changed things completely into another direction. Suddenly, astronomers wishing to work at the observatories became frequent visitors in the Northern part of the country. In the following decades, many other scientific institutions around the world put their eyes on Chile to build the next generation of telescopes. Soon, world's biggest observatory Very Large Telescope (VLT††) from ESO started to being built in Chilean soil together other important projects in consideration for the future. That was the country where the author was born.

Years later, working at the Planetarium from the University of Santiago‡‡, the author collaborated on a project called “The Universe to the south of the world: Our celestial heritage”. In the context of the celebration of the bicentennial of the country's independence and with the contribution of Chilean historians, archaeologists and anthropologists, an exhibition was created to focus on what Chilean's first nations believe about the sky. Together with other initiatives along the country in the following years, Chilean community started to re-discover their celestial heritage. Words, ancient stories and traditions came to light to build again the link of the community with the sky. Nowadays, people commemorate the indigenous' new year every June for the winter solstice (in the Southern Hemisphere), the story about the Yakana (Solís-Castillo & Jaldín 2020), the celestial llama, is once again told to children in the North and the commonly known *Southern Cross* constellation is again identified as the “ostrich leg” in the Southern part of Chile. On the shoulders of our ancestors, astronomy have started to re-establish its bound with the community.

To teach about constellations in the Southern sky we must have in mind that ancient cultures did not recognize the same figures in the sky. Within the cultures that develops in the Andean region, the Inca culture was one of the most important in the Northern part of Chile before the European colonization. The Atacameños, current inhabitants of the Atacama Desert, inherited many of their beliefs and culture. In contrast with

† <https://www.worldometers.info/geography/7-continents/>

‡ <http://www.ctio.noao.edu/noao/>

§ <https://www.noao.edu>

¶ <https://www.aura-astronomy.org>

|| <https://www.eso.org/public/teles-instr/lasilla/>

** <https://www.eso.org/>

†† <https://www.eso.org/public/teles-instr/paranal-observatory/vlt/>

‡‡ <http://planetariochile.cl>



Figure 1. Yakana, the celestial llama. Photograph taken by Alexis Jaldin.

the Western Hemisphere, these Andean cultures created constellations using the dark regions of the Milky Way, not stars. These are called *dark constellations* (Magaña 2006). Common Andean animals such as llamas, birds, foxes and snakes were represented on the sky filling the obscure parts of our galaxy. Figure 1 shows how the Yakana is depicted on the night sky, with Alpha and Beta Centauri as the eyes of the celestial llama. The appearance of the Yakana on the East warned the ancient Atacameños of the beginning of rainy season during the summer, and its disappearance on the West was considered the time when the celestial llama would drink water from the ocean and then bring it back in the summer. Its movement in the sky defined the calendar for these ancient cultures.

This celestial heritage is also present on the ground. In the Atacama desert, where the Atacama Large Millimeter/Submillimeter Array (ALMA[†]) is located in Northern Chile, the extreme conditions have preserved petroglyphs (Vilches 2005) and geoglyphs (Briones & Chacama 1987, Clarkson & Briones 2014) in several areas showing the interest on the sky of ancient cultures. Sun-like symbols, spirals, Saywas (stone altars) and straight lines on the desert's soil are commonly found to be aligned with celestial events like solstices and equinoxes (Moyano 2010). Interdisciplinary scientific teams now gather to study these traces of celestial connection of ancient cultures in Chile.

3. A brighter future for Chilean astronomy.

The exponential growth of astronomical infrastructure installed in Chile during the last decades has positioned the astronomy as a topic of interest for Chilean community and the government. Today is not so strange to find Chilean astronomers talking in TV shows, giving opinions about the future of astronomy in newspapers or science books as best-sellers in the main bookstores throughout the country. Along with public interest, astronomy research groups have been created in several universities and science institutes. On the other hand, cultural astronomy has become a relevant subject to study, gathering astronomers, archaeologists and anthropologists to study the different petroglyphs, geoglyphs and ancient ruins found along the country. These scientific teams are now recovering and re-constructing the ancient connection with the sky that was lost in the past.

Astronomy, as other sciences, is easier to learn when people can experience with their environment. Through known examples, parts of the sky are more easily identified and recognized by the community. In this context, recovering the constellations of Chilean's first nations help to bring the sky closer to people, because instead of a foreign mythological figure they are looking at something familiar and connected with their cultural heritage.

The future of astronomy in Chile seems brighter than ever with a new generation of telescopes planned to be operational in the next 10 years. Giant Magellan Telescope (GMT[‡]), Vera C. Rubin Observatory (former LSST[§]) and Southern part of the Cherenkov Telescope array (CTA[¶]) are international projects that will position our country as the world capital of astronomy. However, the greatest impact of all has been made on younger generations who have grown up knowing how special and unique our skies are, and how astronomy can help us understand where we come from and where we are heading. Our efforts, as scientists and science communicators, should be focused on bringing astronomy closer to communities whatever their culture, language and beliefs are. The making of a more inclusive astronomy is our greatest challenge for the future.

References

- Briones, L. & Chacama, J. 1987, *Chungara, Revista de Antropología Chilena*, 18, 15–66
 Clarkson, P. & Briones, L. 2014, *Diálogo andino*, 44, 41–55
 Magaña, E. 2006, *Boletín del Museo Chileno de Arte Precolombino*, vol. 11, 2, 51–66
 Moyano, R. 2010, *Chungara, Revista de Antropología Chilena*, vol. 42, 2, 419–432
 Solís-Castillo, B. & Jaldín, A. 2020, *Fundación Chilena de Astronomía*, <https://www.fuchas.cl/cielos-de-pueblos-andinos/>
 Vilches, F. 2005, *Boletín del Museo Chileno de Arte Precolombino*, vol. 10, 1, 9–34

[†] <https://www.almaobservatory.org/>

[‡] <https://www.gmto.org>

[§] <https://www.lsst.org>

[¶] <https://www.cta-observatory.org>