Exploring Cultural Competence for Astronomers

By

Carla Bento Guedes

A thesis in fulfilment of the requirements
for the degree of Master by Research Degree

UNSW
AUSTRALIA

School of Humanities and Languages

December 2018

THE UNIVERSITY OF NEW SOUTH WALES

Thesis/Dissertation Sheet

Surname or Family name: **Marques Bento Guedes**
First name: **Carla** Other Names: **Alexandra**
Abbreviation for degree as given in the University calendar: **MRes**
School: **School of Humanities and Languages** Faculty: **Faculty of Arts & Social Sciences**

Title: **Exploring Cultural Competence for Astronomers**

This Master by Research thesis focuses on the intersecting domains of cultural competence, astronomy, Indigenous knowledge, and the implications thereof for ethnographic theory and practice. The aim of this study is to prove that, despite more than 40 years of substantial conflict between Indigenous people wanting to control and protect their land, and Western astronomers who wish to build research facilities on those lands, astronomers have an opportunity to alleviate those conflicts, and achieve mutual respect and understanding. I will argue that many Western astronomers need to increase their cultural competence significantly. By improving cultural competence, astronomers will be able to collaborate meaningfully and ethically with Indigenous peoples and their interests while conducting scientific research on Indigenous sacred lands. Two case studies will be presented to test this hypothesis: (a) The possible lack of cultural competence observed in the case of Hawai'i's sacred mountain and the contentious Thirty Meter Telescope (TMT). The dormant volcano is Hawai'i's most sacred place, where sacred Polynesian ancestors are buried, and is where astronomers are trying to build the telescope; and (b) The Square Kilometre Array (SKA) project, in South Africa and Australia, where astronomers gained a deeper understanding of the different perspective of the sky from working closely with the Indigenous people, opening new areas of opportunity, education, and vocation for the communities. I will compare the process of negotiation with Indigenous stakeholders in each case study on cultural competence, citing the successes, failures, and areas for improvement. Both case studies will be analysed through the Critical Discourse Analysis (CDA) as the chosen qualitative research method. Data findings will be presented and discussed, and critical recommendations to accomplish a culturally competent first encounter with Indigenous peoples will be explored. This thesis will also propose a new theoretical approach to gaining cultural competence specifically for astronomers: the Model of Indigenous Cultural Competence for Astronomers (MICCA), and the theoretical diagram - Astronomy Cultural Competence Continuum. These two new theoretical proposals were designed to help astronomers before, during and after either ethnographic research, in the

implementation of telescope facilities projects, and designing protocols between astronomers and indigenous for various projects. My primary objective in this research is to apply the cultural competency concept to astronomy, as far as I know, for the first time in the literature.

Declaration relating to disposition of project thesis/dissertation

I hereby grant to the University of New South Wales or its agents the right to archive and to make available my thesis or dissertation in whole or in part in the University libraries in all forms of media, now or here after known, subject to the provisions of the Copyright Act 1968. I retain all property rights, such as patent rights. I also retain the right to use in future works (such as articles or books) all or part of this thesis or dissertation.

I also authorise University Microfilms to use the 413-word abstract of my thesis in Dissertation Abstracts International (this is applicable to doctoral theses only).

. . . . .	. . . . .	. . . . .
Signature	Witness	Date

The University recognises that there may be exceptional circumstances requiring restrictions on copying or conditions on use. Requests for restriction for a period of up to 2 years must be made in writing. Requests for a longer period of restriction may be considered in exceptional circumstances and require the approval of the Dean of Graduate Research.

FOR OFFICE USE ONLY Date of completion of requirements for Award:

Originality Statement

‘I hereby declare that this submission is my own work and to the best of my knowledge it contains no materials previously published or written by another person, or substantial proportions of material which have been accepted for the award of any other degree or diploma at UNSW or any other educational institution, except where due acknowledgement is made in the thesis. Any contribution made to the research by others, with whom I have worked at UNSW or elsewhere, is explicitly acknowledged in the thesis. I also declare that the intellectual content of this thesis is the product of my own work, except to the extent that assistance from others in the project's design and conception or in style, presentation and linguistic expression is acknowledged.’

Signed . . . . . Date . . . . . .

Inclusion of Publications Statement

UNSW is supportive of candidates publishing their research results during their candidature as detailed in the UNSW Thesis Examination Procedure.

Publications can be used in their thesis in lieu of a Chapter if:

- The student contributed greater than 50% of the content in the publication and is the "primary author", ie. the student was responsible primarily for the planning, execution and preparation of the work for publication
- The student has approval to include the publication in their thesis in lieu of a Chapter from their supervisor and Postgraduate Coordinator.
- The publication is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in the thesis

Please indicate whether this thesis contains published material or not.

☒ This thesis contains no publications, either published or submitted for publication

☐ Some of the work described in this thesis has been published and it has been documented in the relevant Chapters with acknowledgement

☐ This thesis has publications (either published or submitted for publication) incorporated into it in lieu of a chapter and the details are presented below

CANDIDATE'S DECLARATION

I declare that:

- I have complied with the Thesis Examination Procedure
- Where I have used a publication in lieu of a Chapter, the listed publication(s) below meet(s) the requirements to be included in the thesis.

Name	Signature	Date (dd/mm/yy)

Copyright Statement

Authenticity Statement

‘I certify that the Library deposit digital copy is a direct equivalent of the final officially approved version of my thesis. No emendation of content has occurred and if there are any minor variations in formatting, they are the result of the conversion to digital format. I also authorise University Microfilms to use the 413-word abstract of my thesis in Dissertation Abstract International (this is applicable to doctoral theses only).'

Signed . . . . . Date . . . . . .

Table of Contents

Dedication

For my husband, Carlos Guedes, and my two children, Leonor Guedes and Lourenço Guedes – the three brightest stars in my Universe! This time I have challenged myself to navigate through the "darkest night", and that frightened me immensely. But your light shined for me the whole time, and I managed to end my journey feeling braver, mature, loved and even happier.

This thesis is also dedicated to Indigenous peoples around the world, especially those who have only recently had the opportunity to finally make their voices heard. This simple piece of work is my way of showing the respect, admiration, and gratitude I have for their cultural heritage, capacity for survival, dignity, strength, and infinite knowledge about the nature of all things.

I want to acknowledge the **Bedegal people** (the Traditional Custodians of the land on which University the New South Wales is situated) both past and present.

Special note to Aboriginal and Torres Strait Islander Readers: this thesis contains the names and images of people that might have passed away.

Acknowledgements

I want to thank my husband, and two kids, for the overwhelming support, love, and patience. Recently arrived in Australia, and literally starting life from scratch, this thesis has marked our family's adventure in a very special way. Without the encouragement of my family, here in Sydney, but also in Portugal (mainly, my parents and parents in law), I would never have finished this research. "Obrigada, família. Conseguimos isto juntos!"

If there is a place, and time, where I can publicly thank my two fantastic thesis supervisors, Duane Hamacher and Daniel Robinson, it is here and now. Without their knowledge, kindness, support, and patience with my difficulty in expressing my ideas in English, this work would not have been possible. I will never forget the days when I have heard other research students' complaints about their supervisors. Those were the days when I felt the luckiest researcher of all. The support of my joint-supervisor, Leah Lui- Chivizhe, especially in the beginning where I needed the help of an Indigenous Academic to start designing my research, is something that I need to reinforce here strongly.

I wish to thank my colleague and good friend Trevor Leaman, who first introduced me the field of Cultural Astronomy, to Duane Hamacher and to the Australian Indigenous Astronomy group. Also to Bob Fuller, who I respect and admire both professionally and personally, and with whom I happily shared the majority of the rides to our bush camps, talks and seminars. Stephen Muecke, Marcus Hughes, Michelle Gansevoort, Willian Stevens, Karlie Noon, Kirsten Banks, Bob Pankhurst, Dimitri Douchin, and all the researchers and friends (Indigenous and non-Indigenous) that, directly or indirectly, helped me during my research study, all contributed for me to feel welcomed, integrated and confident.

Special thanks to all the Indigenous Elders, academics, researchers, my students, new friends from all over the world, people I met while participating in bush camps, or meetings in the context of the Australian Indigenous Astronomy group, or in the conferences I have attended. To all people that have somehow teach me something valuable, and inspired me throughout my work.

I want to thank the institutions, societies and academic departments that provided me the opportunities to, not only develop my study, but also to present my research in various talks: University of New South Wales, University of Sydney, University city campus in Melbourne, Australian National University Research School of Astronomy and Astrophysics, University of NSW, International Society for Archaeoastronomy and Astronomy in Culture, National Space

Society of Australia, National Committee for Space and Radio Science, Mars Society of Australia, Global Portuguese Scientists, Portuguese Consulate in Sydney, Sydney Observatory, Mount Stromlo Observatory, and the Powerhouse Museum.

Finally, I thank my dearest long-term friends back in Portugal: Edgar Ramalhete, Carla Rodrigues Cardoso, Patricia Pimentel, Conceição Barbosa, Célia Saraiva, Ana Vieira, Alexandra Mónica Santos, Vanda Neto, Nica Xavier, Nuno Pires e John Fisher. Even though we are geographically distant, more than ever, you did not stop making me feel present in your lives at all times, in the last four years. That feeling of mateship helped me immensely during my research. A special thank to Armando Teixeira-Pinto and Susana Teixeira-Pinto, new amazing Portuguese friends that I luckily met in Sydney, in my first months here. I will never forget that you were the ones who first encouraged me to pursue my academic dream in Australia, in our first bushwalk together. Above all, Maria Rodriges Munz thank you for introducing me to Dr Jaime Gongora – the first academic with whom I have worked in Australia, at the Sydney University. That is where it all began.

List of Figures

List of Tables

1 Introduction and thesis overview

"We traded Indigenous and Western stories. We learned about the different ways we view the same patterns in the sky, such as the Emu in the Sky that lies within the Milky Way. And we learned about striking similarities, such as the story of the Seven Jilas – which is known as the Seven Sisters (Pleiades) in Western astronomy. We journeyed home the next day, inspired by what we had experienced. (...) On the 350-kilometre trip from Geraldton, we stopped in Mullewa. We invited the community of the small town to come out and look at the stars that night. For many of the artists, this was the first time they had looked through a telescope, for a close-up view of Saturn and clusters of stars such as the Jewel Box. It was a great way to break the ice."

- Steven Tingay (2015)

1.1 Hypotheses

Over the last 40 years, there has been substantial conflict between Indigenous people wanting to control and protect their lands, and astronomers who wish to build research facilities on those lands. This thesis will explore the origin of those conflicts, the consequences of those conflicts for Indigenous peoples and astronomers, and how can those conflicts be reduced or maybe stopped in the future.

There is a long list of mountaintops that have become sites of conflict between scientists and Indigenous people (Swanner 2013, Hall 2015). In 1980, astronomers wanted to build three telescopes atop Mount Graham in Arizona: the Heinrich Hertz Submillimeter Telescope, the Vatican Advanced Technology Telescope, and the Large Binocular Telescope (LBT) (Hall,

2015). Sacred sites of the San Carlos Apache Tribe were located on Mount Graham. This led to Indigenous and environmental activists banding together against the project. The environmental activists were concerned about the possible extinction of the American red squirrel, and the Apache were protesting to protect their lands and sacred sites (Hall, 2015). The first two telescopes ended up being constructed as they were small in size and already fully funded when the conflict began. On the other hand, the LBT (designed to occupy much more land to the point that it would obscure the sacred peaks) faced 40 lawsuits and eight federal appeal courts. After several years of legal disputes, the astronomers won their case and the LBT was allowed to be constructed.

In 2000, Arizona's Kitt Peak National Observatory, built on Tohono O'odham lands, became the new site of controversy. Astronomers wanted to construct the VERITAS (Very Energetic Radiation Imaging Telescope Array System), funded by the National Science Foundation (Hall, 2015). In 2005, the Tohono O'odham fought against the telescope's construction and they won their case: the VERITAS was not built in their lands. Almost at the same time, a Hawaiian lawsuit successfully prevented the construction of four new small telescopes on Mauna Kea near the W. M. Keck Observatory.

In all of these long-lasting and diplomatically exhausting conflicts between Indigenous people and astronomers, the focus of the problem–seems to have been two-fold: cultural incompatibilities around the use of the land and the meaning of sacred site for the Indigenous community, and the advancement of scientific and commercial progress for the astronomers. Both communities had been unable to negotiate an effective agreement between them. When astronomers tried to protect both their projects and build an appropriate relationship with the Indigenous people, they had no culturally appropriate strategy to do so.

According to Hall (2015), leaders of the Thirty Meter Telescope (aka TMT – a project in Hawaii, well explored further ahead in this thesis) conducted a thorough environmental impact investigation, held over 300 consultation meetings with the Indigenous community, and paid $3 million a year to lease the site and fund STEM (science, technology, engineering, and mathematics) programs for students. The Indigenous community did not accept the project. Why? This thesis argues that the answer to this question may lie in the history of interaction between these two communities (astronomers and Indigenous people) through their independent histories. I also examine ways astronomers can improve on this relationship through cultural competence training.

Previous studies indicated that there is space to explore and improve astronomers' methods and approaches in working with Indigenous peoples, particularly when building research facilities on Indigenous lands. Swanner (2013), examined three representative examples of this in her PhD thesis *Mountains of Controversy: Narrative and the Making of Contested Landscapes in Postwar American Astronomy.* Swanner researched the dynamic between astronomers and Indigenous traditional owners at three American astronomical observatories between the mid-1970s and 2013: Kitt Peak and Mt. Graham in Arizona, and Mauna Kea in Hawai'i. In the context of her study, Swanner (2013, p. 4) argued:

> *"Strong and long-lasting conflicts between Indigenous peoples and astronomers can profoundly constrict both scientific and spiritual uses of these sacred mountains, resulting in the loss of telescope projects and the increasing bureaucratization of prayer activities at the summit."*

The author also defends the idea that astronomers are often accused of *"being culturally insensitive"* (2013, p. 21) and that this assumption can lead to costly construction delays and ruined financial partnerships with institutions considering an investment in observatories built on Indigenous lands (Swanner, 2013).

All of Swanner's case studies (and the ones further presented in this thesis) were intensively debated by Indigenous communities, through social and print media channels, as well as amongst Indigenous and non-Indigenous scientists. Major concerns focused on issues of cultural appropriation, communication barriers, and difficulty in establishing correct and positive social, cultural, and political relationships with the Indigenous communities. Consequently, these issues reflect poor cultural competence on the part of astronomers.

In a 2016 ABC radio interview, cultural astronomer Duane Hamacher reinforced the role astronomy plays in Indigenous culture by saying that astronomy is a "centre point" as it links the different aspects of subsistence living, timekeeping and hunting, navigation, gathering, fishing, calendars, and agriculture. Hamacher added that:

> *"Western science tends to ignore the cultural aspect [of astronomy], and that is fine for the questions the astrophysicists are trying to ask. They should do*

that. But when you look at that [astronomy] in an Indigenous context, it has a very different meaning, a very different application". [1]

In the same interview, Dja Dja Wurrung man Jida Gulpilil also explained the meaning and the importance astronomy has in his people's culture:

"We are living in between what the land and the stars tell us to do. It is part of the Law."

Gulpilil also said there are different representations of the stars from different cultures worldwide, but argued that the first one was from Aboriginal Australians, sometimes described as *"the world's first astronomers"* (Norris, 2016, p. 5). This might lead one to think more about how relevant it is for astronomers to be well versed in cultural competence.

The historical difficulty of communicating and respecting both the agenda of scientists and Indigenous interests and rights regarding the building of astronomical facilities on Indigenous lands was highlighted by Swanner (2013, p. 57):

"The controversy is rooted in less obvious conflicts between science vs science, religion vs religion, and culture vs culture. (...) These conflicts between the interests of astronomical research and cultural or environmental interests are fundamentally irreconcilable."

Since many Indigenous cultures are oral, a majority of things written about them is biased or influenced by Western society (Walsh, 1991). Even though, nowadays, some Indigenous peoples are already making use of the modern legal system, which is based on written law as opposed to traditional law, which is often not recognised by Westerners or not well known outside of Indigenous communities. This may have created fundamental difficulties for astronomers, as well as for other scientists trying to make contact with, and learn from, Indigenous peoples. Above all, is important to mentioned here that some astronomers are Indigenous people, but white/European people overwhelmingly dominate this space. So

[1] https://www.abc.net.au/news/2016-06-03/astronomy-the-center-point-of-indigenous-culture/7476208

although there is a cross-over, the use of "Western astronomer" in this thesis refers to the power structure of astronomy as a Western scientific discipline dominated by white men.

But new paradigms in which to situate the problem and develop solutions have not been addressed. If past inequities between Western astronomers and Indigenous peoples are to be addressed and changed, the ways in which astronomers currently think and act needs to be reconstructed to be inclusive of Indigenous people and their knowledge. Learning about the Indigenous communities with whom astronomers plan to work is of critical importance. Adopting a culturally competent methodology can enable astronomers to achieve Indigenous collaboration (if not completely, at least to a certain degree). This thesis will build a critical pathway to overcome the sentiment expressed in the Graham telescope project in 2002:

> *"The opposing groups bring incompatibly different systems of politics, knowledge, belief and history to bear, and as a result, are incapable of either understanding or compromise."* (Quoted in Mt. Graham Telescope Project and the University of Minnesota Social Concerns Committee Position Report, March 2002)

The dominant discourses in astronomy have been situated in the Western experience. Western astronomers have constructed and controlled most dimensions of astronomy, from the interpretation and presentation of the sky, to funding and participation in scientific research. It is therefore not surprising that white men have also written most of the literature on astronomy. Consequently, most academic analyses and discussions of astronomy have focused on the experiences and interpretations of Western astronomers:

> *"The idea of a divide between Indigenous knowledge and Western science has been founded on a view that Western science and allied systems of knowledge have formed a dominant discourse that has obliterated, marginalized, or assimilated local, traditional, and Indigenous traditions and discourses"* (Reid et al, 2007, p. 146).

So one might assume that Western discourse has substantially shaped the development of astronomy and that astronomy as a social institution has been implicated in the reproduction of conflicts and inequalities regarding cultural diversity. Consequently, the critical examination of astronomy discourse and how its current formation impacts on the lives of those who have different cultural backgrounds, such as Indigenous peoples, is lacking. Indigenous peoples have their own interpretation of the interests that motivate astronomers:

> *"The telescopes, perceived as the pet projects of white men, are viewed as instruments of power and conquest"* (Swanner, 2013, p. 31).

The explanation for low levels of cultural competence among astronomers has not been adequately investigated, nor have theoretical and methodological approaches been adequately developed for astronomers to address this issue and improve their cultural competency skills. Existing scholarship does not adequately explore why these kinds of conflicts between Indigenous people and Western astronomers occur. Nor does it comment on how cultural competence can be an important component in the process of negotiation with Indigenous peoples.

This thesis will explore the hypothesis that Western astronomers need to develop a framework of cultural competence for working with Indigenous people. This includes training in cultural competency for astronomical organizations to develop policies, protocols, methods and practices that overcome obstacles and shortfalls with astronomers approaching and working in collaboration with Indigenous communities.

To accomplish this, my study will focus on the construction of astronomical facilities (i.e. telescopic observatories) on Indigenous lands. I argue that cultural competence has the potential to improve astronomers' understanding of Indigenous perspectives, culture, and connection to the land and sky. One goal of cultural competence protocol is to bridge the gap between Indigenous and non-Indigenous communities (Slawomir, 2005; Sillitoe, 2015; Sherwood, 2011; Smith, L.T., 2012; Reid, W.V. et al, 2006; Harvey, 2003; Chan et al, 2004; Chapman, 1994; Cram et al, 2013). Astronomers will benefit from training in cultural competence, and this can be of mutual benefit to both Indigenous people and astronomers.

1.2 Thesis aims

This research is based on the intersecting areas of astronomy, cultural competence, Australian Indigenous knowledge, and the implications thereof for ethnographic practice and theory. Due to sparse existing research on this topic, this research study intends to contribute to a better theoretical and practical understanding of Indigenous cultural competence, and the scientific community's approach to working with, and building facilities on, Indigenous sacred lands.

This thesis will propose a new model of cultural competence in action, based on the combination of the Rani Srivastava's "Cultural Competence Continuum Model" (Srivastava, 2006) (fig. 1), and Edgar Schein's "Cultural Iceberg" diagram (Schein, 2004) (Fig2). I will argue that the fundamental concepts of these two models of cultural competence can help astronomers throughout the process of designing protocols between astronomers and Indigenous people, conducting ethnographic research, and the development of telescopes facilities on Indigenous lands. Although these models are usually applied to psychology, medicine, education, Indigenous rights, and environmental studies, the aim of this research is to test their application and adopt them to astronomy. I believe that the model (presented in Chapter 3, section 3.6) will give astronomers the opportunity to re-think their work process and improve interpersonal skills. It has potential to allow astronomers to increase their knowledge, understanding, and appreciation towards the cultural similarities and differences within, among, and between groups to effectively deal with diverse cultural communities (Suh, 2004).

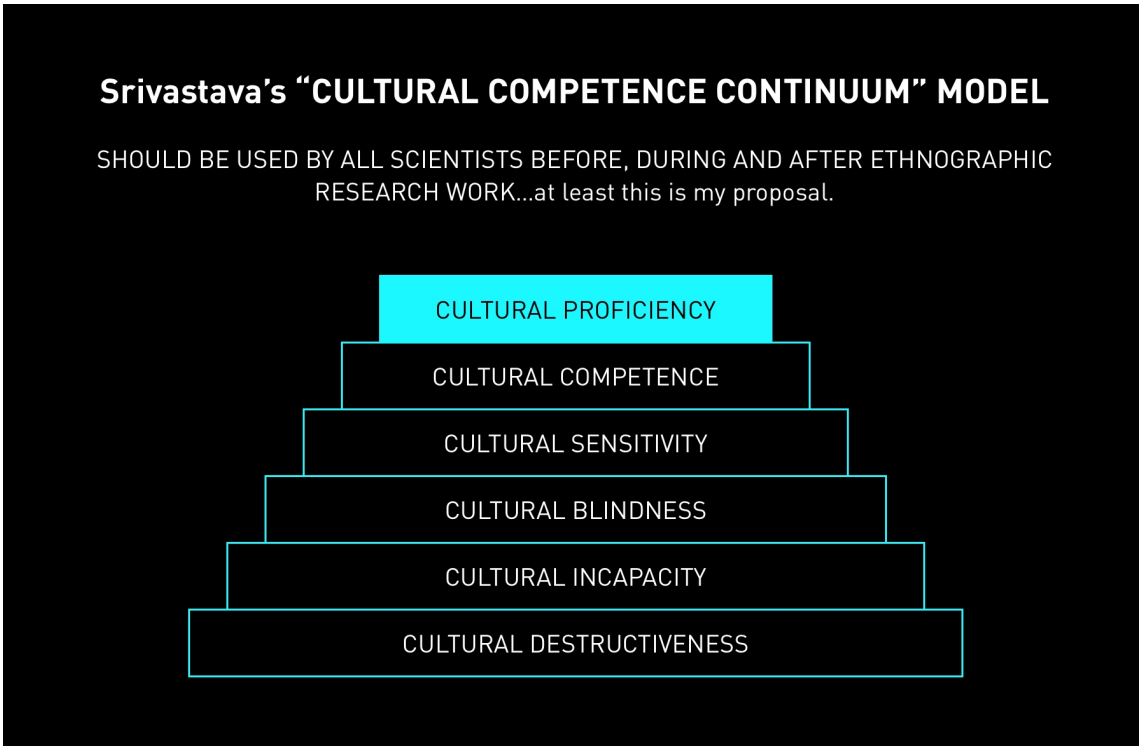

Figure 1 - Srivastava's "Cultural Competence Continuum" model. Srivastava, 2006, p. 17

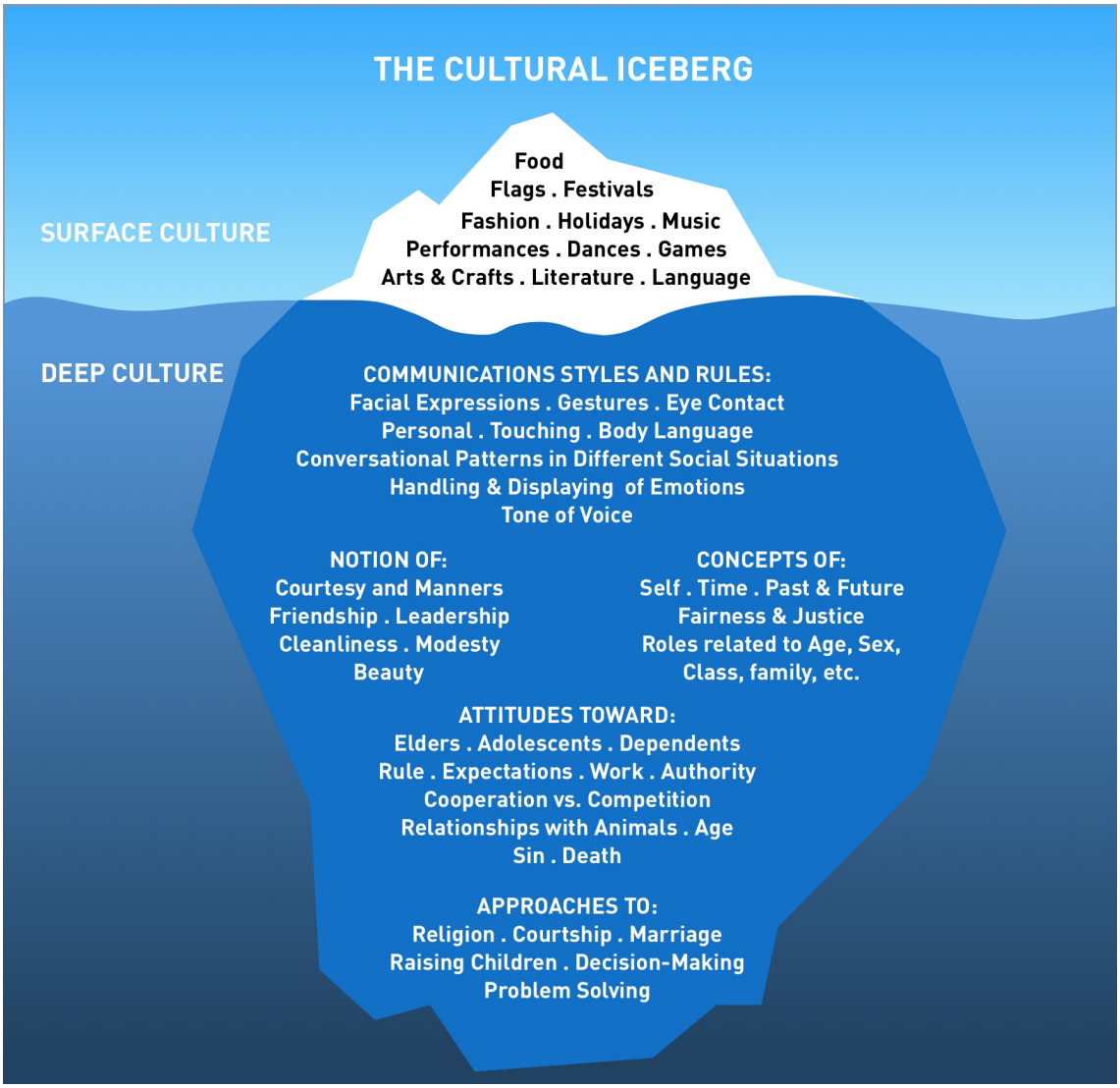

Figure 2 - The "Cultural Iceberg" diagram. Schein, 2004, p. 38

Astronomy, cultural competence studies, and Indigenous studies have each developed their own philosophical and conceptual approaches to researching their subject matter. But each has seemingly neglected the development of a theoretical framework in regards to the nexus between them. Over the last few decades, researchers have extensively debated the role that cultural competence plays in Indigenous health, psychology, education, Indigenous rights, and environmental studies (Buell, 1996; Walker et al, 2016), as well as the opportunities that the implementation of a cultural competence theory can bring to both people and institutions.

In the education area, Krakouer (2015) concluded that the most effective way of ensuring positive outcomes and achieve improved cultural responsiveness, awareness and competency in Australian Education is through a collaborative effort between the educational institution and the local Indigenous community.

Regarding research design, culture also plays a vital role:

> *"(...) in study research design and implementation processes, including the development of research questions and hypotheses, outreach and recruitment strategies, consent activities, data collection protocols, analyzing and interpreting research findings, drawing conclusions, and presenting the results. Depending on the type of research, cultural competence can be crucial to successfully recruit and retaining diverse individuals as study subjects,"* (O'Brien et al., 2006, p. 97).

In our globalised world, the diversity of cultural encounters in the health field demands culturally competent professionals, culturally adequate processes and particular approaches:

> *"Becoming a culturally competent health professional is a demanding prerequisite in this multicultural society."* (Suh, 2004, p. 2)

In his book *Origins of Human Competence: A Cultural-Ecological Perspective*, John U. Ogbu (1981, p. 414**)** explored the concept of cultural competence on its application to environmental research:

> *"Cultural competence is (...) a set of functional or instrumental skills."*

Some academics have other concepts of culture and have considered cultural competence as an important concept, with the potential to be used as an agent of profound change. Culture can be powerful in a literal sense.

A relevant contribution for the cultural competence discussion is Pierre Bourdieu's theory of Cultural Capital. Bourdieu, a well-known French sociologist, was also interested in Cultural Competence. After his ethnographic fieldwork among the Kabyle (Algeria's largest Indigenous group), Bourdieu wrote *Cultural Reproduction and Social Reproduction* (Bourdieu and Passeron, 1977). Bourdieu's concept of Cultural Capital relates to cultural competence. Cultural capital is embodied, objectified, and institutionalised, and as institutionalised the author refers to cultural capital as credentials and qualifications that symbolise cultural competence and authority.

> *"With the academic qualifications, a certificate of cultural competence which confers on its holder a conventional constant, legally guaranteed value with respect to culture, social alchemy produces a form of cultural capital which*

has a relative autonomy vis-à-vis its bearer and even vis-à-vis the capital he effectively possesses at a given moment in time," (Bourdieu, 1977, p. 51).

Cultural Competence as interpreted by Bourdieu here is a central pathway, however "qualifications" in this is not enough. Cultural Competence is a continually growing journey that cannot reach its zenith when someone gains a qualification. Culture competence needs time and demands great effort. Having a certificate of cultural competence is just the beginning of a long process.

Finally, this thesis will relate cultural competence with astronomy and certain aspects of Western viewpoints to better understand their impact on, and interaction with Indigenous peoples (e.g. Ruggles, 2011). Duane Hamacher (2011, p. 13) explains some of the research challenges in the study of astronomy and culture:

> *"No culture will view the natural world in the exact same way as another, nor will basic ideas or perceptions be universal. It is not the goal of Western science to disprove oral traditions or Indigenous views of the cosmos."*

Provision of a more comprehensive understanding of the relationship between astronomy, cultural competence and Indigenous peoples' uniqueness/knowledge/rights may enable rules, protocols, policymakers and providers of astronomy (and science in general) to better address the needs of both Indigenous peoples and astronomers. The practice of astronomy, to be effective and equitable, should recognise the culturally diverse composition of society and be open to innovations that are culturally inclusive and co-operative. This can also mean re-conceptualising the astronomy projects involving the building of facilities on Indigenous lands.

1.3 The Research Problem and Objectives

While achieving these aims, I will try to answer this fundamental research question:

How can cultural competence be applied to Western astronomy, and how can culturally competent astronomers be better prepared to work with Indigenous peoples, especially when developing new telescope facilities on Indigenous lands?

To adequately answer the central question, consideration will be given to three subsidiary questions:

What are the perceptions of the Indigenous peoples involved in these astronomy projects about the facility?

What are the perceptions of the astronomers involved with Indigenous communities?

How can these perceptions influence the work to the mutual benefit of astronomers and Indigenous peoples?

My research explores questions about astronomers' ways of approaching and working with Indigenous peoples in the context of building astronomical facilities on Indigenous lands. Here are the topics I intend to address:

- Cultural awareness and the conflicts related to culture;
- Indigenous perceptions of the sky versus the Western astronomy knowledge;
- The balance of both astronomers' and Indigenous' interests in the protocols for astronomy projects;
- Why and how cultural competence is essential to design the development of any astronomy facility built on Indigenous' land.

Along with the central research problem, four fundamental research objectives will provide the framework for locating and structuring the empirical data collection.

1. Have Western theories of Classical astronomy influenced the formation and maintenance of a certain form of cultural incompetence?
2. What positive factors can cultural competence, as applied to astronomy, bring to facilities built on Indigenous lands?
3. How is Indigenous cultural competence addressed within current astronomy policies, protocols, and practices?
4. How can cultural competence minimize negative processes between Indigenous and non-Indigenous peoples and Western astronomers, particularly the ones working on Indigenous' lands?

The research objectives will each be addressed using an in-depth literature review, theoretical framework and model, and case studies by comparison. In the first phase, this study is based on a well-researched and documented library of the interactions between Western astronomers, Indigenous communities, within the framework of cultural competence. This will be applied to two major case studies: the Thirty Meter Telescope (TMT) in Hawaii, and the Square Kilometre Array (SKA) in Australia. In the second phase, I will compare how the process of negotiation with Indigenous stakeholders in each case study was applied concerning cultural competence, citing the successes, failures, and areas for improvement. A new Cultural

Competence Continuum and a new theoretical model of Cultural Competence for Astronomers will be proposed in Chapter 3.

1.4 The case studies

The TMT received considerably attention in literature and media, and has often labelled as culturally incompetent project:

> *"The TMT demonstrates a microcosm of the challenges Indigenous people face when their traditions are dismissed by Western interests for intellectual or economic gain,"* (Hamacher and Britton, 2015).

> *"(...) the TMT and SKA scenarios differ in important ways. Only in Hawaii would the construction* [of the telescope] *impinge on a sacred burial ground, cause environmental degradation, and potentially reprise historical cultural missteps,"* (Adam Mann, 2016).

On Hawai'i's Big Island stands Mauna Kea, a mountain/volcano named for the god Wakea, the "sky father" (Mauna a Wakea). This site is Hawai'i's most sacred place, where Indigenous peoples' have their most sacred ancestors buried, and where in ancient traditions only the Ali'i (high chiefs) were allowed to climb (Byrne, 2005). It is here that astronomers have been working for years to build the TMT. After the construction of 13 telescopes to date, many Hawaiians think the proposal for the TMT is culturally abusive. In the 1960s, Gerard Kuiper was the planetary scientist who assessed Mauna Kea's value. His opinion of the mountain was clear:

> *"probably the best site in the world – I repeat – in the world - from which to study the moon, the planets, and stars."* (Kuiper, quoted in "Education and Research," in Mauna Kea Science Reserve Master Plan, 2000).

But, at that time, astronomers did not consider the mountain sacred site. And only in the late 1990s, Native Hawaiians were able to make, for the first time, an open cultural claim on the

mountain. Powered by both the geothermal victories and political mobilisation of the Hawaiians[2] on the Big Island, Indigenous people and environmental activists presented strong opposition to the observatories with accusations of cultural and environmental insensitivity by the astronomical community. It soon became apparent to the astronomers at Mauna Kea that Indigenous narratives about the mountain's value carried great cultural significance for the Hawaiians (Swanner, 2013). The definition of sacred site as a cultural claim, and the perception this mountain was threatened by the observatories, gave Indigenous peoples the power to stop the telescope's construction (Swanner, 2013).

The SKA has been considered by many (Indigenous and non-Indigenous peoples) as a relatively culturally competent project:

> *"The success of the Ilgarijiri collaborative project (included in SKA project) is based upon several principles, which can help to inform and guide future cultural collaborative projects,"* (Goldsmith, 2014, p. 205).

> *"We're still interested in our stories of how we see the sky, but we're looking at how astronomers are talking to us about their perceptions of the sky. A lot of Indigenous artists are excited by the idea of looking at the sky differently," (Green, 2014)*[3]

The Square Kilometre Array (SKA) project, located in both Southern Africa and Australia, seems to be able to help scientists gain a deeper knowledge and understanding of a different perspective of the night sky by working collaboratively with the Indigenous custodians, opening new pathways for the education, opportunity, and vocation. The project seems to be relatively culturally competent, and so far is a peaceful example regarding Indigenous feedback and acceptance.

---

[2] Associated Press, (2016). University of Hawaii pulls out of Hualalai Geothermal Study, Retrieved 2/6/17, from https://www.washingtontimes.com/news/2016/feb/23/university-of-hawaii-pulls-out-of-hualalai-geother/

[3] Ymaji artist Chairmane Green, interviewed by Laurie, V. (September 27, 2014) for The Weekend Australian. Retrieved 8/9/2017, from https://www.theaustralian.com.au/arts/review/astronomy-project-unites-indigenous-artists-from-wa-and-south-africa/news-story/7d73d0227d2e3264f36509999205caf5

The SKA project utilised tools of diplomacy for science when working with the Aboriginal community and the land to be used for the project. The SKA Organisation was established in December 2011 (in the UK) as a not-for-profit company to formalise the link between the international partners and to centralise the leadership of the project. Eleven countries are members of the SKA Organisation – Australia, Canada, China, France, India, Italy, New Zealand, South Africa, Spain, Sweden, the Netherlands, and the United Kingdom.[4]

The art project *SKA-Shared Sky* established a strong connection with the Indigenous community and brought scientists and Indigenous peoples together to explore different perceptions of the sky. SKA Shared Sky aimed to bring together, for the first time, Australian and South African Indigenous elders and artists in a collaborative exhibition celebrating Indigenous astronomy from Australia and South Africa. This thesis argues that these initiatives were all positive, effective, and culturally competent steps to bringing Indigenous communities and astronomers together. I also hold that this experience is proof that Indigenous people are willing to share their ancestral knowledge about the sky, and astronomers are receptive to improve their scientific approach through this kind of cultural collaborations.

My research will examine these two case studies by comparing the level of cultural competence applied to both projects. I will chart a comparison narrative on the development process, cultural challenges and ways to overcome those challenges. I will also explore the Indigenous peoples' acceptance to the projects, consequent Indigenous peoples' reactions to the telescopes facilities and the places where they were built. Astronomer's attitudes and motives, methods to approach Indigenous peoples, and ways to share knowledge (Western and Indigenous knowledge), including forms to pay the respect to the land and the people will also be presented. In the end, my objective is to discuss the level of success of both TMT and SKA projects. This thesis will also provide the framework for analysing both astronomers' and Indigenous peoples' level of involvement in these projects, and the essence of the protocols used to facilitate the relations between all parts involved. It will also be used to investigate how an astronomy project like the TMT or SKA can be helpful to learn more about cultural equity challenges in the scientific environment, and about cultural competence used as the first step regarding methodology (Smith, 2012) to accomplish a successful astronomical project.

---

[4] Square Kilometre Array official website, Retrieved 23/10/17 from skatelescope.org

In the third phase, a critical analysis of the literature and empirical data will facilitate theory building – cultural competence applied to the construction of astronomical facilities on Indigenous lands. Finally, I develop a framework for cultural competence for astronomers to address these issues and create pathways for positive and mutually beneficial collaborations and interactions between astronomers and Indigenous people in the future.

This is a challenging and complicated proposal, as astronomers' interests and motivations are often at odds with those of Indigenous peoples. The astronomer's difficulties can be aggravated if they find serious differences of opinion regarding the cultural significance of knowledge and location, and also ownership of information, inside the Indigenous community itself. If astronomers desperately want a telescope facility built on a mountain that the Indigenous stakeholders firmly reject, who wins out in the end? Do the astronomers continue to push forward using legal channels that historically benefit Western and colonial enterprises or do they accept that they will need to find another location for their facility? I suggest that this can be overcome in the early stages if the astronomy organizations and personnel are appropriately and adequately trained in cultural competence.

Given the knowledge gap about cultural competence for astronomers, this study is well placed to make a significant contribution to the existing body of knowledge with application to current astronomical research and development. It does so by crossing case studies and creating a new understanding of cultural competence in astronomy from their examples of success and cultural conflict with the Indigenous peoples involved. This research will also provide the basis for further investigations of other cultural competence issues in other scientific areas. While this thesis will be empirically limited to astronomers and astronomical facilities, the ideas and concepts generated might provide frameworks that future studies can apply beyond the limits of this research.

1.5 Thesis Outline

The thesis aims to explore the relationship between the discourses and structures of astronomy and the opportunity that astronomers have to increase not their scientific knowledge about the sky, but improve the work processes for facilities built on Indigenous lands by applying the theory of cultural competence as a fundamental "starting point" methodology. The interrogation of these issues is addressed through an analysis of literature, and the presentation of two case studies as a research methodology, and interpreting the data through a narrative of comparison. The outcomes of the research aim to provide a better understanding of the levels of

cultural competence in modern astronomy, especially in astronomy projects involving facilities built on Indigenous lands. Consequently, the research will suggest a new model for astronomers that can be used to improve their skills of cultural competence through future policy development and encouragement of Indigenous culturally competent practices.

The structure of the thesis

This thesis is divided into five chapters, appendices, and a single references section. Below, I highlight the nature and goals of each chapter.

Chapter 1 – Introduction

This chapter will introduce the reader to the whole point of the thesis. It is where I address the problem, propose a solution, and mention the method for achieving this solution utilising a theoretical foundation. It is a set of the aims and goals and gives context to the research.

Chapter 2 – Literature Review

In this chapter, the Literature Review and introduces the reader to the academic discipline of cultural competence and its usual areas of application, including its history and development and the specific area of Indigenous cultural competence. The chapter then provides past and present research in Indigenous knowledge, and the construction of astronomical facilities on Indigenous lands across the globe. This section also presents a brief overview of the cultural astronomy (explaining why the study of Aboriginal astronomy is relevant and important). Related with this last point, the First Astronomers and their perception of the sky vs Western astronomers and their scientific approach is reflected in the literature review. The concept of a sacred site for Indigenous peoples is also explored.

Chapter 3 – Theory and Methodology

The third chapter concerns the theoretical and methodological framework of the analysis. The presentation of one new model of cultural competence for astronomers will be the primary focus of this chapter.

Chapter 4 – Presentation and comparison of the two Case studies – TMT vs SKA

This chapter presents the Thirty Meter Telescope project. The history, context, and problems with the TMT project, since the first development of Mauna Kea. What happened in 2015 with the protests, what was the backlash from the astronomical and Indigenous communities, and what could have been done to prevent or alter the negative impact of the proposed telescope utilizing the methods and theory discussed in Chapter 3. This chapter also presents the Square Kilometre Array. The history, context, and the positive aspects of this relatively successful project will be explored. The last part of chapter 4 will present the qualitative methodology used in this research, as well as its research findings and following discussion.

Chapter 5 – Implications and conclusions

This chapter is the final discussion about the all subject matter: how can the new cultural competence model for astronomers proposed in this thesis improve the level of success in projects that involve Indigenous, astronomers and big scale telescopes facilities built in Indigenous land. This last chapter also presents the final implications, framework and recommended guidelines for astronomers.

1.6 Considerations and Limitations

This thesis is not intended to have any Indigenous or Western "activist" interpretation. To reinforce this point, every time the words Western and Indigenous are used they are always in capital *W* and *I* respectively. This could be seen for some as a detail of little importance. However, in the context of the cultural competence theory, on which this thesis is based, I place an equal focus and level of balance on both Indigenous peoples' culture and interests, and Western astronomy. I am a Western student, and this thesis' supervising panel includes two Western academics (Duane Hamacher and Daniel Robinson). However, the topic was largely shared and explored with Indigenous colleagues (academics, students, and astronomers). I hope this will affect this study positively, as my primary goal is to achieve the best cultural competence possible applied to a Master by Research level.

This thesis is not based on ethnographic fieldwork conducted by me. In future work Western and Indigenous astronomers will participate in the research at the *Cultural Interface*

(Nakata, 2007) to find ways these two knowledge systems can learn from each other for mutual benefit. Regarding this Master by Research thesis, no claims for the significance of the research beyond these delimitations will be made.

2 Literature Review

2.1 Literature review on culture

An important starting point for this research is to reflect upon the different meanings, interpretations and ideas of 'culture'. A basic definition of culture is a “way of life” (William, 1976). This idea underplays the different types of culture – national, regional, popular, local, Western, Indigenous – to cite but a few. However, culture as a “way of life” does not encapsulate the individual experiences of people inhabiting particular cultures. Within any cultural group, there will be always different ideas and attitudes reflecting peoples’ individual positions, lifestyles, and outlooks as a result of factors such as age, class, and gender (Eriksen, 1997). There are also different dimensions to culture and cultures, notably institutional, political, social, economic and historical. The complex nature of culture has led some authors to even conceptualize other analytical categories. Pierre Bourdieu (1977, 1990, 1993) introduces his conception of “habitus”: a realm or system in which groups and individuals learn and develop over time cultural attitudes and dispositions, which are not uniformly pursued but are instead exercised uniquely in relation to particular contexts or fields. However, this “system of acquired culture in relation to particular dispositions” (Bourdieu, 1990a, p. 13), as the author describes it, does not take sufficient account of the ways in which cultures are permeated by the flows and processes of the Intersection with other cultures.

The lack of conceptual consensus over “culture” is especially evident within academia. Not only do disciplines such as cultural studies, Indigenous studies, anthropology, and sociology have their approaches to the subject, these disciplines have often divergent and complex views about what constitutes as culture. Many sociologists defend the position that we acquire culture through a range of socialization institutions and practices (Bordieu, P. and Passeron, J. (1977). Marxists and functionalists think differently about the political ends that this serves (though I lack the space in this thesis to explore this in more depth). Anthropologists like Adam Kuper (1999**)** employ the phrase “culture wars” to express the extent and nature of the debates surrounding definitions of culture within his discipline. Early anthropologists

approach culture by presenting and criticizing the “other” as "exotic", contributing to the domination of non-Western cultures and for the discredit of the Anthropology as a science (Shweder, 2000, p. 162)**.** Maori researcher Linda Tuhjwai Smith criticises this specific point with a strong Indigenous perspective in her book *Decolonizing Methodologies*. She argues that

> *“(...) Some Western disciplines, such as anthropology, made the study of us (Indigenous peoples) into ”their” science. (...) Stories were generally the experiences and observations of white men whose interactions with Indigenous ‘societies’ or ‘peoples’ were constructed around their own cultural views of gender and sexuality”* (Tuhiwai Smith, 2012, p. 9-11).

In response to this criticism, anthropologists have been sensitive to the issue of cultural pluralism, a view that dates back to Franz Boas (1886-1911), who strongly emphasized the necessity of respect for cultural differences and of recognizing that each culture pertains to a specific, historically contingent way of life. But, as with Pierre Bourdieu’s conceptions of “habitus,” it is pertinent to reiterate that one culture is not immune to another culture; rather they both inform and are informed by external forces. Anthropology has traditionally investigated “the local” in all its various manifestations, thereby potentially ignoring “the visitor” and “his” influences upon culture, and also the possibility of universal values and practices (Wilson, 1997). However, more recent anthropologists such as Ulf Hannerz (2003) now actively engage with the "external forces", with the impact of the “visitor”. In Hannerz’s particular case, this reflection has led him to delineate cultural diversity, complexity, and innovation or creativity as ongoing tendencies. Nowadays, cultural scientists are more inclined to agree that culture requires an “other” to define itself, but this becomes more problematic under conditions of hybridity. Contemporary patterns of global migration, with the exchange of peoples ensuring that each region becomes less culturally distinctive, can unsettle the concepts of “the West”, and implicitly the “non-Western.”

So, one can think that culture is mobile and that it travels (Clifford, 1992, 1997). And the conception of culture as movement applies not only to people but also to the flows of images, ideas, sounds, symbols, and objects that circulate the globe, crisscrossing national borders in the process (Hopper, 2006). Cultures move, adapt and change (Lury, 1997). All the colonization periods in history proved this, and that is why is so challenging to view Indigenous peoples’ cultures in isolation after the influences they were exposed to throughout periods of colonization. This thesis will focus on this issue further ahead, dedicating attention to the specific relationship between the cultures of Indigenous Australia and the cultures of Western (European) and non-Indigenous peoples, including the ways in which Western and Indigenous

peoples perceive processes of science and astronomy differently. The possibility that culture is something dynamic and transformative brings new challenges to conspectus of identity and identity-formation. So how it is possible to have stable identities? Paul Hopper (2006: 41) argues that

> *"(...) culture has moments of stability: periods of time when networks or clusters of people come to identify with – depending on the particular type of artifacts, texts and objects, and are able to internalize these elements of the reproduced within a myriad of social contexts, providing us with interpretative frameworks, value-systems and sources of identity"*

"Webs of meaning" (Geertz, 1973) is a similar concept that recognizes the reason why people tend to reside in their countries of birth and hence are subjected to its socialization processes, and many will continue to work and/or live in the same localities for significant periods of their life, developing attachments to their respective cultures (Hopper, 2007). Having said this, diversity or plurality will perhaps always exist, no matter what the influence of the globalization might bring. Numerous clusters and webs that go to make up culture will often be a particular rather than a universal experience, reflecting regional, local and other forms of distinctiveness.

In this study, I will argue that in between two different "webs of meaning" there is a space for connectivity, and that is where I believe it is possible to promote a positive and constructive dialogue between the "we" and the "other". I will explore the space of action between the cultural frameworks of First Nations people and Western astronomers. This thesis will argue that somewhere, somehow, in a "moment of cultural stability" both Indigenous peoples and Western astronomers have an opportunity to share values and acknowledge similarities and differences that should achieve mutual respect and understanding.

2.2 Literature review on cultural competence

Cultural Competence is a theoretical framework. But above all it is a practical facilitation process in which both Indigenous peoples and astrophysicists are given ample opportunities to acquire culturally relevant knowledge, increase self and other-awareness, confront emotional and communication challenges, and practice context-pertinent communication skills (Bennett, 2003; Brislin & Yoshida, 1994; Ting-Toomey, 2004). According to Ting-Toomey and Oetzel (2001, p. 21),

> *"(...) the big picture is to prepare individuals to communicate appropriately and effectively across a diverse range of cultures or in a particular culture and to achieve a comfortable degree of 'goodness of fit' between the new culture and the homeland culture."*

The greater the cultural distance between the two parties, the greater chance of assessment, judgment, and misjudgement. Cultural distances can run very deep and lead to conflicts, such as historical grievances, challenges to cultural worldviews, strong and long-lasting positions of submission vs power and belief (Ting-Toomey, 2004). Through a cultural competency-based work process and an inter-cultural approach focused on conflict resolution, I believe that Western astronomers can improve their skills to "*communicate adaptively across cultures*" (Push, 2004). Skills to solve conflicts between cultures are something that Western astronomers can learn and utilize especially if they are interested in building research facilities, such as telescopes, on Indigenous peoples' lands. Based on the concept of cultural competence, Integrated Threat theory (Stephan & Stephan, 2003) fuses various effective theories of social identity and reflects on how feelings of fear or identity threaten hatred and conflict. Feelings of fear or threat are closely aligned with Gudykunst's (2005) notions of anxiety management issues and ineffective communication. Integrated Threat Theory proposes four antecedent conditions that prime various types of perceived threat: total ignorance, gaps in knowledge, contact, and status (Ting-Toomey, 2004. Research testing Integrated Threat Theory (Plant & Devine, 2003; Stephan et al, 2000) demonstrated that this model allows one to consistently predict prejudice and attitudinal hatreds from dominant mainstream groups (e.g. white/European) toward minority groups (e.g. African, Asian, Latino, and immigrant groups) in a Western-colonial multicultural society like Australia, Canada, or the USA (Ting-Toomey, 2004). This thesis will not discuss this theory in great detail, however, the results of these studies show that fear and anxiety can interfere with expectations and intensify the perceived threat levels when interacting with cultural "strangers". Consequently, these negative emotions can lead both sides in this cultural dialogue to consider the "other" as "*someone with whom there is some tension*" (Ting-Toomey, 2001). With false stereotypes and competition for resources, members from dominant and minority groups might view each other with suspicion, disrespect, and destructive outlooks (Ting-Toomey, 2001).

> *"Without culture sensitiveness, conflicting parties cannot learn to uncover the implicit "ethnocentric lenses" they use to evaluate behaviors in an intercultural situation"* (Ting-Toomey, 2007; Ting-Toomey and Kurogi, A. 1998, pp. 259)

Without cultural self-knowledge and others' cultural ignorance, Western astronomers cannot work respectfully with Indigenous peoples, if they want to implement new telescope facilities on Indigenous lands. Basically, only with a certain level of cultural knowledge can they have an accurate perspective, or can reframe their interpretation of an interaction situation from the other's culture standpoint (Ting-Toomey, 2007; Ting-Toomey and Kurogi, A. 1998). Knowledge here refers to developing an in-depth understanding of relevant culture-based Indigenous Knowledge systems and communication concepts that can help to manage the intercultural relationship and intergroup conflict-resolution constructively (Canary & Lakey, 2006).

Oetzel et al. (2006) reflected on the "Mindfulness" theory, which is usually applied to psychology. Briefly, these authors defend that to be a mindful communicator across cultural boundaries, one needs to have both the macro-level and the micro-level viewpoints within an imaginative field. A Western astronomer can be a mindful decoder of intercultural conflict. For that, she/he must develop the understanding of the social-ecological factors and embedded contexts that frame and shape the particular intercultural conflict episode. Mindfulness can be practiced and reflected through a deep state of listening and watching without judgment (Thich, 1998). It is a process of observation without reaction. The Mindfulness process can seriously increase the cultural competence of Western astronomers. Mindfulness emphasizes the following steps:

a. learning to view a conflict situation from several vantage points or perspectives;
b. learning to create new categories through which a specific behaviour may be understood; and
c. learning to cultivate options in face of the cultural differences and interaction unpredictability (Ting-Toomey, 2007).

Through this process, Western astronomers can learn to shift perspectives and be able to understand an Indigenous way of seeing (Bennett & Bennett, 2004). Moreover, between the intent and the impact of any verbal and nonverbal message there is an essential difference. Cultural differences such as individualism-collectivism, small/large power distance patterns (Hall, 1976; Ting-Toomey, 2007) might affect the communication between scientists and Indigenous peoples. An effort to avoid a situation of conflict between the two parties should be focused on experience sharing, identifying positions and clarifying needs, reframing particular issues and prioritizing the issues (i.e., aiming to achieve the common interests of both parties). Exploring concrete alternatives, evaluating them, and arriving at a creative problem-solving

outcome (via the informing, opening and uniting communication skills that can be found as universal between Western astronomers and Indigenous peoples) should be the process (Ting-Toomey, 2007).

Western astronomers work in a field where some decisions are directly related with others' places, others' ways of seeing the world, others' lifestyles, others' cultural experiences and backgrounds, others' collaboration and knowledge, and, above all, others' observation and perception of the sky. This has become a necessity of increasing the sensitivity and competence across cultural contexts. For instance, in the field of astronomy, curricula need to be adapted accordingly, and in the workplace facilities need to be created to enhance this learning process, as it does not happen accidentally. If left to themselves, without any awareness or guidance, astronomers are in fact prone to increase culture-related prejudices and stereotypes in their contact with other cultures rather than alleviating or eliminating them. Having said this, I found that the astronomy literature does not mention this culturally competent approach towards astronomy as a discipline. It almost seems that astronomers' encounters with "others" was forgotten or left aside, which lead scientists to errors that cost money, and lead to scientific knowledge loss.

Note: As the title of this section refers, this chapter is only a brief introduction to cultural competence regarding the literature review. I will go back to the essence of cultural competence develop the concept in depth in the next chapter of this thesis.

2.3 A lack of Western astronomy literature on cultural competence

Astronomical literature has a significant limitation, regarding concepts of culture, ethnicity and race and their impact on research in the discipline. Although "race" and "ethnicity" are often used interchangeably, race usually refers to shared physical characteristics of a group, and ethnicity to identification with a presumed shared heritage (Rubin, 1995).

One cannot oversimplify concepts such as culture, race or ethnicity. Racial difference is one of the most fundamental concepts that divides the social life (Rubin, 1995) and deeply entrenched racism in Australia is an issue Indigenous Australians continue to face. Thus, the terms ethnicity and race must be used critically. Both concepts need to be understood as culturally and historically separately contextualized concepts (Rubin, 1995). Inexact perspectives of culture are stagnant because they do not leave space for cultural change and do

not address diversity within cultural groups (Taylor, 2013; Shaw, 2005). One limitation related to incorrectly designed theoretical models and programs based on cultural competence is the lack of efficacy of those models and programs in acknowledging and promoting the diverse and fluid nature of culture and self-identity. This only reifies deconstructing barriers between non-Indigenous and Indigenous peoples. Without the recognition that culture is flexible, cultural competence efforts fail to account for these differences or similarities adequately.

Naïve applications of culture in astronomical research may also, intentionally shift blame on Indigenous people for miscommunication, a lack of collaboration, or disinterest in sharing astronomical knowledge. However, Indigenous peoples often have an entirely different interpretation. For example, Native Hawaiians protested the placement of the Thirty Meter Telescope (TMT) atop Mauna Kea. They not consider themselves as "protesters", but rather act and speak as "protectors". "Hawaiian Indigenous activists say they aren't against research, they simply want their values respected" (Mann, 2016). The rallies received worldwide attention and have, for the time being, shuttered construction of the TMT.

For some astronomers, culture is both problematic to scientific research (as the understanding and acceptance of others' culture demands extra time and effort), and the solution to all the difficulties encountered in ethnographic research (as the understanding and acceptance of culture understanding can also alleviate, or even resolve, critical ethnographic research barriers). In this regard, by emphasizing the culture of Indigenous peoples, a cultural competence model poorly designed for astronomers can fail to recognize Western science as a cultural construction to be considered within a certain context.

> *"Both situations (TMT and SKA scenarios) show that modern astronomy can share fundamental questions with ancient cultures and collide with their sensibilities,"* (Mann, 2016).

In this respect, a well-designed model of cultural competence must not be limited to mere considerations of Indigenous peoples' culture and language proficiency, but must also recognize their astronomical knowledge and traditions. Recognizing that encounters between Western astronomers and Indigenous peoples entail engagement with the language and culture of astronomy will broaden the importance of sharing knowledge about the sky in general, beyond that of interpreters or culture brokers.

The work of Fuller et al. (2014) is a good example of an appropriate cultural approach to working with an Indigenous community. They developed a research project with Kamilaroi and

Euahlayi Aboriginal communities that brought valuable knowledge to the discipline of cultural astronomy and helped the communities to record and share knowledge and reconstruct which had been damaged by colonisation. A 'giving back' component facilitated the development of teaching materials in close collaboration with key elders. These materials (video and print) are now helping educate high-school students about Kamilaroi and Euahlayi culture and their perception of the night sky. Another example of a culturally competent scientific encounter with Indigenous communities is that of Torres Strait Islander academic Martin Nakata et al. (2014),

"*who propose to develop software, archives, and web interfaces to allow Indigenous communities to share their astronomical knowledge with the world on their terms and in a culturally sensitive manner*," (Norris, 2016).

Researchers such as Stanbridge (1857), Mountford (1976), Haynes (1992), Johnson (1998), Cairns & Harney (2004), Norris (2010), Hamacher (2012), understood that astronomers should be considered as a cultural being - situated agents that are neither passive nor neutral. They showed that astronomers should be actively creating, shaping, and negotiating their way through their encounter with Indigenous peoples. This human-centred approach allows researchers to produce a more appropriate relationship with Indigenous peoples.

Aboriginal people have lived in Australia for more than 65,000 years (Clarkson et al., 2017), speaking over 350 distinct languages (McConnell and Thieberger 2001). Aboriginal people have among the deepest, oldest, and most diverse cultures on the planet, and are arguably the world's oldest astronomers (e.g. Haynes 1992).

Although many Aboriginal cultures are quite distinct from each other, there are some common "moments of stability" (Hooper, 2006). For example, most Aboriginal cultures share the concept of the "Dreaming" (depending on the Aboriginal language, this overall concept has different names and representations), which relates to the time when world was created by ancestral spirits (Nicholls, 2014). These spirits left laws that guide social practices and knowledge of the world as a whole. The challenge is to identify these laws to understand the plenitude and meaning of the planet and how we are supposed to live on it. "Naturally, the night sky is an important chapter of this manual (…) for existence" (Norris, 2007). Aboriginal peoples have always used the night sky to understand the world to find ways to thrive. For example, Aboriginal and Torres Strait Islander people use the stars for navigation (Fuller, 2016), calendar development (Clarke, 2003) and plant/animal behaviour (Cairns, 1996). Aboriginal peoples have an in-depth knowledge about the sun (Wells, 1964), the moon (Wells, 1964; Hulley, 1996), the eclipses (Bates, 1904; Hamacher & Norris, 2011), the planets

(Hamacher & Banks, 2018), astronomical measurements (Norris et al, 2008), meteors (Hamacher & Norris 2009), and impact events and craters (Hamacher & Norris 2009, Hamacher & Goldsmith, 2014).

To collect and understand the astronomical knowledge of Indigenous peoples (specifically the Australian Indigenous peoples), cultural astronomers rely on the examination of oral traditions. As Aboriginal and Torres Strait Islander cultures are oral, the knowledge is kept through memory (Kelly, 2015) and transmitted through material culture and oral tradition, generation after generation.

2.4 The first culturally competent Western astronomer in Australia.

William Dawes may have been the first Western astronomer studying Australian Aboriginal peoples. He arrived in Sydney with the First Fleet on 26 January 1788 and I argue that he was the first culturally competent Western astronomer, conducting research and ethnographic work with the Eora people. I base this on his interaction with the young woman named Patyegarang, from whom he recorded some of the Eora people's astronomical knowledge:

> *"Eora people believed that the Sun returned to the east over their heads rather than under the ground, as believed by most other groups"* (Norris, 2016).

Secondly, he

> *"set down with the mob and learned language, and he also learned about the local people in great depth. He made a very close relationship with the local people,"* (Troy, 2017).

This means that he accomplished his scientific goals while practicing culturally appropriate ethnographical techniques, working with Indigenous people collaboratively and respectfully. The end of his mission in Australia was also marked with a very important event: at that time, Aboriginal people of Sydney came to be seen as a threat by Governor Philip, because their supplies were being stolen by Aboriginal people who wanted to trade with the French, who arrived just after the British. Aboriginal people reacted, and it ended with convicts

even being killed. The Governor decided that he had to send a powerful message through to the local Aboriginal population that killing his people was unacceptable. He then decided to mount punitive expeditions to send that message, including the attempt to kill and behead ten Aboriginal men. Dawes was one of the scientists assigned to go and find ten Aboriginal men, kill them, and prove it by bringing their heads back in bags. Due to his humane, respectful and protective approach to the Aboriginal community, Dawes refused to obey the governor's order. As a result, Dawes was sent back and was not allowed to return to Australia (Byrne, 2003).

> *"Dawes was not only an accomplished astronomer, but spoke five languages, had a keen interest in botany, mineralogy, engineering, cartography and music, compiled the first Aboriginal-English dictionary, and was an outspoken opponent of slavery,"* (Norris, 2016).

2.5 Astronomy's need for cultural competence

Literature on Australian Indigenous Astronomy shows that Indigenous astronomical knowledge is rich and complex (Norris 2016). However, some Western astronomers still live with the paradigm that Aboriginal culture is somehow "primitive" (Norris, 2014). The practice of Western science can also be exclusive and colonial in nature. American astronomer and activist Chanda Prescot-Weinstein (2017) strongly argues that:

> *"(...) it is evident (...) that science can be a tool of the oppressor by aiding those who are engaging in oppressive practices, such as slavery."*

Prescot-Weinstein (2017) concludes that "*training fails to prepare us (astronomers) for these conversations… a problem universities should fix*."

Some anthropologists continue to focus more on the "exotic" characteristics of Indigenous people and culture rather than on their scientific knowledge and achievements (Tuhiwai Smith, 2012). This paternalistic scientific approach to studying Indigenous peoples can be directly related to a certain lack, or poorly conducted methods of cultural competence applied to scientific research. Cultural competence training can be a valuable skill to collaborating with Indigenous traditional owners in planning telescopic facilities on their land, avoiding conflicts.

In order to understand these conflicts and develop a theoretical approach framed on cultural competence, , one must learn how literature has been referring to the concept of *sacred space* for the Indigenous peoples. From an Indigenous perspective, Tuhiwai Smith (2012) believes that

> "*all early Westerners were travellers who came with a mission (scientific, religious or entrepreneurial), rather than with a sense of adventure, and many decided to stay*."

This can be the first critical error made when astronomers decide to build observing facilities on Indigenous lands. They tend to arrive with this intention in mind. They decide to stay and build new facilities on sacred places that are restricted to highly ranked Elders. In this thesis, I analyse two case-studies where Western astronomers worked with Indigenous people to construct telescope facilities, but in different ways with extremely different results. First is the Thirty Meter Telescope (TMT), which is planned for construction atop Mauna Kea, the highest mountain in the Pacific and Hawai'ians' most sacred place. The second is the Square Kilometre Array, a collection of radio telescopes scattered across the desert region of central Western Australia, which is the traditional land of the Yamatji Aboriginal people.

2.6 Indigenous sacred sites and astronomical facilities

Sacred sites are areas of special spiritual significance to Indigenous peoples. They are places of worship and remembrance (Oviedo et al., 2015), usually restricted by taboos to particular members of a community and special protocols for activities or rituals. These sites are fundamental parts of cultural identity and play a key role in law and tradition. Some sacred sites of Indigenous peoples have in some cases a complex and troublesome history because many of them have been appropriated or destroyed, and not acknowledge or respected by Western society. According to Ojanlatva & Neumman (2017)

> "*sacred site means much more than just a description of a piece of land or a certain position in the land space*."

They are part of Indigenous peoples' knowledge, which is distinct from the Westernised concept of the world. Sacred spaces are related to a firm belief in the presence of ancestors and other spiritual beings. Thus, sacred sites play an important role in Indigenous peoples' culture

and their identity (Herrmann and Heinamaki, 2017). Carmichael et al. (1994; p.3) reinforce the same idea:

> *"Sacred place carries with it a whole range of rules and regulations regarding people's behaviour in relation to it and implies a set of beliefs to do with the non-empirical world, often in relation to the spirits."*

For Aboriginal and Torres Strait Islander peoples, sacred sites are deeply related to the connection with the land, sea, and sky. To give one of many examples, for Warlpiri people to the northwest of Alice Springs, ancestors broke the Milky Way (*Yiwarra*) into individual stars that we see today. Some fragments fell to earth, creating sacred places (Johnson, 2005). Thus, connections are made on a daily basis between ancestors, people, stars, and land. The telling of Dreaming stories reinforces knowledge about the relationship between the land and sky, social behaviour, land formations, and sacred places[5].

Western astronomers should understand the concept of sacred through the Indigenous people's cultural lens, and not from a Western point of view. Astronomers need to understand that the Indigenous ontological concept of "building" is not with the same that Western society gives to the act of "building" (Ojanlatva & Neumman, 2017). One can interpret that the idea of "building" on Indigenous peoples' sacred lands is something that naturally divides Western astronomers' interests and objectives from the Indigenous peoples' ways of understanding, and protecting their sacred sites.

For Australian Indigenous peoples, the variety and complexity of what is understood as "sacred" is stressed, accompanied by the notion of necessary limitations in language, culture, and differentiation among Indigenous peoples' communities and extended families (Herrmann, and Heinamaki, 2017).

Indigenous sacred sites worldwide represent works of ancestral communities (Herrmann, and Heinamaki, 2017), such as petroglyphs and archaeological sites[6]. However, a majority of sacred places are natural landscapes including rivers, springs, deserts, forests, rocks, groves,

---

[5] Australian Government official website Retrieved 9/1/17 from cultureandrecreation.gov.au

[6] Sacred Natural Sites website, Custodian Statement 2008, retrieved 5/3/18 from https://sacrednaturalsites.org/

coral reefs, coastal waters, and mountains. As some of the Indigenous sacred deserts and mountains are the most desirable places to build astronomical facilities, Western astronomers will always need to understand this and acknowledge the importance of working closely with communities and following proper protocol. And the United Nations Declaration of the Rights of Indigenous Peoples[7] is very clear at this point:

> *"Indigenous peoples have the right to manifest, practice, develop and teach their spiritual and religious traditions, customs and ceremonies; the right to maintain, protect, and have access in privacy to their religious and* ***cultural sites****; the right to the use and control of their ceremonial objects; and the right to the repatriation of their human remains"* (UNDRIP 2012, Article 12 (1))

It also means that astronomers must face and accept the possibility that their proposal may be rejected, and any actions to continue pushing through the proposal (say through legal avenues) is in direct violation of this declaration and may seriously jeopardise or destroy future working relationships with Indigenous people and future support and engagement with those communities. Astronomers must learn to acknowledge and accept "no", as they do not have an inherent right to develop Indigenous land (Hamacher and Britton, 2015).

2.7 Summary

Literature review reinforces a lack of published materials, theoretical approaches, or other links related to cultural competence for astronomers. All the references I have used in this chapter are from the fields of anthropology, sociology, psychology, ethnography, ecology, human and social studies, cultural astronomy, and cultural competence as applied to other fields such as health, education, communication, and Indigenous studies.

However, I find that many relevant bibliographic references regarding theories and methodologies in the field of cultural astronomy) reveals increasing interdisciplinary

[7] United Nations official website, UNDRIP 2012, retrieved 5/3/2018 from https://www.un.org/development/desa/indigenouspeoples/declaration-on-the-rights-of-indigenous-peoples.html

collaboration between astronomy and the social sciences, with application to designing efficient and humanistic-centred scientific ways of conducting research.

This chapter also reinforced the need and the pertinence in researching in the niche area of cultural competence concerning astronomy to improve astronomers' relationships with Indigenous peoples. I believe this should be a priority to working towards efficient scientific research and management processes. Being able to improve astronomers' cultural competence with tools and skillsets to achieve respectful and fair relations with Indigenous communities can lead to meaningful and mutually beneficial outcomes regarding research and education.

In the next chapter, I will focus on developing a theoretical methodology of cultural competence for astronomers, which I will explore in more detail with the support from theoretical models already tested in other fields of science with success.

3 Theoretical Framework

3.1 Exploring Indigenous cultural competence for Western astronomers

There are several iterations and conceptualizations of cultural competence: Ethnic Competence (Gallegos, 1982; Green, 1995), Civic Competence (Koehn & Swick, 2006), Cultural Awareness (Winkleman, 2005), Transnational Competence (Koehn & Swick, 2006), with the greater number of authors preferring the term "Cultural Competence" (Cross, & Issacs, 1989, Weaver, 2005, Lum, 2005). Following these sources, as well as those referenced in the previous chapter, I will continue to use the term *cultural competence* to present the new culture-in-action model to be used in the field of astronomy. Having in mind that cultural competence is a perspective and/or concept to be applied as a tool for effective intervention, improvement of the communication, conflict resolution and outcomes in the multicultural work environment (Klienman & Benson, 2006; Williams, 2006), rather than a "theory" in the classical sense.

Advances in culture theory may have arisen as a consequence of improved cultural competence. Through cultural competence theory, behaviour-based orientations to culture have changed. Culture was once considered to be constituted by patterns of actions and customs (Gaines, 1992); after the cultural competence approach, culture started to be understood as a dynamic process of shared meanings, situated in and emerging from interactions between individuals (Jenkis, 2004). The negative side of the previous behaviour-based approach of culture is that it may have the potential towards stereotyping of minority populations. In contrast, process-oriented understanding reinforces flexibility, mobility, and dynamism as vital components of culture. Greater appreciation by Western astronomers of the richness, complexity, mobility, and indeterminate nature of culture would facilitate scientific research and improve initial contacts with the Indigenous communities. Most importantly, conflicts would be alleviated. By accepting and understanding culture through openness and a willingness to seek clarification and deeper knowledge, Western astronomers will be more attentive and receptive

to identifying and acknowledging the scientific information embedded in the traditions of Indigenous peoples (Nakata, 2007).

Through ethnographic studies of Indigenous astronomy, Western astronomers can utilize an appropriate cultural competence model of collaborative work to contribute to astronomical research, education, and engagement. The most relevant aspect to take into account is that the appropriate culturally competent astronomy model must construe "culture as something to be ready for" rather than "something to know" (Boas, 1911; Bourdieu, P., 1977). These two systems of knowledge often collide in Western and Indigenous encounters. Western astronomers are experts in the Western scientific approach to understanding the sky; Indigenous peoples are experts in specific traditional perceptions, and ways of using that sky knowledge. Western astronomy tends to focus on positivism and empiricism, generally shying away from ideas of culture, spirituality, and anything viewed as "subjective" in their pursuit of acquired astronomical knowledge. Indigenous knowledge, however, utilises a different approach, incorporating ritual, narratives, spirituality, and social significance. Thus, these cultural astronomy encounters ought to be viewed as two-way learning encounters (Nakata, 2007). In short, following the ethical practices of Western cultural astronomers who are successfully working with Indigenous peoples, I advocate the incorporation of a new cultural competence astronomy model into astronomical ethnographic research and astronomical facilities building projects' in Indigenous lands.

Cultural competence is not acquired by learning a set of facts about a particular Indigenous group in a limited timeframe (Barbujani, G., et all, 2008). Cultures are diverse and continuously evolving. Improving cultural competence is a demanding, ongoing process that begins with cultural awareness (Barbujani, G., et all, 2008), and a commitment to understanding the role that culture plays in astronomy. For astronomers who work with Indigenous peoples, the first step is to understand their own culture as a basis for understanding others. Next, they must cultivate the willingness and ability to acquire knowledge of the Indigenous peoples' cultures. This involves learning about and respecting Indigenous worldviews, beliefs, values, and attitudes (Barbujani, G., et all, 2008) toward astronomy, sacred lands, perceptions of the elements of the sky, and the way these perceptions are embedded in their daily routines, relations, and rituals. Astronomers should then incorporate culturally appropriate knowledge, understanding, and attitudes into their actions (e.g., communication style, verbal messages, policies, collaborative research work, etc.) thereby conveying their cultural competency and their organisations' cultural responsiveness during the contact, and consequent work process.

On the other hand, culturally responsive skills can improve Indigenous peoples' engagement in Western astronomy, as well as the relationship between both communities. Increased skills also improve respect, mutual understanding, and acceptance about what are considered "good" and "bad" practices, in both Indigenous and Western astronomers. Most importantly, cultural competence has the potential to decrease conflicts and improve the equity regarding power and decision-making. Cultural competence improves the sustainability of astronomy as an institution/organization/research-field/scientific-field's sustainability by reinforcing the value of flexibility, equity, and responsiveness in addressing the current and changing needs of Indigenous communities. It also serves to decolonise Western astronomy by acknowledging Indigenous interpretations of the sky and working inclusively and collaboratively.

More culturally responsive work strategy can also help mitigate conflict between scientists and Indigenous peoples when astronomers work in developing facilities in Indigenous lands. Advocating for culturally responsive practices and protocols increases trust between the Indigenous community, the astronomers, and local authorities, and astronomers should keep this in mind when designing flexible protocols, research methodologies, and construction plans. Every point in the protocol should meet the cultural needs of the Indigenous community and should integrate traditional practice where appropriate, using available human and material resources. Also, when Western astronomers are working on Indigenous lands, their scientific facilities and research objectives need to be as culturally relevant and useful for the Indigenous community as they are for scientific purposes. The work environment must be conducive to Indigenous peoples participation in protocols planning and the consideration of the Indigenous community's feedback on the cultural relevance of the plans being provided.

Cultural competence for astronomers, in general, is a dynamic, ongoing process that begins with awareness and commitment and evolves into culturally responsive organizational policies and procedures[8] "*A commitment to improving cultural competence must include resources to help support ongoing fidelity to these policies and procedures along with ongoing process policies and procedures*". This will enable astronomers to respond more appropriately

[8] Vista CE website, Cross Cultural Counselling online Course, retrieved 3/2/18 from https://www.getceusnow.com/uploads/crosscultural.htm

to Indigenous peoples in a culturally competent manner. Important points that should be reflected upon when formulating culturally relevant policies and procedures include[9]:

1. Understanding of an Indigenous peoples' astronomical knowledge and traditions;
2. How that knowledge is applied to daily life, relationships, and actions;
3. Understanding that culture's concepts of sacredness; links between the land, sea, and sky; and ontological and epistemological views of the intersection between culture and science;
4. Clearly demarcating the boundaries a Western astronomer should never cross, with particular relevance to racism, cultural appropriation, and colonising rhetoric and actions.; and
5. Respecting access to knowledge at culturally appropriate levels.

The need for cultural competency in astronomy is recognised, but the term itself is poorly understood. The term "cultural competence" evolved from older terms such as "cultural sensitivity", "cultural awareness", and "cultural skills". Sensitivity and awareness refer to requirements on the part of the astronomer and imply a need for specific knowledge and skills (Smith, 1998) Cultural competence takes the concept one step further: it refers to the ability of astronomers working in Indigenous lands/sacred sites, for example, to apply knowledge and skill appropriately in interactions with Indigenous peoples. "Cultural" is the adjectival component of the term, while "competence" refers to the performance aspect (Burchum, 2002).

Leininger talked about the need for culturally competent care in the late 1960s and called nurses and other healthcare providers to develop a comparative focus to illustrate patterns, expressions, values, and "lifeways" within, and between, cultures (Leinginger, 1991). She referred to "lifeways" to describe a cultural group's way of life concerning customs and practices (Srivastava, 2007). The concept of cultural competence includes respect, as well as knowledge and skills and the ability to use the three elements efficiently in cross-cultural situations (Brach & Fraser, 2000; Sue, 2001). Hudecek (2002) cites five essential elements of cultural competence that all professionals exposed to new cultures need:

1. Valuing cultural diversity;

[9] Vista CE website, Cross Cultural Counselling online Course, retrieved 3/2/18 from https://www.getceusnow.com/uploads/crosscultural.htm

2. Having the capacity for cultural self-assessment;
3. Being aware of the "dynamics" inherent when cultures interact;
4. Having institutionalized cultural knowledge;
5. Developing adaptations in service delivery that reflect an understanding of cultural diversity.

Rodriguez (1999) notes that being culturally competent does not mean knowing everything about every culture or needing to abandon one's own cultural identity. Instead, it means respect for differences and a willingness to accept the idea that there are many ways of viewing the world (Srivastava, 2007). Also, there is general agreement that cultural competence includes action, knowledge and skill, and represents a lifelong process.

3.2 The Cultural Competence Continuum Applied to Astronomy

Cultural competence has been described as a continuum that ranges from cultural destructiveness to cultural proficiency (Kerr, Struthers & Huynh, 2001). Unlike other approaches that advocate cultural competence as a method of enhancing the quality and effectiveness of the theory's practical use, the Cultural Competence Continuum (Fig. 1) highlights that a lack of competence can be destructive. In other words, cultural competence is a necessary component for effective inter-cultural collaboration relationships and needs to be used seriously. Although the continuum is presented linearly, it should not be interpreted as a series of predetermined, rigid phases; on the contrary, it presents possible ways to respond to cultural differences and the steps outline developmental tasks that reflect growth toward a goal of cultural proficiency (Srivastava, 2007).

Figure 3 - Astronomy Cultural Competence Continuum diagram, adapted by the author from the Srivastava's Cultural Competence Continuum

Cultural destructiveness, refers to actions, mentality, and organisational policies focused on one superior/powerful culture to the extent that other cultures are dehumanized and destroyed. Historical examples of cultural destructiveness can be found with respect to Australian Indigenous peoples whose children were removed from their homes and placed in homes and schools run by non-Indigenous people (the so-called *Stolen Generations*). Cultural destructiveness can occur in academia as well, starting from the ethnographic research method of individual researcher-Indigenous encounters. When the insensitivity or prejudice of the researcher impedes the collaboration or development of knowledge, it crosses the line from cultural incompetence to destructiveness. Smith (2012, p. 8) describes this very clearly and assertively:

> *"Many of the earliest Western researchers were not formally 'trained' and (...) they represent the Other to a general audience back in Europe which became fixed in the milieu of cultural ideas. Images of the 'cannibal' chief, the 'red' Indian, the 'witch' doctor, or the 'tattooed and shrunken' head, and stories which told of savagery and primitivism, generated further interest, and therefore further opportunities, to represent the Other again and again."*

Cultural incapacity refers to the inability that some Western astronomers have in communicating with, and consequently understanding, Indigenous people, especially in processes of building astronomical facilities in traditional lands. The dominant Western discourse and understanding of the world serve as the norm to all processes/methods/approach, and systemic biases lead to paternalism or exclusionary approaches for diverse communities (Srivastava, 2007). Both subtle and not-so-subtle messages emphasise the idea that members of "Other" communities are not welcome, valued, considered, or able to fit into the framework of Western astronomy. The expectation is that the minority cultures will adapt to, accept, and even be grateful for, the new astronomical facilities built on their traditional land. In this case, culturally incapacity is said to exist when astronomers are aware of the need to do things differently but do not recognize the significance of cultural competence or see it as their role, or else feel powerless against the "system" (Rorie et al., 1996). The lack of language interpretation services may be one example of cultural incapacity.

Cultural blindness occurs when the existence of cultural differences is denied in a desire to be unbiased and treat all peoples identically (the "I don't see colour" argument). Cultural blindness prevents one from examining longstanding systematic biases (Srivastava, 2007) that exist in astronomy as an academic field, and with astronomers as professionals and individuals. Thus, it prevents astronomers from developing ways of enhancing the quality and equity of

astronomy encounters and projects for (and with) all communities. Astronomers who feel it is critical to approach all their interlocutors, collaborators, colleagues the same way are at risk of cultural blindness. Like anyone else, an astronomer can easily fail to recognise differential needs and interests, and may exhibit culturally blind behaviours. This leads to behaviours that are normalised within the cultural framework of the astronomer, which usually equates to being a Western white man. For example, an astronomer in a work meeting with Indigenous people presents a time-schedule that s/he normally uses with Western interlocutors (time scales can be different for Indigenous and non-Indigenous peoples). Or the astronomer asks questions the a manner as if the Indigenous collaborators are non-Indigenous (sentences, words, concepts, and perceptions often have different meanings depending on one's cultural background).

Another strong and common example can be seen when some non-Indigenous activists passionately defend policies, advocate rights, take actions, and design projects based on their own culture's worldviews. This results in failing to consider questions such "Is this something the Indigenous community really needs/wants, or is this an idea purely motivated or based on my Western way of seeing things?" "Am I being culturally competent taking Indigenous believes as if they were my own?". One's goodwill should not be the motivator or rationale if the goal is to increase one's cultural competence. One should not seek a pat on the back or "ally cookies", but rather an opportunity to overcome deficiencies in their cultural competence and rise to a set standard of behaviour. Cultural blindness is to make a decision as if the Indigenous person was also a Westerner. Even if a decision was made to completely delete Western culture from the equation, it would be always interfere to some degree. An appropriate solution to culture blindness might be to demonstrate respect and embrace the differences of the two worldviews instead of treating Indigenous and non-Indigenous views identically.

Cultural pre-competence refers to the recognition of needs based on culture and some movement towards meeting those needs. Examples of cultural pre-competence include a commitment to civil rights and social justice; engagement with individuals and communities to ask "What, when, how am I allowed to contribute?"; and the development of inclusive policies and workforce equity initiatives (Srivastava, 2007).

It is possible that some astronomers falsely believe that engaging in one or two initiatives makes them culturally competent, thus compromising further progress along the continuum. Demoralization is another potential difficulty that can arise when an astronomer encounters challenges during activities and initiatives at this stage. Lack of progress is regarded as a failure, which in turn can lead to reluctance to make subsequent efforts, and again progress on the continuum is compromised. Cultural competence is characterized by a recognition of, and

respect for, difference and an ongoing effort toward self-assessment and working with diversity. Cultural competence requires an understanding of the relationship between policy and practice and a commitment to policies that enhance services to culturally competence (Srivastava, 2007).

Cultural competence (cultural proficiency) happens when Western astronomers and organizations value inclusion, equity, and actively seek out the positive and decisive role that culture can play in astronomy, particularly with regard to facilities built in Indigenous lands.

Rather than just providing "unbiased" scientific knowledge about the night sky, culturally proficient astronomers and organizations seek opportunities to learn more about different perspectives, create teams of astronomers from a range of cultural backgrounds, sharing knowledge based in intercultural sharing considering ancient practices within the scope of modern astronomy where appropriate, enhancing ways of communication, developing conflict resolution skills, and work to issues that could potentially damage collaborations and relationships.

The transformation must come from the organizations, agencies, research institutions, scientific publishers, and the astronomers themselves.

3.3 Astronomy's cultural Competence at an organizational-level

For good outcomes in astronomy, cultural competence is needed at the individual, team, organizational, and systemic levels. While each level can be developed in isolation, all levels need to work together to be effective (Srivastava, 2016). Cultural competence involves more than accepting diversity; it also means challenging systemic barriers and changing the existing structures and practices that perpetuate intolerance, oppression, and inequity (Carter, 2001; Cortis, 2003).

I believe it would be effective to recognize that the barriers do not result from Indigenous cultures, but rather from the values and beliefs inherent in the systemic framework of Western astronomy, and from the insufficient training at the academic and professional levels. A better option is to view culture not as a problem to be overcome but as a leverage point – a point that can significantly affect an outcome (Srivastava, 2007). Focusing on cultural consideration in astronomy can be a powerful tool in providing astronomical projects and facilities that can be relevant and meaningful for the Indigenous communities, and in turn, will lead to more positive

results in the scientific advancement of astronomy and cultural knowledge. Cultural competence techniques at the organizational level can reduce cultural issues in Western astronomical practices. Some of these techniques are especially pertinent for astronomers working directly with Indigenous peoples[10]:

- Communication that is culturally sensitive and respectful, being aware of potential mistrust of governments and other institutions, as a result of past history;
- Use of culturally sensitive language and preferred terminology in line with current policy directives;
- Implementation of culturally specific practices as described in relevant national, state, and local guidelines, policies and frameworks that pertain to working with specific Indigenous peoples;
- Respectful use and recording of information identifying Indigenous peoples' status in line with current policy directives;
- Providing interpreter services;
- Recruitment and retention policies (of Indigenous members of the community);
- Training in all cultural aspects that are relevant for specific contexts;
- Collaborating with Indigenous astronomers (to share knowledge and as culture brokers and liaisons);
- Writing culturally competent astronomical publications. This can include consulting with Indigenous stakeholders at all stages of publication, seeking Indigenous collaborators for inclusion in the research, including those collaborators as authors, seeking Indigenous referees for peer-review, acknowledging Indigenous elders as traditional custodians of knowledge, and including appropriate Indigenous stakeholders in assessing tools, interpreting data, and clarifying Indigenous meanings and perspectives;
- Inclusion of community stakeholders in decision-making processes (elders, cultural mentors, advisors, supervisors);
- Immersion of the work-team into Indigenous culture (to overcome one's own ethnocentrism) by (a) accessing relevant Indigenous knowledge about complex cultural structures and protocols, and (b) developing non-verbal communication

[10] NSW Department of Community Services official website, retrieved 3/4/2018 from http://www.community.nsw.gov.au/__data/assets/pdf_file/0017/321308/working_with_aboriginal.pdf

skills, such as the appropriate use and interpretation of posture, gestures, and eye contact[11]. The importance of silence or pauses in discussions[12], or concepts of Men's and Women's Business[13];

- Administrative and organizational accommodations (including altering physical environments and written materials, which influences access and utilization);
- Commitment to understand and work within local cultural protocols and kinship structures of Indigenous communities;
- To respectfully follow Indigenous protocols in community contexts (such as seeking permission to visit, checking appropriateness of moving around the community);
- To be aware of cultural "prohibitions' (such as referring to recently deceased person by name, just to give an Australian example);
- To talk, officially at an organizational-level, with the right person to gather specific information;
- To learn how to prepare important work meetings with Indigenous stakeholders[14].

---

[11] For example, many non-Indigenous people perceive eye contact as a key component of communication. However, for others, looking someone straight in the eyes may be considered rude or disrespectful

[12] silence does not mean that the individual does not understand, but rather that they are listening and thinking and may wait to hear others' ideas before expressing their own views. For example, there are times when Indigenous Australians may remain non-committal or they may be awaiting community support or input

[13] Aboriginal peoples share a common tradition of secret and non-secret women's and men's business. This means that women exclude men from some ceremonies, as do the men with women. Integrity of law is preserved by secrecy, and mixed ceremony maintains harmony. Diane Bell (1986:78) indicates that for remote Aboriginal communities of Central Australia: *"the usual pattern is that during the day men socialize with men and women with women, each in an area taboo to the other ... Today, as in the past, at evening time when men and women come together in family camps ... [m]atters of common concern are discussed between husband and wife, and the produce of the day is shared. In the ebb and flow of daily life the independence and interdependence of the sexes is clearly illustrated. Wendy Ludwig (1983:79) observes "the traditional way of coming to a consensus within an Aboriginal community is a process of consultation throughout the community ... it can take a long time and should not be rushed"*

[14] For example: be aware of the need to be conscious of differences in communication styles; as mentioned previously in this list, allow time for people to think through questions and their answers, and never forget silence does not always mean Indigenous do not understand; to make the meeting and environment relaxed with some general welcoming conversation and be genuinely interested in the person; to be aware that some people may choose to bring a support person with them; to consider making the meeting place culturally friendly by placing Indigenous artworks, for example; be careful of assuming all Indigenous people have in-depth knowledge of their culture or history. For various reasons, including separation from community and family, many Indigenous people have been isolated from learning about their community and culture; to take time to get to know the individual before making any assumption about their Indigenous' knowledge.

3.4 Generalizations vs Stereotypes

Some authors consider generalizations about any cultural group to be inappropriate (Masi, 1996). They criticize this chiefly on the basis that generalizations are not appropriate because they ignore variations within a cultural group and therefore stereotype individuals. The term "culture" refers to shared values, beliefs, norms, and patterns. Shared values do not preclude individual differences or indicate ubiquitous worldviews. Generalizations might be necessary to understand groups, but they should not be imposed upon individuals within those groups (Srivastava, 2007). It is important to differentiate between generalizations and stereotypes: generalizations are a necessary "starting point", indicating trends and patterns that require additional information as to their appropriateness and applicability to specific individuals and situations. Stereotypes are an "end point" in which complexities are not explored and assumptions are imposed (Kendall, 2002). Generalizations often are useful in helping Western astronomers begin a conversation with some understanding of common traits that may be relatively consistent within and across Indigenous and Western communities. Stereotypes stop and close conversations and knowledge development.

3.5 Cultural complexity thinking

The varied perspectives, myths, and misconceptions about culture reveal that cultural issues are dynamic, complex, and often paradoxical. Within a group, they are both universal and diverse. The paradoxical nature of cultural issues can be understood through the principles of complexity thinking – a way of thinking that simultaneously seeks to distinguish (but not separate) and to connect.

> *"To understand complexity is to know how to accept ambiguity, contradiction, the inaccuracy of concepts and the phenomenon and to accept the unexplainable"* (Browaeys & Baets, 2003, p. 336)

The following three key aspects of complexity thinking can be used to help understand cultural competence:

a) The "dialogic" principle means that two logics can exist together without the dual nature being lost in a unit. Culture is about groups in a system as well as about individuals, where the individual is simultaneously part of and separate from the group.

b) The principle of "recursivity" means that causes simultaneously are effects. Culture is about differences and the differences, in turn, have an impact on cultural ways of being. Individuals create culture through their interactions; at the same time, culture influences the interactions that occur.
c) The "hologrammic perspective" means that parts and wholes co-exist simultaneously. Individuals are whole entities but also are part of a cultural group and carry the culture as a whole around with them (Browaeys & Baets, 2003)

Viewing culture and cultural competence through the prism of complexity means that the development of cultural competence is an approach or a strategy, not a program full of specific content and information.

3.6 The Model of Indigenous Cultural Competence for Astronomers (MICCA) – a Srivastava's Culture Care Framework adaptation.

I propose a Model of Indigenous Cultural Competence for Astronomers (MICCA). It is inspired by the Culture Care Framework (Srivastava, 1996), which is itself based on the framework core concepts of Madeleine Leininger's *Theory of Culture Care Diversity and Universality* (Leininger, 1995). I will explore the basic concepts that link these two cultural competence perspectives, focusing my framework proposal specifically on the Srivastava's model, experimenting its possible adaptation to astronomy, and Western astronomers' encounters with Indigenous peoples (using Australian Indigenous peoples as an example).

Srivastava's developed her model the early 1970s when Leininger (an anthropologist and nurse theorist) and Arthur Kleinman (a psychiatrist and medical anthropologist) identified the need to integrate aspects of anthropology into health care. In 1991, Leininger launched the field of *transcultural nursing*. At the time, Leininger and Kleinman noticed health care professionals tended to assume that the problems of communication were on the client's side, without questioning their own values and assumptions. My understanding that a field like medicine - where communication, tolerance, and understanding must be tremendously profound and effective in the relation between health practitioners and clients - made me reflect, realizing that perhaps relationships between Western astronomers and Indigenous peoples around the world require the same need for cultural competence.

The *Culture Care Framework* was first developed by Rany Srivastava in 1996. It was inspired by Leininger's *Theory of Culture Care Diversity and Universality*. It evolved out of Srivastava's attempts to apply and teach cultural understanding in clinical situations, as well as from ongoing discussions with nurses, physicians, social workers, dieticians, and volunteers. Healthcare providers practicing in a diverse, multicultural society are acutely aware of the need to provide care that is consistent with a client's cultural values. But they continue to face the challenge, often on a daily basis, of how to apply this understanding in practice.

The *Culture Care Framework* has been adapted, and often referenced in other areas such as business, psychology, education, Indigenous rights, and environmental studies. In this thesis, I aim to start a reflection - a "draft" on how this cultural competence framework can be adapted and put in action in a very practical and effective way in the field of astronomy. The objective is to support the hypothesis that MICCA has the power to centre concepts like culture and equity in astronomy's agenda, and can also represent an efficient tool for helping situations of cultural conflict in astronomical projects involving Indigenous peoples and their lands.

MICCA is the first attempt of creating a cultural competence program specifically focused on astronomers working with Indigenous peoples, as a tool to improve their cultural competence before, during, and after ethnographic research; to guide them through Indigenous recruitment and engagement; to help them overcome cultural conflicts occurring from the implementation of facilities in Indigenous lands, and designing protocols for astronomers working with Indigenous communities.

In order to be a culturally competent program, as well as an effective tool for applying cultural competence in action, MICCA must entail a strong collaboration/partnership between Western astronomers and Indigenous people, as well as Indigenous Elders, leaders, and stakeholders. The term 'partnership' has become a catchword to describe almost any type of collaborative relationship between different organizations (Hunt, 2010). "*Multi-organizational and community based partnerships have become dominant social inclusion methodologies, particularly in promoting more joined up strategies to address cross cutting community issues"* (Reddel, 2008). As such they reflect a confusing mix of market and collaborative principles. The way organizations share power and control, and respond to obligations regarding sharing and disseminating information (Hunt, 2010; Fowler, 2000) has an impact on how partnerships are understood and developed (MacDonald, 2001). "*Partnerships may involve relationships at a variety of levels, between individuals in organizations, organizational management, and individuals and organizations, such that even an Australian Indigenous worker in a mainstream organization can be said to be in partnership*" (Haynes et al, 2014). A key factor in establishing

effective partnerships is clarity of purpose (Taylor 2011). This thesis will present the theory behind MICCA and demonstrate the pertinence of such program to Western astronomers. To achieve this, I draw from published theoretical material and the fundamental structure of the Srivastava's work (2007). However, MICCA can also relate to established Indigenous theory and practice. For example, *ATSIHEAC (2015) 'Indigenous Participation in Science, Technology, Engineering and Mathematics Disciplines'* has also addressed the need for cultural competency in STEM. The ATSIHEAC STEM Roundtable, held in December 2013, identified a number of actions for Deans of faculties that could improve access and outcomes. These included: building the next generation of culturally competent and informed STEM faculty; embedding Indigenous world views and knowledges into the curriculum and pedagogy for pre-service STEM teachers; providing second chance pathways into STEM education for Indigenous students; supporting change through sharing resources and expertise across faculties and the sector as a whole; and embed Indigenous targets into faculty-level accountability mechanisms. Moreover, the ethic of care described in CATSINaM (2017) *The Nursing and Midwifery Aboriginal and Torres Strait Islander Health Curriculum Framework*, demonstrates the importance of considering the holistic health, wellbeing and spirituality of Aboriginal people in the delivery of services and institutional interactions. While CATSINaM's application is to nursing, Srivastava's work is also on clinical practice and nursing, so there is an obvious synergy, but CATSINaM is a uniquely Indigenous model. CATSINaM sets out a three-tiered model for novices, intermediate and entry to practice of cultural safety (2017: 17-19). Cultural safety is a vital concept to Aboriginal scholarship. It outlines that mainstream Australian (non- Indigenous) modes of knowledge and practice are inherently damaging to Indigenous people, regardless of their intent, and require careful rethinking. MICCA is a framework deeply inspired on these principles.

3.6.1 MICCA overview

MICCA is an approach to astronomy that stresses understanding and interacting in a way that respects and integrates the values, beliefs, and expectations of Indigenous collaborators. Western astronomers need to consider the following:

- Recognize the gaps that may exist between the values of Indigenous people and Western astronomers;
- Working with Indigenous peoples can bridge the gaps that may exist between representation, goals, collaboration, and needs between Indigenous people and Western astronomy;

- Culture can be affected by research in astronomy and astronomical development projects;
- Western astronomers must able to ascertain Indigenous values, needs, beliefs, history, the influences of colonisation, social and political characteristics, perceptions of the night sky, and astronomical knowledge.

3.6.2 MICCA's Six Core Assumptions

1. Individuals may belong to many cultures, not just one (Srivastava, 2007);
2. All individuals approach a situation from their own individual and cultural bias;
3. Culture influences every aspect of our lives, yet we are rarely conscious of it (Leininger, 1995);
4. While individuals may share characteristics, values, and beliefs with others, the degree to which the characteristics are shared can vary greatly (Leininger, 1990);
5. Cultural differences are not about right or wrong – just differences;
6. Self-awareness is the first, critical, and vital step in developing cultural competency.

3.6.3 MICCA's Six Principal Features

1. Integrate patterns and perspectives of cultural diversity;
2. Focuses on self-awareness and provide a way of knowing the "Other";
3. Provides strategies for bridging the gap between "Self" and "Other";
4. Recognizes the interactions between individuals and their own contexts;
5. Suggests ways of moving from understanding to awareness towards to application;
6. Responses to differences are automatic, frequently negative, often unconscious, and influence the dynamics of all interactions.

3.6.4 MICCA structural elements

MICCA consists of three main elements that are needed to provide true cultural competence:

1. <u>Cultural Sensitivity</u> places the focus of the "self", and refers to awareness, understanding, and attitude toward culture;

2. Cultural Knowledge identifies that cultural competence is more than just an attitude. It is based on Indigenous ontologies;
3. Cultural Resources recognize that what happens in encounters between Western astronomers and Indigenous communities depends not only on the competence of the astronomer but also on the context and environment.

MICCA is an action-oriented framework using Leininger's (1995) modes of decision making for bridging the gaps between cultures (Figure 4).

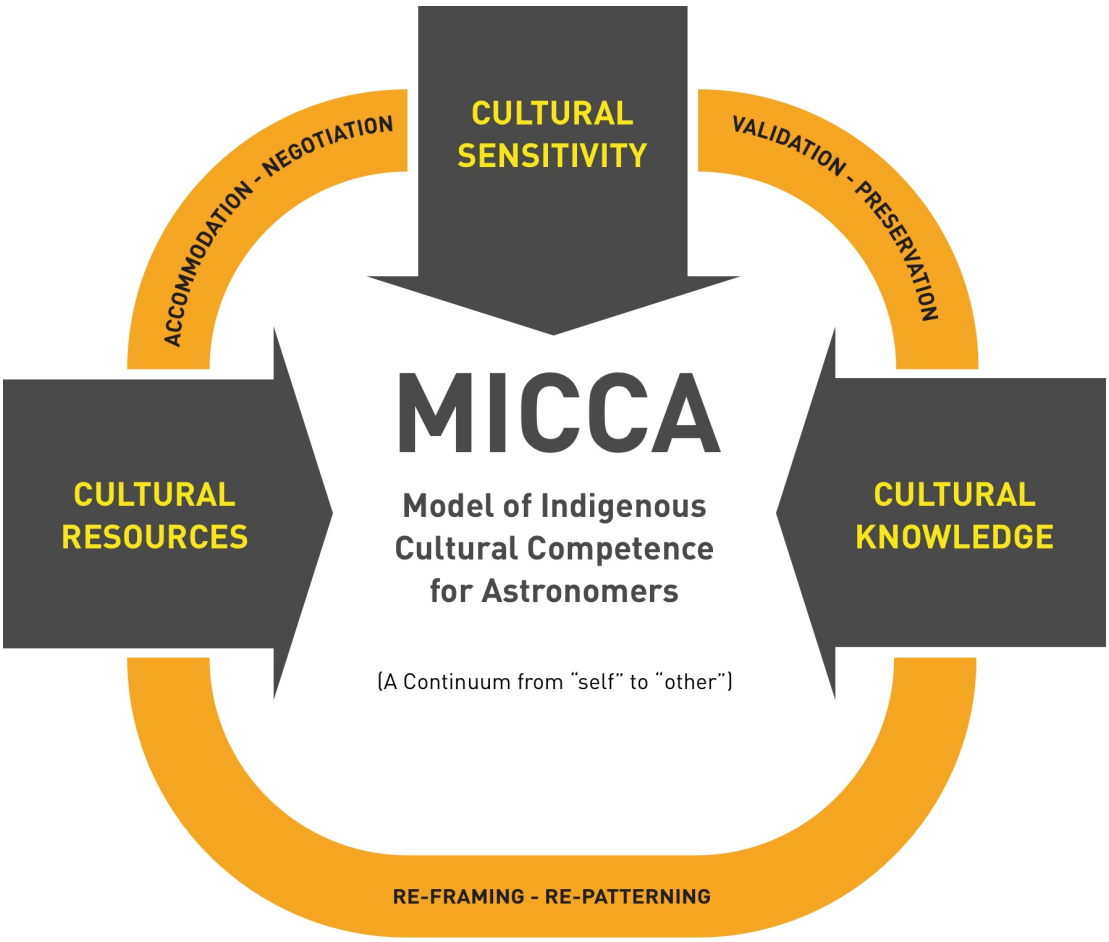

Figure 4 - Author's diagram adapted from Srivastava's Culture Care Framework (1996) – MICCA

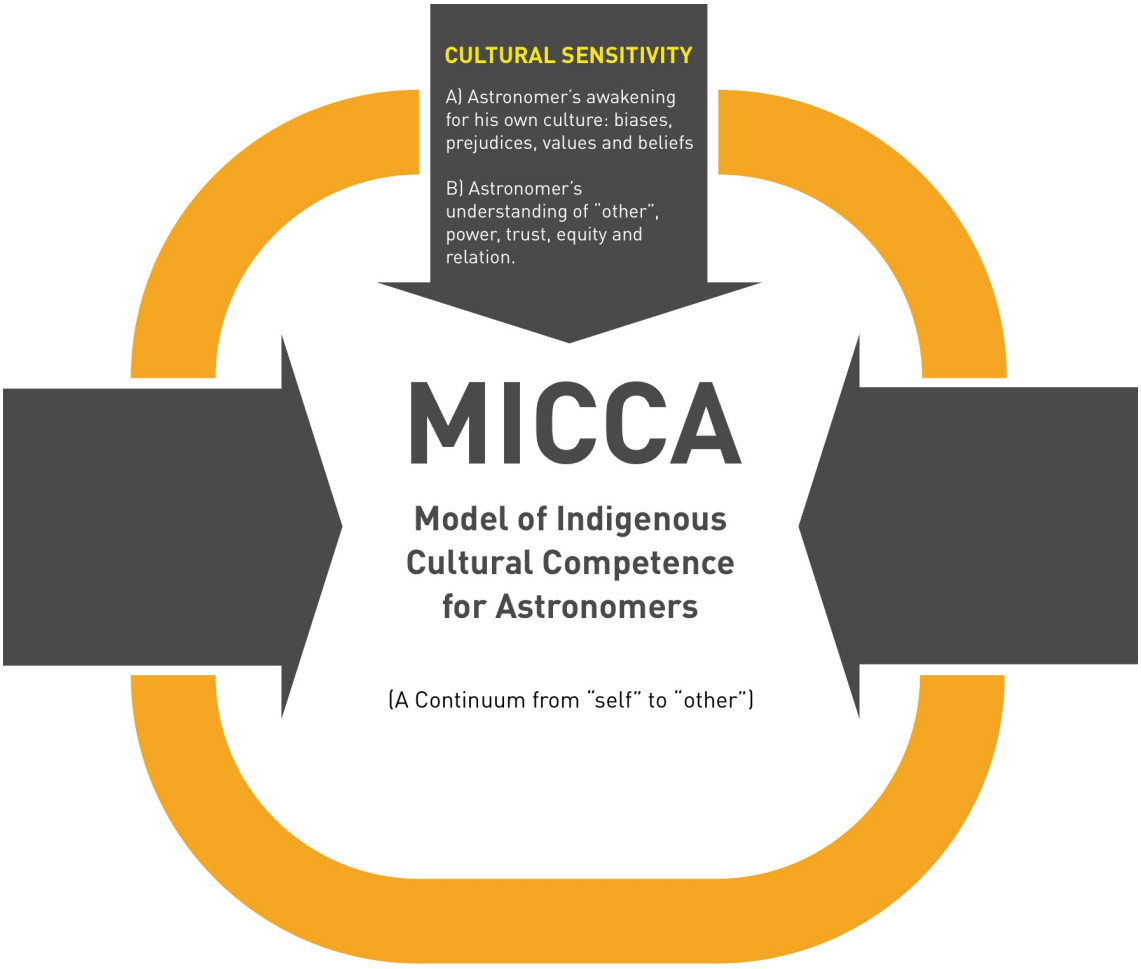

Figure 5 - Author's diagram adapted from Srivastava's Culture Care Framework (1996) - MICCA Cultural Sensitivity element

A) Cultural Sensitivity

MICCA Cultural Sensitivity element refer to: awakening for the concept of culture; awakening for "my own" culture (values, biases and prejudices); awakening for the relationship and its dynamics through differences; and awakening for issues like trust and multiplicity of identities.

Cultural Identity and cultural identities

Each individual lives under a strong intersection of identities - age, lifestyle, ethnicity, gender, religion, etc. That is why all individuals share a sense of "sameness" and belonging to multiple groups and is therefore simultaneously a part of multiple cultures. Identity is shaped by heritage as well as experiences, but should not be considered a synonym for culture. Social

labels of identity neither dictate nor predict particular ways of thinking; they simply point to possible interpretations and experiences that may influence the way of thinking (Wear, 2003). MICCA recognizes that multiple identities exist within the individual. The challenge of the astronomer is to identify the potential identities that could be affecting a situation at any given time, and from then on work on the interaction with Indigenous peoples. The astronomer's challenge is to be able to determine how the Indigenous peoples' various dimensions of age, gender, nation, clan, and social rule (among others) have an impact on the current situation.

As an example, Australian Aboriginal and Torres Strait Islander peoples

> *"continue to be over-represented in the following areas: welfare systems, child protection systems, homelessness, health systems, juvenile and criminal justice systems and unemployment. At the same time, it is acknowledged that past government legislation and practices enforced on Indigenous Australian (e.g. assimilation policies) have contributed to Indigenous Australian being one of the most disadvantaged socio-economic groups in Australia. The effects of these policies have left lasting inter-generational impacts which need to be addressed, and have contributed to sensitive issues like dispossession of land, family fragmentation, mental health/social and emotional wellbeing issues, grief and loss problems, poverty, racism, poor housing standards, below standard literacy and numeracy rates, alcohol and substance abuse/misuse and over-representation in the juvenile and criminal justice system,"* (Human Rights and Equal Opportunity Commission, 2007).

Relationship and the dynamics of difference

As human beings, we tend to respond to the unusual and unfamiliar with vigilance and suspicion (Srivastava, 2007). Reactions to differences are generally automatic, often subconscious, and are based on inherent cultural assumptions. Lack of familiarity or experience with something usually involves fear of losing something, such as control, power, values, traditions, sacred sites, the sense of security. For example, Indigenous communities who have land on which astronomers wish to construct astronomical facilities may be a fear losing control of their ancestral land damage to sacred, spiritual, and ritual places, material and ritual culture, and environmental impacts. Astronomer may fear compromising scientific research, not being able to access the best places in the world to observe the sky, subpar data, and issues related to money, status, career, grants, and political power. Fear on both sides may influence the dynamics of the relationship between Indigenous communities and Western astronomers.

Identifying, understanding, and respecting the dynamics of difference is the first step to managing the ways to minimize the negative and optimize the positive opportunities associated with cultural diversity. Cultural Sensitivity requires that astronomers become aware of their assumptions and avoid labelling and judging Indigenous people. But it also requires that they become aware of the assumptions that others may have, or make, about them. When astronomers know how they might come across to others in particular situations, they can better understand and manage the dynamics proactively, thus avoiding, or at least minimizing, misinterpretations or unintentional influences. Many factors influence the dynamics of interaction. MICCA focuses on two – trust and power.

Trust

As a consequence of intense professional and public interest in space related subjects, some astronomers feel that their status automatically makes them deserving of admiration and trust. This assumption may be wrong. Research in Indigenous astronomy or astrophysics, or the construction of astronomical facilities developed on Indigenous lands, can harbour the expectation that Indigenous people disclose a great deal of their culturally sacred information, or to relinquish control of their lands and sacred sites in the name of science. Indigenous people may not have any interest in that. In these circumstances, Indigenous people may have great difficulty trusting astronomers with whom they cannot interact with effectively, simply because they not seem to understand or respect them right from the start of the relationship. Astronomers need to remember that trust is likely to be fragile at the beginning of a relationship and that Indigenous peoples' trust can increase or decrease based on their interactions with astronomers depending on their cultural sensitivity. The impact of first impressions cannot be underestimated (Srivastava, 2007). It is important to ensure that sufficient time and effort is spent early in the relationship to gain Indigenous stakeholders' trust, instead of taking the trust for granted. Key steps in building trust may include acknowledging the Indigenous person's potential mistrust of the Western astronomy (and society overall) as a system while building a personal commitment to learning the Indigenous peoples' perspectives and developing a relationship that is respectful and non-judgemental (Betancourt, 2004).

Power

Like trust, power is a complex concept. Often they are intrinsically connected. The relationship between Western researchers and Indigenous peoples is one of unequal power. Smith starts her book "Decolonizing Methodologies – Research and Indigenous Peoples" reflecting on this very assertively:

> *"The ways in which scientific research is implicated in the worst excesses of colonialism remains a powerful remembered history for many of the world's colonized peoples. It is a history that still offends the deepest sense of our humanity. Just knowing that someone measured our 'faculties' by filling the skulls of our ancestors with millet seeds and compared the amount of millet seed to the capacity for mental thought offends our sense of who and what we (Indigenous) are. It galls us that Western researchers and intellectuals can assume to know all that it is possible to know of us, on the basis of their brief encounters with some of us. It appals us that the West can desire, extract and claim ownership of our ways of knowing, our imagery, the things we create and produce."* (Smith, 2012, p.1)

Homi Bhabha used the concept of 'third space' to describe the liminal, intercultural space between cultures (Bhabha, 1994). The author believes that in societies where cultural diversity is encouraged, discrimination or racism is 'rampant' (Haynes et al, 2014). Bhabha argued that the universalism "*masks ethnocentric values, norms and interests"*, and he rejected the idea of a purely oppositional space where one culture has more power than the other. Instead he suggested everything happens in between. This 'third space' requires different ways of relating so other positions, views and identities can emerge through interaction, negotiation and translation between, for example, the 'colonizer' and the 'colonized' (Haynes et al, 2014). Through collaboration/partnership, each has the opportunity to disrupt colonial narratives and create new possibilities (Bhabha, 1996). Nakata (2007) suggests that each can engage in rigorous discussion to share ideas, experiences and understandings at the cultural interface (Haynes et al, 2014). This can result in a struggle between two knowledge systems '*where things are not clearly black or white, Indigenous or Western'* (Nakata, 2007:9). The "third space" is a cultural complex area, dynamic and subject to sudden changes in power relations (Haynes, et al 2014). Given the legacy of colonization, Australian Indigenous peoples may be hyper alert and suspicious of (colonial) Western control. Therefore, at the heart of an intercultural partnership attempting to negotiate power, is trust. Inter-organizational and interpersonal trust remains integral to partnership performance (Zaheer et al, 1998; Haynes et al, 2014).

Culturally competent Western astronomers are expected to use their power appropriately. More importantly, these astronomers must share power with Indigenous people as equals, and accept that the power must be given to Indigenous people when Western astronomers intend to utilize or develop Indigenous lands. In the early 1990s, the Ontario anti-racism secretariat produced a document that identified five barriers to equity which, when understood and put to

good use, can turn into the building blocks for equity, and at the same time be considered as elements of power (Ontario Ministry of Citizenship, 1995):

1. Information
2. Connections
3. Experience and expertise
4. Resources
5. Decision making

Western astronomers are expected to make certain that Indigenous peoples not taken advantage of, and at the same time to use their power and privilege to enhance the relationship with the Indigenous communities to help them achieve power equity, especially in terms of decision making. Only when the astronomer understands the power dynamics involved in interactions and social processes, s/he can use the five building-block elements to purposefully balance the power.

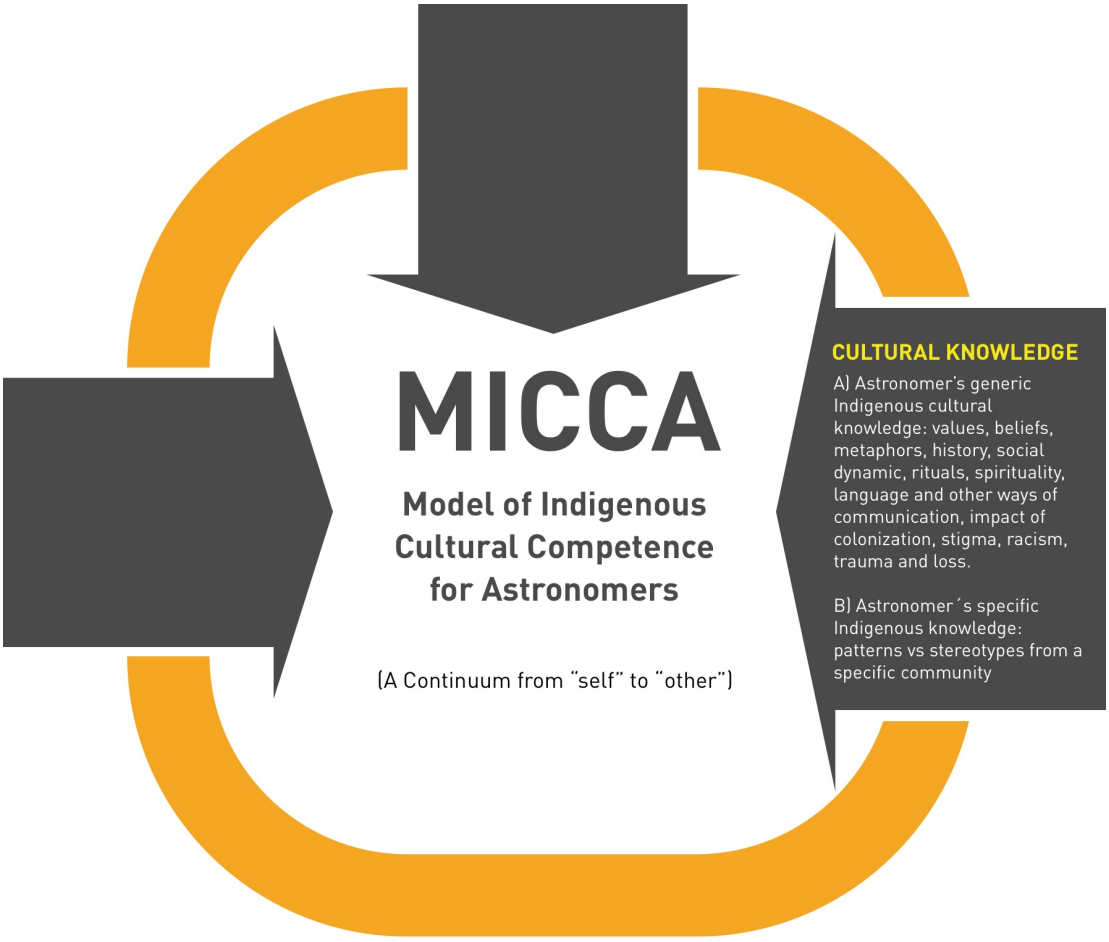

Figure 6 - Author's diagram, adapted from Srivastava's Culture Care Framework (1996) - MICCA Cultural Knowledge element.

B) Cultural Knowledge

Cultural Knowledge involves learning about many factors:

1. Worldviews, values, beliefs, representations, metaphors, signs, etc., in general, across the Indigenous community and, if it presents relevant, across their "neighbours";
2. Specific historical, social, political, ritual, spiritual characteristics (and possible variation in time – how, why and the level of its impact) related to the Indigenous community;
3. Local and national demographics;
4. Inequalities in general;
5. Linguistic and communication issues;
6. Indigenous astronomical knowledge, and how the community represents this knowledge through art, music, dance, ceremony, stories, etc.;
7. Specific Indigenous perceptions of sacred sites;
8. The impact of the Western colonization, racism, and stigma, trauma and loss on Indigenous people;
9. Human rights, especially the right to self-determination;
10. Recognizing the Indigenous diversity, strengths;
11. Previous encounters between Western astronomers and Indigenous people;
12. Elders of the community (who they are and their role in the community)
13. Indigenous astronomers in the community (obtaining information about them and their role both in the community and research field, their methodologies and their findings)

The vast variety and quantity of cultural information can be overwhelming. However, MICCA provides a streamlined approach that allows astronomers to focus on Specific Cultural Knowledge – the knowledge that focuses on the specific Indigenous groups with whom the astronomer is trying to communicate effectively. However, geographically close Indigenous peoples tend to interact and share cultural characteristics. Therefore, MICCA's Specific Cultural Knowledge should include relevant information about neighbouring Indigenous communities as well. As an example, today only about 120 of more than 250 pre-colonial Australian Aboriginal languages are still spoken today. As Elders pass away, many of these languages can be lost forever. (https://www.crashsymphony.com.au/voice-over-sydney-aboriginal/). Language is more than a simple way to communicate, it is an essential cultural element, unique to each people, and plays a central role in a sense of identity. It is also the vehicle with which cultural knowledge - such as songs, traditional stories, and even astronomy - are stored. However, astronomers must take into consideration that, despite the fact that all Indigenous Australian

peoples have links and consequently share characteristics, all of them are unique in their essence, and that is why the MICCA's Specific Cultural Knowledge should be applied regarding Cultural Competence process.

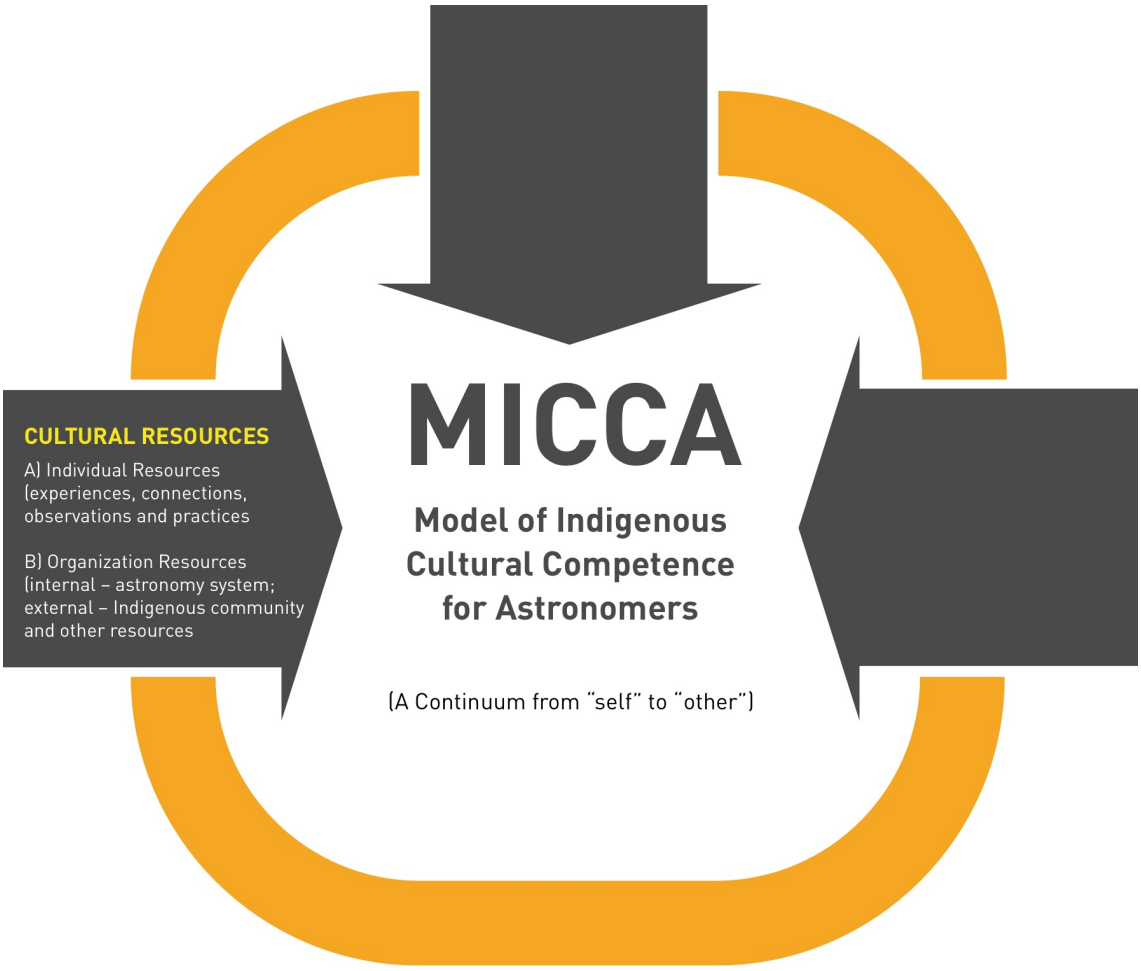

Figure 7 - Author's diagram adapted from Srivastava's Culture Care Framework (1996) - MICCA Cultural Resources element

C) Cultural Resources

Cultural Resources is the third element of MICCA. The reason why the MICCA framework is the first study of cultural competence for astronomers may be the fact that is a very hard tool for astronomers to gain by themselves. The academic, research and industry contexts where the astronomer develops his or her career should be his or her most powerful resource in order for him or her to achieve a culturally competent performance as an astronomer who needs to face, and overcome the challenges, difficulties and obstacles of working immersed in a completely new and different culture.

Through individual-level resources, astronomers can develop cultural competence in several ways:

- seeking information;
- reflecting on experiences,
- developing diverse connections;
- engaging in Indigenous cultural networks;
- creating opportunities to share knowledge with Indigenous astronomers in order to learn about their way of communicating, research and at the same time knowing more about their social role in the community;
- seeking language lessons;
- doing individual literature review about the specific community's Indigenous astronomy;
- watching films, documentaries, and accessing other media; etc.

The astronomer can start by seeking out opportunities to interact with people from an Indigenous community. However, it is very challenging to engage with people and learn about Indigenous peoples' worldviews and approaches to astronomy and the contentious space around sacred lands used in the name of science, and colonization. This requires taking the risk of being unwelcomed and not being offended or discouraged should that occur. That is why astronomers need what MICCA identifies as *Organizational Level Resources*. These resources may be both internal and external to the organization.

Internal resources include policies, guidelines and protocols that create an expectation for cultural competence in astronomy. Internal organizational resources also include support from a diverse workforce (Indigenous and Western astronomers/researchers from other fields such as Indigenous studies, Indigenous law, cultural astronomy, astrophysics, communication, cultural competence, and related areas working as a multidisciplinary team), as well as interpreter services (Indigenous and Western interpreters working as a team), and services that offer complementary knowledge, equity, and intercultural experiences. The external organizational resources may include a variety of partnerships such as community leaders, elders, amateur astronomers, Indigenous researchers and academics, artists, and activists. It is critical that astronomers view such services and partnerships as learning resources to help develop their own abilities. It also serves as a resource that the Indigenous community can use to be well informed about the culture and strategy of the organization, astronomers involved in the project, the project's scientific goals, scientific and economic interests, strategies, collaborations, involvement, and benefits for given back to the community.

Leininger's Three Modes of Action/Decision

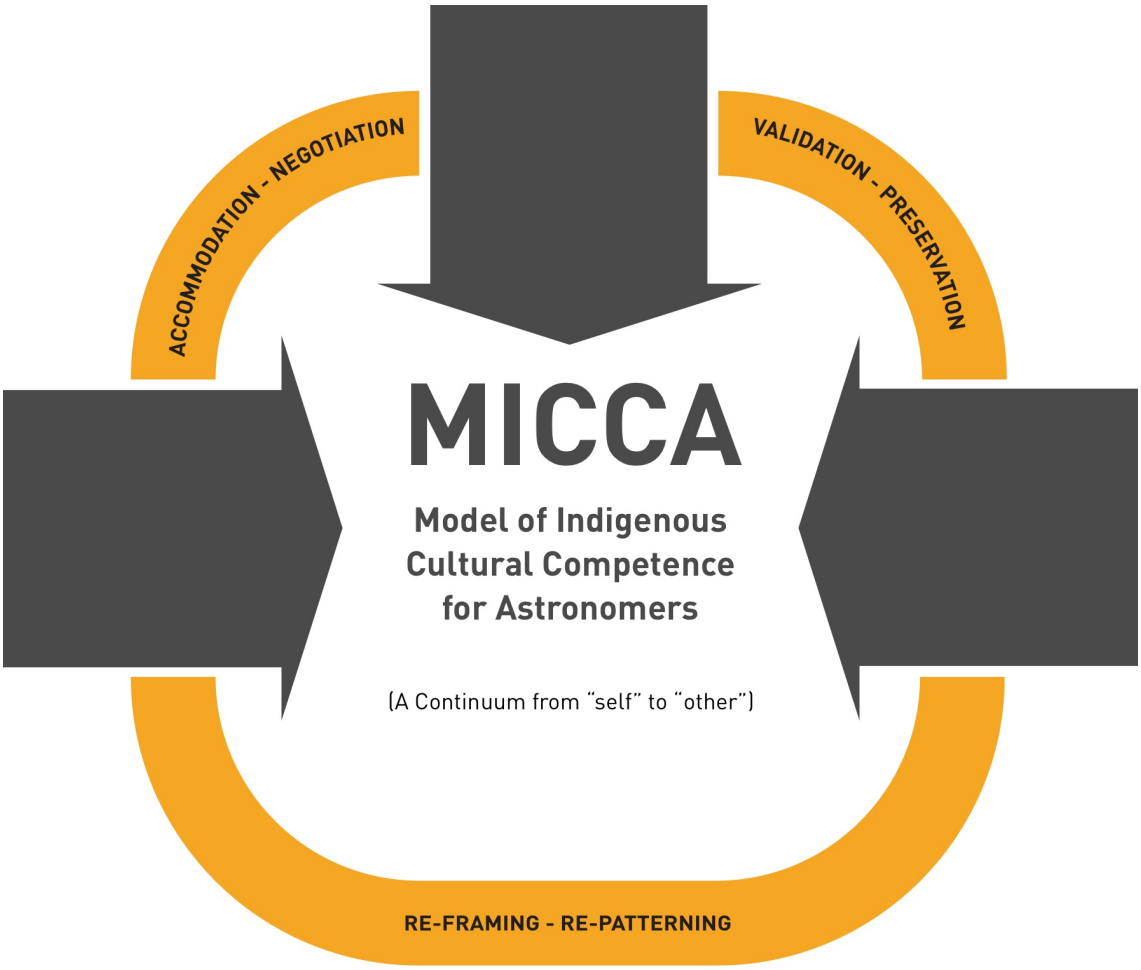

Figure 8 - Author's diagram adapted from Srivastava's Culture Care Framework (1996) - MICCA Three Modes of Action/Decision element.

The three elements previously presented – Cultural Sensitivity, Cultural Knowledge, and Cultural Resources – allow astronomers to understand themselves and others. However,

> *"(...) identifying a cultural gap does not automatically mean we know how to bridge it"* (Srivastava, 2007).

Like the *Culture Care Framework*, MICCA will include strategies for identifying key Indigenous values and priorities, and address differences that may exist between the Indigenous peoples' and astronomers' ways of approaching astronomical research. Although the need for negotiation and accommodation is widely accepted, MICCA includes the strategies of

validation and reframing – two vital supports for negotiating process and help ensure that the Western astronomers' encounters with Indigenous peoples are culturally competent.

In order to bridge the gap, the astronomer should start by understanding the similarities and differences between him and Indigenous peoples, starting by clearly defining astronomer's and Indigenous' interpretation of, and both groups agendas to the specific situation. For that, the astronomer can use tools such as informal/formal/individual or group interviews/meetings with the appropriate Indigenous member of the community. In these encounters, the astronomer has the opportunity to show understanding and awareness of the cultural conflict issue. For that the astronomer can use an appropriate and specific set of critical questions (a short or long questionnaire, depending on the astronomy project, cultural gap and/or conflict, and Indigenous invited to participate), useful, changeable throughout the meeting if necessary, totally adaptable to the mood of the Indigenous, and culturally sensitive and appropriated. The following questions are some of the possible "ice-break" examples of questions that can be used to bridge the gap, negotiate important decisions or initiate conflict-solving processes:

- What do you think is the issue for you and your community relating to this astronomy project?
- What do you think has caused the issue?
- What does this astronomy project mean to you? How does it affect you?
- What are the major problems or difficulties you think this astronomy project can cause in your life and your community life?
- What kind of solution do you suggest to solve this conflict?
- What do you fear most about this project?
- What does your community fear most about this project?
- Who else (from your family and/or community) should be consulted or involved in this process/project?

MICCA's preservation/validation

MICCA's preservation/validation refers to actions and decisions that help Indigenous retain the important culture, astronomical perspectives, social values, and lifeways. This approach has to do with making efforts to integrate Indigenous peoples' interests and contributions to the astronomy project. The term "validation" emphasizes the need for Indigenous to be "*recognized as legitimate preferences and not just idiosyncratic beliefs,"* (Srivstava, 2007, p. 91).

It is important to reinforce the idea that acknowledging and supporting Indigenous' values, traditions, and interests does not necessarily mean that the astronomer has to agree with or endorse all of it. Cultural competence encourages both sides of the process always to try to find the values, interests and practices that are important for mutual goal setting. However, the majority of the cultural conflicts between Western astronomers and Indigenous peoples that involve sacred lands must be considered with critical care as some of these processes may be culturally destructive for the Indigenous people.

MICCA's accommodation/negotiation

- Make it suitable or adapt
- Negotiate with others for meaningful and beneficial astronomy outcomes.

Here the astronomer is encouraged to explore ways to accommodate Indigenous choices by minimizing risks and finding ways to overcome barriers. Using interpreters to ensure that Indigenous peoples can participate in the decisions; allowing multiple different families or community members to participate in work meetings; and scheduling meetings respecting Indigenous peoples' concept of time or their calendar of important events are some examples of this accommodation.

For negotiation to be successful, it needs to be supported by education (Katon & Kleinman, 1980) "*so that the choices that are made are informed"* (Srivastava, 2007, p. 92). In astronomical projects, negotiation often occurs around the use of sacred land, which communities may be reluctant to accept due to fear of losing those lands or fear of inappropriate and disrespectable use of Indigenous culture. This can easily lead to processes of cultural destructiveness, serious misunderstanding, or total incredibility. It is important that Western astronomers both learn about, and provide, information on the various astronomical projects under consideration. Adapting Srivastava's mode of cultural care:

> *"When considering the ~~mode of cultural care~~ [MICCA] accommodation/negotiation, ~~healthcare providers~~ [astronomers] should avoid seeing the strategies as 'either/or' and should explore the 'this and…' approach instead. A useful question to ask is 'what would it take to _____?'; the blank can be filled with whatever the ~~client's~~ [Indigenous people'] values are demanding. The answer may, in turn, generate another 'what would take' question,"* (Srivastava, 2007, p. 93)

MICCA's re-patterning/reframing

- To learn new ways of doing astronomy with Indigenous stakeholders and resolve cultural conflicts between astronomers and Indigenous communities
- To equally apply to astronomers and Indigenous stakeholders

The mode in action reframes preconceived ideas to discover new meanings and new patterns. Re-patterning is about changing our patterns to do things differently. Reframing is about seeing something different. For example, Western astronomy may not make a separation between "Men's or Women's business" relating to observation and interpretation of sky objects and astronomical phenomena. Australian Aboriginal and Torres Strait Islander peoples make a separation between Men's business and Women's business. For Indigenous Australian women there are specific ceremonies, language, song, dance, storytelling, and artwork that reflects women's role as the nurturer, healer and caretaker of their family and community. The initiation of young Aboriginal and Torres Strait Islander men into their "secret business" occurs through a sustained series of discipline tasks that can include: tooth avulsion, nose piercing, circumcision, among other ritualistic practices. The period of these tasks varies according to the community's law and results in the young boys becoming valued community members, men fit for hunting and family life. And all of these cultural characteristics are related to Men's business. Having said this, Australian Indigenous astronomy tends to reflect some of these cultural and social characteristics. Some objects in the sky are often related exclusively to women or strictly with men. This is a new pattern for Western astronomy that should be acknowledged and used in new ways of interpreting cultural astronomy. Western astronomers should take time to hear, include, respect, and value Indigenous knowledge from Elders. Indigenous astronomers should also seek the opportunity to learn more about the Western astronomy if Western astronomical projects are proposed to be developed on Indigenous lands or engage the community. In summary, both ways of doing astronomy should be considered by both sides. This can lead to new and cooperative ways of understanding and observing the night sky.

3.7 Summary

To conclude this chapter, Srivastava's Culture Care Framework (1996), transformed to the new approach to integrating culture into practice through MICCA has the potential to effectively improve Western astronomers' encounters and collaborations with Indigenous peoples.

I have presented MICCA's context, pertinence, overview, assumptions, principal features, structural elements, some practical examples, and the main reason why this model of cultural competence in action is needed in astronomy. It is important to note this is simply the first theoretical and methodological draft of the MICCA. I aim to explore, improve, test and understand the pros and cons of the model in the future. For that phase of the MICCA project, I will develop my research with the supervision of both Western astronomers and Indigenous stakeholders with whom I expect to learn and develop MICCA in a culturally competent way. I have presented MICCA's context, pertinence, overview, assumptions, principal features, structural elements, some practical examples, and the main reason why this model of cultural competence in action is needed in astronomy. It is important to note this is simply the first theoretical and methodological draft of the MICCA. I aim to explore, improve, test and understand the pros and cons of the model in the future. For that phase of the MICCA project, I will develop my research with the supervision of both Western astronomers and Indigenous stakeholders with whom I expect to learn and develop MICCA in a culturally competent way. My aim is to continue exploring the concept of transformational partnerships (Butcher et al, 2011; Mackey, 2012) and see how MICCA might be further developed in future to achieve a true collaboration with Indigenous people, culture and knowledge. To continuously test the efficiency of the model and further developing the MICCA framework with the help of diverse and representative Indigenous people is essential. Above all, setting up a transformational partnership with Indigenous people to review and evaluate the implementation of the MICCA in the specific astronomy field will be the next stage of this study.

The following chapter is dedicated to two case studies chosen to reinforce the differences between an astronomical project that may be considered culturally competent and one where cultural-conflicts are clear, serious, and long-lasting. Both projects involve astronomical facilities built on Indigenous lands:

- **The Thirty Meter Telescope** (TMT) is an optical telescope with a diameter of 30 meters, proposed for construction on Mauna Kea, Hawai'i's most sacred mountain. Many Hawaiians feel the project is culturally abusive and environmentally insensitive.
- **The Square Kilometre Array** (SKA) is an array of radio telescopes with a combined area of one square kilometre. It is planned for construction in both South Africa and Australia. Here, astronomers gained a deeper understanding of the local Indigenous perspective of the sky and worked closely with the communities. This project seems to be a good example of cultural competence and I will try to demonstrate that is one

of the reasons SKA is a project that opened up new areas of opportunity, education, and vocation for the local Indigenous communities.

4 Case Study Comparison

4.1 Research methodology

Thomas Kuhn's concept of "Paradigm Shift" refers to "*a fundamental change in the basic concepts and experimental practices of a scientific discipline.*" (Kuhn, 2012). In describing a paradigm shift in Indigenous research, Indigenous researchers mean a shift to adopt Indigenous worldviews and knowledge into the research methodology (Haraway, 1998). Leanne Simpson's seven principles of Indigenous worldviews are the following: 1) knowledge is dependent upon connections, even those between living and non-living things, in this way, it is cyclical and holistic; 2) there is not one truth, but many, and one's truth is shaped by ones experiences; 3) everything is alive; 4) all things are equal; 5) the land is sacred; 6) the relationship between people and the spiritual world is important; 7) human beings are least important in the world (Simpson, 2000). "*Before this shift, the majority of the research up to the end of the 20th century was anthropological and conducted within a colonial framework*" (Haraway, 1998). The research was mainly quantitative with little or no meaningful involvement of the Indigenous peoples, so it is natural that Indigenous peoples feel suspicion towards researchers in general (and, in particular, anthropologists). Therefore, control, planning, methods and results of the research have always been in the hands of the researchers who were mainly non-Indigenous people with little or no knowledge of Indigenous people and their ways of living and understanding the world (Haraway, 1988). "*After the paradigm shift, both qualitative and quantitative research are used, moving into a postcolonial movement where participatory engagement and Indigenous researchers are actively contributing to the dialogue concerning what research needs to be done in the field of Indigenous studies*" (Haraway, 1988).

Also, non-Aboriginal researchers are seen less as the conventional "external experts". As a non-Indigenous researcher I position myself exactly here. To be more precise, I do not even see myself as an "expert", the only truly experts in Indigenous Studies are, in fact, the Indigenous peoples themselves. I prefer the term "partner" as my primarily intention is to be involved in developing new understandings of Indigenous knowledge, and my main objective is

to ensure that my research benefits directly Indigenous peoples, their culture, their needs and their rights. At the same time, I aim that my research promotes a positive and transformational "bridge" between Indigenous peoples and non-Indigenous astronomers.

Linda Tuhiwai Smith says the following: "Research is probably one of the dirtiest words in the Indigenous world's vocabulary." (Tuhiwai, 2012). Donna Haraway also writes this: "Research has historically been performed on Indigenous people, treating them as objects and rarely with, or for the benefit of, Indigenous peoples. In this way, research symbolizes one of the foundational avenues for colonialism to objectify and study Indigenous people." (Haraway, 1988). After Tuhiwai Smith and Haraway, I, as a non-Indigenous person, want to be a researcher post-"paradigm shift". For that, I started by incorporating qualitative research in this study. In the first stage of my research, I opted for researching a specific cultural aspect (language, as a form of freely expression), from an outside perspective. In the future, I will test my research findings through a participatory engagement with the Indigenous peoples included in this study.

Qualitative research methods were chosen to explore and compare the cultural competence of the two case studies. One of the strengths of qualitative methods is their use as exploratory tools when precedents are challenging to find. As I discovered close to nothing about cultural competence in the astronomical literature, qualitative methods are of particular relevance to the present research. Therefore, this thesis will present and analyse data, using qualitative critical discourse analysis (CDA) methods, to trace the relationship between text, discussion and the social relationships (Fairclough, 1985) between Western astronomers and Indigenous peoples in both case studies. If language is a significant part of culture, then it is also a central element to qualitative research. Thus, the analyses and comparison of texts samples is an adequate methodological option to know more about the cultural competence of these two projects.

I will expose how language (both astronomers' and Indigenous peoples') is implicated in relations of power and dominance (Habermas, 1971) in the sense of advocating cultural competence. This comparative analysis will utilize the CDA technique in social practice (Fairclough, 1989). The goal is to make a comparison between the astronomers' vs Indigenous peoples' discourses, and how these discourses are reproduced and transformed for either dominance or marginalisation.

The qualitative content analysis focuses on intentionality (why certain texts or speeches are produced) and its implications (what are the consequences in producing those texts or

speeches), and has strong parallels with thematic analysis. In this thesis, four types of texts will be collected and analysed: written text (such as online journal articles, and scientific papers), oral text (such as talks and seminars), audio-visual text (such as TV programs, public movies and videos from YouTube), and hypertext (text found on the Internet, mostly on the social media like Facebook and Twitter).

38 samples were collected for discourse analysis related to each one of the case studies, SKA and TMT. I gathered together every reference to TMT and SKA that I could find with a simple search through Google, and then I applied a randomized selection algorithm to the list. I then analysed trends and patterns, and codes were defined and used in the same way in the two case studies:

1. **RED** for destructive words or phrases related to the TMT/SKA in general, to the TMT/SKA scientists in particular, or to Indigenous peoples.
2. **GREEN** for constructive words or phrases related to the TMT/SKA in general, to the TMT/SKA scientists in particular, or to Hawaiian Indigenous peoples.
3. **BLUE** for neutral words or phrases related to culture, either that of the scientific community or Hawaiian Indigenous community culture.
4. **PURPLE** for destructive words or phrases related to culture, either scientific community culture or Hawaiian Indigenous community culture.

In order to achieve the minimum level of subjectivity possible in the analysis of the research data, the key-words included in these codes refer specifically to the following:
- Meaning of DESTRUCTIVE WORDS in code RED and PURPLE: words that destroy or cause much damage.
- Meaning of CONSTRUCTIVE WORDS in code GREEN: words that promote further positive development or advancement.
- Meaning of NEUTRAL WORDS in code BLUE: words that are not aligned with or supporting any side or position in a controversy. The neutral words gathered for this particular code can be related to either Indigenous' culture or non-Indigenous astronomers' culture.

The intention here is to have as much transparency and neutrality as possible from the researcher's point of view. To accomplish that, and also to have a general idea about the work developed by the media online and offline, the research started by collecting texts available on Google and YouTube by searching by "SKA project and Indigenous culture sensitivity" and "TMT project and Indigenous culture sensitivity ".

Through content analysis it is possible to relate known characteristics of audiences to messages produced for and by them. Through the CDA method, one can track, compare and analyse patterns of communication possibly related to the topic of the culture and cultural competence. Using this qualitative research tool it is also possible to analyse the flow and the impact of the communication between Western astronomers and Indigenous peoples in the particular context of the two case studies

In this sense, the success of projects involving the construction of observing facilities on Indigenous lands is directly linked with an appropriate level of cultural competence in action. Therefore, this research is framed in CDA as the chosen qualitative methodology.

This qualitative research ultimately assumes that experiences can be told in a multiplicity of ways (Clarke et all, 1997). In this particular study, qualitative research through the CDA allows one to understand both astronomers' and Indigenous peoples' perspectives. In sum, qualitative research allows the observation and analysis of the character of naturally-occurring human behaviour, cultural and social events, and processes that are then examined regarding their relationship to the context in which they occur (Hammersley, 1990).

However, qualitative research has limitations, as does critical discourse analysis. Generalized concepts and assumptions can occur as a consequence of a small number of texts collected using the CDA method, for example. A particular “dangerous universalism” can lead to generalised treatment of all minority groups, and crude stereotypes about Indigenous peoples or Western astronomers must be avoided. Developing stereotypes can lead to assumptions that Indigenous peoples are all alike or, worse, that their culture is static. This is often used to debase people from their land and assert archaic views of “primitivity”. And the opposite may happen as well. Stereotypes can lead to assumptions that all Western astronomers are culturally incompetent, or that they are focused on "science at all costs" when literature shows that this is a precipitated conclusion (Tingay, 2015). Thus, stereotypes encourage people to blame the more exclusive one of the parts - either Western culture or Indigenous culture.

Given the knowledge gap on cultural competence for astronomers, this study is well placed to make a significant contribution to the existing body of knowledge with application to current research and development. However, the primary objective is to provide frameworks that future studies can apply beyond the limits of this thesis and limitations inherent in the qualitative methodology the CDA method used. The purpose of this thesis is to start the conversation and generate ideas, concepts, understanding, and interpretations.

I now present the case-studies and the research findings analysed using the CDA method Finally, I will discuss this qualitative research as a comparative analysis of both case studies.

4.2 Case Study 1 – TMT

Figure 9 – Picture from Mauna Kea, Hawaii. Credits to Joe Marquez, The New York Times

The Thirty Meter Telescope (TMT) is considered astronomy's next-generation optical observatory. With adaptive optics, the TMT will allow scientists to see deeper into space and observe cosmic objects and phenomenon like never before. With its 30m prime mirror diameter, TMT will be three times as wide, with nine times more area, than the largest currently existing visible-light telescope in the world[15].

This $1.4 billion telescope will enable astronomers to address fundamental questions about star and planet formation, the history of galaxies, the physics of the early universe, and the investigation of black holes in the centre of galaxies (including our own Milky Way), and the evolution of the large-scale structure of the Universe[16]**.** The advanced capabilities of the TMT will very likely lead to discoveries scientists cannot predict. With an unprecedented impact on science in general, and how we all understand life and humanity, this telescope will

[15] Thirty Metre Telescope official website, retrieved 10/5/2018 from http://www.tmt.org/

[16] Ibid

be revolutionary. TMT images will be 12 times sharper than the images captured by the Hubble Space Telescope[17].

The possibility of having a giant telescope capable of unpacking many of the mysteries of the universe is, and a subject of major interest to all astronomers, engineers, astrophysics and all the scientific community in general. Funded in Canada and USA, the TMT is a multinational project with participants including the University of California, California Institute of Technology, China, Japan, and India, where engineers are already producing most of the software[18].

Figure 10 – Youtube video "TMT software developed in India", retrieved 24/5/2018.[19]

In 2009, "After a rigorous five-year campaign spanning the entire globe that measured virtually every atmospheric feature that might affect the performance of the telescope[20]". TMT scientists elected Mauna Kea, Hawaii's tallest mountain, as the best place in the world to build the TMT. The choice was made based on Mauna Kea's dark sky from a lack of light pollution, clean air, good weather, almost equatorial location, good astronomical seeing, low humidity,

[17] Ibid

[18] Ibid

[19] https://www.youtube.com/watch?v=9uVnP3UdlIk

[20] Thirty Metre Telescope official website, retrieved 10/5/2018 from http://www.tmt.org/

high altitude (4,205 m), its position above most of the water vapour in the atmosphere, and above 40 per cent of the Earth's atmosphere[21].

Even though Mauna Kea seems to be the ideal site to build the TMT, the mountain is also land protected by the *Historic Preservation Act*, meaning that Mauna Kea is a sacred site to Kanaka Maoli Peoples. This land, especially the top of the mountain where scientists want to build the telescope, is a sacred centre.

> *"As many ancestor has it's a home of deities. Created by their forbearers, the sky god Wakea and the Earth mother Papa, the 4.000-meter mountain is a place of unique spiritual connection between Kanaka Maoli and their ancestors. It is many ways a living temple, a site of numerous shrines and ceremonies and an important burial ground (Rutherford, 2017)" (see movie embedded in Figure 3 to learn more).*

Figure 11 – Youtube video, Hawane Rios, young Indigenous spiritual leader in a talk on Kanaka Maoli peoples and their relation with the Mauna Kea mountain, retrieved 10/3/2018.[22]

---

[21] Institute for Astronomy, University of Hawaii website, retrieved 12/5/2018 from http://www.ifa.hawaii.edu/

[22] https://www.youtube.com/watch?v=GZFMUz5sFEU

Since the 1960s, twelve other telescopes have already been constructed on the 525-acre (212 ha) land use known as the "Astronomy Precinct" established in 1967 and located within the Mauna Kea Science Reserve. The Reserve is leased by the State of Hawaii's Department of Land and Natural Resources and managed by the University of Hawaii. In turn, the University leases land to multi-national investors interested in technology and science, particularly astronomy. In 2033, the lease expires and the land finally reverts to the state of Hawaii. However, the Indigenous peoples who are protesting against the TMT construction (there have been protests since the first telescope was built in 1964), argue that the law requires projects to pay fair market lease value of the land they use.

> *"There's an exemption in the law for the University of Hawaii, but Kealoha Pisciotta, the president of Mauna Kea Anaina Hou – the group which opposes building the telescope, believes that shouldn't apply to the governments of China, Canada, Japan and other parts of the project,"* (Knapp, 2015).

According to Pisciotta who was interviewed by Forbes in 2015, (Knapp, 2015):

> *"while TMT is proffering this money, it isn't in compliance with the law. You can't pay rent on whatever you want. Fair market is definitely more than a million".*

For the Kanaka Maoli peoples, this place also plays an integral role in Hawaii's water cycle, as they collect water from its summit for ceremonies and healing. So for them, "not even the most holy people are supposed to go there" (Overbye, 2016). But TMT scientists insist in going there, also staying and build telescopes there.

> *"In the 1969s it was believed that only one telescope was going to be built in Manua Kea, but in the first few years, they ended up building four. That broke trust."* Said Pisciota to Forbes (Knapp, 2015).

It is not only Kanaka Maoli peoples who are preoccupied with the mountain's wellbeing. Activists and environmentalists have opposed the TMT, arguing that 30 years of astronomy on the mountain had a negative impact on the Native culture of the mountain and on nature. "Many environmentalists believe the telescope will taint the aquifer next to the mountain. Others say they're worried about the endangered species that live there" (Dickerson, 2015). An environmental impact study performed by NASA in 2007 finally concluded that the 13 telescopes built so far in the Mauna Kea has caused "significant, substantial and adverse" (NASA, 2001) damage to the mountain.

In the same year, Peter Adler, the consultant and sociologist contracted by Moore Foundation to evaluate the context of the TMT project in Mauna Kea did an important report[23] warning the following: "(…) if TMT decides to pursue a Mauna Kea site it will inherit the anger, fear, and great mistrust generated through previous telescopes planning and siting failures and an accumulated disbelief that any additional projects, especially a physically imposing one like the TMT, can be done properly" (2007, p.3).

The anthropologist J. Kehaulani Kauanui, from Wesleyan University in the U.S., also agree that "telescopes on a sacred mountain constitute a form of colonial violence" (Overbye, 2016).

Concerns about the environmental damage and concerns about the use of the land by the observatories are indeed critical to the Kanaka Maoli peoples, but what is even more serious for these Indigenous Hawaiian peoples is the disrespect for their culture and their relation with the sacred mountain of Mauna Kea, as Pisciota explained in her interview previously mentioned above "For us, it's impractical and offensive that this was a top-down decision. (…) It's destructive, it's not inclusive." (Knapp, 2015).

Although, TMT scientists seem to have tried to stop the protests through an "emergency kind of friendly dialogue attempt", it was too late for the Indigenous people that would have preferred to be involved in the project from the very beginning. "We're doing a workforce pipeline to ensure Hawaiians can work on the project," said Sandra Dawson, who manages community affairs for the TMT projects, in an interview to Forbes online (Knapp, 2015). But at the same time, Sandra Faber, Professor Emeritus at UC-Santa Cruz forwarded and emailed to other astronomers encouraging her peers to sign a petition supporting the TMT construction. The email eventually became public, again this caused indignation of many Hawaiian Indigenous peoples, since its content was not culturally respectful:

> *"The Thirty-Meter Telescope is in trouble, attacked by a horde of native Hawaiians who are lying about the impact of the project on the mountain and who are threatening the safety of TMT personnel. Government officials are*

[23] see the full document here - https://www.keystone.org/wp-content/uploads/2015/12/102607-Mauna-Kea-Telescope-Assessment.pdf

supporting TMT's legality to proceed but are not arresting any of the protestors who are blocking the road".

Sandra Faber's term "horde of natives" and the assumption "(Indigenous people) (…) are lying" is racist. A few days later, Faber posted an apology that began by saying: "It is very unfortunate that my email contained some inflammatory and insensitive language."

Protestors at Mauna Kea caused delays in the construction of the TMT, leading to frustration from some leaders within the astronomical community. In April 2015, opponents successfully stalled the project with a peaceful, but assertive, protest (see movie embedded in Figure 12)

Figure 12 – Big Island Video News, Indigenous protesters stopped the official lunch of the TMT in April 2015, retrieved 13/4/2018.[24]

On December 2015, following sustained pressure, The Supreme Court of Hawaii ruled in favour of the Indigenous and environmental activists, revoking the telescope's first construction permit. The situation is not yet resolved. According to the TMT website, on the 14 April 2018:

[24] https://www.youtube.com/watch?v=EWp_bZCfaNI

"The TMT International Observatory (TIO) Board of Governors at its meeting this week deferred a decision on whether to continue towards building the Thirty Meter Telescope in Hawaii or to consider the alternative in the Canary Islands. (...) 'TMT is grateful that the legal process is moving forward in Hawaii and we remain hopeful of court decisions that will allow us to resume construction on Mauna Kea', said TIO Board Chair Henry Yang. 'We remain respectful of and will continue to follow the legal and regulatory processes'".

In conclusion, this presentation of the TMT case study indicates the following:

1. The TMT project is not a peaceful one, and because of that its timeline was severely compromised, the construction of the telescope is deferred indefinitely. The project in Mauna Kea is too close to be considered a waste of time and money. Most importantly, the TMT project is increasingly alienating the community of astronomers from the Indigenous community;
2. Indigenous people from Mauna Kea do not necessarily see themselves not as protesters of the TMT project. Instead, they consider themselves "protectors" of the mountain. Kanaka Maoli people are concerned with the adverse environmental consequences of this astronomy project (after the last 30 years of telescopes built on the mountain). They also feel indignation about the land lease, which for them is not respecting the law. But most importantly, Indigenous Hawaiian people have indicated that this project is culturally destructive and that it is impractical, offensive, and exclusive.

These facts response directly to the research question of this thesis: are Western astronomers culturally competent? The answer seems evident if one looks to the TMT project attentively. This case study supports the hypothesis that Western astronomers need to develop a framework of cultural competence for working with Indigenous people. Training in cultural competency for astronomical organisations is necessary to develop policies, protocols, methods and practices that overcome obstacles and shortfalls with astronomers approaching and working in collaboration with Indigenous communities in cases such as this one.

What follows is the presentation of the 38 texts samples in the context of the TMT. The text samples were collected from academic papers, journal articles, TV interviews, Indigenous peoples giving talks in schools and seminars, and social media. The texts are from Indigenous peoples, cultural activists, environmental activists, astronomers, journalists and other relevant opinion leaders that had the opportunity to be involved, directly and indirectly with the TMT project. With this content analysis, I am interested in analysing patterns that can corroborate the

premise that culture incompetence is the fundamental base of the lack of success of the TMT project.

4.2.1 TMT's research findings

Table of content meaning:

1. **RED** for destructive words or expressions related to the TMT in general, to the TMT scientists in particular, or to Hawaiian Indigenous peoples.
2. **GREEN** for constructive words or expressions related to the TMT in general, to the TMT scientists in particular, or to Hawaiian Indigenous peoples.
3. **BLUE** for neutral words or expressions related to culture, either scientific community culture or Hawaiian Indigenous community culture.
4. **PURPLE** for destructive (explicit or implicit) words or expressions related to culture, either scientific community culture or Hawaiian Indigenous community culture.

Table 1 - TMT's Content Analysis

Article/Movie/Talk	**Quotes/Content**
Adam Mann, Science writer link https://www.ncbi.nlm.nih.gov/ pmc/articles/PMC5167173/	*"Across the globe, in Australia and South Africa, astronomers are gearing up to build the Square Kilometer Array (SKA), which will become the largest radio telescope in the world. Here too, local indigenous peoples will be affected, as the astronomers aim to use their land. And in these two locations, as in Hawaii, the indigenous communities bear scars from centuries of colonial exploitation and mistreatment.* *But thus far, the culture clash has proven much more disruptive in Hawaii."*
Adam Mann, Science writer	*"Modern-day astronomers have inherited this*

link https://www.ncbi.nlm.nih.gov/ pmc/articles/PMC5167173/	*ancient tradition, but their endeavors have sometimes clashed with indigenous peoples. In the late-1980s, the San Carlos Apaches quashed plans for the Mount Graham National Observatory in Arizona. In 2005, the Tohono O'odham Nation prevented Kitt Peak Observatory from being built on their tribal reservation. Most recently, Native Hawaiians have protested the placement of the Thirty Meter Telescope (TMT) atop Mauna Kea, a volcanic mountain that many consider sacred. The rallies received worldwide attention and have, for the time being, shuttered construction of the next-generation TMT. Activists say they aren't against research, they simply want their values respected."*
Adam Mann, Science writer link https://www.ncbi.nlm.nih.gov/ pmc/articles/PMC5167173/	*"TMT and SKA scenarios differ in important ways. Only in Hawaii would the construction impinge on a sacred burial ground, cause environmental degradation, and potentially reprise historical missteps."*
Adam Mann, Science writer link https://www.ncbi.nlm.nih.gov/ pmc/articles/PMC5167173/	*"…(TMT) shows that modern astronomy can share fundamental questions with ancient cultures and collide with their sensibilities."*
Adam Mann, Science writer link https://www.ncbi.nlm.nih.gov/ pmc/articles/PMC5167173/	*"Telescope after telescope went up (30 years of TMT astronomical activity on the mountain), often with little regard for Native Hawaiian's historical and spiritual connection to the place."*
Joshua Lanakila Mangauil, Indigenous Hawaiian cultural practitioner	*"The mountain was set aside for conservation"*

link https://www.ncbi.nlm.nih.gov/ pmc/articles/PMC5167173/	
Doug Simons, astronomer, executive director of the Canada–France–Hawaii Telescope that also sits on Mauna Kea link https://www.ncbi.nlm.nih.gov/ pmc/articles/PMC5167173/	*"That's a more vocal and strident movement (the Hawaiian sovereignty movement, which tends to see this as a symbolic way of making their grievances known."*
Kealoha Pisciotta, who helped found Mauna Kea Hui, the group that brought the suit against TMT link https://www.ncbi.nlm.nih.gov/ pmc/articles/PMC5167173/	*"The interest in discovery is a noble endeavor and we support that (...) but it can't live in an ivory tower removed from humanity."*
Alex Knapp, Forbes Science writer link https://www.forbes.com/sites/ alexknapp/2015/06/12/ understanding-the-thirty-meter-telescope-controversy/#646c86ae62af	*"There are a number of reasons for this opposition, including concerns about environmental damage, concerns about the use of the land by the observatories essentially rent-free, and most importantly, Mauna Kea's status as a sacred site to the indigenous Hawaiian people."*
Dr. Michael Bolte, an associate director for the TMT project link https://www.forbes.com/sites/ alexknapp/2015/06/12/	*"It was clear from the beginning that if we wanted a permit we needed hearts and minds of people on the big island, but that hadn't been the case in the past"*

understanding-the-thirty-meter-telescope-controversy/#646c86ae62af	
Kealoha Pisciotta, the president of Mauna Kea Anaina Hou, which opposes building the telescope link https://www.forbes.com/sites/ alexknapp/2015/06/12/ understanding-the-thirty-meter-telescope-controversy/#646c86ae62af	*"This is not only an ecologically sensitive area. (...) For Hawaiians, it's where our origin story begins. It's a place where significant ancestors are buried, so it's a burial ground. It's the abode of the gods and goddesses, and you have to go there with strong reverence."*
Kealoha Pisciotta, the president of Mauna Kea Anaina Hou, which opposes building the telescope link https://www.forbes.com/sites/ alexknapp/2015/06/12/ understanding-the-thirty-meter-telescope-controversy/#646c86ae62af	*"In the 1960s, it was believed that only one telescope was going to be built on Mauna Kea. But in the first few years, they ended up building four. That broke trust"*
Kealoha Pisciotta, the president of Mauna Kea Anaina Hou, which opposes building the telescope. link https://www.forbes.com/sites/ alexknapp/2015/06/12/ understanding-the-thirty-meter-telescope-controversy/#646c86ae62af	*"For us it's impractical and offensive that this was a top-down decision"*
Kealoha Pisciotta, the president of Mauna	*"It's destructive, it's not inclusive, and it's*

Kea Anaina Hou, which opposes building the telescope link https://www.forbes.com/sites/ alexknapp/2015/06/12/ understanding-the-thirty-meter-telescope-controversy/#646c86ae62af	*going to cause many more problems and it's not fair to the scientists who are up there"*
Dr. Chanda Prescod-Weinstein, an astrophysicist at MIT link https://www.forbes.com/sites/ alexknapp/2015/06/12/ understanding-the-thirty-meter-telescope-controversy/#646c86ae62af	*"The important distinction here is that it doesn't matter that Mauna Kea is sacred – it's that it's Hawaiian, and they (Indigenous Hawaiians) should decide what happens to it"*
Dr. Chanda Prescod-Weinstein, an astrophysicist at MIT link https://www.forbes.com/sites/ alexknapp/2015/06/12/ understanding-the-thirty-meter-telescope-controversy/#646c86ae62af	*"Science at all costs mentality could erode public support for science"*
Dr. Chanda Prescod-Weinstein, an astrophysicist at MIT link https://www.forbes.com/sites/ alexknapp/2015/06/12/ understanding-the-thirty-meter-telescope-	*"I have heard not so great stories about Hawaiian students who are getting turned off by science because they feel community is against Hawaiians. That's too bad because science belongs to all people."*

controversy/#646c86ae62af	
Kealoha Pisciotta, the president of Mauna Kea Anaina Hou, which opposes building the telescope link https://www.forbes.com/sites/ alexknapp/2015/06/12/ understanding-the-thirty-meter-telescope-controversy/#646c86ae62af	*"This is the principle of the mountain and the sanctity of Mauna Kea calls on us to raise the standard. We cannot be vengeful. We need to find pono [righteous] solutions. We need to find good things for astronomers. Cooperation is, I think, really the true part of our human nature, not competition. I think we have to go back to cooperation to survive the future."*
Janet D. Stemwedel, Forbes Ethics writer link https://www.forbes.com/sites/ janetstemwedel/2015/06/12/ the-thirty-meter-telescope-reveals- ethical-challenges-for-the-astronomy- community/#329155766902	*"Ethics is fundamentally a matter of sharing a world. Part of being an ethical scientist is successfully sharing a world with non-scientists. Often the challenges to this involve disagreements about whether or how to spend public money on knowledge-building, and whether or how to let the resulting knowledge guide policy. Sometimes the challenge can be a disagreement about where to put a scientific tool like the 18-story tall Thirty-Meter Telescope (TMT)."*
Janet D. Stemwedel, Forbes Ethics writer link https://www.forbes.com/sites/ janetstemwedel/2015/06/12/ the-thirty-meter-telescope-reveals- ethical-challenges-for-the-astronomy- community/#329155766902	*"However, a group of Native Hawaiians has vocally objected to siting the TMT on Mauna Kea, a mountain with special spiritual significance. Protestors at Mauna Kea caused delays in the construction of TMT, leading to frustration from some leaders within the astronomy community"*
Sandra Faber, Professor Emeritus at UC-Santa Cruz, in a very controversial intercepted personal email, encouraging astronomers to sign a petition supporting TMT.	*"The Thirty-Meter Telescope is in trouble, attacked by a horde of native Hawaiians who are lying about the impact of the project on the mountain and who are threatening the safety of TMT personnel. Government officials*

	are supporting TMT's legality to proceed but are not arresting any of the protestors who are blocking the road."
Janet D. Stemwedel, Forbes Ethics writer link https://www.forbes.com/sites/janetstemwedel/2015/06/12/the-thirty-meter-telescope-reveals-ethical-challenges-for-the-astronomy-community/#329155766902	*"Some recipients of the email in the astronomy community were troubled. The description of the "horde of native Hawaiians" on the attack seemed racially charged, and the assertion that the protestors were lying about impacts impugned their motives. (It also suggested that perhaps Faber and other astronomers didn't understand the particular sorts of impacts that most concerned the anti-TMT protestors.)"*
Joshua Mangauil, better known by his Hawaiian name of Lanakila, one of the more mediatic TMT's oponents link https://www.nytimes.com/2016/10/04/science/hawaii-thirty-meter-telescope-mauna-kea.html	*"Like snakes you are. Vile snakes. We gave all of our aloha to you guys, and you slithered past us like snakes."*
Kealoha Pisciotta, the president of Mauna Kea Anaina Hou, which opposes building the telescope link https://www.nytimes.com/2016/10/04/science/hawaii-thirty-meter-telescope-mauna-kea.html	*"It's not science versus religion. We're not the church. You're not Galileo."*
Michael Bolte, an astronomer from the University of California, Santa Cruz, who serves on the TMT board link	*"Not a lot of thought was given to culture issues."*

https://www.nytimes.com/2016/ 10/04/science/hawaii-thirty-meter- telescope-mauna-kea.html	
Dennis Overbye, The New York Times journalist. link https://www.nytimes.com/2016/ 10/04/science/hawaii-thirty-meter- telescope-mauna-kea.html	*"Some native Hawaiians complained that their beloved mountain had grown 'pimples' and that the telescope development had interfered with cultural and religious practices that are protected by state law."*
Nelson Ho, a photographer and Sierra Club leader (sierraclubhawaii.org) link https://www.nytimes.com/2016/ 10/04/science/hawaii-thirty-meter- telescope-mauna-kea.html	*"They wouldn't listen. They just kept playing king of the mountain."*
Dennis Overbye, The New York Times journalist. link https://www.nytimes.com/2016/ 10/04/science/hawaii-thirty-meter- telescope-mauna-kea.html	*"An audit by the State of Hawaii in 1998 scolded the university for failing to protect the mountain and its natural and cultural resources. An environmental impact study performed by NASA in 2007 similarly concluded that 30 years of astronomy had caused "significant, substantial and adverse" harm to Mauna Kea"*
Kealoha Pisciotta, the president of Mauna Kea Anaina Hou, which opposes building the telescope link https://www.nytimes.com/2016/ 10/04/science/hawaii-thirty-meter- telescope-mauna-kea.html	*"Cinder cones are burial sites. It's time to not let this go on."*

Peter Adler, a consultant and sociologist hired by the Moore Foundation, to look into the consequences of putting the telescope in Hawaii. link https://www.nytimes.com/2016/10/04/science/hawaii-thirty-meter-telescope-mauna-kea.html	*"In case TMT decide to pursue a Mauna Kea site it will inherit the anger, fear and great mistrust generated through previous telescope planning and siting failures and an accumulated disbelief that any additional projects, especially a physically imposing one like the TMT, can be done properly."*
Mr. Mangauil, hula dancing and Hawaiian culture teacher. link https://www.nytimes.com/2016/10/04/science/hawaii-thirty-meter-telescope-mauna-kea.html	*"Our connection to the mountain is like, that's our elder, the mother of our resources. We're talking about the wau akua, the realm of where the gods live."*
Mr. Mangauil, hula dancing and Hawaiian culture teacher. link https://www.nytimes.com/2016/10/04/science/hawaii-thirty-meter-telescope-mauna-kea.html	*"There are no shrines on the very summit, which should be a lesson: Not even the most holy people are supposed to go there."*
Dr. Simons, the Canada-France-Hawaii TMT director link https://www.nytimes.com/2016/10/04/science/hawaii-thirty-meter-telescope-mauna-kea.html	*"It really tugged at us to see the staff going from being proud to scared in a matter of weeks"*
Hawaiian Supreme Court link	*"Quite simply, the Board put the cart before the horse when it issued the permit."*

https://www.nytimes.com/2016/ 10/04/science/hawaii-thirty-meter- telescope-mauna-kea.html	
Joshua Mangauil, better known by his Hawaiian name of Lanakila, one of the more mediatic TMT's oponents link https://www.youtube.com/ watch?v=J5LV57eFx-k	*"They (TMT) failed. With us and with the our mountain"*
Hawane Rios, Indigenous singer and one of the youngest and powerful link https://www.youtube.com/ watch?v=GZFMUz5sFEU	*"We are not protesters. We are protectors"*
Hawane Rios, Indigenous singer and one of the youngest and powerful link https://www.youtube.com/ watch?v=GZFMUz5sFEU	*"This mountain is who we are. Researchers, talk to us before you make decisions. Let this land speak to your soul. Came and join us. Come and stand with us. Let us unite. We all are born of all things."*

4.3 Case study 2 – SKA project

Figure 13 – SKA official website, Indigenous Ymagiman and kids, in the SKA location, retrieved 10/12/2017.[25]

The Square Kilometre Array (SKA) is an international project to build the world's largest radio telescope[26].

The big difference between the optical telescopes like the TMT and the radio telescopes such as the SKA is that the latter will explore the Universe by detecting radio waves emitted by a wide range of objects. Optical telescopes can be hampered by poor weather conditions on Earth or clouds, as radio telescopes, working with signals at a longer wavelength, can be used even in cloudy skies. However, to obtain the same level of detail and resolution as the optical

[25] https://www.skatelescope.org/

[26] Square Kilometre Array official website, retrieved 5/6/18 from http://www.skatelescope.org/

telescopes, radio telescopes have to be much larger or have a larger collecting area, as light is a much shorter wavelength[27].

Having said this, the scale of the SKA represents a huge leap forward in both engineering, research and development towards building and delivering a unique instrument, with the detailed design and preparation now well underway. SKA is one of the largest scientific endeavours in history: thousands of dishes and up to a million antennas that will enable astronomers to monitor the sky in extraordinary detail and survey the entire sky much faster than any system currently in existence[28].

Ten member countries are the cornerstone of the SKA, around 100 organisations across about 20 countries are participating in the design and development of the SKA. World leading scientists and engineers designing and developing a system which will require supercomputers faster than ever before, and network technology that will generate more data traffic than the entire Internet[29]. SKA will be built in two phases: the first phase (between 2019 and the late 2020s) will involve testing the full system; the phase 2 will complete the telescope arrays at both sites (Africa and Australia), and become fully operational in the late 2020s[30]. The project as developed with success so far and SKA will already start conducting science observations in the mid-2020s with a partial array (see the movie in Fig. 6 to learn more).

In the context of this thesis, the most relevant detail of the SKA project is that both places that were chosen (and already fully approved for the co-location of the SKA) on Indigenous lands: South Africa's Karoo region[31]. and Western Australia's Murchison Shire[32]. These co-hosting locations are some of the most remote areas on Earth and were chosen due to their unique atmospheric conditions above the desert sites, and their radio quietness. With no light pollution, no noise, no radio interference, no Internet, no recent history of earthquakes or hurricanes, no mobile phones, no microwave ovens, no garage-door openers, and almost no people, these two places are perfect for the implementation of the SKA. South Africa's Karoo

[27] Ibid

[28] Ibid

[29] Ibid

[30] Ibid

[31] SKA official website, retrieved 5/6/18 from https://www.skatelescope.org/africa/

[32] SKA official website, retrieved 5/6/18 from https://www.skatelescope.org/australia/

desert will host the core of the high and mid-frequency dishes, ultimately extending over the African continent. Australia's Murchison Shire will host the low-frequency antennas[33].

Figure 14 – CSIRO, "Building the world's biggest telescope (Australian Academy of Science seminar 2014, December 2, *"Building the world's biggest telescope"*, talk by Dr Lisa Harvey-Smith's [online video] retrieved 4/01/2018.[34]

- Australian Aboriginal Yamaji and South African San people have unique ways to explain why the sky looks the way it does. Indigenous artists from both regions were invited by the SKA scientists to do paintings and other art representations (such as installations and collage) based on their traditional stories about the night sky. The concept was named *SKA Shared Sky* (an idea initiated out of a multi-year project that preceded it, called "Ilgarijiri – Things Belonging to the Sky") and resulted in an exciting form of sharing knowledge - scientists shared pure science with the Indigenous peoples, and Indigenous peoples had the opportunity to share their cultural astronomy through art and traditional stories.

[33] SKA official website, retrieved 5/6/18 from http://www.skatelescope.org/

[34] https://www.youtube.com/watch?v=jFXUzEgpA

Working together in the SKA Shared Sky, scientists and Indigenous artists realized the extensive overlap between their descriptions of the night sky. In a traditional San story, the stars are sung into being by the Great Star Gaunu, which is Vega in Western astronomy (Mann, 2016). When astronomers explained to the same artists that Vega was used as a baseline for measuring other stars' (brightness), they made the connection with their ancestral knowledge and appreciated the swap of information (Mann, 2016). One of the Yamaji Centre artists, Kevin Merritt, painted Venus trailed by a brilliant light because in Yamaji cultural astronomy there is a story where the creator spirit (Venus) flies over the world tied to her sisters via a celestial rope. To Western astronomers, this faint line is known as zodiacal light, and it arises from sunlight reflecting off dust in the plane of the solar system (Mann, 2016).

Figure 15 - SKA official website, Dr Lisa Harvey-Smith sharing SKA with Indigenous Yamaji children, retrieved 6/6/2018.[35]

[35] https://www.skatelescope.org/

In Australia, the Yamaji artists have painted the night sky for over a decade, looking at contemporary stories and traditional stories. Here are two more stories told by the Yamaji Art Centre artists, for a YouTube movie[36] in the context of the SKA Shared Sky:

> *"Some of the artworks that we've been painting in the art centre have been about the Milky Way and the Emu in the Sky. The emu in the sky tell us about the time to go looking for emu eggs. My mum especially couldn't wait for the first emu eggs so she could bake us a yummi cake"* (Margaret Whithust, Indigenous artist, 2015)

> *"My paintings, my stories are about the Seven Sisters and the Orion. When you see the Milky Way, there are six bright ones and one very pale, faint star. But whithin this particular star is a constellation in itself where there are millions and millions of other stars. And we can't see them with the naked eye"* (Kevin Merritt, Indigenous artist, 2015)

By showing interest, respecting the culture, and accepting the fact that Indigenous peoples have relevant knowledge about the sky, SKA scientists found the best way to relate with the traditional owners of the lands that they intend to use for the implementation of their project. One can say that cultural astronomy represented through art was a well-succeeded lesson about cultural competence in action, which allowed the SKA project to build a strong bond with the Indigenous peoples from its areas of interest.

Both Indigenous communities involved in the SKA Shared Project have suffered greatly from the effects of colonialism - another "coincidence" that helped this art project to be such an interesting and relevant event for them. Hunter-gatherer communities had been devastated in South Africa during the preceding centuries and the /Xam language (from the San people) was driven to extinction (Mann, 2016). Some of the Yamaji artists are descendants of the Stolen Generations, Aboriginal children whom the Australian government attempted to "civilize" by forcibly separating them from their families and culture in the first half of the 20th century (Mann, 2016). One can say that both South African San and Australian Aboriginal artists found

---

[36] Department of Industry, Innovation and Science (2015, May 29), New science, ancient land – the SKA telescope inspires new Indigenous Art, Australia. Retrieved from https://www.youtube.com/watch?v=5jCNK7HSeUE&feature=youtu.be

in the SKA Shared Sky a way to share and value the two cultures, but also a form of healing old cultural scars.

> *"Shared Sky stems from a vision by the SKA to bring together under one sky Aboriginal Australian and South African artists in a collaborative exhibition celebrating humanity's ancient cultural wisdom. This vision embodies the spirit of the international science and engineering collaboration that is the SKA project itself, bringing together many nations around two sites in Australia and South Africa to study the same sky.[37]"*

Figure 16 - SKA official website, collaborative painting from Aboriginal Yamaji Artists from Western Australia, and a collaborative quilt from South African indigenous artists exposed at the Shared Sky exhibition, retrieved 6/6/18.[38]

The Shared Sky project was, and still are, a very well-succeeded event with exhibition venues throughout the world. The exhibition already has been featured across Australia, and in various European countries such as Belgium, Italy, United Kingdom, Spain and South Africa.

[37] SKA official website, retrieved 5/6/18 from http://www.skatelescope.org/

[38] https://www.skatelescope.org/

Figure 17 - Cultural Astronomy Channel, Astronomy in Cape Town (AICT), SKA Shared Sky Exhibit Iziko 2015.[39]

These kinds of events are the ones that can bring Indigenous art and cultural astronomy to a new and exciting audience worldwide. On the other hand, these cultural initiatives are also the ones capable of transforming and improving the relationship between the Indigenous people's communities and the scientific community. Apparently, this is interesting material to the opinion leaders in politics, science, and Indigenous communities. Media channels, on and offline, are spreading the SKA Shared Sky, and so the SKA project benefits from it as well. Meanwhile, Indigenous peoples are naturally proud of their artistic achievement, their cultural identity, astronomy, art, and their excellent relationship with the SKA scientists.

Bellow are the 38 texts samples in the context of the SKA, which are the content of my qualitative research. The samples were collected from academic papers, journal articles, TV interviews, Indigenous talks in art exhibitions, astronomy seminars and social media. The texts are from Indigenous peoples (mostly artists), astronomers, journalists and other relevant scientists and Communication managers from the SKA team. In this case study's content analysis, I aim to find patterns to compare to the TMT project.

[39] https://www.youtube.com/watch?v=OdrbdYPxxto

4.3.1 SKA's research findings

Table of content Subtitles:

1. RED for destructive words or expressions related to the SKA in general, to the SKA scientists in particular, or to Australian or African Indigenous peoples.
2. **GREEN** for constructive words or expressions related to the SKA in general, to the SKA scientists in particular, or to Australian or African Indigenous peoples.
3. **BLUE** for neutral words or expressions related to culture, either scientific or Indigenous community culture.
4. **PURPLE** for destructive (explicit or implicit) words or expressions related to culture, either scientific community or Australian or African Indigenous community culture.

Table 2 - SKA's Content Analysis

Article/Movie/talk	**Quotes/Content**
Yamaji Art Centre, SKA Shared- Sky Australia link https://twitter.com/realscientists/ status/567821642245763073	*"It doesn't matter where we live on this barna (earth). Nganha (we) all sharing the same llgari (sky). Those two are sharing the sky – Australia and South Africa"*
Chairmare Green, Yamaji Art Centre, SKA Shared-Sky Australia	*"It was a two-way thing between the scientists, SKA, the visit out to Boolardy, and a different way of looking at the sky and sharing our stories with the SKA people, and also with the rest of the world"*
Margaret Whitehust, SKA Shared-Sky artist link https://www.youtube.com/watch?v=5j CNK7HSeUE&feature=youtu.be	*"The painting that I did was Jupiter and the ten moons. I painted this after hearing that Jupiter has ten moons, because when I looked through the telescope I could see at least two moons on each side. This inspired me to do this painting"*

Lisa Harvey-Smith, Research Group Leader at CSIRO's Australia Telescope National Facility's Science Program. She was previously the Project Scientist for CSIRO's Australian Square Kilometre Array Pathfinder Telescope ASKAP, during which time she led the development of the ASKAP Early Science Program link https://www.youtube.com/ watch?v=jFXUzEgpAAM	*"It's really important to build local relationships. The Wadjarri Yamatji people are the traditional custodians of the land and our relationship with the Wadjarri people is incredible important for us and for our presence there (SKA site). We do engage with the community in various forms, one of them is by running a mentoring program in the local school, and this is one of the most rewarding things I do in my all job, I must admit."*
Lisa Harvey-Smith, Research Group Leader at CSIRO's Australia Telescope National Facility's Science Program. She was previously the Project Scientist for CSIRO's Australian Square Kilometre Array Pathfinder Telescope ASKAP, during which time she led the development of the ASKAP Early Science Program link https://www.youtube.com/ watch?v=jFXUzEgpAAM	*"I've been going there with colleagues to the school and we show them (Indigenous kids) the telescopes, the craters on the moon, we've done lessons which includes explaining how telescopes work, designing constellations, we do simulations of black holes, we take the kids from the school to the telescope site to show them the super computer facilities, the dishes… This is been a really rewarding partnership! And throughout time there is a really level of trust and appreciation between the two communities, and that is one of the most valuable things about building a relationship when you built something in a remote area that shouldn't be overlooked at all"*
Lorenzo Raynard, Communication Manager at SKA South Africa. link https://www.ncbi.nlm.nih.gov/ pmc/articles/PMC5167173/	*"So we are being very careful with how we're addressing expectations, and making sure that local communities can own the project and be inspired by its potential to have a positive influence on young people and their appreciation of science."*

Poet Jeni Couzyn, who established the center to promote the art of /Xam-speaking people, SKA South Africa link https://www.ncbi.nlm.nih.gov/ pmc/articles/PMC5167173/	*"We were hugely excited. I personally think that art and science should meet, and where they meet important things can happen."*
Charmaine Green, Yamaji Art Centre, SKA Shared-Sky Australia link https://www.ncbi.nlm.nih.gov/ pmc/articles/PMC5167173/	*"With colonization there's been a lot of disruption. But what they couldn't disrupt was the sky. You can't mine the sky; you can't move people from the sky."*
Kevin Merritt, Yamaji Art Centre artist, SKA Shared-Sky Australia link https://www.ncbi.nlm.nih.gov/ pmc/articles/PMC5167173/	*"And the astronomers told us that Vega was used as a baseline for measuring other stars' [brightness]. I found that very interesting."*
Jeny Couzyn, Artistic Director, Bethesda Arts Centre, SKA Shared-Sky South Africa link https://www.youtube.com/ watch?v=IYubwiaduqM&list= PLkRTE4QUVRQOot2jVkD SRj8W2yw3U8x3N	*"Hopefully, we'll be able to do the connections that the SKA's vision was about, which is bringing together art and science"*
Mathieu Isidro, Deputy Communications&Outreach Manager, SKA Organization	*"SKA bring together for the first time works of art by the Indigenous artists from Australia and from South Africa"*

link https://www.youtube.com/ watch?v=IYubwiaduqM&list= PLkRTE4QUVRQOot2jVkD SRj8W2yw3U8x3N	
Jeny Couzyn, Artistic Director, Bethesda Arts Centre, SKA Shared-Sky South Africa link https://www.youtube.com/ watch?v=IYubwiaduqM&list= PLkRTE4QUVRQOot2jVkD SRj8W2yw3U8x3N	*"I think is extremely difficult for artists and scientists to work together, so this (SKA Shared-Sky) is something quite unique"*
Mathieu Isidro, Deputy Communications&Outreach Manager, SKA Organization link https://www.youtube.com/ watch?v=IYubwiaduqM&list= PLkRTE4QUVRQOot2jVkD SRj8W2yw3U8x3N	*"Indigenous have a very reach connection to the night sky and the sites, and we really want to explore that"*
Prof. Phillip Diamond, SKA Organisation Director General link https://www.youtube.com/ watch?v=IYubwiaduqM&list= PLkRTE4QUVRQOot2jVkD	*"I think this is a fantastic collaborative venture across the Indian ocean"*

SRj8W2yw3U8x3N	
Department of Industry, Innovation and Science. Welcome to Country - a Wajarri perspective on Australia and New Zealand's bid to host the SKA-(OLD) movie. link https://www.youtube.com/ watch?v=_qwIGNsjuCg	*"The owners of this land (Wajarri people) know the rocks, the plants, the animals – and the sky"*
Godfrey Simpson, Wajarri man. Welcome to Country - a Wajarri perspective on Australia and New Zealand's bid to host the SKA-(OLD) movie. link https://www.youtube.com/ watch?v=_qwIGNsjuCg	*"I'd like to say welcome to Boolardy and welcome to Wajarri country. Welcome! As Wajarri people we give our blessing for this project, the SKA project, to go ahead"*
Department of Industry, Innovation and Science. Welcome to Country - a Wajarri perspective on Australia and New Zealand's bid to host the SKA-(OLD) movie. link https://www.youtube.com/ watch?v=_qwIGNsjuCg	*"Today the Australian SKA Pathfinder Telescope is delivering such benefits as high-speed internet connectivity to remote communities, cadetship programs and mentorship for Indigenous students"*
Godfrey Simpson, Wajarri man. Welcome to Country - a Wajarri perspective on Australia and New Zealand's bid to host the SKA-(OLD) movie. link	*"We don't see it (SKA) as a big footprint if you like, on the land. It's more like just scratching the surface."*

https://www.youtube.com/ watch?v=_qwIGNsjuCg	
Department of Industry, Innovation and Science. Welcome to Country - a Wajarri perspective on Australia and New Zealand's bid to host the SKA-(OLD) movie. link https://www.youtube.com/ watch?v=_qwIGNsjuCg	*"There's something right about using country that's been cherished for tens of thousands of years by members of one of the world's oldest cultures as the site of a telescope that will peer billions of years into the past"*
Daryl Libury, Media Liaison, at SKA South Africa Shared-Sky project international media briefing on Youtube. link https://www.youtube.com/watch? v=VtxqLpuCwMQ&list=PLkR TE4QUVRQOot2jVkDSRj8W 2yw3U8x3N&index=3	*"SKA Shared-Sky it's a collaborative exhibition celebrating humanity's ancient cultural wisdom"*
Lorenzo Raynard, Communication Manager, at SKA South Africa, at SKA South Africa Shared-Sky project international media briefing on Youtube. link https://www.youtube.com/watch? v=VtxqLpuCwMQ&list=PLkR TE4QUVRQOot2jVkDSRj8W 2yw3U8x3N&index=3	*"SKA Shared-Sky is a concept to be able to look at the shared sky between the SKA colocation countries (Australia and South Africa) and captures that in a way which looks as far back into time so that we can be able to look how people have looked at the exact same sky back into history"*
Lorenzo Raynard, Communication Manager, at SKA South Africa, at SKA South Africa Shared-Sky project international media	*"What is also interesting in bringing together these two Indigenous groups from both South Africa and Australia it is realize what is*

briefing on Youtube. link https://www.youtube.com/watch?v=VtxqLpuCwMQ&list=PLkRTE4QUVRQOot2jVkDSRj8W2yw3U8x3N&index=3	*common between Wadjarri and Karoo areas. They have suffer similar historical dissemination, where there is been genocides, really bad practices around the handling of these particular cultural groups. Art work also helps them to deal and heal to/from those particular disasters in the past"*
Sandra Sweers, Lead Artist of the South African SKA Shared-Sky, at SKA South Africa Shared-Sky project international media briefing on Youtube. link https://www.youtube.com/watch?v=VtxqLpuCwMQ&list=PLkRTE4QUVRQOot2jVkDSRj8W2yw3U8x3N&index=3	*"I want to know why the stars mean so much to Aboriginal peoples, and I know that they are also curious about us. If we know each other's backgrounds we will see each other in a different way. I would love to know their background and I'm willing to give them our background"*
Charmaine Green, Yamaji Art Centre, SKA Shared-Sky Australia, at John Curtin Gallery, Perth link https://www.youtube.com/watch?v=e0bR1WHlXhc&index=4&list=PLkRTE4QUVRQOot2jVkDSRj8W2yw3U8x3N	*"With the SKA Shared-Sky we worked a lot more closely with the scientists (...) the collaboration was really interesting. We did a star map called the Shared Sky Map (FIG.XX) and that is based on to looking at the Westerner or non-Aboriginal peoples star designs, but also our design as well"*
Charmaine Green, Yamaji Art Centre, SKA Shared-Sky Australia, at John Curtin Gallery, Perth link https://www.youtube.com/watch?v=e0bR1WHlXhc&index=4&list=	*"To work (with the scientists), we (Indigenous artists) had also to Google, research, looked at pictures of nebulas, constellations, things that we wouldn't even think about ordinarily… That sort of changing and swopping of knowledge inspire us to look at each other's differently. And like I repeatedly say… we all*

PLkRTE4QUVRQOot2jVkDS Rj8W2yw3U8x3N	*look at the same sky but we all see different things"*
Robin Boddington, ASKAP Aboriginal Liaison Officer, at ABC channel. link http://www.abc.net.au/local/stories/ 2011/06/03/3235350.htm	*"There are these big antennas sitting in the bush, I mean you know they're (Wadjarri people) probably used to having windmills sitting in the bush and now it's all changing, everyone's changing and people are learning different things"*
Robin Boddington, ASKAP Aboriginal Liaison Officer, at ABC channel. link http://www.abc.net.au/local/stories/ 2011/06/03/3235350.htm	*"Their kids (Wadjarri people) are lucky cos they got the land, their learning of the Aboriginal culture, plus their learning the new ways of the (SKA) project, learning new things from the scientists"*
Antony Schinckel, CSIRO ASKAP Director, at ABC channel link http://www.abc.net.au/local/stories/ 2011/06/03/3235350.htm	*"Will help remind CSIRO staff, the observers and the astronomers of the Wajarri ownership of the land and (their) traditions"*
Robin Boddington, ASKAP Aboriginal Liaison Officer, at ABC channel. link http://www.abc.net.au/local/stories/ 2011/06/03/3235350.htm	*"Antony 'ant' Schinckel (CSIRO ASKAP Director) 'Minga', that's what 'ant' means in Wajarri… he even goes by a Wajarri name himself… so he's wrapped he loves it, that's what we keep calling him now"*
Robin Boddington, ASKAP Aboriginal Liaison Officer, at ABC channel. link http://www.abc.net.au/local/stories/ 2011/06/03/3235350.htm	*"They work really closely with each other and we do a bit of heritage with them and develop a cultural awareness package"*
Robin Boddington, ASKAP Aboriginal	*"We're coming together in another way you*

Liaison Officer, at ABC channel. link http://www.abc.net.au/local/stories/ 2011/06/03/3235350.htm	*know, in a scientific way, from old to new I guess"*
Simon Berry, SKA director of policy development. link https://www.ncbi.nlm.nih.gov/ pmc/articles/PMC5167173/	*"Romantically speaking, we have a window from two different continents looking at the same blanket of the heavens above"*
Adam Mann, Science writer link https://www.ncbi.nlm.nih.gov/ pmc/articles/PMC5167173/	*"For Shared Sky, artists interested in preserving these tales met with astronomers and swapped stories, enriching each other's understanding."*
Adam Mann, Science writer link https://www.ncbi.nlm.nih.gov/ pmc/articles/PMC5167173/	*"Working together, the artists and scientists realized the extensive overlap between their descriptions of the night sky."*
Steven Tingay, Professor of Radio Astronomy at the Curtin University who worked with Indigenous artists from Yamaji Art in Geraldton, the largest town close to the SKA site. https://theconversation.com/indigenous-culture-and-astrophysics-a-path-to-reconciliation-42607	*"On the 350-kilometre trip from Geraldton, we stopped in Mullewa. We invited the community of the small town to come out and look at the stars that night. For many of the artists, this was the first time they had looked through a telescope, for a close-up view of Saturn and clusters of stars such as the Jewel Box. It was a great way to break the ice."*
Steven Tingay, Professor of Radio Astronomy at the Curtin University who worked with Indigenous artists from Yamaji Art in Geraldton, the largest town close to the SKA site.	*"Around the campfire, the group (astronomers and Indigenous people) came alive: reservations fell away and stories about the stars flowed naturally. We traded Indigenous and western stories. We learned about the*

https://theconversation.com/indigenous-culture-and-astrophysics-a-path-to-reconciliation-42607	*different ways we view the same patterns in the sky, such as the Emu in the Sky that lies within the Milky Way. And we learned about striking similarities, such as the story of the Seven Jilas – which is known as the Seven Sisters (Pleaides) in western astronomy"*
Steven Tingay, Professor of Radio Astronomy at the Curtin University who worked with Indigenous artists from Yamaji Art in Geraldton, the largest town close to the SKA site. https://theconversation.com/indigenous-culture-and-astrophysics-a-path-to-reconciliation-42607	*"We all need to take steps toward reconciliation. Sometimes those steps are via unexpected channels – such as astrophysics and art"*

4.4 Discussion and comparison of the research findings of both Case Studies

The data gathered, and the information obtained, for the comparative analysis of these two case studies are taken in consideration to offer some relevant comments on the level of cultural competence of the Western astronomers. Here follows the conclusions of the research findings, given here in the visual form of two pie charts.

Chart pies Subtitles:

- **RED** for destructive words or phrases
- **GREEN** for constructive words or expressions
- **BLUE** for neutral words or expressions related to culture
- **PURPLE** for destructive (explicit or implicit) words or phrases related to culture

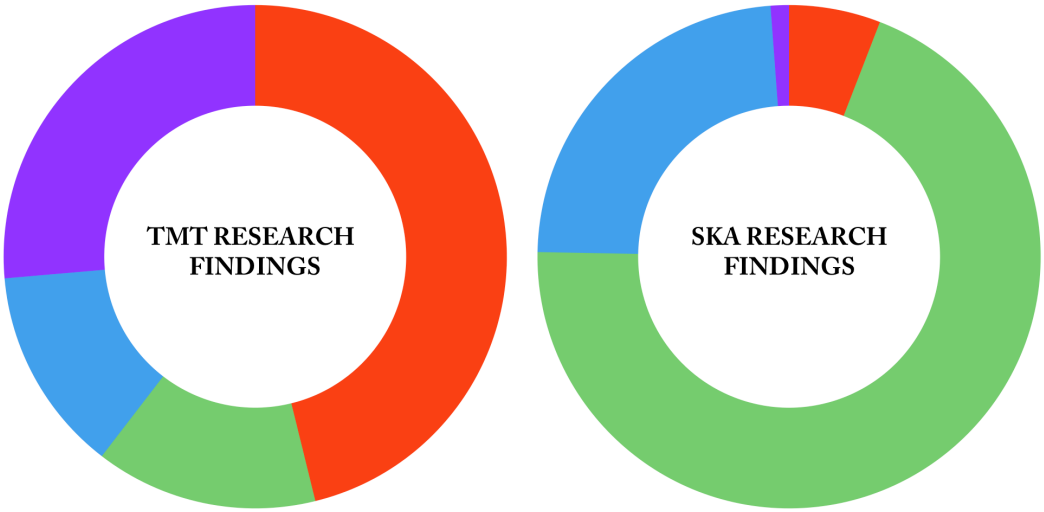

Figure 18 - Author's diagram "comparison of the research findings

As a conclusion about the research problems and questions presented in Chapter 1 of this thesis, principally, this qualitative research methodology – CDA has demonstrated the following:

- The way the TMT project is perceived by Indigenous Hawaiian people, cultural and environmental activists, social scientists, some Western astronomers, journalists and some opinion leaders in social media is far more DESTRUCTIVE/NEGATIVE than the SKA project is. The number of destructive words or expressions related with the TMT that were found and coded as RED, in the 38 texts samples collected, was 42 samples. As in the SKA's collected data, the number of codes **RED** were just 5.
- Analysing the findings on code **GREEN**, I discovered that people directly or indirectly related, or were merely opinionative about the topic, are mostly more POSITIVELY inclined towards the SKA when compared with the trend regarding the TMT – 59 words or phrases applied in speech and written text about the SKA can be considered constructive. For the TMT, findings collected only 13 green coded words or phrases were found.
- The code **BLUE** results are also evident: 12 samples of text about CULTURE were collected in the TMT case study, while in the SKA's research 20 samples were found. This finding can lead us to conclude that in the case of the TMT project people (and Media in general) are more distracted with the Hawaiian Indigenous protests, and the impact that they are having on the astronomer's agenda then focused on the cultural destructiveness that TMT represents to the Indigenous peoples. The results of this

research code also indicate that SKA is a project more focused on culture, and how scientists are trying to accept and promote Indigenous ways of perceiving the sky. These 20 samples based on the oral or written words and phrases related with culture (either astronomers', Indigenous' or SKA's as a scientific project), can be a consequence of the SKA Shared-Sky artistic project, where culture is the base and the essence of this cross-cultural initiative.

- The code **PURPLE** is perhaps the one who confirms more effectively the hypothesis of this thesis – Western astronomers are in need of more, or at least better, cultural competence in action when working with Indigenous peoples, especially in sacred lands? The purple code of this research confirms that a large number of texts are being produced (orally and written) for TMT including DESTRUCTIVE/NEGATIVE words or phrases related with culture (either scientific culture or Indigenous culture). 20 samples were collected for TMT while for SKA only 1 sample was gathered. The more obvious conclusion here is that in TMT these research findings are beneficial to TMT's external image as an astronomy project, as well being harmful to astronomers in the process. And, above all, these numbers are adverse to Hawaiian Indigenous peoples who are seen as "protesters" by some, and as "protectors" by others. Cultural destructiveness, as I have presented it in chapter 3 of this thesis through the new model proposed – MICCA, is a negative phenomenon that is profoundly affecting both Hawaiian astronomers and Indigenous communities. In sum, the purple code of this CDA corroborates the central conviction that made me conduct this research: comparing these two astronomy projects both developed in Indigenous lands (being the TMT intended to be built in an Indigenous sacred land) the SKA project is the more culturally competent. TMT failed in approaching and best way to deal with culture/Indigenous peoples/sacred site's understanding and acceptance. Therefore, between the two astronomy projects studied in this thesis, the TMT's astronomers are the ones who are more in need of cultural competence.

Much more is to be codified, analysed and further discussed in the light of the collected data of this qualitative research.

The next chapter of my thesis will present the final implications and conclusions of my work so far on this topic.

5 Conclusion

5.1 Considerations and Limitations of the Research

In the context of the cultural competence theory, I have tried to place an equal focus and level of balance on both Indigenous peoples' culture and interests, and Western science's intentions and non-Indigenous astronomers' difficulties. However, this balance was difficult to maintain, mainly because this thesis was not based on ethnographic fieldwork. My research explored the literature on astronomy, Indigenous studies and cultural competence, as well as the intersections of these domains. But I soon discovered that the bibliography is sparse on the explanation for low levels of cultural competence among astronomers working with Indigenous peoples in sacred lands. This topic has not been adequately investigated, nor have theoretical and methodological approaches been sufficiently for astronomers to address this issue and improve their cultural competency skills. Existing scholarship does not adequately explore why conflicts between Indigenous people and Western astronomers occur in major astronomical projects. Neither does it comment on how cultural competence can be an essential component in the process of negotiation with Indigenous peoples.

Soon after undertaking this study, I realized to complete this research with the adequate cultural competence, ethnographic fieldwork should ideally be conducted with both communities – Western astronomers and Indigenous peoples. Regarding this Master by Research thesis, no claims for the significance of the research beyond its limitations will be made, as outlined earlier in Chapter 1, section 1.5 – Considerations and Limitations.

I also need to consider my profile as a researcher as a significant limitation in this study: I am not Australian, I am not Indigenous, English is not my native language, and I am not an astronomer. On the other hand, I recognize that my profile as the researcher, and with academic background in anthropology and extensive professional experience in communication sciences, have ended up being significant assets towards this thesis. As a foreign researcher observing,

interacting with, and interpreting the actions of Australian Indigenous peoples, and astronomers from different cultural backgrounds, an “outsider’s” point of view allowed me to have some neutrality, cultural distance, and critical perspective needed to conduct an in-depth level of analysis. I conducted this research with a similar cultural sensitiveness and respect towards both astronomers and Indigenous peoples.

Another limitation of this study is the nature of the chosen qualitative research methodology. One of the strengths of qualitative methods is their use as exploratory tools when precedents are challenging to find. As I discovered close to nothing about cultural competence in astronomy in the literature, qualitative methods were of particular relevance to the present research. To explore the comparison between the Indigenous cultural competence of two specific case studies the Critical Discourse Analysis (CDA) was the opted method. Through this qualitative method, I was able to trace the relationship between text and talk and the social bond (Fairclough, 1985) between Western astronomers and Indigenous peoples in both processes. I explored language as an essential cultural element that links both projects. Therefore, the CDA is a logical option as this is a research method that uses language as the leading data research. By using CDA as the qualitative method, I was able to make a comparison between the astronomers’ vs. Indigenous peoples’ discourses, and how these discourses are reproduced and transformed which are becoming dominant and marginalized. By exposing and analysing the data findings, I demonstrated how language (astronomers’ and Indigenous peoples’) is implicated in relations of power and dominance (Habermas, 1971), and in the sense of advocating cultural competence change.

However, qualitative research methodologies, particularly the CDA method, have their limitations. Generalized concepts and assumptions can occur as a consequence of a small number of texts collected through the CDA method. In the case of this study (due to thesis’ deadlines and length constringes) only 76 samples (38 for each one of the two case studies) were considered for analysis.

The primary goal of this research was to provide frameworks that future studies can apply beyond the limits of this thesis and the limitations inherent in its qualitative methodology and the applied CDA method. That said, the purpose of this thesis is to offer these research results as a "start of the conversation" to generate ideas, concepts, understanding and interpretation that will always represent the "tip of the iceberg" given the lack of information in the literature on the topic.

5.2 Conclusion notes and "take-home message" to Western astronomers

I begin the conclusion section of this study by confirming my thesis' core hypothesis: Western astronomers need to develop a framework of cultural competence for working with Indigenous people. Most importantly, this study's research findings indicate that some of the major astronomical projects intended to developed in Indigenous people's sacred lands, such as the Thirty Meter Telescope among others presented in the first chapter of this thesis, are, in fact, culturally incompetent. For these astronomers already working with Indigenous peoples in Indigenous sacred lands, but also for the next generation of young astronomers, training on cultural competency is something to be seriously taken into consideration. Training in Indigenous cultural competence needs to be included in academic programs and courses from the university undergraduate level. Astronomical organizations need to develop policies, protocols, methods, and practices that overcome obstacles and shortfalls with astronomers approaching and working in collaboration with Indigenous communities in Indigenous lands.

The thesis' literature review reinforced the lack of published materials, theoretical approach or any other link that I came across with related to cultural competence specifically applied for astronomers. All the references that I have used in this study were bibliography from different fields of knowledge, such as anthropology, sociology, psychology, ethnography, ecology, globalization, human and social studies, cultural astronomy, and cultural competence applied to various fields such as health, education, communication and Indigenous studies.

Given the knowledge gap on cultural competence for astronomers, this study is well placed to make a significant contribution to the existing body of knowledge with application to current astronomical research and development.

Most importantly, this study also reinforces that Indigenous academics around Australia (but also in other parts of the world) are now more than ever in control of emerging understandings of Indigenous knowledge and Indigenous Studies. This positive movement can be of mutual benefit for Indigenous and non-Indigenous peoples, as long as culturally competent ways of sharing knowledge can be found through transformational partnerships in all areas. Indigenous scholars such as Nakata, Bronwyn Fredericks, Deanne Minniecon, Naomi Franks, Maree Heffernan, Priscilla Sette, Shelley Thomas-Prokup, Donna Haraway, Emma Haynes and many others are participating in this complex discussion around culture, intercultural space, encounters with the "Other", Western knowledge decolonization, and Indigenous research methods. This can be transformative to all.

I sum my research conclusions by using only two of the CDA research codes as examples of the overall research data findings. The RED CODE (for destructive words or expressions related to the TMT in general, to the TMT scientists in particular, or to Hawaiian Indigenous peoples) indicated that **in the 38 texts samples collected, 42 negative words or expressions related with the TMT were found. As in the SKA's same exact collected data, the number of RED CODES was only 5**. The results indicate that Indigenous Hawaiians, activists, social scientists, various Western astronomers, journalists and some opinion leaders perceive the TMT far more negatively than the SKA project. They expressed their thoughts through their discourse on social media/ academic papers/ journal articles/TV interviews/Indigenous talks in art exhibitions and astronomy seminars. One can interpret this negative discourse in several layers of analysis. One possible conclusion is that these research findings are representative of the TMT's lack of cultural competence. The PURPLE CODE (for destructive, explicit or implicit, words or expressions related to culture, either scientific community culture or Hawaiian Indigenous community culture) confirms even more effectively the hypothesis of this thesis. This code is particularly useful to present the contrast between the TMT' and SKA' level of cultural competence: a much larger number of texts (orally and written presented) was produced for TMT including destructive words or phrases related with culture (either scientific culture or Indigenous culture) comparing with the SKA - **20 samples were collected for TMT, while for SKA only 1 sample was gathered.**

Overall, these research findings are not positive to TMT's external image as a culturally competent astronomical project. This research shows that the negative nature of these discourses is harmful to astronomers in the process, and also to astronomers in general, due to the fact that this will be the most powerful optical telescope in the world once is built, and a lot is being said and written worldwide about the TMT regarding its culturally insensitivities. Above all, these research findings are adverse and clearly representative of the high level of cultural destructiveness towards Hawaiian Indigenous peoples, who's culture is not being understood nor respected, and it should be.

On the other hand, the research findings regarding the SKA project revealed that some astronomers are already aware that only with well-designed training, respectful protocols, effective policies, adequate methods, and collaborative practices based in Indigenous cultural competence, is possible to achieve success on the development of astronomical projects in Indigenous lands. The chapter four of this thesis explores, in detail, how culturally competent the SKA process has been so far, how astronomers and Indigenous peoples have been benefiting from it, and how all astronomy's community can learn with this positive case study.

In the light of this Qualitative research results, I have dedicated the chapter 3 of the thesis to the presentation of two theoretical proposals: the **Astronomy Cultural Competence Continuum diagram** (Figure 3, page 37) and the **Model of Indigenous Cultural Competence for Astronomers (MICCA)** (Figure 4, page 47). These two theoretical exercises advocate cultural competence as a method of enhancing the quality and effectiveness of the theory's practical use and reinforce that a lack of competence can be destructive. In other words, cultural competence is a necessary component for effective inter-cultural collaboration relationships and needs to be used seriously.

Although the **Astronomy Cultural Competence Continuum diagram** is presented linearly, it should not be interpreted as a series of predetermined, rigid phases; on the contrary, it offers possible ways to respond to cultural differences and the steps outline developmental tasks that reflect growth toward a goal of cultural proficiency (Srivastava, 2007). **MICCA** is an approach to astronomy that stresses understanding and interacting in a way that respects and integrates the values, beliefs, and expectations of the "Other."

MICCA and the **Astronomy Cultural Competence Continuum diagram** are proposed here as theoretical exercises on the complexities of culture and on the overwhelming task that Indigenous cultural competence can represent to Western astronomers. However, the **Astronomy Cultural Competence Continuum diagram** can help astronomers to reflect and position themselves in the cultural competence continuum. The astronomer is challenged to question his level of cultural competence within the continuum: is she/he closer to the lowest level - Cultural Destructiveness, where Western astronomer's attitudes, practices, and policies are so harmful that are destructive to diversity?; Is she/he closer to the higher level - Cultural Competent/Cultural Proficiency, where Western astronomers and organizations value diversity and seek out the decisive role that culture can play in astronomy projects that involves facilities built in Indigenous lands, for example?

As far as I have learned from the literature, **MICCA's** framework is the first attempt of creating a cultural competence program specifically focused on astronomers working with Indigenous peoples, as a tool to improve their cultural competence before, during and after their ethnographic research. MICCA can be helpful guiding astronomers when they publish Indigenous knowledge of the night sky, to help them overcome cultural conflicts recurring from the implementation of telescopes facilities in Indigenous lands, and designing protocols between astronomers and Indigenous for various projects. To be itself a culturally competent program as well as a useful tool applying Cultural competence in action, **MICCA** must be a result of an active collaboration between Western astronomers and Indigenous astronomers, as well as

Indigenous Elders/leaders and other members of the specific communities where astronomical facilities were built or are in the process of being build. However, for this Master by Research thesis, I only presented the theory behind the **MICCA's** project and demonstrated the pertinence of such a cultural competence program for Western astronomers.

As the final consideration, this study has reinforced the need and the pertinence in exploring and researching in this niche of cultural competence concerning astronomy to improve astronomers' encounter with Indigenous peoples. By enhancing their cultural competence, astronomers will also be able to increase their knowledge about the night sky while having the opportunity to share Western science as well. Cultural competence also leads to more efficient scientific research, management of process deadlines and better financial coasts often unpredictable if there is cultural insensitivity from the beginning. From the Indigenous peoples' side, an increasing and improvement of the astronomer's Indigenous cultural competence will, finally, promote the respect for their lands, sacred sites, peoples, culture and astronomical knowledge that they are entitled to, deserve and seek to see recognized. Cultural competence in-action can have the power to bring Western astronomers and Indigenous peoples together, if not completely, at least to a reasonable, respectful and mutually beneficial level of positive and constructive dialogue.

Lastly, I reserve the final lines of this Master by Research thesis to reinforce that this research is only the "tip of the iceberg," and that much more is to be explored regarding cultural competence for the astronomer. However, as a sum of the knowledge I gained throughout this research study, and in the form of "take-home message" to all the astronomers that may come across with this study, I will end with the following fundamental recommendations to accomplish a cultural competence first encounter with Indigenous peoples:

a) Try start by recognizing the gaps that may exist between Indigenous 'and astronomers' values (Western astronomers, as they are normally the 'guests' in the Indigenous lands. As 'Guests,' astronomers should respect first in order to be respected);

b) Try to start by working with Indigenous peoples to bridge the gaps that exist between Indigenous' values, needs, rights and interests, and astronomer's values, needs, obligations, and interests, plus the scientific goals vs. Indigenous decisions;

c) Try to start be aware of the research in astronomy, and other astronomy projects directly and indirectly related to Indigenous peoples that may be affected by culture, either negatively or positively. And learn from it;

d) Try to start by ascertaining Indigenous values, needs, beliefs, history/colonization influences and consequences, preferences, social and political characteristics, the perception of the night sky and astronomy's knowledge manifestation in material culture (songs, dreaming, dance, rock art, and sacred site significance);

e) Start by being ready to wait, to listen, to learn and to share when asked to do so. And be open to acknowledge the sky's knowledge overlaps between Indigenous and astronomers. And be respectful towards the use you give to that knowledge.

References

Arthur, Bill and Morphy, Frances (eds), (2005), ***Macquarie Atlas of Indigenous Australia***, Macquarie Library, Sydney.

Bhabha, H.K.(1994). ***The location of culture***. London: Routledge.

Barbujani, G., Magagni, A., Minch, E., and Cavalli-Sforza, L.L. (2008). ***An apportionment of human DNA diversity.*** In ***Proceedings of the National Academy of Sciences of the United States of America.*** Journal of Behavior Health Services 35(3), 347-357.

Bates, D., (1904), ***Papers of Daisy Bates***, National Library of Australia.

Bates, D. (1944). ***The Passing of the Aborigines: A Lifetime Spent Among the Natives of Australia***. John Murray, London.

Bell, Diane (1986) ***Central Australian Aboriginal Women's Love Rituals***. In, Eleanor Leacock and Helen I. Safa (eds) Women's Work: Development of the Division of Labour by Gender. Massachusetts: Bergin and Garvey Publishers Inc, 75-95.

Bennet, J.M. (2003), ***Turning Frogs into Interculturalists: A student-centered development approach to teaching intercultural communication*** in R. Goodman, M. Philips and N. Boyacigiller (eds) ***Crossing Cultures: Insights from Master Teachers*** (pp. 157-170), London: Routledge.

Bennett, J.M. and Bennett, M.J. (2004), ***Developing intercultural sensitivity: An integrative approach to global and domestic diversity***, in D. Landis, J. Bennett and Bennet (eds) ***Handbook of Intercultural Training*** (3rd edn). Thousand Oaks, CA: Sage.

Betancourt, J. (2004). ***Cultural competence – Marginal or mainstream movement***. New England Journal of Medicine. 351(10), 953-955.

Boas, F. (1886), ***The Limitations of the Comparative Method of Anthropology Science***, 4, 103.

Boas, F. (1911), ***The Mind of Primitive Man***, New York: MacMillan.

Bordieu, P. (1977), ***Outline of a Theory of Practice***, Cambridge: Cambridge University Press.

Bordieu, P. (1990), ***The Logic of Practice***, Cambridge: Polity.

Bordieu, P. (1993), ***The Field of Cultural Production***, Cambridge: Polity.

Bordieu, P. and Passeron, J. (1977), ***Cultural Reproduction and Social Reproduction***, in Richard K. Brown (Ed.), Knowledge, Education and Cultural Change. London: Tavistock.

Bourdieu, P. (1986), ***The Forms of Capital, Handbook of Theory of Research for the Sociology of Education***. CITY, NY: (Publisher/Press)

Brach, C. & Fraser, I. (2000). ***Can cultural competency reduce racial and ethnic health disparities? A review and conceptual model***. Medical care research and review. 57 (suppl.1), 181-217.

Brislin, R. and Yoshida, T. (1994), ***Intercultural Communication Training: An Introduction***. Thousand Oaks, CA: SAGE.

Browaeys, M. & Baets, W. (2003). ***Cultural Complexity: A new Epistemological perspective***. The Learning Organizations. 10(6), 332-339.

Buell, J.M. (2009), ***Ethics and leadership: Setting the right Tone and Structure Can Help Others in theirs Decision Making***. Healthcare Management Ethics. CITY, NY: (Publisher/Press)

Burchum, J.L. (2002). ***Cultural competence: an evolutionary perspective***. Nursing Forum, 37(4), 5-11.

Byrne, D. (2003). ***The ethos of return: erasure and reinstatement of Aboriginal visibility in the Australian historical landscape***. In the Historical Archaeology, 37(1), 73-86.

Byrne, L. L. D. A. (2005). ***Mauna Kea: A Guide to Hawaii's Sacred Mountain***. Honolulu, Hawaii, Watermark Publishing.

Cairns, H., (1996), ***Sydney Rock Carvings and Astronomy***. Unpublished Manuscript,

Cairns, H., & Harney, (B. Y. 2004), Dark Sparklers: ***Yidumduma's Aboriginal Astronomy***, Published by Hugh Cairns, Sydney.

Canary, D. and Lakey, S.G. (2006), ***Managing conflict in a competent manner: A mindful look at events that matter*** in J. Oetzel and S. Ting-Toomey (eds) ***The Sage Handbook of Conflict*** Communication,.Thousand Oaks, CA, Sage.

Carmichael, D.L., 1 Hubert, B. Reeves, and A. Schansche, eds. (1994). ***Sacred Sites, Sacred Places***. Routledge, London.

Carter, R.T. (2001). ***Back to the future in cultural competence training***. The Counseling Psycologist. 29(6), 787-789.

Chan, L. and Costa, S. (2004), ***Participation in the Global Knowledge Commons: Challenges and Opportunities for Research Dissemination in developing countries***, in New Library World, CITY, Canada.

Chaptman, A. R. (1994), ***Human Rights Implications of Indigenous Peoples Intellectual Property Rights***, in Society for Applied Anthropology, Oklahoma.

Clarke, G., Humberstone, B., & Hargreaves, J. (1997). ***Researching women and sport.*** Basingstoke, Macmillan.

Clarke, P. A. (2003a), ***Where the Ancestors Walked: Australia as an Aboriginal Landscape***, Allen & Unwin, Sydney.

Clarkson, C., Z. Jacobs, B. Marwick, R. Fullagar, L. Wallis, M. Smith, et al., (2017), ***Human occupation of northern Australia by 65,000 years ago***, Nature 547(7663), 306–10.

Clifford, J (1997), ***Routes: Travel and translation in the Late Twentieth Century***, Cambridge, MA: Harvard University Press.

Clifford, J. (1992), ***Travelling Cultures***, in L.Grossberg, C. Nelson and P. Treichler (eds), ***Cultures Studies***, London: Routledge, pp. 96-116.

Cortis, J. (2003). ***Managing Society's difference and Diversity***. Nursing Standard. 18(14-16), 33-39.

Cram, F. et al (2013), ***The Journey Begins,*** in D.M. Mertens, F. Cram & B. Chillisa (Eds) ***Indigenous Pathways into Social Research: Voices of a New Generation,*** Left Coast Press, California.

Cross, T.; Bazron, B. & Issacs, M. (1989). ***Towards a culturally competent system of care***. Vol.1. Whashington DC. Georgetown University Child Development Center.

Davis, R. (2010), ***Culture as a Weapon System,*** in Middle East Report, Washington/DC.

Dickerson, K. (2015), ***Hawaiin astronomer reveals why he supports the telescope that's tearing his community apart,*** Business Insider Australia, 8 October 2015.

Eriksen, T.H. (1997), ***Multiculturalism, Individualism and Human Rights: Romanticism, the Enlightenment and Lessons from Mauritius***, in R.A. Wilson (ed.), ***Human Rights, Culture and Context, London***: Pluto Press, pp. 49-69.

Fairclough, N.L. (1985), ***Critical and Descriptive God's in Discourse Analysis***, Journal of Pragmatics 9, pp.739-763.

Fairclough, N.L. (1989), ***Language and Power***, London: Longman.

Fowler A. (2000). ***Partnerships: Negotiating Relationships***. ***A Resource for Non-governmental Development Organisations*** (Occasional Papers Series No. 32). Oxford: International NGO Training and Research Centre.

Fuller, R. S., (2016), H***ow Ancient Aboriginal Star Maps have Shaped Australia's Highway network***. The Conversation, 7 April 2016.

Gallegos, J. (1982), ***The ethnic competence model for social work education***. In B.White (Ed.), ***Color in a white society***. Silver Spring, National Association of Social Workers.

Gertz, C. (1973), ***The Interpretation of Cultures***, New York: Basic Books.

Goldsmith, J. (2014), ***The Ilgarijiri Project: a Collaboration Between Aboriginal Communities and Radio Astronomers in the Murchison region of Western Australia***, Journal of Astronomical History and Heritage, 17(2), 205–215 (2014).

Green, J. (1995). ***Cultural awareness in the human services. A multi-ethnic approach***. Needham Heights, Ally and Bacon.

Gudykunst, W.B. (2005), ***An anxiety/uncertainty management (AUM) theory of strangers' intercultural adjustment***. In W.B. Gudykunst (ed) ***Theorizing about Intercultural Communication***. Thousand Oaks, CA: Sage.

Habermas, J. (1971), ***Reflections on the Linguistic Foundation of Sociology: the Christian Gauss Lecture***, In J. Habermas (ed.) (2001), in the ***Pragmatics of Social Interaction: Preliminary Studies in the Theory of Communicative Action***. Cambridge: Polity Press.

Hall, S. (2015), ***Hawaii's Telescope Controversy Is the Latest in a Long History of Land-Ownership Battles***. Scientific American, 11 December 2015.

Hall. E.T. (1976), ***Beyond Culture***. New York: Doubleday.

Hamacher, D.W. (2012) ***On the Astronomical Knowledge and Traditions of Aboriginal Australian***. Doctor of Philosophy thesis, Department of Indigenous Studies, Macquarie University, Sydney, Australia.

Hamacher, D.W. and Banks, K. (2018) ***The Planets in Indigenous Australian Traditions***, Oxford Research Encyclopedia of Planetary Science, edited by Peter Read. Oxford: Oxford University (in press)

Hamacher, D.W. and Britton, T.R. (2015) ***Mauna a Wakea: Hawai'i's sacred mountain and the contentious Thirty Meter Telescope***. The Conversation, 21 September 2015.

Hamacher, D.W and Norris, Ray P. (2011) ***Eclipses in Australian Aboriginal Astronomy.*** Journal of Astronomical History and Heritage,

Hammersley, M. (1990). ***Classroom ethnography: Empirical and methodological essays.*** Milton Keynes: Open University Press.

Haraway, D. (1988). ***Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective.*** Feminist Studies, 14(3), 575-599.

Hannerz, U. (2003) ***Special Issue Devoted to the Work of Ulf Hannerz***, Global Networks, 3, 3.

Harvey, D. (2003) ***The New Imperialism***. Oxford University Press.

Haynes, R. D., (1992) Australian Journal of Astronomy, 4, 127.

Haynes et al. (2014). ***Examining the potential contribution of social theory to developing and supporting Australian Indigenous-mainstream health service partnerships***. International Journal for Equity in Health, 13, 75

Herrmann, T. M. and Heinämäki, L. (2017) ***Experiencing and Protecting Sacred Natural Sites of Sámi and other Indigenous Peoples***. Springer Polar Sciences, Springer International Publishing, Finland.

Hopper, P. (2006) ***Living with Globalisation***. Oxford: Berg.

Hudecek, N. (2002) ***Cultural competence: reflect elements of cultural diversity in attitudes, policies, and services***. *Inside case Management,* 9(9), 1-3.

Hulley, C.E. (1996) ***Dreamtime Moon***. Reed Books, Chatswood, NSW.

Human Rights and Equal Opportunity Comission. ***Bringing Them Home***. www.humanrights.gov.au/social_justice/bth_report/apologies_state.html

Hunt J. (2010). ***Partnerships for Indigenous Development: International Development NGOs, Aboriginal Organisations and Communities*** (CAEPR Working Paper No. 71/2010). Canberra: Australian National University.

Johnson, D. (1998) ***Night skies of Aboriginal Australia: a noctuary***, Oceania Monograph No. 47, University of Sydney Press.

Kelly, L., (2015) ***Knowledge and Power in Prehistoric Societies: Orality, Memory and the Transmission of Culture***. New York: Cambridge University Press.

Kendall, J. K. (2002) ***Racism as a source of disparity in families with attention deficit hyperactivity disorder***. Advances in Nursing Science. 25(2)-22-39.

Kerr, M; Struthers, R. & Huynh, W. (2001) ***Workforce Diversity***. American Association of Occupational Health Nursing Journal, 49(1), 13-20.

Klienman, A. & Benson, P. (2006). ***Anthropology in the clinic: the problem of cultural competency and how to fix it***. PLoS Med 3(10): e294.

Knapp, A. (2015) ***Understanding the Thirty Metre Telescope Controversy.*** Forbes, 12 June 2015.

Koehn, P. & Swick, H. (2006). ***Medical education for changing world: Moving beyond cultural competence into transnational competence***. Academia Medicine, 81(6), 548-556.

Kuhn, Thomas. (2012). ***The Structure of Scientific Revolutions***. Chicago: University of Chicago Press (50th limited edition)

Kuper, A. (1999), Culture: ***The Anthopologists' Account***, Cambridge, MA: Harvard University Press.

Leininger, M. (1991). ***The theory of culture care diversity and universality***. In M. Leininger (Ed.), ***Culture care diversity and universality: a theory of nursing***. (pp. 5-72). New York: National League for Nursing.

Leininger, M. (1995). ***Overview of Leininger's Culture Care Theory***. In M. Leininger & M.R. MacFarland (Eds.), ***Transcultural Nursing: Concepts, Theories, Research and Practice*** (2nd ed.), pp. 93-114. New York: McGraw Hill.

Leininger. M. (1990). ***The Significance of Cultural Concepts in Nursing***. Journal of Transcultural Nursing. (2 (1), 52-59).

Lum, D. (Ed.) (2005). ***Cultural competence, practice stages, and client systems***. Belmont, CA. Thomson Brooks/Cole.

Lury, C. (1997), "The Objects of Travel", in C. Rojek and Jurry (eds), ***Touring Cultures***, London: Routledge, pp. 75-95.

McDonald J., Murphy A., Payne W. (2001). ***Ballarat health consortium: a case study of influential factors in the development and maintenance of a health partnership***. Australian J Primary Health, 7:75–82.

Maegraith, B.G. (1932), ***Transactions of the Royal Society of South Australia***, 56, 19.

Mann, A. (2016), ***Science and Culture: Looking at a Shared Sky, through the Lens of Art,*** in Proceedings of the National Academy of Sciences of the United States of America.

Mann, A. (2016), Science and culture: ***looking at a shared sky, through the lens of art***. in PNAS Astronomy, Anthropology, 13; 113(50): 14165–14167.

Masi, R. (1996). ***Inclusion: How can a health system respond to diversity***. In A.S. Zieberth (Ed.). ***Pinched: A management guide to the Canadian Arquipelago***. Nepean, ON: Pinched Press.

Mathews, J. and White, I. (1994), ***The opal that turned into fire: and other stories from the Wangkumara***. Magabala Books, Broome.

McConnell, P. and N. Thieberger, (2001) ***State of Indigenous languages in Australia -2001***. Australia State of the Environment Second Technical Paper Series Natural and Cultural Heritage. Canberra: Department of the Environment and Heritage.

Morgan, J., (1852), ***The Life and Adventures of William Buck-ley***, MacDougall, Hobart.

Mountford, C.P. (1976), ***Nomads of the Australian Desert***, Rigby, Ltd., Adelaide.

Mt. Graham Telescope Project and the University of Minnesota Social Concerns Committee Position Report, (March 2002).

Nakata, M. (2007), ***The Cultural Interface***, The Australian Journal of Indigenous Education 36 (S1), 7-14.

Nakata, M., Hamacher, D. W., Warren, J., et al. (2014), ***Using Modern Technologies to capture and share Indigenous Astronomical Knowledge.*** Australian Academic & Research Libraries, 45, 101.

Nicholls, C.J. (2014), ***"Dreaming" and "The Dreaming" – An Introduction***, The Conversation 23 January 2014.

Norris, R. P. (2016), ***Dawes Review 5: Australian Aboriginal Astronomy and Navigation,*** in Publications of the Astronomical Society of Australia (PASA), Cambridge University Press.

Norris, R. P. (2010), ***Communicating Astronomy with the Public.*** Journal, 9, 5.

Norris, R. P. (2014), The Conversation 23 April 2014 (arXiv:1405.7108).

Norris, R.P., (2007), ***The Emu in the Sky and other Stories***, CSIRO ATNF Newsletter, October.

Norris, R.P., 2008c, ***Emu Dreaming***, Australasian Science, Vol. 29, No. 4 (May 2008).

NSW Departament of Community Services (1999). ***Working with Aboriginal People and Communities– a Practice Resource***.

O'Brien, R. et al (2006). ***Self-assessment of cultural attitudes and competence of clinical investigators to enhance recruitment and participation of minority populations in research***, in Journal of National Medical Association, NY.

Oetzel, J.G., Ting-Toomey, S. (2003) ***Face concerns in interpersonal conflict: A cross-cultural empirical test of the face-negotiation theory*** in ***Communication Research 30***.

Ogbu, John U. (1981), ***Origins of Human Competence: A Cultural-Ecological Perspective.*** In Child Development, Vol. 52, Nº2 (Jun.1981), pp. 413-429.

Ojanlatva, E. and Neumman, A. (2017), ***Protecting the Sacred in the Finnish Sápmi: settings and challenges***, in Heinamaki, L. and Martina, T., ***Experiencing and Protecting Sacred Natural Sites of Sámi and Other Indigenous peoples***. The Netherlands. University of Tilburg.

Overbye, D. (2016), ***Under Hawaii's Starriest Skies, a Fight Over Sacred Ground***, in The New Your Times, 3 October 2016.

Oviedo, G., Jeanrenaud, S., Gland, M.O., (2005) ***Protecting Sacred Natural Sites of Indigenous and Traditional Peoples: an IUCN Perspective***. Switzerland.

Parker, K.L. (1905), ***The Euahlayi Tribe: a study of Aboriginal life in Australia***, Adamant Media Corp., Boston.

Plant, E. and Devine, P. (2003), ***The antecedents and implications of interracial anxiety*** in ***Personality and Psychology Bulletin 29***.

Prescod-Weinstein, C. (2017), ***Curiosity and the End of Discrimination***, in Nature Astronomy, 1-0145.

Push, M. (2004), ***Intercultural Training in historical perspective***, in D.Landis, J. Bennett and M. Bennett (eds), ***Handbook of Intercultural Training*** (3rd edn), Thousand Oaks, CA: Sage.

Reddel T. (2008). ***Reframing governance and service delivery by 'place and partnership': some ideas and lessons from Queensland. In Brotherhood of St Laurence and the Department of Planning and Community Development: Social Inclusion and Place Based Disadvantage Workshop***; 13 Jun. Fitzroy, Vic: The Brotherhood of St Laurence Research & Policy Centre.

Reid, W.V. et al (2006), ***Bridging Scales and knowledge Systems. Concepts and Applications in Ecosystem Assessment***, in Walter World Resources Institute.

Rodriguez, B. (1999). ***What is cultural competence?*** Chicago: Family Resource Coalition.

Rorie, J.; Paine, L. & Barger, M. (1996). ***Cultural competence in primary care services***. Journal of Nurse-Midwifery, 41(2), 92-100.

Rubin, L.B. (1995), ***Families on the Fault Line: America's Working Class Speaks About the Family, the Economy, Race, and Ethnicity***. New York, Harper Perennial.

Rutherford, G. (2017), ***Approval Given to Thirty Metre Telescope on sacred Mountain***, in the EcoWatch, 10 October 2017.

Ruggles, C.L.N. (2011b), ***Pushing back the frontiers or still running around the same circles? Interpretive archaeoastronomy thirty years on***, in Archaeoastronomy & Ethnoastronomy: building bridges between cultures, edited by C.L.N. Cambridge University Press.

Schein, E. (2004), ***Organizational Culture and Leadership,*** in Journal Transcultural Nursing, SAGE Journals, USA.

Shaw, S.J., (2005), ***The politics of recognition in culturally appropriate care.*** Medical Anthropology Quarterly 19:290–309, 2005.

Sherwood, J. et al (2011), ***Indigenous Studies: Teaching and Learning Together,*** in P. Purdie, G. Milgate & H.R. Bell (Eds), Melbourne: Australian Council for Educational Research.

Shweder, R.A. (2000), ***Moral Maps, 'First World' Conceits, and the New Evangelists***, in L.E. Harrison and S.P. Huntington (eds), ***Culture Matters***, New York: Basic Books, pp. 158-76.

Sillitoe, P. (2015), ***Indigenous Studies and Engaged Anthropology. The Collaborative Moment***, in Durham University, UK.

Simpson, L. (2012) ***Anishinaabe ways of knowing***. In J. Oakes, R. Riew, S. Koolage, L. Simpson, & N. Schuster (Eds.), *Aboriginal health, identity and resources* . Winnipeg: Native Studies Press, pp. 165-185.

Slawomir, M. (2005), ***Cross-Cultural Competence***, in Routledge, Canada and USA.

Smith, L.S. (1998). ***Concept analysis: Cultural competence***. Journal of Cultural Diversity, 5(1)-4-10.

Smith, L.T. (2012), ***Decolonizing Methodologies: Research and Indigenous Peoples***, New Zealand, Otago University Press, pp. 9-11.

Smith, L.T. (2012), ***Decolonizing Methodologies. Research and Indigenous Peoples***, in Otago University Press, NZ.

Srivastava (1996). ***Culture Care Framework: An approach to integrating culture into practice***. Unpublished report for access and equity initiative. Toronto: Wellesley Hospital.

Srivastava, R. (1960), ***The Healthcare Professional's Guide to Clinical Cultural Competence***, in Mosby, Canada.

Srivastava, R. (2016, in press). ***Understanding clinical cultural competence***. In J.A. Rummens & M-B. Beiser (Eds.). ***Navigation diversity: Immigration, ethnicity and health***. Toronto: University of Toronto Press.

Stanbridge, W.E., (1857), Proc. Phil. Inst. of Vic., Trans. 2, 137.

Stemwedel, J. (2015), ***The Thirty Meter telescope Reveals Ethical Challenges For the Astronomy Community***, in Forbes, 12 June 2015.

Stephan, C. and Stephan, W. (2003), ***Cognition and affect in cross-cultural relations***, in W.B. Gudykunst (ed.) ***Cross-Cultural and Intercultural Communication***. Thousand Oaks, CA: Sage.

Stephan, W., Diaz-Loving, R. and Duran, A. (2000) ***Integrated Threat theory and Intercultural attitudes: Mexico and the United States*** in Journal of Cross-Cultural Psychology 31.

Stephan, W., Stephan, C. and Gudykunst, W.B. (1999), ***Anxiety in intergroup relations: A comparison of anxiety/uncertainty management theory and integrated threat theory***, in International Journal of Intercultural Relations 23.

Sue, D.W. (2001). ***Multidimensional facets of cultural competence***. The Counseling Psychologist. 29(6), 790-821.

Suh, E. (2004), ***The Model of Cultural Competence Through an Evolutionary Concept Analysis***. Journal of Transcultural Nursing, 15(2), 93 -112pp.

Swanner, L. (2013), ***Mountains of Controversy: Narrative and the Making of Contested Landscapes in Postwar American Astronomy***. PhD dissertation, DEPT, Harvard University, USA.

Tayab, A. and Narushima, M. (2014), ***Here the Residents,*** Journal of Transcultural Nursing.

Taylor, J.S. (2003), ***The story catches you and you fall down: tragedy, ethnography, and 'cultural competence.'*** In Medical Anthropology Quarterly, 17, pp.159–181, 2003.

Taylor, K.P. (2011). Thompson SC: ***Closing the (service) gap: exploring partnerships between Aboriginal and mainstream health services***. Aust Health Rev, 35:297–308.

Thich, N.H. (1998), ***The heart of Buddha's Teaching***. Berkeley, CA: Parallex Press.

Ting-Tomey S. and Kurogi, A. (1998). ***Facework Competence in Intercultural Conflict: An updated face negotiation theory.*** In International Journal of Intercultural Relations, 22(2): 187-225, pp. 259.

Ting-Tomey, S. (2004), ***Translation conflict face-negotiation theory into practice*** in D. Landis, J. Bennett and - M.Bennett (eds) ***Handbook of Intercultural Training*** (3rd edn) (pp. 217-248). Thousand Oaks, CA: Sage.

Ting-Tomey, S. and Oetzel, J.G. (1999), ***Communicating Across Cultures***, New York: Guilford Press.

Ting-Tomey, S. and Oetzel, J.G. (2001), ***Managing Intercultural Conflict Effectively***, Thousand Oaks, CA: Sage.

Tingay, S. (2015), ***Unlocking the mystery of the first billion years of the universe***, in The Conversation, 18 February 2015.

Tingay, S. (7 July, 2015). ***Indigenous Culture and Astrophysics: a path to Reconciliation***, The Conversation

Troy, J. (2017), in Sydney's Cultural Competence course. University of Sydney. Coursera online courses.

Walker, R. et al (2014), ***Working Together: Aboriginal and Torres Strait Islanders Mental Health and Wellbeing Principles and Practice***. P. Dudgeon, H. Milroy & R. Walker (Eds), ***Cultural Competence-Transforming Policy, Services, Programs and Practice***. ACT, Australia: Department of the Prime Minister and Cabinet, Australian Government.

Walsh, M. (1991), ***Overview of Indigenous languages of Australia in Language in Australia,*** Edited by Suzanne Romaine, Cambridge University Press.

Wear, D. (2003). ***Insurgent multiculturalism: rethinking how and why we teach culture in Medicine education***. Academic Medicine. 78, 549-554.

Weaver, H. (2005). ***Explorations in cultural competence: journeys to the four directions***. Belmont, CA. Thomson Brook/Cole.

Wells, A.E. (1964), ***Skies of Arnhem Land***. Angus & Robertson, Sydney.

William, R. (1963), ***Keywords***, London: Fontana.

Williams, C. (2006). The epistemology of cultural competence. ***Families in society: the journal of contemporary social science***. 87(2), 209-220.

Wilson, R.A. (1997), ***Human Rights, Culture and Context: Anthropological Perspectives***, London: Pluto Press.

Winkelman, M. (2005). ***Cultural awareness, sensitivity & competence***. Peosta, Eddie Bowers Publishing Co, Inc.

Zaheer A., McEvily B., Perrone V. (1998). ***Does Trust Matter? Exploring the Effects of Interorganizational and Interpersonal Trust on Performance***. Organ Sci, 9:141–159.