Knowledge relativity: Carnarvon residents' and SKA personnel's conceptions of the SKA's scientific and development endeavours

by

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Abstract

Carnarvon, a small and isolated town in the Northern Cape, is the South African host-town of an international radio astronomy project, the Square Kilometre Array (SKA). The notion of pushing the boundaries of knowledge lies at the heart of this multibillion-rand, big-science project, but this desire stands in stark contrast to many Carnarvon residents' lived realities which are characterised by poverty, low levels of education and high levels of drug and alcohol misuse. The SKA justifies this massive expenditure through a specific development discourse that sees science and development to be in a causal relationship and promises that the SKA will benefit all of society. Most Carnarvon residents, however, are uncertain as to how the SKA will bring about *local* development as their understandings of what development entails differ from the science-development discourse that the SKA promotes.

Many black residents still suffer the consequences of a long history of land dispossession and racial oppression and struggle to make a living. For them, the SKA symbolised a beacon of hope when the Department of Science and Technology (DST) first announced in 2012 that Carnarvon will host the SKA as promises of job opportunities were made. But since then, the SKA has emerged as a controversial entity as it has not fulfilled residents' high expectations of "development". Furthermore, the SKA has also brought about major changes in this small town in a relatively short timespan which many residents did not expect nor accept.

These are the conditions that prompted my study of Carnarvon residents' and SKA personnel's conceptions of the SKA's scientific and development endeavours. Carnarvon was my main research site where I conducted interviews with residents to explore their conceptions of the SKA, as well as the role of their social context in this. I also interviewed a few SKA staff members to discern how their conceptions mesh with Carnarvon residents' conceptions. Through Pierre Bourdieu's concept of *habitus*, I explored not only how Carnarvon residents and SKA personnel conceived of the SKA, but also "where" they were coming from in their conceptions. Deep-seated power relations underlie Carnarvon residents' and SKA personnel's conflicting conceptions of the SKA's scientific and development endeavours. I consider these conflicting conceptions and unequal power relations in relation to Bourdieu's concepts of *habitus*, field, capital and *doxa*, together with assemblage thinking and Bruno Latour's notions of 'matters of fact' and 'matters of concern'.

Opsomming

Carnarvon, 'n klein en geïsoleerde dorpie in die Noord-Kaap, is die Suid-Afrikaanse gasheer-dorp van 'n internasionale radio astronomie projek, die Square Kilometre Array (SKA). Die idee om die grense van kennis te verskuif lê ten grondslag van hierdie multibiljoen-rand, groot-wetenskapsprojek, maar hierdie begeerte staan in 'n starre kontras met baie van Carnarvon se inwoners se beleefde realiteite wat gekenmerk word deur armoede, lae vlakke van opvoeding en hoë vlakke van dwelm en alkohol misbruik. Die SKA regverdig hierdie massiewe uitgawe deur 'n spesifieke ontwikkelingsdiskoers te propageer wat die wetenskap en ontwikkeling in 'n oorsaaklike verhouding teenoor mekaar stel en deur te belowe dat die SKA almal in die samelewing sal bevoordeel. Meeste van Carnarvon se inwoners is wel onseker oor presies hoe die SKA *plaaslike* ontwikkeling te weeg sal bring, aangesien hul verstaan van ontwikkeling verskil van die wetenskap-ontwikklingsdiskoers wat die SKA promoveer.

Baie swart inwoners ly steeds onder die gevolge van 'n lang geskiedenis van grondonteiening en rassige onderdrukking en sukkel om 'n bestaan te voer. Die SKA het vir baie inwoners 'n baken van hoop gesimboliseer toe die Departement van Wetenskap en Tegnologie (DWT) in 2012 Carnarvon as die gasheer-dorp van die SKA aangekondig het, aangesien beloftes van werksgeleenthede gemaak was. Sedertdien het die SKA ontpop as 'n kontroversiële entiteit aangesien dit nie aan inwoners se hoë verwagtinge voldoen het nie. Verder het die SKA ook groot veranderinge oor 'n relatiewe kort tydperk in hierdie klein dorpie te weeg gebring, wat baie inwoners onkant gevang het en nie aanvaar het nie.

Hierdie kondisies het aanleiding gegee tot my studie van Carnarvon-inwoners en SKA personeellede se opvattings van die SKA se wetenskaplike en ontwikkelingsondernemings. Ek het die meeste van my navorsing in Carnarvon uitgevoer waar ek onderhoude met inwoners gevoer het om hul opvattings oor die SKA te verken, asook die rol van hul sosiale kontekste daarin. Ek het ook onderhoude met SKA personeellede gevoer om te vas te stel hoe hul opvattings met betrekking tot die SKA in mekaar pas met dié van Carnarvon-inwoners s'n. Deur Pierre Bourdieu se konsep, *habitus*, het ek nie net Carnarvon inwoners en SKA personeellede se opvattings verken nie, maar ook "waar" hulle vandaan kom in hul opvattings. Diep gesetelde magsverhoudings is onderliggend aan Carnarvon-inwoners en SKA personeellede se botsende opvattings van die SKA se wetenskaplike en ontwikkelingsondernemings. Ek oorweeg hierdie botsende opvattings en ongelyke magsverhoudings in terme van Bourdieu se konsepte van *habitus*, *field*, kapitaal en *doxa*, tesame met *assemblage thinking* en Bruno Latour se begrippe, '*matters of fact*' en '*matters of concern*'.

Acknowledgements

Dedications

Leopold, thank you for encouraging me throughout the writing of this thesis and for taking care of the many things that sometimes fell through the cracks when things got hectic. Most of all, thank you for always growing with me.

To my dad, thank you for working as hard as you did so that Leana and I could go to university and for always making time for us.

To my mom, thank you for your love and support and for always showing interest in what this study was about.

Leana, thank you for being the best sister I could wish for and for showing me that a Master's can be done.

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AAA	Astronomy Advantage Area
ADIRC	African Data Intensive Research Cloud
AGA	Astronomy Geographic Advantage Area Act
AgriSA	South African agricultural industry association
ANC	African National Congress
ANT	Actor-network theory
DST	Department of Science and Technology
CKRF	Cosmopolitan Karoo Research Forum
CSIR	Council for Scienitific and Industrial Research
HCDP	Human Capacity Development Programme
IT	Information Technology
KAT-7	Karoo Array Telescope
LAP	Land Acquisition Programme
MeerKAT	*Meer* [More of] Karoo Array Telescope
NGO	Non-Governmental Organisation
NRF	National Research Foundation
PUS	Public Understanding of Science
RFI	Radio Frequency Interference
RMS	Rhenish Mission Society
SARChI	South African Research Chairs Initiaive
SALT	Southern African Large Telescope
SAAO	South African Astronomical Observatory
STS	Science and Technology Studies
SDGs	Sustainable Development Goals
SLESD	Sociology of Land Environment and Sustainable Development
SKA	Square Kilometre Array
SKA SA	Square Kilometre Array South Africa
TAC	Treatment Action Campaign
UN	United Nations

Chapter 1: Introduction

The Square Kilometre Array (SKA) is an international radio astronomy project that will be built in South Africa and Australia and is projected to extend into another eight African countries in phase two. It is being built on the back of a South African radio telescope array known as MeerKAT, which is located 90 km from the small Karoo-town of Carnarvon in the Northern Cape. (See Figure 1.1 below.) Once complete, the SKA will be the world's largest radio telescope, with unprecedented data processing abilities, and will open up extraordinary new opportunities for astronomers to explore the universe. Construction of phase one of the SKA is planned to start in 2018.

Its 'host' site, Carnarvon, has a population of around 6 600 people. Most people speak Afrikaans as their home language (96.2%) and are considered "coloured"[1] in terms of the old apartheid-era classificatory system (86.8%), with 7.6% counted as white and 4.8% as black (Statistics South Africa, 2011). Currently the town's economy revolves around sheep farming; as one resident said: '*Carnarvon se ekonomie loop op vier kloutjies*' [Carnarvon's economy walks on four trotters] (SKA Stakeholder's forum meeting, 2017). With widespread unemployment, low levels of formal education and high levels of alcohol abuse (Atkinson, Wolpe & Kotze, 2017:22-23), the local community's daily realities stand in stark contrast to a project that seeks to uncover the mysteries of the universe.

It is this contrast that has prompted my study. Its main focus is to understand what Carnarvon residents think about the science and development endeavours driving the SKA project and to see how well their understanding meshes with that of the project; this requires that I also explore how SKA personnel conceive of the SKA project. The SKA places considerable emphasis on "development" and promises to change not simply Carnarvon, but the whole world for the better. This has left Carnarvon residents with great expectations of "development" flowing from the project; however, my study confirms other findings (Van der Hoef, 2016; Wild, 2016; Walker & Chinigò, 2017), that many local people do not feel that the SKA is delivering on these promises. Contesting notions of the relevance of astronomy and the link between science and development underlie this issue. In this study therefore, I explore Carnarvon residents' and SKA personnel's different conceptions of the SKA's science and development endeavours. I do this through a qualitative research design in which I draw especially on Pierre Bourdieu's concept of *habitus* to understand their differing perspectives, as it sheds light on individuals' social contexts. I also work with assemblage thinking, which I find useful for

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[1] The term is still widely used by residents, for whom these categories have become normalised; I discuss the complexity of racial identities below.

understanding the SKA as a complex institution operating across different scales and shaped by both human and non-human entities.

In this introductory chapter I provide background on my study and research site. I first discuss the rationale and research questions for this study. I then give a brief overview of Carnarvon's history, with a particular focus on its history of land dispossession and racially unequal education under apartheid, which has shaped the persistent racial inequality and poverty in the town. I then provide background on the SKA by giving a brief account of what radio astronomy entails and the history of the SKA in South Africa. I end this chapter with an outline of the rest of this thesis.

Figure 1.1: A map of the Northern Cape showing Carnarvon and the SKA site, with its precursor MeerKAT.
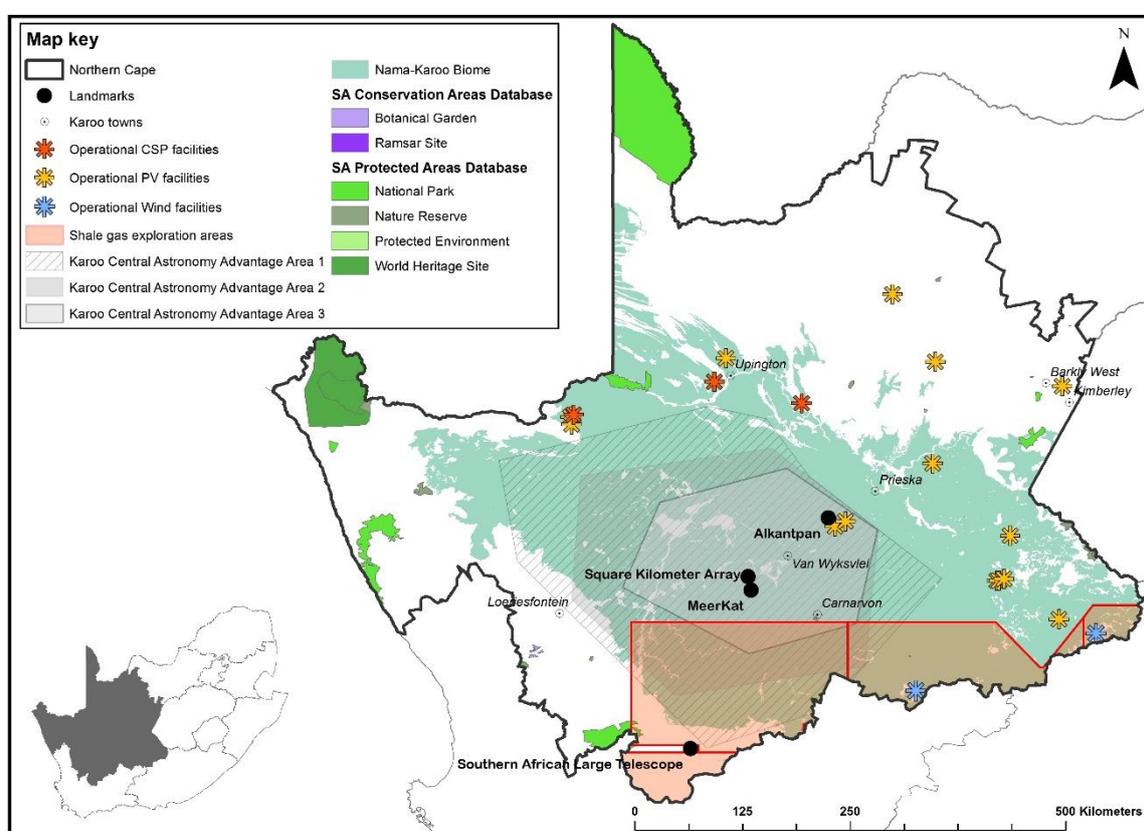
Source: SARChI Research Chair in the Sociology of Land, Environment and Sustainable Development, 2017.

1.1   Research rationale and research questions

The primary goal of the SKA globally is to answer some of the most fundamental questions in science, such as how did the universe form and evolve, and what is the nature of dark matter and dark energy (Square Kilometre Array Organisation, 2016). An important subsidiary goal for South Africa's Department of Science and Technology (DST) is to build national capacity in science, engineering and computer science (DST, 2015:23); the DST has also identified economic development on a local level

through local infrastructural development and business opportunities as an important spinoff but this, as is discussed further, has proved more elusive.

The questions driving the SKA project are not just fundamental scientific questions but also profoundly existential, as they relate to our very existence as a species and our place in the universe. The astronomical research that the SKA will enable has the potential to impact other fields of knowledge such as religion and philosophy and it can therefore be seen as a 'transformational science machine' (Braun, 2017). Nobel Prize-winning physicist, Steven Weinberg, has aptly pointed out how knowledge about the universe can impact philosophies of life:

> It is almost irresistible for humans to believe that we have some special relation to the universe, that human life is not just a more-or-less farcical outcome of a chain of accidents reaching back to the first three minutes, but that we were somehow built in from the beginning…. It is hard to realize that this all [i.e., life on Earth] is just a tiny part of an overwhelmingly hostile universe. It is even harder to realize that this present universe has evolved from an unspeakably unfamiliar early condition, and faces a future extinction of endless cold or intolerable heat. The more the universe seems comprehensible, the more it also seems pointless (Weinberg, 1993:154).

It is not the nihilism in Weinberg's statement that I find striking, but, rather, the way in which gaining new knowledge in the field of astronomy can profoundly impact people's worldviews. The impact may differ in intensity and focus. For some, it may leave them feeling that nothing really matters, while for others it may leave them with a sense of wonder and awe; yet others may say they could not care less.

When I visited Carnarvon in November 2016 for my first extended stay, I quickly discovered that my initial interest in residents' thoughts on the SKA's big science questions, such as the origins of the universe, revealed the unequal relationship between myself and my research participants. It was not only that my privileged position as a (white) postgraduate researcher empowered me to enter their space and ask them questions about their views on the origins of the universe, but that it also afforded me the space to ponder issues such as the place of humanity in the universe. Many Carnarvon residents have never had the luxury to ponder about the things that have interested me, nor had the opportunity to study science as a school and university subject.

The unequal relationship between myself and my research participants pointed me towards what I soon came to see as an even greater gap, and that is the one between Carnarvon residents and the SKA as a big science project. Whereas the SKA involves the spending of huge sums of money in the name of science, many people in Carnarvon do not have enough money to get by on a daily basis, and struggle to comprehend the science behind the huge expenditure on the SKA project that they are hearing about. However, what many residents were most concerned about was not what the SKA was

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about but whether, regardless of the nature of the project, it would uplift the community as the DST had promised, when it first informed the community in 2008 that Carnarvon might host the SKA.

This experience led me to refine my original research question, which was on local people's understandings of the origins of the Universe, and focus more on their understandings of the SKA as both a science and a development project. My main research questions thus focus on Carnarvon residents' conception of the SKA and can be summarised as follows:

- How do Carnarvon residents conceive of the SKA's scientific and development endeavours?
- Why do Carnarvon residents conceive of the SKA's scientific and development endeavours as they do?

While my primary interest is how Carnarvon residents conceive of the SKA, I have also interviewed a few SKA scientists and project staff to understand their perspectives and the extent to which this differs from that of Carnarvon residents. The supplementary research questions of this study therefore extend my research questions to core SKA personnel as follows:

- o How do SKA scientists and project staff conceive of the SKA's scientific and development endeavours?
- o Why do they conceive of the SKA's scientific and development endeavours as they do?

My underlying premise is that the very different social contexts of Carnarvon residents' and core SKA personnel play an integral role in how they conceive of the SKA's research and development endeavours. The implication of this is that I do not only want to know *how* residents and SKA staff conceive of the SKA, but also *why* they conceive of the SKA as they do. It is therefore critical that I understand their different contexts in order to answer my research questions. Here I have found Pierre Bourdieu's concept of *habitus* particularly helpful for thinking about research participants' contexts. (I explain this concept in detail from page 40 to 43.) Also thinking about the SKA in terms of assemblage thinking has helped me see how the SKA project operates across different scales and how power moves within this assemblage to push changes that are in accordance with the broader functioning of the SKA as a global assemblage.

1.2   Background: Carnarvon and the SKA

In this section, I first provide background on the history of Carnarvon and show how deeply entrenched the social divisions in the town are and how race and land are intertwined within this process. Thereafter, I provide some background on the SKA as a globally significant science project.

Here, in the spirit of interdisciplinarity, I briefly explain the underlying science behind radio astronomy and end with an account of the development of the SKA project in South Africa.

1.2.1 Carnarvon

Carnarvon's early history and the dispossession of land

Carnarvon's history is filled with stories of different groups of people competing for land, resources, basic rights, dignity and more. Rock paintings attest to the long presence of the earliest groups of Karoo people, the hunter-gatherer /Xam and the pastoralist Khoekhoe (although Adhikari, 2014:34, 36) shows the porous nature of these demarcations). These groups lived in relative harmony, but in the early colonial period fighting broke out once the *trekboers* (Dutch settler farmers) started moving northward from the Dutch East India Company settlement at Cape Town from the beginning of the eighteenth century. Adhikari (2014:3-4, 36) shows that the farming practices of the *trekboers* were diametrically opposed to the indigenous people's lifestyles and describes how the *trekboers* would seize land, resources and even the Khoekhoe's livestock. The Khoekhoe society rapidly disintegrated as a result of this disruption (Adhikari, 2014:36). Some 'resorted to hunter-gathering', others joined the /Xam in raiding the *trekboers'* stock and yet others 'became trusted servants' of farmers (Adhikari, 2014:36).

According to Penn (2005:20), resources such as grazing land and water became scarcer as a result of overgrazing and the drying up of water resources such as *vleis* (wetlands). This resulted in the dying out or migration of game which the /Xam had hunted for food, leading to their hunting the *trekboers'* livestock as a means of survival. According to De Wet Nel (Interview, 2016), a local historian and retired lawyer from Carnarvon, the *trekboers* would form commandos to 'search and destroy' the /Xam. '*As hulle hom gekry het dan het hulle hom geskiet*' [If they found him, they shot him]. The extreme drought of 1828 caused the /Xam to slaughter more of the trekboers' livestock, which led the colonial authorities to decide to establish a group of displaced Xhosa people from the colony's Eastern Frontier as a buffer between the *trekboers* and the /Xam.

This group was then allowed to move from the Fish River area to a spring near present-day Carnarvon, called Schietfontein (Potgieter, 1997:10). In 1839, this Xhosa group received 98 000 morgen[2] of land around Schietfontein from Sir George Napier, the British governor of the Cape, as a reward for their successes in maintaining peace between the /Xam and the *trekboers* (Nel, interview, 2016 and

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[2] 1 morgen = 0.8567 hectares

Anderson, 1985). This is the land on which present-day Carnarvon was established. After a series of attempts on the part of white settlers to take over the land of Schietfontein (Potgieter, 1997), colonial authorities announced in 1860 that the original 98 000 morgen that belonged to the Xhosas should be redistributed. The settlement some five kilometres away from Schietfontein (then called Harmsfontein[3]) was divided into an inner and outer commonage. The outer commonage was reserved for Xhosa farmers but the inner commonage was divided into 200 plots. Each plot included its own small piece of grazing land. 112 of these plots were allocated to Xhosas, 55 to *basters[4]*, one to the Rhenish Mission Society (RMS), with the remaining 32 to be sold at an auction, the proceeds of which were to go to the mission station (Anderson, 1985:120). In this time white farmers managed to secure rights to the surrounding crown lands.

Anderson (1985) notes that together with the redistribution of land the colonial authorities put stifling regulations in place that made it near impossible for the Xhosas and *Basters* to farm productively. If people could not meet these requirements they would lose their land. One of these requirements was that the Xhosa landowners on the outskirts of town had to fence their land to make it jackal-proof (Nel, interview, 2016). These requirements, along with regulations on herd size and the relatively small size of the allocated plots within the inner commonage, made it impossible to make a living. According to Nel (2016), 'Sheep farming is not very lucrative. You must own a very large farm to make a decent living.' Over time people became increasingly poor and were forced to sell their properties to white land owners. 'A domino-effect of Xhosa and "Bastaard" dispossession followed' (Christie, 2017:17).

After the establishment of the Union of South Africa in 1910, land regulations became more discriminatory. One of these regulations was the Carnarvon Outer Commonage Act of 1913, which saw the outer commonage, which had previously belonged to Xhosa people, divided up and sold. Through the dispossession of land that once belonged to black people, white settlers established themselves as successful commercial farmers. Commercial sheep farming has become the mainstay of Carnarvon's economy but has deepened social and economic divisions between black and white residents. In recent years commercial sheep farming has also become less labour-intensive, as a result of technological advances such as electrical fences, which minimise the need for (black) herders. This has led to even deeper divisions between white farmers and black residents. Pam Christie (2017:30) states that:

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[3] The town's name was changed to Carnarvon in 1874 in honour of the British colonial secretary, Lord Carnarvon (Welcome to Carnarvon, 2017).
[4] *Basters* was the name given to people from mixed race ancestry (Penn, 2005:22).

Generations of white ownership of farms erased the history of earlier ownership and even earlier occupation of the land by others, and supported a sense of justified Afrikaner emotional attachment to the land and the institutions of the town: its NG church, its school, and its municipality. Under white hegemony, the assumption was that others were entitled to be in the town, in their separate churches and schools, and in largely segregated residential areas.

Christie (2017:27) also shows how white residents sought to distinguish themselves from their black counterparts during the course of the twentieth century and how institutions such as the white NG church played a critical role in forging a distinctive Afrikaner identity. Under apartheid, racial divisions became crystallised as legislation was introduced to enforce and justify racial separatism.

Apartheid's racially discriminatory legislation and Carnarvon

The apartheid government passed a series of racially discriminatory laws such as the Population Registration Act of 1950 which required that all citizens must be classified as either Asian, native, coloured or white according to assumed racial characteristics. This classificatory system reflected a social hierarchy in which being characterised as white afforded one the most benefits and rights and people classified as 'native', later 'Bantu' and then 'black', were placed at the bottom. The racial hierarchy was in evidence before apartheid finalised it, with Christie (2017:29) describing how a Carnarvon man, Andries Boezak, registered all new-born black babies as "coloured" in the 1940s. Boezak's act was a means of mitigating the tension between Xhosa and coloured residents in the church and also because 'coloured people were accorded higher social status and potential access to [more] benefits than their "Bantu" counterparts' (Christie, 2017:29).

The Prohibition of Mixed Marriages Act (1949), which prohibited marriages or sexual relationships between white people and people of other racial groups, was another discriminatory law that affected lives in Carnarvon and elsewhere. According to Nel (2016), immorality cases were some of the most unpleasant cases that he had to deal with as a lawyer. In his interview with me he spoke of the enormous consequences that offenders faced during apartheid:

> *Hier was ook een boer wat aangekla was onder die Ontugwet. Ek het vir hom 'n advokaat gekry op Beaufort [Wes], maar dit was so 'n stigma gewees dat hy die plaas later verkoop het. Weg! Hy is uit sy vrou uit, uit sy kinders uit. Daai wetgewing was geweldig brutaal. En daar was nog meer… waar mense heeltemal sosiaal geostriseer is as gevolg daarvan. Hier was nog op Vanwyksvlei ook so hier en daar een en dan word hy uitgeskop deur die wit gemeenskap* (Nel, interview, 2016).

> [Here was a farmer who was also accused under the Immorality Act. I got him an advocate in Beaufort [West], but it was such a stigma that he later sold his farm. Gone! His wife left him, his children left him. That legislation was very brutal. And there were more... where people were

totally socially ostracised as a result. There were a few here and there in Vanwyksvlei too and then they were kicked out by the white community.][5]

Another discriminatory law was the Group Areas Act of 1950 which required racial groups to live separately from one another. In Carnarvon five families were displaced from their original homes as the area in which they lived was zoned as a white area (Christie, 2017:30). This Act also threatened the heritage of Carnarvon's coloured community, in that some of the first homes built in a coloured area (De Bult) were earmarked for demolition to establish a new white neighbourhood. The coloured community fought back fervently and came out victorious after a long struggle when, in 1992, as national negotiations started to introduce democracy in South Africa, the people of De Bult received individual title deeds to their properties (*A chance to restore their heritage*, 1998). Christie (2017:30) states that the Group Areas legislation was yet another episode among 'the rhythms of possession and dispossession, which, even small in scale, had historical resonance of serious weight'.

Religion and (un)equal education in Carnarvon

The Rhenish Mission Society (RMS) established the first church and school in Carnarvon in 1847. Both the church and the school accommodated all people regardless of race but the first public, i.e. state-supported, school was exclusively for white children. However, according to Kitshoff (1974, in Christie 2017:26) this school had an '*Engelse gees*' [English/British spirit] which was not acceptable to the Afrikaners. The minister of the NG church[6] saw the need for a school with a Dutch and religious emphasis and so established a free school that was more acceptable to the white people in town (Christie, 2017:26). The white school, however, 'fostered a particular Christian and language/cultural identity, even when schools were not officially CNE[7] schools' (Christie, 2017:27). In 1921, this school was extended to include a high school and in the following year 450 learners were enrolled (Christie, 2017:26).

Before the beginning of apartheid in 1948, most schools for children of colour continued to be run by missionary societies. In 1943, the RMS announced that their settlements in South Africa were no longer sustainable and proposed that their church and school become part of the NG church's mission, the *Sendingkerk* (Christie, 2017:27). The NG church agreed and the old Rhenish Mission Church became the NG *Sendingkerk*, later the Uniting Reformed Church (URC). According to Christie (2017:27), this transfer 'ushered in a new period for the [black/coloured] school, which continued its

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[5] All English excerpts from interviews that were conducted in Afrikaans were translated by myself.
[6] The NG church is the *Nederduitse Gereformeerde Kerk* [Dutch Reformed Church]
[7] CNE stands for Christian National Education

steady growth as a primary school'. The NG church granted a loan for a new school to be built, but unfortunately it burnt down in 1966 (Christie, 2017:27). After it was rebuilt, it became a state school for coloured children.

The white and coloured schools were amalgamated after the end of apartheid. For a while the schools were racially mixed, but, according to one of my informants, after an all-coloured school committee was chosen, white people began to send their children to other schools in the district or further afield (Liezel,[8] interview, 2017). Today white children who are not sent away to boarding schools in other towns are registered for home schooling and gather every day in a support centre in a private house (Christie, 2017:2). White and black/coloured children therefore rarely get a chance to interact as schools and churches continue to be racially segregated. It was also striking to me how few white children of school-going age I saw in Carnarvon during my field work.

The black and white churches have played very different roles in residents' lives. Whilst the white NG church played a significant role at fostering an Afrikaner nationalist identity during apartheid, the black NG church laid emphasis on social justice and equality. In the post-apartheid period the black NG church has made efforts to talk to the white NG church about the possibility of merging their churches, but social conservatism stifles any strides toward transformation. While religion is an important element of the *habitus* of both black and white Carnarvon residents, their different histories have inculcated different understandings of the role of religion and the church among residents, an issue I return to in Chapter 4.

Confronting the complexity of racial identity in contemporary Carnarvon

Apartheid has certainly left its mark on Carnarvon, as seen in the way its origins in a racially hybrid settlement have been obscured and its system of racial classification has become part of residents' frames of reference. Today, many residents refer to themselves as definitively either "white" or "coloured" or "black", although a racially mixed ancestry is common, such as in the case of Elsa:

> *Nee, kyk... my pa se familie, my oupa van pa se kant af... Hy kom van die, soos hulle nou daai tyd genoem het, toe word hulle nou die Khoisan of San. Nou my oupa kom uit daai geslag, hy is 'n suiwer, soos hulle nou noem, Khoisan. Hy is 'n suiwer Khoisan. My ouma van pa se kant af is so bietjie uitgebaster. Sy is so van swart mense afkomstig, ek weet nie of sy van Xhosas of Zulus afkomstig is nie, maar sy het 'n swart agtergrond ook. Maar sy is ook Khoisan, haar ma was 'n Khoisan vrou, maar haar pa was 'n swart man. Maar my oupa van pa se kant af is suiwer. Sy ma*

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[8] Names used to identify respondents are pseudonyms unless they are clearly speaking in an official capacity

was Khoisan, sy pa was Khoisan. So daarom neem ek aan ons is 'n suiwer nasie, want my oupa was 'n suiwer Khoisan nasie en my pa is 'n suiwer Khoisan nasie. My oupa, my ma se pa was weer 'n afkoms van Duits en sy vrou is ook Khoisan, so van my ma af kom 'n Duitse herkoms. Hulle was so b... die basters met die gladde hare, maar daai rooieriges. So daarom het sy die bloedlyn, sal ek sê, gebreek (Elsa, interview 2016).

[No, see... my father's family, my grandfather from my father's side… He is from the, like they called it back then, then they became the Khoisan or San. Now my grandfather comes from that generation, he is a pure, like they nowadays say, Khoisan. He is a pure Khoisan. My grandmother from my father's side is a bit hybrid. She comes from black people, I don't know if she comes from Xhosas or Zulus, but she has a black background too. But she is also Khoisan, her mother was a Khoisan woman, but her father was a black man. But my grandfather from dad's side is pure. His mother was Khoisan, his father was Khoisan. So therefore, I assume we're a pure Khoisan nation, because my grandfather was a pure Khoisan nation and my father is a pure Khoisan nation. My grandfather, my mother's father, had a German origin. My grandfather from mom's side he has a German origin and his wife was also Khoisan, so from my mother's side comes a German origin. She comes from… and her father is German so her bloodline is a German background. They were b… the basters with the smooth hair, but that reddish hair. So therefore, she broke the bloodline, I'll say.]

This complex family history is suggestive of the Karoo as a 'cosmopolitan' space (Walker, 2016; Potgieter, 1997:9) in which different groups of people have not only fought bitterly for land and resources but have also lived together, come to share the same religion and made families together. This complex history exemplifies how racial categories, such as "coloured", "African" and "white" are oversimplified and misleading in terms of the town's history. Yet these categories have become so entrenched and filled with meaning that they continue to inform people's understanding of themselves and others. Their use is therefore at once warranted and not warranted, as they reflect the history of racial segregation and apartheid in the town yet fail to reflect the complexity of social relationships in that history.[9]

In working through these issues, I have decided to use the generic term 'black' as far as possible to refer to people of colour in this thesis, rather than to privilege the apartheid-era distinctions among

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[9] This account does not do justice to the richness of Carnarvon's history. For a more detailed account, see Anderson (1985), Nel (2015) and Potgieter (1997). Penn (2005) and Adhikari (2014) provide more detailed accounts of the early history of the Great Karoo.

people who were not classified as white (i.e. coloured, Indian and African). In reaching this decision I have been encouraged by the comments made by Jeffrey, a black council member from Carnarvon who told me:

> *In Carnarvon sal jy sien is nie wesenlike swart mense soos wat jy sal verwys na as tradisionele swart mense soos jou Xhosa of jou Zulu nie. Ons is bruin mense. En ons verwys na die bruin mense as die swart mense* (Jeffrey, interview, 2016)*.*

> [In Carnarvon you'll see there are no true black people that you would refer to as traditional black people like your Xhosa or your Zulu. We are brown/coloured people. And we refer to the brown/coloured people as the black people.]

Carnarvon today

After the transition to democracy in 1994 the ANC won the first democratic municipal election in Carnarvon in 1995. This has tipped the political balance of power in Carnarvon away from the white community although not their hold on social and economic power. Many white residents still grieve this loss and the others that have followed. According to Christie (2017:3), they repeat the same 'mantra': 'First they took our municipality, then they took our school, and now they want our church'.

Memories of injustices and perceived injustices play a huge role in the racism and race thinking (and therefore racial segregation) that still plague the town. During my fieldwork, many residents spoke about how the town is still very racially segregated. Nicolas (2016 & 2017), Margaret (2016) and Liezel (2017) spoke about how transformation is still a far-fetched dream as institutional integration after the end of apartheid has had little effect on day-to-day social relationships in the community, because racial segregation and the unequal social hierarchy that this supports are so entrenched. Liezel (Interview, 2017) said:

> *Ek dink daar het baie dinge in Canrarvon self gebeur wat maak dat ons sit waar ons van dag sit. Dis nie so eenvoudig as om te sê, ja, maar ons bly nou in die nuwe Suid-Afrika en dinge werk nou anders nie*.

> [I think many things happened in Carnarvon itself that influenced where we are today. It's not as simple as saying we're living in the new South Africa and things work differently now.]

According to Atkinson *et al* account of the 'social fabric' of Karoo towns, there is 'practical co-operation across racial lines in government departments or private work places' (2017:23) to some extent. This is something that I also observed during my fieldwork; however, I did not come across many friendships between white and black residents and no romantic relationships between them either, which is indicative of the general superficiality of inter-race relations in comparison to same-

race relations. However, Atkinson *et al* state that joint action between racial groups is on the increase as people from different racial groups come to share social and economic projects and goals (2017:23). In terms of Carnarvon, the SKA has to some extent instigated co-operation between racial groups as residents came to realise that they can only assert themselves against the SKA's approach in dealing with them if they stand together; nevertheless, unequal racial relations are still very prevalent and are characterised by apartheid's racial hierarchy in terms of residents' social and economic status.

Atkinson *et al* (2017:22) also point to a 'fairly solid social base', as a general characteristic of Karoo towns. In Chapter 4, I will speak to how strong social networks act as a safety net for many residents who struggle to make a living. Another characteristic that Atkinson *et al* highlight is the importance of religion (2017:23), another theme I address in Chapter 4. In my fieldwork, I did not come across a single non-religious resident. All residents with whom I spoke were Christians and most residents viewed their Christianity as an important aspect of their identity. White and black residents did, however, speak in different ways about Christianity: whereas black residents spoke about Christianity in terms of their relations to others, white residents spoke in more personal terms of their religion.

Atkinson *et al* furthermore speak of the social issues that many Karoo towns face. They mention low levels of education, widespread poverty and serious alcohol and drug problems as the most pressing issues (2017:23). These issues are also found in Carnarvon. In the Kareeberg district, 16.7% of people above 20 have no schooling, whilst 81.1% of people above 20 do not have matric (Statistics South Africa, 2011). Drug and alcohol abuse is also rife in Carnarvon. Atkinson *et al* (2017:23) do, however, state that Karoo towns have lower levels of serious crime compared to many urban centres. Many residents with whom I spoke corroborated this and said that they experience the town as generally a safe place.

Although there are many social issues that plague the town, the stable social relations Atkinson *et al* talk of play a huge role in residents' experience that 'there isn't a better place to stay' (Aletta, 2016). Residents also displayed a strong connection to the town's natural environment. I will speak more to these matters in Chapter 4 when I address Carnarvon residents' *habitus*, as the town's history and social circumstances shape "where" Carnarvon residents are coming from in their conceptions of the SKA's science and development endeavours.

1.2.2   Background of the SKA

What is the SKA?

When completed the SKA will be a next-generation radio observatory that will consist of many radio dishes, hence the term 'array' in the name. The combined surface area of these dishes is projected to

make up about one square kilometre (SKA SA, 2017a). South Africa, together with eight other African countries (Botswana, Ghana, Kenya, Madagascar, Mauritius, Mozambique, Namibia and Zambia) and Australia, will host the SKA (Square Kilometre Array Organisation, 2016). The Australian radio dishes will pick up low radio frequencies, whilst the African dishes will pick up middle and high radio frequencies. Phase one is set to commence in 2018. During this phase, 133 radio dishes will be constructed on the project's core site near Carnarvon. It will incorporate the 64 radio dishes of its precursor, MeerKAT, which is nearing completion on this site (SKA SA, 2017). (See Figure 1.2 below.)

SKA phase one in South Africa will therefore consist of a total of 197 radio dishes spread over a baseline of up to 150 kilometres (SKA SA, 2017). This site consists of a condensed 'core' zone, where the radio dishes are fairly close to one another, and three spirals of less concentrated dishes that will protrude from the core. (See Figure 1.3 below.) Construction of phase two is set to commence in 2023 Phase two will entail the construction of radio dishes in the eight African partner countries. The entire SKA project is planned to consist of some 3 000 radio dishes (SKA, 2017).

Figure 1.2: A MeerKAT dish at the SKA core site outside Carnarvon

Source: SKA SA, http://www.ska.ac.za/gallery/meerkat/

Figure 1.3: Map showing the core site and three spirals of SKA SA phase 1

Figure 1-1: Karoo Central Astronomy Advantage Areas
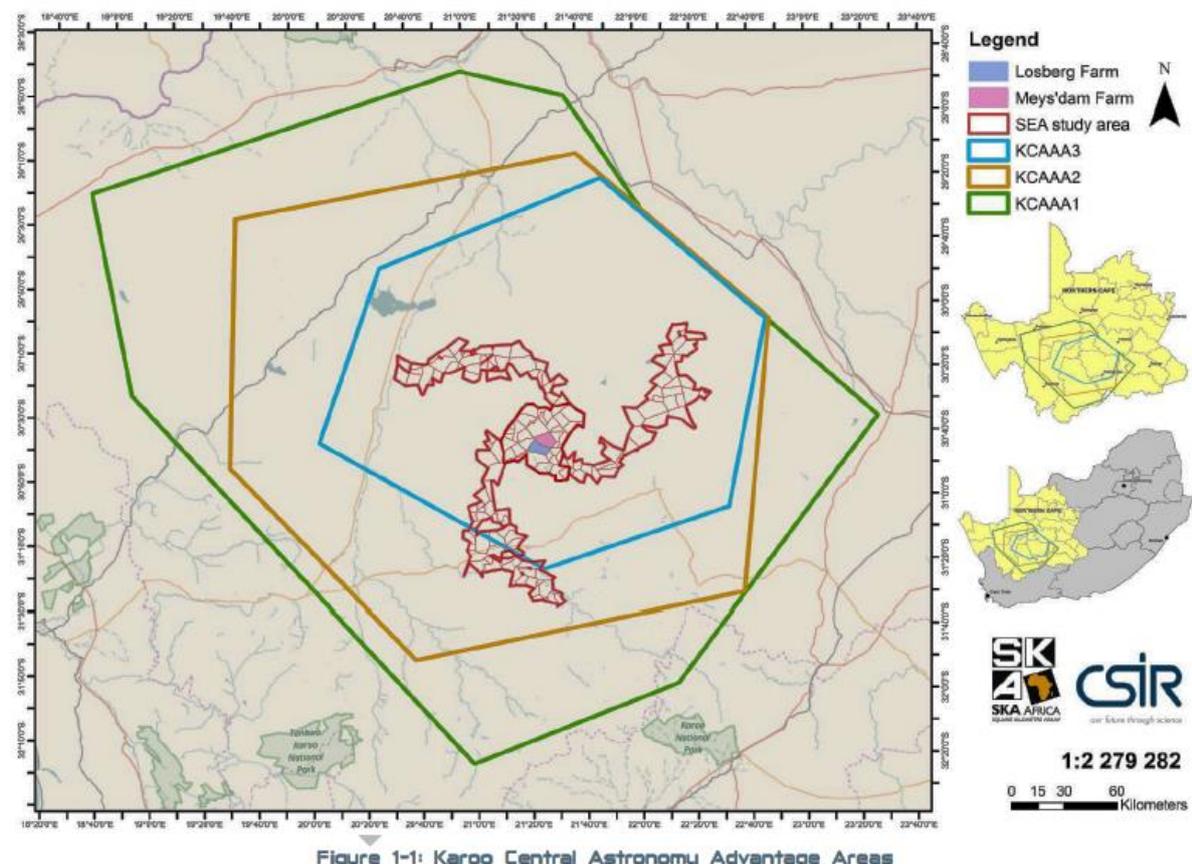
Source: CSIR,2016:4.

This is truly a pioneering project as scientists are uncertain of the full extent of what they may learn about the universe through it. SKA South Africa's website does, however, list a few research interests, including understanding 'how stars and galaxies are formed, and how they evolved over time', as well as perhaps detecting 'life elsewhere in the Universe' and obtaining 'a better understanding of dark energy and dark matter' (SKA SA, 2017).

What is radio astronomy?

Radio astronomy differs from optical astronomy in ways that impact significantly on its site requirements and other land uses, hence its overall impact on its local environment. Whereas optical astronomy works with visible light on the electromagnetic spectrum to look at space, radio astronomy or radio interferometry uses radio waves. Interferometry refers to a special technique to gather information from electromagnetic waves whereby the phenomenon of wave interference (where electromagnetic waves can either get amplified or cancelled out by one another) is used (Interferometry explained, 2017). Things like radio galaxies that would otherwise be undetectable

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through optical interferometry become detectable through radio interferometry (Garret, 2007). Figure 1.4 below shows the electromagnetic spectrum and which electromagnetic wavelengths can enter the Earth's atmosphere.

Figure 1.4: The electromagnetic spectrum.

Source: Rice University, http://cnx.org/contents/jr8IjSNO@3/The-Electromagnetic-Spectrum
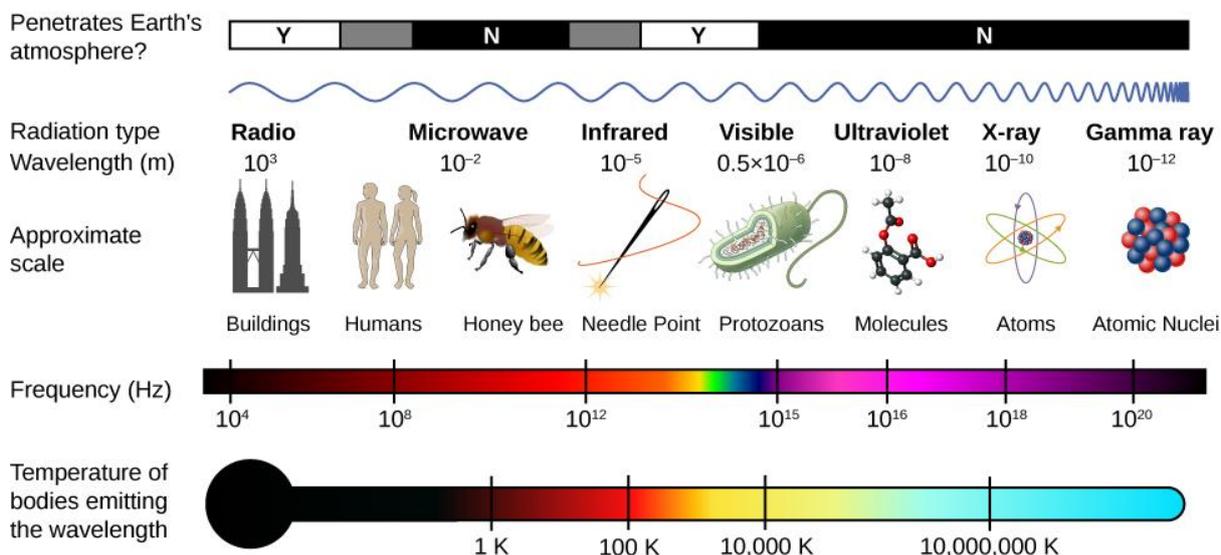
According to the SKA Organisation's official website (2017):

> Radio telescopes are significantly more sensitive than conventional radios and detect the very weak radio signals from outer space which are processed by computers to form images of the Universe. A radio telescope is made up of an antenna, receiver and processing back-end (or data recorder). By building large antennas with sophisticated receivers incorporating amplifiers, the weak cosmic signal is detected and amplified. If they are spread over a large area, the array will have very good resolution, i.e. it will be able to distinguish very fine details in the objects it observes.

For a radio telescope to pick up these cosmic signals (radio waves), there must be little to no radio frequency interference (RFI). Things like mobile phones, microwaves and even electrical sparks can emit electromagnetic waves with a frequency that can interfere with the cosmic signals that the SKA dishes are designed to pick up. The SKA project thus requires a radio-quiet area around the core zone and the dishes in the three spiral arms, to protect the dishes from any damage that RFI may cause. As discussed further below, this has major implications for the people living in close proximity to the core site, which was identified by experts as the perfect site for the SKA, in part because it was deemed to be a very radio-quiet area (SKA SA, 2017). Other factors in its favour were its altitude and the atmosphere's dryness (Square Kilometre Array, 2017). The SKA core site is protected under the

Astronomy Geographic Advantage Area Act of 2007, which provides 'for the preservation and protection of areas within the Republic that are uniquely suited for optical and radio astronomy' (South Africa, 2008:2). In 2010, it was also announced as a national key point (About government - programmes Square Kilometre Array, 2017).

History of the SKA in South Africa

According to the SKA Organisation's official website (2017) the SKA started in 1993 when the International Union of Radio Science (URSI) established a working group to develop 'scientific goals and technical specifications for a next-generation radio observatory'. Today there are ten member countries that form part of the SKA Organisation and work together to realise its goals (Square Kilometre Array Organisation, 2017). The establishment of the SKA Organisation coincided with the shift to democracy in South Africa. According to Gastrow (2014:82-83), countries in the southern hemisphere have a geographical advantage for astronomy as they have a better view of our galaxy, the Milky Way. The newly elected government was quick to capitalise on this and to promote South Africa as an astronomy destination. The establishment of the Southern African Large Telescope (SALT) in 2005 marked South Africa's first step as a democratic country toward this goal.

Gottschalk (2005:33) states that the ANC government spent more money on astronomy in its first decade of rule than previous governments from 1910-1990 combined. He also suggested that investing in astronomy was a strategic move on behalf of the ANC government, driven by a desire to enhance 'national prestige, the dignity of the continent of Africa and Black dignity'. This perspective has been endorsed by later commentators. In 2009 Whitelock, quoting from the Department of Arts, Culture, Science and Technology *White Paper* of 1996, pointed to the significance of the drive to prove South Africa's competence:

> Scientific endeavour is not purely utilitarian in its objectives and has important associated cultural and social values. It is important to maintain a basic science competence in 'flagship' sciences such as physics and astronomy for cultural reasons. Not to offer them would be to take a negative view of our future - the view that we are a second-class nation, chained forever to the treadmill of feeding and clothing ourselves (2009:590).

According to Gastrow (2014:83), investment in astronomy projects a favourable image, one of 'modernity, international standing and validation for African scientific and intellectual capabilities'. Most recently Dr Bernie Fanaroff, the former director of SKA SA who played a key role in securing the South African bid, has corroborated this view, arguing that the SKA provides the perfect opportunity for South Africa to prove its scientific and engineering competence on an international level (Fanaroff, 2017).

In 2003, South Africa put in a bid to host the SKA. In support of the bid the South African Parliament passed the Astronomy Geographic Advantage Act (AGA) in 2007 (About government - programmes, 2017). In terms of this Act, the entire Northern Cape Province, with the exception of the Sol Plaatje Municipality (Kimberley) has been declared as an astronomy advantage area (AAA) with strict regulations on radio frequency interference (SKA SA, 2017). On 25 May 2012, the SKA Organisation announced that South Africa and Australia would share the hosting of the SKA. According to the SKA Site Advisory Committee (SSAC), South Africa, with its African partner countries, was deemed a more appealing choice in terms of 'technical, scientific and other factors […] as well as the African implementation plans and cost factors', but the decision was made to share the project with Australia in the spirit of inclusivity and cooperation (About government - programmes Square Kilometre Array, 2017).

In 2005 the South African government launched a Human Capacity Development Programme (HCDP) in light of the possibility of the country being chosen to host the SKA and the clear need for greatly enhanced capacity in astronomy and engineering that such a project would require (Atkinson *et al*, 2017:39). This investment in national capacity is widely heralded as being very successful. According to the SKA website:

> To date, the [HCDP] has supported more than 830 postdoctoral fellows, postgraduate and undergraduate students doing science and engineering degrees and research at universities, and universities of technology, and to FET [Further Education and Training] students training to be artisans. In addition, the project is supporting six research chairs at South African universities (SKA SA).

However, while the South African government has focused on boosting skills in mathematics, physics and engineering at the tertiary level, its attention to promoting these skills at school level has been much less impressive. Commentators Wild & Nordling (2016) point out that instead of boosting capacity in these subjects in the national secondary school system, the government has instead chosen to lower the percentage needed to pass mathematics and physics to just 30%. This might prompt more learners to take these subjects (which are generally seen as simultaneously difficult and prestigious), as it has become easier to pass them; however, while the lowered passing level may make the pass rate look much better than in previous years, it renders a pass in these subjects as effectively meaningless in terms of skill levels required to pursue a career in engineering, computing and astronomy.

The SKA's Land Acquisition Programme (LAP)

The SKA's land acquisition process for SKA phase one has been a difficult one. The AGA was set in place to ensure that land would be available for the SKA project. The AGA contains strict regulations to protect any Astronomy Advantage Area (AAA) against RFI. It also facilitates the buying of any land within the Karoo Central Astronomy Advantage Area and ensures that land may be expropriated if no agreement can be reached with land owners. According to the SKA SA Manager of Land and Institutional Management, 'expropriation will only be considered in extreme cases if all other efforts to come to an agreement with the property owner have been exhausted' (SKA, 2016:4).

In 2008 the government bought two farms, Losberg and Meysdam (totalling 14 000 hectares), to build an array of seven radio dishes, namely KAT-7, to prove South Africa's scientific and engineering competence. These two farms also became the site of MeerKAT, which SKA phase one will incorporate. The SKA claims that they initially thought that these two land parcels would be enough land for SKA phase one and that sheep farming could continue on the surrounding farms. However, at the end of 2015 the SKA announced that it would need to acquire a further 36 farms or 117 676 hectares as they had discovered that 'human activity' causes RFI which could damage the radio dishes (Kahn, 2015). Thereafter the SKA entered into negotiations with the 22 owners of the 36 land parcels, buying 32 of the land parcels and making 'alternative arrangements with 4 owners on a total area of 10 415 hectares' (Kirsten, 2016:iii).

The buy-out of 32 farms in the region was a sensitive topic of discussion throughout my fieldwork as residents felt cheated. Many Carnarvon residents are concerned that the loss of productive farming land may impact the local economy negatively as so many people are dependent in one way or another on commercial agriculture (around 48% of the local population of the Kareeberg district, according to one calculation) (Atkinson *et al*, 2017:27). The buy-out of the 32 farms does not only jeopardise the future of farm workers and their dependents, but also workers at the local abattoir. Farmers surrounding the SKA core site have also expressed concern over a possible increase in predators on the SKA's core site and the possible effect of livestock losses (Atkinson *et al*, 2017:28). Black residents whose families experienced land losses in the past and would like to claim back their land are concerned that their land claims will be rendered meaningless since the government has practically signed over the whole Northern Cape to astronomy by passing the AGA. What emerged through my fieldwork is that residents do not trust the SKA when it says that it has acquired all the land it needs, as they have said that in the past and then announced later that they needed extra land after all. Furthermore, the SKA has not met residents' expectations in terms of alternative job provision and opportunities for economic growth. Residents' foremost concern, however, was about the SKA's

approach in dealing with them, with many Carnarvon people feeling they have never been fully informed of the impact the SKA would have on their local environment.

Local development commitments

Carnarvon residents first heard about the Department of Science and Technology's (DST) plan to host the SKA near Carnarvon in 2008, five years after the bid to host the SKA had been submitted (Wild, 2016). According to Wild (2016), the DST painted a very positive picture to the community, with promises of job opportunities, local development projects and improved opportunities for students in the fields of maths and science. The SKA has identified five focus areas for improving the surrounding towns, namely: 'investing in the youth, supporting community upliftment programmes, developing small to medium enterprises, nurturing learners' talent, and ensuring that communication connectivity is not compromised' (SKA, 2016:1).

SKA South Africa's official website (2017) claims that they have created over 1 000 jobs through infrastructure upgrades and construction on and around the SKA SA site and ensured that a minimum of 14% of the overall contract value of SKA construction projects 'should include participation from local contractors' (SKA, 2016:4). The SKA also claims it has boosted the local economy through a salary injection of R 9.46 million in 2015 and R 8.45 million in 2016, as well as through expenditure at local suppliers (Atkinson *et al*, 2017:64). According to Atkinson *et al* (2017:64), a total of R 15.2 million was spent in 2015 and R 52.3 million in 2016. Since 2011, the SKA SA has also awarded 40 bursaries to deserving students from Carnarvon and surrounding towns to enrol at the high school in Carnarvon as part of their Human Capital Development Programme. At the end of 2016, four matriculants from Carnarvon received bursaries to further their studies in the fields of computer science and physics at tertiary institutions (SKA SA, 2017). In cooperation with the NGO Teach SA, the SKA SA has also provided the high school with a mathematics and science teacher and, in partnership with another NGO, has opened a computer centre in Carnarvon where people can learn how to use computers and the internet (SKA SA, 2017).

In these ways, the SKA has attempted to meet its commitments to uplift Carnarvon and other surrounding towns as part of the investment in astronomy. The rollout of these initiatives on the ground has, however, not been smooth and both my and other studies have found that local perceptions of the value and success of these initiatives are far from uniformly positive. Thus, Van der Hoef (2016) found that the Computer Centre was not functioning properly for long stretches of time in 2015/16 and that technical support from the SKA to fix hardware problems as they arose was lacking. Wild (2016) also stated that one of the SKA's main challenges in its relationship with the communities in the small towns surrounding the SKA was managing expectations, as the project's

social objectives were never clearly quantified from the start. As a result, many local residents were complaining that they did not know what to expect from the SKA any more and perceived its representatives to be dishonest.

I will speak to these exclusionary experiences as well as possible reasons behind them in my discussion of my research findings. It seems that Carnarvon residents' initial enthusiasm about the SKA, at least until early 2016 when they heard that the SKA will have a much greater impact than expected, was directed at the promises of jobs and local development and was never about possible scientific discoveries - an important issue that I return to in Chapters 4 and 5.

1.3   Chapter outline

In the next chapter, on my research design, I lay out the conceptual framework for this study and discuss my research methodology. In Chapter 3 I review relevant literature in the fields of science and technology studies, the 'public understanding of science', science communication, and the sociology of knowledge, focusing in particular on issues and debates that are relevant to the case of the SKA in Carnarvon. In Chapter 4 I deploy the concept of *habitus* to discuss from "where" Carnarvon residents' and SKA personnel approach the SKA as a big science project and how they conceive of its science endeavours. In the last chapter, I turn to their very different conceptions of the SKA's development commitments among Carnarvon residents and SKA personnel, paying special attention to the SKA's development discourse and its implications. In this chapter I also conclude my study by reflecting on my findings.

Chapter 2: Research Design: Conceptual Framework and Research Methodology

The theories that I use for this study have certain implications for my research design. I have therefore combined my discussion of my conceptual framework and my research methodology into a single chapter.

In what follows, I first review the theories that have shaped my conceptual framework, as they have been central to my choice of research methodology and my interpretation of the data that I have collected. These theories - assemblage thinking, actor-network theory and Bourdieu's concept of *habitus* - all heed the importance of context and complement one another in unexpected ways. I begin in section one with a discussion of assemblage thinking and actor-network theory and then compare the two, as there are some important similarities and contrasts between these theories that are important for thinking about 'the politics of things'. Thereafter I discuss Latour's conception of *dingpolitik* before turning to Bourdieu's concepts of field, capital and *doxa*, followed by a more in-depth discussion of his concept of *habitus*. In section two I discuss my research methodology and its link to the theories with which I have worked. This section includes a discussion of my various research trips to Carnarvon. I end this chapter with a discussion of research ethics and the ethical challenges raised by this study.

2.1   Conceptual framework

'The subjective horizon and knowledge of all social agents is said to be shaped by their practical involvement in a specific part of the social world, such that all agents, including social scientists, must see the world from "somewhere"' (Crossley, 2001:93). This idea captures the underlying premise of this study: that individuals' social contexts influence the way they view the world around them. To understand Carnarvon residents' views of the SKA on the one hand and SKA personnel's views on the other, I need to understand from "where" they are seeing it. This has led me to engage with social theories that are particularly sensitive to context, such as Pierre Bourdieu's ideas around *habitus*.

I have also considered it necessary to engage with theories that recognise the role of both human and non-human entities in shaping the power relations between the SKA as a big science project and Carnarvon residents. Here I have found assemblage thinking particularly helpful for thinking through the complexity of the interrelatedness of human and non-human entities. I also found Bruno Latour's conception of the politics of things (*dingpolitik*) useful in understanding how certain things (or in the case of this study, certain discourses) can become objects of contestation (i.e. political).

2.1.1   Assemblage thinking

Assemblage thinking is concerned with the way the social world is concretely assembled through human and non-human entities. It starts from a point of 'ontological equality' which means that it makes no assumptions as to which entities are dominant within an assemblage (Müller, 2015:85). Power emerges through the connections that entities within an assemblage form. Deleuze and Parnet (1987:69) describes an assemblage as:

> a multiplicity which is made up of many heterogeneous terms and which establishes liaisons, relations between them across ages, sexes and reigns - different natures. Thus, the assemblage's only unity is that of co-functioning: it is a symbiosis, a 'sympathy'. It is never filiations which are important but alliances, alloys; these are not successions, lines of descent, but contagions, epidemics, the wind.

This description may seem vague, but comparing assemblages to something like the wind exactly emphasises the contingent and complex nature of assemblages. This quote also highlights the importance of relations within assemblages, as it is only through relations that assemblages hold together.

Key to assemblage thinking is the notion of what are termed relations of exteriority. As the term implies, relations of exteriority mean that the relations between different entities within an assemblage are external to the entities themselves and are not connected to their very being. In the case of the SKA, it could for instance mean that astronomers are not defined simply by their relationships to other entities within the assemblage. The implication of this is that entities' relations do not determine their being or the assemblage's being. Another implication is that assemblages are not equal to the sum of the *relations* within it, as each entity brings something more to the assemblage, that does not necessarily figure in the relations that they form (DeLanda, 2006:10-11). According to DeLanda (2006:11), 'relations do not have as their cause the properties of the [component parts] between which they are established.'

Martin Müller (2015) has identified five important features of assemblages. Firstly, assemblages are heterogeneous. This means that anything can form part of an assemblage, be it humans, animals, things or ideas, whilst there 'are no assumptions as to what is the dominant entity in an assemblage'. In terms of thinking about the SKA as a complex assemblage, it is clearly heterogeneous as many very different kinds of entities form part of it - for instance, people, land, God, jackals, radio receivers, money, etc. - none of which should be regarded as *a priori* the dominant entity. This points to the emergent nature of power in assemblages.

Secondly, assemblages are relational, meaning that they are formed out of entities that stand in relation to others (Müller, 2015:28). As already mentioned, these are called 'relations of exteriority', as entities' existence does not depend on their relations to other entities within the assemblage (DeLanda, 2006:10). Each component within the SKA as a global assemblage (people, land, radio receivers, etc.) thus has its own autonomous existence and unique qualities, and can be 'plugged in' (DeLanda, 2006:10-11) and out of the assemblage.

Thirdly, assemblages are productive (Müller, 2015:29). What is meant by this is that assemblages 'produce new territorial organisations, new behaviours, new expressions, new actors and new realities' (Müller, 2015:29). In terms of the SKA as an assemblage, it is clear that it has produced new relationships between countries as well as new capacities within South Africa, and for many people in Carnarvon, it has certainly produced 'new realities'.

Fourthly, and related to this last point, Müller identifies 'reterritorialisation' and 'deterritorialisation' as related features of assemblages. According to Bureš (2015:18), entities within assemblages can sometimes play stabilising or destabilising roles and for Deleuze these two roles go hand in hand with the features of territorialisation and deterritorialisation. An entity like the Astronomy Geographic Advantage Act (2007), for instance, which I discussed in the introductory chapter, can be seen to be playing both a stabilising and a destabilising role in the Karoo. Its stabilising role with regard to territorialisation is seen in the way it has led to most of the Northern Cape province being designated by the central state as an Astronomy Advantage Area (AAA), with potentially significant consequences in terms of state regulatory powers over land use. Its destabilising role is seen in the way the Act has enabled the state's acquisition of farms in the Carnarvon area for the SKA project, with the consequent displacement of farmers from their farms and, possibly, the district, and likely job losses in the local abattoir as fewer sheep will be raised for the local meat industry in the district.

Lastly, Müller (2015:29) identifies 'desire' as the fifth feature of assemblages. According to Müller and Schurr (2016:224) desire, wish or affect 'becomes together with the assemblage, not as the result of it'; it is what 'makes assemblages coalesce together'. Müller and Schurr (2016:224) point out that although Deleuze and Guattari see desire 'as manifested in a distributed arrangement', the idea of desire in assemblages is no longer applicable without humans. It thus seems that this feature implies an emotional component. According to Müller (2015:36) 'One could even argue that affect and emotion are the *tertium quid* of the social and the material, making the socio-material hold together or fall apart'. In the case of the SKA, it is the desire to attain more knowledge of the universe and to position South Africa as a leader in global science that first forms and then holds together the relations between humans (astronomers and engineers) and machines (radio receivers, computers, etc.).

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2.1.2   Actor-network theory (ANT)

According to its proponents, first and foremost ANT should be seen not as a theory of 'the social', but, rather, as a sociological approach that has the potential to 'reassemble the social' through its only accessible parts, i.e. relations between actors. ANT theorist Bruno Latour warns against privileging 'the social' in these relationships as this assumption leads to explanations of phenomena *through* the social, in explanations that privilege social ties, social forces or socialisation (Latour, 2005a:63). Latour also warns against the imposition of boundaries. According to him:

> While we are well aware that the first feature of the social world is this constant tracing of boundaries by people over some other people, sociologists of the social consider that the main feature of this world is to recognize, independently of who is tracing them and with what sort of tools, the unquestionable existence of boundaries (Latour, 2005a:28).

Latour (2005a:13) promulgates a different sociology, namely a sociology of associations, in order to side-step what he regards as the fallacious thinking behind the sociology of the social. According to him, sociologists of associations 'take as the major puzzle to be solved what [sociologists of the social] take as its solution, namely the existence of specific social ties revealing the hidden presence of some specific social forces' (Latour, 2005a:5). He contrasts the way in which the respective sociologies understand the word 'social'. For him, the idea of 'associations' is closer to the original meaning of 'social', a term which is derived from the root *sequi* (meaning 'to follow'); hence the name of his proposed sociology:

> …it is possible to remain faithful to the original intuitions of the social sciences by redefining sociology not as the 'science of the social', but as the tracing of associations. In this meaning of the adjective, social does not designate a thing among other things, like a black sheep among other white sheep, but a type of connection between things that are not themselves social (Latour, 2005a:5).

The task of sociologists of associations is therefore to describe those associations among actors which form a network. This forms the basis of ANT as an approach to research. Latour (2005a:61) asserts that sociologists should 'follow the actors themselves' and not assume the dominance of any actors. Furthermore, these actors can be either human or non-human (Latour, 2005a:10). In the end, the goal of ANT is not to disassemble 'the social' into its various associations, but, rather, to reassemble it through the only bits and pieces accessible to sociologists, which is the associations among actors.

Compared to the sociology of the social, Latour's proposition is radical. He asserts that the sociology of associations must be completely relativist to keep up with the actors:

"We won't try to discipline you, to make you fit into our categories; we will let you deploy your

own worlds, and only later will we ask you to explain how you came about settling them." The

task of defining and ordering the social should be left to the actors themselves, not taken up by

the analyst (Latour, 2005a:23).

2.1.3   Comparing ANT and assemblage thinking

Müller (2015) has identified some important similarities between ANT and assemblage thinking. According to him, ANT, like assemblage thinking, is *heterogeneous* as it acknowledges both human and non-human actors. ANT is also *productive*, 'conceiv[ing] of relations of human and non-human entities as *producing* new actors and new ways of acting' (Müller, 2015). ANT also emphasises the ontological equality between all entities: 'For ANT, all entities - whether it is atoms or governments - stand on equal ontological footing to begin with' (Müller, 2015). According to Müller (2015:), it is the associations that become established between entities that influence 'whether one becomes more powerful than the other' and not intrinsic qualities that inherently make some entities more powerful than others. Furthermore, ANT also recognise the contingency of relations among the socio-material: 'There is no social order. Rather, there are endless attempts at ordering' (Law, 1994:101).

Although there are many criticisms of ANT, for instance that ANT does not take social context into account (as it only focuses on associations between actors), Müller (2015:30 & 31) argues that ANT has a more 'concrete conceptual apparatus' and a clearer relationship to politics than the more philosophical assemblage thinking. According to Müller (2015:31) assemblage theory acknowledges that certain entities can be politically significant through their intrinsic properties; in that way, it differs from ANT that only sees things as political through associations. But things can only *become* political if human entities ascribe value to the properties of such entities. Although it may seem that certain entities are intrinsically valuable, it is only because human entities view their properties as valuable in the first place (through associations with those entities) that they appear to be intrinsically valuable. It thus seems that associations and specifically *human* associations are integral to what is political. Here Bourdieu's concepts of field, capital and *doxa* are useful for understanding exactly what 'becomes political', an issue I return to in section 2.1.4 below.

Barry (2001:6,201) describes politics as 'the ways in which artefacts, activities or practices *become* objects of contestation' (emphasis added). ANT's exclusive focus on associations between entities is a positive point when it comes to understanding politics as it shows that things *become* or *emerge* as political through their *associations.* With regards to Carnarvon residents and the SKA, there is little to no agreement on the intrinsic meaning and the value of key entities at stake in the disputes between them, such as land and astronomy. Carnarvon residents and the SKA global assemblage ascribe

different values to the same things. On some issues both sides view the same thing, for instance land, as valuable, but in completely different ways while in other cases one side views something as valuable which the other side does not see as valuable at all, as with astronomy as a human endeavour.

2.1.4   *Dingpolitik* and matters of concern

According to Barry (2002:271), politics (understood as 'the institutionalised practices of parties, governments and parliaments') can often have anti-political effects, as political decisions can thwart politics understood as the possibility of contestations or disagreements. He points to how public matters of contestation often become muted through legislation and technical regulation by government. This becomes clear in the instance of the SKA, where radio astronomy as an 'activity of contestation' in Carnarvon is turned into a technical matter through legislation such as the AGA of 2007. Barry (2002:271) states that 'In general, legislation and technical regulation have the effects of placing actions and objects (provisionally) outside the realm of public contestation, thereby regularizing the conduct of economic and social life, with both beneficial and negative consequences'.

I observed this effect during my field work when SKA personnel would simply reply that 'everything we do is legal' when Carnarvon residents voiced their discontent over the loss of 118 000 hectares of agricultural land. By making sure all the legal checkboxes are ticked, political issues such as the loss of land are turned into technical issues. Carnarvon residents may fundamentally disagree with the legislation but the legislation was signed by a democratically elected government which acts on behalf of all voters. Again, Carnarvon residents' dissatisfaction becomes reduced to a technical matter.

> After the vote is cast, the mark of the vote itself does not bear (or should not bear) any visible trace of the complexity of the voter's investments in the process or its outcome. Once the choice is made, the vote becomes detached from its entanglement in a particular place, time and personal experience (Barry, 2002:269).

In thinking about these issues, I have found the distinction Latour draws between 'matters of fact' and 'matters of concern' very helpful. Latour (2005b:16) points to the gap that arises between the 'political sphere' and the 'reality people have to put up with'. He calls this unavoidable issue the 'crisis of representation' that lies at the very heart of democracy. According to him (2005b:4), politics has always been concerned with the representation of people and their problems. The difficulty lies in representation itself: is it possible for *everybody* to be represented? And then, what issues should get raised? Here Latour highlights the tension between what politics should ideally be (somehow representative of all) and what it is in reality.

He therefore argues that we need to rethink how we go about doing politics. He proposes a politics driven by 'matters of concern' and not 'matters of fact'. Crucial to understanding the distinction between matters of concern and matters of fact is the question of how issues get framed. According to Latour a linear notion of "progress" so often becomes promulgated as *the* royal road to progress/development. Progress thus becomes framed in a particular way. This notion becomes the hegemonic view and is simply made out to be a matter of fact. Contesting notions are then marginalised and made out to be '"irrational," "backward" or "archaic"' (Latour, 2005b:30). In this way, some people's issues and needs are made out to be matters of fact, whilst other people's issues and needs can simply be brushed aside as standing in the path of "progress", where they are 'left to linger in the limbo of irrationality' (Latour, 2005b:29).

By portraying a certain (linear) notion of progress as a matter of fact, this proposed trajectory is made out to be in the interest of everybody: it is a fact that such and such will benefit everybody. In this way, the gravitas of the word "fact" gets misused in the name of what *some* would call progress. This view disregards the many complicated entanglements that facts carry with them (Latour, 2005b:31). Politics, in this sense, works by feigning objectivity and hoping that time will destroy all things 'non-progressive' (Latour, 2005b:29).

According to Latour, we now face the trouble of *really* representing everybody. He uses the image of a 'phantom public' to portray the difficulty of grasping or realising this difficult feat. Latour's solution is a politics that revolves around 'things' and 'matters of concern', meaning that we must not pretend that there is one image of truth (matter of fact) for everyone:

> What we are trying to register here […] is a huge sea change in our conceptions of science, our grasps of facts, our understanding of objectivity. For too long, objects have been wrongly portrayed as matters-of-fact. This is unfair to them, unfair to science, unfair to objectivity, unfair to experience (Latour, 2005b:9).

Latour (2005b:31) proposes a new politics, namely *dingpolitik*. He defines *dingpolitik* as:

> The degree of realism that is injected when: a) Politics is no longer limited to humans and incorporates the many issues to which they are attached; b) Objects become things, that is, when matters of fact give way to their complicated entanglements and become matters of concern; c) Assembling is no longer done under the already existing globe or dome of some earlier tradition of building virtual parliaments; d) The inherent limits imposed by speech impairment, cognitive weaknesses and all sorts of handicaps are no longer denied but prostheses are accepted instead; e) It's no longer limited to properly speaking parliaments but extended to the many other assemblages in search of a rightful assembly; f) The assembling is done under the provisional and fragile Phantom Public, which no longer claims to be equivalent to a Body, a Leviathan or a State;

g) And, finally, *dingpolitik* may become possible when politics is freed from its obsession with the time of Succession[10].

These are fruitful ideas for understanding the conflicts in Carnarvon around the construction of the SKA. As my discussion in Chapters 4 and 5 shows, both the SKA Organisation and SKA SA promote a linear notion of progress and make their science and development endeavours out to be matters of fact that are absolutely to the benefit of all in society. Carnarvon residents, on the other hand, have their own ideas – matters of concern – about what progress and development in their district should entail.

2.1.5   Assemblage thinking, *dingpolitik* and Bourdieu

According to Müller (2015:35), ANT and assemblage thinking studies should be open to supplementation by other social theories. Similarly, Barry (2013:417) has stated that 'ANT is not a theory that can or should merely be applied, without distortion or modification'. In their study on global security assemblages in Africa, Abrahamsen & Williams (2014) have linked assemblage thinking to Bourdieu's theories around field, capital, *doxa* and *habitus*, as they contend that assemblage theory is not sufficient by itself to explain power struggles. Müller (2015) also asks important questions regarding power relations in assemblages, where Bourdieu's ideas are useful: 'How does power result from assemblages and actor-networks and what effects does it have? How is the emergence and the shape of 'matters of concern' an uneven process, in which not all can partake in the same way' (Müller, 2015:36)?

Bourdieu is interested in explaining the hegemony of certain social groups over others as well as the reproduction of such groups' hegemony (and others' marginalisation). Class is therefore important in Bourdieu's theory and a great deal of his work is focussed around distinctions between classes and how capital gets used to reproduce class distinctions and thus the hegemony of a certain class over others. Bourdieu also emphasises the importance of history and how it influences people's 'schemes of perception, thought and action' through his concept of *habitus* (Bourdieu, 1990:54). In the following section, I first discuss his concepts of field, capital and *doxa*. I then discuss his concept of *habitus* in more detail as it is a key concept for understanding the gulf between Carnarvon residents' and SKA personnel's conception of the SKA.

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[10] The time of Succession refers to a linear notion of progress over time (Latour, 2005b:29-30).

Field, capital and doxa

Bourdieu's concept of field refers to specific social domains which have their own forms of capital (things and ways of doing that are agreed to be valuable) and its own "rules" or common-sense ways of doing (*doxa*). According to Bourdieu (1986:20), the status of a person in a specific field depends on their ability to wield the necessary forms of capital. Bourdieu's notion of capital is therefore central for understanding how status is acquired and thus how certain classes/ideas/discourses/languages, etc. become hegemonic. Bourdieu (1986) speaks of economic capital (money), social capital (social connections and networks), cultural capital and symbolic capital (esteem or status afforded by other forms of capital). Of these, cultural capital is his most renowned form of capital; it refers to educational qualifications, *savoir faire* and the possession of certain material things that are 'highly regarded' (Crossley, 2001:87).

Bourdieu (1990:50-51) asserts that people are constantly battling to acquire status in different fields. The academic field, for instance, requires a certain vocabulary and demeanour for a person to be taken seriously. These can be regarded as expressions of cultural capital. However, the same vocabulary and demeanour would evoke laughter and ridicule in a street gang (i.e. the field of gangsterism). This shows that different ways of doing things are regarded as valuable, i.e. regarded as capital, in different fields.

Bourdieu (1990:66-67) also likens the act of competing for status and recognition in a certain field with playing a game. (Henceforth, if I talk about game/s or player/s I am always referring to fields and to individuals in fields, respectively). The objective of playing a game is to win. In the context of fields, the objective is to acquire status, and individuals do so by deploying the necessary capital. In the same way that the rules of different games differ, so do the implicit "rules" or *doxa* of different fields. Knowledge of the rules and what counts as capital are thus integral to playing the game successfully.

Crossley (2001:86) points to a significant difference between Bourdieu's concept of "game" and actual games, which is that in the former players misrecognise their own 'constitutive work' in the perpetuation of their specific game. Individuals legitimise fields when they partake in its practices by following its rules and wielding its specific capital (Crossley, 2001:85-86). The more individuals become invested in a certain field, the more they legitimise the field. Invested individuals take the *doxa* and capital of a field for granted and see it as inherently valuable and meaningful. Invested individuals therefore feel as if they are partaking in something meaningful. Bourdieu (1990:66) uses the term *illusio* to refer to this feeling that the game has inherent meaning. However, according to Bourdieu (1990:66-67) the capital and *doxa* of fields are arbitrary. The arbitrariness of a certain field is unveiled

when outsiders (people who are not part of the field) view its capital and *doxa* (and thus the field itself) as strange or even meaningless.

> Although fields are not hermetically sealed, their "players" nevertheless chase after goals and adhere to distinctions and norms that often strike the outsider, who does not believe in the game or share its *illusio*, as peculiar and perhaps even meaningless. As in games, distinctions and rules only matter or have meaning for those involved, those who know how to read the game and have a stake in it. (Crossley,2001:86).

Bourdieu (1986:26) states that the appropriation of value to certain things (which effectively turns them into capital) is arbitrary and has nothing to do with the things themselves. That which bears value (capital) rather hinges on tacit agreements. 'Habitus is important in this respect because such agreements are precisely rooted in habit; indeed, they are so deeply rooted that they are seldom identified as agreements at all' (Crossley, 2001:87). This means that there is nothing inherent about the things that bear value that make them valuable. For instance, there is nothing inherent about a certain accent (such as vocal characteristics) that makes it more valuable or legitimate than another accent. It is through the objective recognition of a certain accent as *distinct* from another within a unified linguistic field and 'agreements […] rooted in habit' that a certain accent can become culturally more valuable than another accent.

Capital and *doxa* therefore always presuppose value and meaning. Individuals who are invested in a specific field will therefore always sanction the capital and *doxa* of their field as positive, even virtuous, as their specific capital and *doxa* (which they also embody through *habitus*) would be rendered worthless if their field ceases to exist (Bourdieu, 1990:188). Their game must therefore be protected at all costs or they (invested individuals) would lose their status (symbolic capital). Other capital and *doxa* must be excluded and are 'negatively sanctioned because they are incompatible with the objective conditions' of the particular field that needs to be protected in order for its invested individuals to hold their status (Bourdieu, 1990:56).

Habitus

Wacquant (2005:316) describes *habitus* as 'the way society becomes deposited in persons in the form of lasting dispositions, or trained capacities and structured propensities to think, feel and act in determinant ways, which then guide them'. It is the notion that individuals' histories are incorporated within them, thus the social fields, capital and *doxa* that have formed part of their upbringing (their social worlds). This becomes embodied history and includes the cultural capital that individuals have acquired over time. This embodied history influences individuals' perceptions (their worldviews), their

behaviour and their expectations (Bourdieu, 1990:46 & 54). In this way, *habitus* refers to an interplay between individuals' past and present and their inner and outer worlds.

Bourdieu emphasises the importance of history in the formation of *habitus* and cites this excerpt from Emile Durkheim to explain how the past influences individuals' present:

> In each one of us, in differing degrees, is contained the person we were yesterday, and indeed, in the nature of things it is even true that our past personae predominate in us, since the present is necessarily insignificant when compared with the long period of the past because of which we have emerged in the form we have today. It is just that we don't directly feel the influence of these past selves precisely because they are so deeply rooted within us (Durkheim, 1977 in Bourdieu, 1990:56).

This excerpt shows, firstly, how social worlds become embodied in individuals and secondly, how individuals are unaware of the process of embodiment. According to Bourdieu (1996:466), 'the schemes of the habitus […] function below the level of consciousness and language, beyond the reach of introspective scrutiny or control by the will'. The fact that individuals are not aware of the workings of *habitus* (i.e. the interplay between their internal and external social worlds) is crucial in making them feel that their fields, its capital and *doxa* have intrinsic value and meaning. The unconscious nature of *habitus* therefore makes individuals' "games" feel real and meaningful. According to Crossley (2001:93) '… social agents must perceive and treat (misrecognise) the arbitrary framework of social fields as real and natural if they are to play effectively'. Bourdieu's notion of the 'natural attitude' implies that individuals do not question the value or meaning of the "games" they play as 'practical action requires a relatively unquestioning and unreflexive attitude toward life' (Crossley, 2001:93). The existence of social fields thus requires individuals' belief in them (and thus their investment).

According to Bourdieu (1990:59 & 67), it is through *habitus* that individuals are able to recognise the field in the first place. *Habitus* and field 'are locked in a circular relationship' (Crossley, 2001:87), where *habitus* is formed through being in a particular field which in turn reproduces the field through learnt behaviour (Bourdieu, 1990:67). According to Bourdieu (1990:61):

> the habitus tends to protect itself from crises and critical challenges by providing itself with a milieu to which it is as pre-adapted as possible, that is, a relatively constant universe of situations tending to reinforce its dispositions by offering the market most favourable to its products.

The *habitus* therefore inclines individuals to stick to what they know and to avoid milieus and situations where their acquired forms of capital may not hold ground and thus the feeling of being out of place: '… when habitus encounters a social world of which it is the product, it is like a "fish in water":

it does not feel the weight of the water and it takes the world about itself for granted' (Bourdieu & Wacquant, 1992:127). The contrary is also true, which is that individuals feel self-conscious and like a fish out of water when they find themselves in unfamiliar fields. Here Reay (2004:437-438) disagrees with Crossley (2001:83) that *habitus* lies 'beyond the reach of introspective scrutiny' and calls for a more open attitude towards people's consciousness of their *habitus*. She argues that individuals become more aware of their own *habitus* when they encounter unfamiliar fields or 'events that cause self-questioning' (Reay: 437-438). Bourdieu did, however, acknowledge some aspects of people's consciousness of *habitus* in his later work, such as *The State Nobility* (1998)*.*

Bourdieu's notion of *habitus* has been criticised for being overly deterministic (Reay, 2004:432). Bourdieu does place a lot of emphasis on the role of *habitus* in the reproduction of fields, class, culture, etc., but that does not mean that he is arguing that one's *habitus* determines one's actions. Rather, he argues the contrary: 'habitus goes hand in hand with vagueness and indeterminacy' (1990:77). The concept of *habitus* sheds light on both the reproduction of class and culture as well as social change. Reay (2004:436) states that 'when habitus encounters a field with which it is not familiar, the resulting disjunctures can generate change and transformation'. It is the feeling of being a fish out of water (i.e. the feeling of being out of place when one encounters an unfamiliar field) that leads people to strive for change, whether it is within themselves (through education for instance) or outside of themselves (through activism for instance).

The disjunctures individuals experience when their *habitus* consistently mismatches the world they encounter can lead to a schism: 'a habitus divided against itself, in constant negotiation with itself and its ambivalences, and therefore doomed to a kind of duplication, to a double perception of the self, to successive allegiances and multiple identities' (Bourdieu, 1999:511). In *The Weight of the World*: *Social Suffering in Contemporary Society*, Bourdieu (1999) sheds light on how this schism is experienced as social suffering*,* as those who do not possess the necessary capital and know-how required to 'make it' in the world also experience an awkward encountering of the self as not succeeding by virtue of just being themselves. According to Reay (2004:), this leads to 'a myriad adaptations, responses, reactions and resistances to "the way the world is", but also of individuals struggling to make the world a different place' – something I witnessed in Carnarvon where residents show evidence of both acceptance (including despondency) of 'the way the world is', as well as resistance to it. This is consistent with Reay's argument against determinism.

Casey (2001:401) points to the connection between *habitus* and place and says that 'A particular place gives to habitus a familiar arena for its enactment and the lack of explicit awareness of that place as such, its very familiarity, only enhances its efficacy as a scene in which it is activated' (Casey,

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2001:410). Although Bourdieu does not specifically address "place" in his work, Casey argues that it is everywhere present. Easthope (2004:133) also invokes the connection between *habitus* and place and says that *habitus* is 'intrinsically connected to the concept of "rootedness", but also to our "sense of place"'. Easthope (2004:133) considers how rapid changes in places affect people, which is not unlike the confrontation with an unfamiliar field. In the same way that an unfamiliar field can cause people to feel like fish out of water, rapid changes due to external forces can also lead to a diminished feeling of rootedness and thus people's 'need to create a sense of place as "secure and stable" is heightened' (Easthope, 2004:133). The SKA in Carnarvon is an example of how external forces can rapidly change people's experience of the place in which a specific *habitus* gets enacted, as I discuss in Chapter 4.

Bourdieu (1990:58 & 59) says that 'homogeneity of conditions of existence' and 'identical histories' create a shared *habitus*. This leads a particular class to have shared '"reasonable, common-sense", behaviours', which means that such behaviours are 'likely to be positively sanctioned' (Bourdieu, 1990:55-56). Consequently, all contrary behaviours or all 'extravagances' are negatively sanctioned ('not for the likes of us') (Bourdieu, 1990:56). The implication of sanctioning behaviour as either positive or negative (according to the congruence or incongruence with *habitus*) is the shared belief in 'the logic characteristic of a particular field, whose objective future they [i.e. invested individuals] anticipate' (i.e. the reproduction of their particular field and thus belief in its particular forms of capital and *doxa*) (Bourdieu, 1990:56). Bourdieu (1990:46 & 60) does however state that 'no two individual habituses are identical', although similar conditions of existence as seen in a particular class are likely to lead to a 'non-individual system of internalized structures, common schemes of perception, conception and action'. According to Bourdieu (1990:60) the individual habituses within a single class are 'united in a relationship of homology, that is, of diversity within homogeneity reflecting the diversity within homogeneity characteristic of their social conditions of production'.

> The practices of the members of the same group or, in a differentiated society, the same class, are always more and better harmonized than the agents know or wish, because, as Leibniz again says, 'following only (his) own laws', each 'nonetheless agrees with the other'. The habitus is precisely this immanent law, *lex insita*, inscribed in bodies by identical histories, which is the precondition not only for the co-ordination of practices but also for practices of co-ordination (Bourdieu, 1990:59).

2.2   Research methodology

2.2.1   Research design considerations

My conceptual framework has influenced my research design in a number of ways. Firstly, I needed to use research methods that would be effective in exploring social context. Secondly, I had to be

conscientious about acknowledging power relations and the different ways in which they manifest during the research process. Thirdly, I had to be aware of the significance of non-human entities during the research process and, finally, I had to be open to unexpected things that might change my research direction, as actors set the agenda.

As already argued, I regard context as essential for understanding how and why Carnarvon residents and SKA personnel conceive of the SKA's scientific and development endeavours in their respective ways. In deciding on my research methodology, I therefore adopted a qualitative research strategy, informed by Bourdieu's concept of *habitus*, to understand "where" my research participants are coming from in their conceptions of the SKA. Since I am not only interested in *how* Carnarvon residents and SKA personnel conceive of the SKA, but also in understanding their points of departure, I have also adopted an interpretivist approach. An understanding of the world as 'multiple and performative' and (social) structure as contingent underlies assemblage thinking, ANT and Bourdieu's 'theory of practice', and this, again, calls for an interpretive approach.

Here it is worth noting that although assemblage thinking is very useful for thinking about the complexity of the social world, I found it unwieldy to apply methodologically speaking. ANT is somewhat more helpful in this regard. According to Munro (2009) 'the starting point for an ANT study is the assumption that anything can happen, and that there is no distinction between reality and its interpretations' (Munro, 2009 in Almila, 2016:135). Latour's call on researchers to 'follow the actors themselves' translates into doing 'anything and everything s/he finds suitable in order to trace the relevant connections, while staying true to the methodological principles at the core of ANT' (Almila, 2016). According to Law (2007:2), it does not make sense to develop strict rules for doing research if all actor-networks are different. The implication is that researchers should be flexible and resourceful in finding the relevant actors in the field, yet mindful of ANT's tenets (such as heterogeneity and ontological equality as discussed earlier).

The research design of this study could also be seen as taking the form of a case study. According to Bryman (2012:66), a 'case study entails the detailed and intensive analysis of a *single* case' (emphasis added). This of course leads to the question: what is my case? Bryman (2012:67) states that cases are most commonly associated with single locations, such as communities or organisations. He also notes that it is often complicated to distinguish between a cross-sectional design and a case study. Here he gives the example of a study by McKee and Bell (1985) on the experience of unemployment of 45 couples in a British town by the name of Kidderminster, and argues that this is a cross-sectional rather than a case study, as in this study the location (Kidderminster) only provides a 'kind of backdrop' to the findings and is not the unit of analysis itself (Bryman, 2012:68).

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In my study, however, the locality in which the SKA is being built is integral to my understanding of the SKA as a complex assemblage, operating in the Karoo, near the small town of Carnarvon.

Although I focus on both a place (Carnarvon) and an organisation (the SKA), I would argue that this can still be regarded as a study of a *single* case. The SKA has become part of Carnarvon, but Carnarvon has not become part of the SKA in the same way or to the same extent. While the SKA is changing Carnarvon (for instance, by 'diversifying' its economy, putting it on the international radar, attempting to educate youngsters in mathematics and science, etc.), Carnarvon and the other small towns in the district that are affected by the SKA are largely peripheral to the workings of this big-science project. The SKA as an organisation retains its autonomy while impacting on the lived realities of many Carnarvon residents. Since Carnarvon was my main research site and not the SKA, I would argue that this reinforces my point that this study is a case study. Thinking about the SKA in Carnarvon in terms of assemblage thinking also points to it as a single case.

Bryman (2012:68) does, however, state that he 'would prefer to reserve the term "case study" for those instances where the "case" is the focus of interest *in its own right*' (emphasis added). It could be contested whether the instance/case of the SKA in Carnarvon is the focus of this study '*in its own right'* as I focus on selected aspects of the case, namely conceptions of the SKA's scientific and secondly development endeavours. From this perspective, my research design does not fit neatly with textbook definitions but can, rather, be seen as falling somewhere between a cross-sectional design and a case study.

2.2.2   Research methods

In operationalising my research design, I used a range of qualitative research methods in which semi-structured interviews were the main method. Additional data collecting methods included participant observation at various public meetings called by the SKA and other stakeholder groups, and documentary and website analysis. While doing my field work in Carnarvon I also attended two church services and spoke informally to numerous people about what life in Carnarvon is like and what they think of the SKA. I did not spend an equal amount of time in a purely SKA environment, but did conduct interviews with a range of SKA staff members in their working environments. I visited the MeerKAT/SKA site, had a quick tour of the SKA's office in Pinelands, attended a public lecture by the former director of the SKA SA, Dr Bernie Fanaroff, and was also able to engage with a number of scientists and officials associated with the SKA, who gave presentations to the weekly Cosmopolitan

Karoo Research Forum (CKRF) run by the SARChI Research Chair in which my research project is located.[11]

Since September 2017 I have also been part of a WhatsApp group, by the name of 'SKA *belangegroepforum*' [SKA stakeholders' forum]. From what I can gather, this group consists mostly of Carnarvon residents and serves as a platform for discussing SKA-related issues as well as logistics for meetings etc. Being a member of this group has given me further insight on some of the views of Carnarvon residents who form part of this group and has allowed me to monitor developments in Carnarvon with regards to the SKA on an ongoing basis.

My research questions and the underlying premise that all perceptions are situated shaped the questions I asked participants. In exploring with them how they conceive of the SKA in terms of its science and development endeavours, I kept in mind that all my participants, both Carnarvon residents and SKA personnel, are speaking form "somewhere" and tried to gain more insight as to "where" that was to *understand* their perspectives. The fact that I could visit Carnarvon (my main research site) four times during my research period (2016-2017) also helped in that I could trace how Carnarvon residents' reception of the SKA changed over time and to go back to participants and ask new questions at later stages in my research.

2.2.3   Field work

My field work in Carnarvon took place between February 2016 and May 2017. It involved a total of four weeks, spread over five trips. My first encounter with the town was in February 2016, when I visited it as part of a general field trip involving the SARChI research programme in which my study is located. My next visit came in May 2016, when I visited Carnarvon and surrounding towns with three other students, to attend a series of SKA public meetings. Here I was able to observe directly the dynamics between Carnarvon residents and SKA professionals. This was followed by another visit in September 2016, when I stayed in the town as a member of a research team conducting a socio-economic survey for the SARChI research programme in Vanwyksvlei, a small town to the north of Carnarvon that is also affected by the building of the SKA. During this stay, in addition to my exposure to the impact of the SKA project in the wider district, I was able to interview a Carnarvon resident who subsequently became one of my key informants. I was also able to speak informally to other residents

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[11] CKRF is the weekly research forum of the South African Research Chairs Initiative (SARChI) of the Sociology of Land, Environment and Sustainable Development of which I am part. Presenters on and from the SKA included: Raynard (2016); Gastrow (2016); Goedhart (2016); Binneman (2017); Kirsten (2017); Davidson (2017) and Chibueze (2017).

in the town and to make contacts for more formal interviews for when I returned to Carnarvon a month later, at the beginning of November 2016. On this research trip, I stayed in Carnarvon for ten days, during which I conducted more interviews and also spent time interacting informally with residents and walking around the town observing how people kept themselves busy. I also went to a church sermon.

During this visit, it became apparent to me that most residents did not know or understand what the SKA's scientific goals are about but also, more significantly for my study, that most were not particularly interested in the SKA's science ambitions either. Rather, their primary concern around the project was whether they or somebody they knew could get a job from the SKA. This brought home to me the difficulty of making a living in Carnarvon as well as the significance of the town's history of educational inequality in terms of local people's understanding of science. It also pushed me to pay more attention to what residents' 'matters of concern' are.

My next visit to Carnarvon was in May 2017 and lasted two weeks. During this visit, I conducted more interviews, some with new participants and some with participants with whom I had previously interacted. What emerged strongly was how, over the course of time, my participants' attitudes toward the SKA had become increasingly negative, except for one participant whose son had started working at the SKA in the interim. Since my visit in November 2016, the SKA had appointed a new manager who works with stakeholders on different levels (local, provincial and national) and many residents spoke of their interactions with this person. I was able to interview him during this visit and also attended a church sermon where he preached. He also organised for another research team member and myself to visit the SKA core site.

All sorts of allegations, rumours and accounts of clashes between Carnarvon residents and SKA staff members surfaced during this visit. For instance, an SKA staff member accused a local religious leader of having 'a white agenda', while some residents complained to me that SKA staff members were haughty and treated them as if they were illiterate. On my last evening I attended a community meeting where no SKA staff members were allowed. During this meeting, community members spoke about the possibility of establishing a representative SKA stakeholders' forum to discuss SKA-related 'matters of concern'. The meeting became a bit unruly as one attendee in particular interrupted other speakers, complained about the conduct of the meeting, and accused those present of intolerance. During this meeting, the main speaker said that no 'SKA spies' were allowed in the meeting and asked attendees not to share what was discussed with SKA personnel. As my discussion of my research findings will show, his concerns about the sharing of information with SKA personnel were not without substance. These difficult dynamics are dealt with in more detail in Chapter 5.

My interviews

Altogether I conducted 32 interviews with 27 participants who can be broken down as follows:

- 20 Carnarvon residents, 19 of whom had never worked for the SKA and one who had worked as an on-site construction worker
- 6 SKA personnel (2 astronomers, 2 engineers, 1 manager, 1 ex-manager)
- 1 person who works for the South African Astronomical Observatory (SAAO) in Sutherland.

Information on the gender, race and age of my participants is found in Appendix A.

From the outset, I weighted my interviews towards Carnarvon residents as I anticipated that, given their employment status and professional identity, professionals employed by the SKA could be expected to be more homogenous in terms of their education and class as well as their views of the SKA and understanding of astronomy. I found a snowball sampling approach most applicable to Latour's instruction to 'follow the actors themselves' as I could rely on actors' knowledge of to whom else I should speak. Some participants who came to know of me and what I was doing from people in their networks also identified themselves to me and became incorporated as participants.

Since this was a qualitative study, I did not aim for a strictly representative sample of Carnarvon, but am confident that by attending SKA public meetings, listening to participants' perceptions of how 'the people' or 'the town' feels, and talking informally to many people in the town, I did get a good overview of prevailing sentiments toward the SKA. A few SKA personnel who spoke about Carnarvon residents' general sentiments also corroborated what I was hearing and seeing among Carnarvon residents. I did, however, purposely try to vary my interview sample in terms of race, age and gender, to be sensitive to the possibility that people's conceptions of the SKA could vary across these variables. These variables are integral to the formation of *habitus* and, as discussed in Chapter 4, I found race and age to be noteworthy in this regard. Assemblage thinking and ANT's tenet of heterogeneity also influenced my approach to dealing with discourse and ideas as significant components of the mix.

My interviews with SKA personnel were conducted in three sites: Carnarvon, the SKA office in Pinelands and Stellenbosch University. I gained access to these participants in a number of ways, including the weekly CKRF meetings and referrals.

Data analysis

I analysed the data that I collected in two stages that corresponded with my research questions. Since one set of research questions was to understand *how* Carnarvon residents and SKA personnel conceived of the SKA's scientific and development endeavours and the other set of questions *why*

they conceived of the SKA in their respective ways, I distinguished between data that was descriptive from explanatory data (i.e. data that explained something). I then analysed how the two sets of data are related. I analysed the explanatory data through thematic analysis. The thematic analysis of the Carnarvon residents' interviews proved more complex than that of the SKA interviews, as the former were much more in-depth and personal. I also analysed my notes of CKRF meetings, SKA public meetings and SKA documentation in terms of discourse analysis to understand how ways of phrasing led to issues being framed in a particular way, as well as how empty signifiers like "development" and the selective sharing of information get used to portray certain ideas of the SKA.

2.2.4   Ethical considerations

This study was approved as a 'low-risk' study by the Research Ethics Committee (REC): Humanities of Stellenbosch University (see Appendix B). In developing my research methodology, I ensured that my research practices were in line with the ethical code for human research at the University as well as that of the International Sociological Association (ISA). All my interviews were voluntary and based on the principles of informed consent, and I have used pseudonyms to protect participants' identity as far as possible (see Appendices C and E). I explained to participants what the study was about before the start of interviews, that their participation would be on the basis of anonymity and their identities kept confidential. I also asked whether I could record the interviews, with all but one participant agreeing to being recorded.

One of the main ethical challenges I encountered was around ensuring participants' anonymity. Carnarvon is a very small town and residents mostly know one another, what they do for a living as well as other details of each other's lives; using pseudonyms does thus not guarantee that local people reading my thesis will not be able to make an informed guess as to who the informant might be. Ensuring the anonymity of SKA personnel was also problematic as most personnel to whom I spoke have very specialised jobs. I have therefore chosen not to disclose exact job titles for SKA personnel but to use general job titles such as engineer or astronomer. I also use general job titles for Carnarvon residents and do not disclose the institutions or businesses for which they work.

With regards to Carnarvon residents' experiences of the interviews, I sensed that generally participants enjoyed talking to me about their lives in Carnarvon and experienced the interviews as cathartic: in the words of one interviewee, '*As jy klaar gepraat is dan voel jy die wêreld is van jou skouers af*' [When you're done talking you feel as if the world is lifted from your shoulders] (Nicky, interview, 2016). One resident, however, reminded me of the pressure that social research can also place on participants. Unlike most of the other participants who had much to say, this particular participant was very reticent. I had to encourage her and reassure her that there was no such thing as

an incorrect answer as she repeatedly said '*Ek/Ons weet so min'* [I/We know so little] (Sara, interview, 2016). I realised that she felt very self-conscious talking to a university student, while she herself had not had the opportunity to finish school.

Another difficult issue that came up was the use of derogatory racial terms by participants in interviews. Participants who used these terms were generally not referring to other people, but were talking about their own experiences of racism and their memories of apartheid. One resident, for instance, spoke of his experience working on the SKA site and how a white staff member would use racially derogatory terms and make him feel uncomfortable. This confronted me with whether I should use these words myself when I quoted participants. Because these words are offensive my immediate reaction was not to use them; however, upon reflection I decided to retain the original as not to do so would mean censoring what my participants have said and thereby both glossing over their experiences and hurt, and not reflecting the social reality I encountered as I encountered it.

Some residents expressed deep concerns about the future of the town and feared that issues such as alcohol and drug abuse might become worse. Many residents spoke about this concern, but for one of my participants drug abuse was a particularly vexing issue as both her sons are addicted to *tik* (crystal methamphetamine). This woman started crying during our interview when she spoke of her sons' addiction. I found this distressing and had to fight back tears of my own as I tried to be supportive of and receptive to this woman's pain. The seriousness of the issue of drug and alcohol abuse struck me again just after this interview, when a young mother with a baby with Foetal Alcohol Syndrome approached me for money. I also experienced the other side of the drug issue in town when I interviewed a person who sells drugs. I had not known that this person sells drugs before I scheduled the interview and I had to try not to appear shocked during our interview as this and other upsetting personal details were disclosed. I also tried to be receptive rather than judgemental. This encounter with someone who could be seen as a good person doing bad things brought home to me the murkiness of the terrain of research ethics in practice.

Another difficult ethical dilemma I had to negotiate was how to respond to an informant who appeared to want to make a positive change in Carnarvon, but disclosed what I considered unethical ways of dealing with people. Given the tensions around the SKA project and the strong feelings that it elicited among my participants, it was also challenging to retain my neutrality as a researcher while not compromising my own feelings around what is morally right.

My experience of interviewing SKA personnel was that several were initially cautious about what to expect at the start of the interviews, but soon warmed up and seemed to enjoy the interviews. I suspect that the contestations between the SKA and Carnarvon is what caused these SKA personnel's

initial edginess, as they were aware that my study also included Carnarvon residents. After one interview, one SKA participant said that she had expected me to be hostile and was surprised that I had not been and had enjoyed the interview. Such comments from participants validated my own experience of my interviews as positive and enjoyable overall, even when some participants discussed troubling matters.

Although I was aware that my being an Afrikaans-speaker afforded me some communicative advantage in Carnarvon, I was not aware of the extent of this advantage until some residents expressed their dismay at having to speak English on occasion. One resident said that Carnarvon residents '*is baie bang vir Engels'* [are very scared of English] (Michelle, interview, 2016). One SKA participant spoke of her experience of staying in Carnarvon and how residents had spoken much more freely once they realised that she could speak Afrikaans. She also said that an SKA colleague had experienced residents as rather hostile toward him as he only speaks isiZulu and English.

Chapter 3: Shifting Dynamics: Science, Politics and Society

In this chapter, I review literature in the fields of Science and Technology studies (STS), the 'Public Understanding of Science' (PUS), and science communication. These are multi-disciplinary fields that draw on a wide range of sources and use a wide range of data collection methods. Engaging with this literature is essential for understanding the very different understandings of the relevance of science in general and astronomy in particular held by most Carnarvon residents on the one hand and core SKA personnel on the other. This literature also sheds light on how issues of contestation between Carnarvon residents and SKA personnel depend on how they get framed and how the hegemony of science can be used to back-up framing issues in certain ways. This literature also emphasises the importance of context and power in the relationship between science and the public; it has impacted my reading of the contestations between Carnarvon residents and the SKA by making me more conscientious of the unequal power relations and people's contexts within this relationship.

The way these fields overlap and merge with each other reflects the complexity of the subject matter. Instead of focussing on each body of literature separately, I have therefore preferred to discuss major cross-cutting themes and the sea changes over time in the thinking about the relationship between science and society within them, as the relationship between science and society has changed. I begin with a discussion in section 1 on major shifts in science studies from the 1950s onwards and then address debates on the democratisation of expertise in section 2 and the general trend toward a more inclusive approach in the relationship between science and society, where 'science meets the public' and the public 'speaks back' to science (Gibbons, 1999:12). I then discuss the question of knowledge and power in what have been termed 'pluralistic knowledge societies' and how science's hegemony is used to promote certain ideas of development. I conclude this chapter by discussing the decolonisation of science debate in South Africa very briefly, as the SKA in South Africa raises some important questions in this regard, and then engaging with the still fairly limited sociological literature on the SKA in South Africa.

3.1   The extension of scientific knowledge to other fields and its consequences

The relationship between science and society has been a tumultuous one over the past century, laced with both atrocities and triumphs. Joseph Vining (2004) recounts some of the most brutal science experiments conducted in Manchuria, Nazi Germany and Pol Pot's Cambodia. In the case of South Africa, Project Coast, a chemical and biological warfare programme of apartheid, has been described as 'probably the greatest scientific scandal in South African history' (Hodes & Schumacher, 2015:3). At

the same time, science has also brought about life-saving inventions such as antibiotics and new and improved means of communication and transport that have changed the world for the better.

In the early 1980s Weingart (1982:53) argued that, as a knowledge system, science had come to accrue legitimising power as a result of 'the victory of rationality in the world', which led to the filtering-through of scientific knowledge and methods into other domains of society. According to him, the extension of scientific knowledge into other fields had led to a more fluid relationship between science and society. By that time science had, to a certain degree, replaced the traditional orienting functions of many institutions such as law and education, as these institutions had increasingly started to draw on scientific knowledge and practices (Weingart, 1982:54). This process, which Weingart termed 'scientification', is directly linked to power and legitimacy, as the power and legitimacy of other institutions decreased as they became more dependent on science, whilst the power and legitimacy accorded to science increased. However, these traditional institutions did not cease to exist as 'science […] cannot orient human action' (Weingart, 1982:54).

The changing relationship between science and society has also impacted on the academic terrain, as seen in the field of science studies. Collins and Evans (2002) review some of the major sea changes in science studies from the 1950s onward. They show how there has been a gradual shift from thinking about science and society as distinctly separate domains to analysing the merging of the two.

According to Collins and Evans (2002), scientific authority held a relatively unproblematic position during the 1950s and 1960s. This was the 'golden age' for science, as individuals with a scientific background were highly esteemed and were often regarded as experts not only in their own fields, but in other fields as well (Collins & Evans, 2002:239). During this time, science studies research mostly attempted to determine what was known as the 'scientific literacy' of citizens, as it was widely accepted that citizens ought to be scientifically literate if they were to be effective citizens, at a time when scientific knowledge determined many decision-making processes in a variety of fields. A 'deficit model', which suggests that 'scientific and technical literacy is a good in short supply outside the ranks of scientists and engineers' (Sismondo, 2010:174), underlay research studies conducted in this vein. According to Bauer, Allum and Miller (2007:80), the literacy model suggests that the problem of the public's scientific deficiency can be solved simply through education: a view that characterises the approach to public education of the SKA.

Irwin & Wynne (1996:4) noted that the argument for improving the public's science knowledge through education rested upon three justifications. The first justification is that technical understanding and abilities will be essential for work in the future, the second that science has

become part of society's cultural understanding, and the third that a greater public understanding of science is essential for a modern democracy.

In the 1960s science became increasingly 'drawn into the political process' due to its legitimising power (Maasen & Weingart, 2014:2). For instance, during this time scientific knowledge was used to justify opposing stances on the merits and threats of nuclear power. Through this, the public was exposed to scientific contestations which for the first time showed that 'scientific knowledge is not unequivocal, that its implementation entails risk, and that there can, in fact, even be a complete lack of knowledge' (Maasen & Weingart, 2006:2). This led to the demystification of scientific knowledge, as it was seen that the scientific field is not as clear-cut as it was commonly thought to be (Collins & Evans, 2002:236). As a result, traditional notions of expertise were called into question.

These developments, along with the publication of Thomas Kuhn's path breaking book, *The Structure of Scientific Revolutions* (1962), ushered in a new period in thinking about science. Until this time, scientific knowledge had been placed on a pedestal and scientists were seen to have 'special access to the truth' (Collins & Evans, 2002:236). Kuhn, however, showed how even scientists' world views change during what he terms 'revolutions', when the uncovering of new knowledge leads to completely different ways of thinking about and conducting scientific research (i.e. a paradigm shift). He overthrew the popular notion of scientific knowledge as building systematically on previous knowledge ('knowledge through accumulation') and showed how new discoveries and anomalies in scientific research could bring about drastic changes in established knowledge.

The extension of scientific knowledge into the political domain and its resultant contestations, together with the new perspective brought about by Kuhn's work on scientific revolutions, affected a paradigm shift in science studies. According to Collins and Evans (2002:239), the end of the 1960s marked the end of the positivist phase in science studies. A social constructivist approach marked the next sea change in science studies and played an important role in challenging views of science as separate from "the social" (Collins & Evans, 2002:239). Social constructivism in science studies argues that scientific and technical debates cannot be settled through the application of scientific methods, experiments and observations alone, but that science is always a socially situated activity and that scientists and therefore the scientific knowledge they produce are influenced by social factors (Collins & Evans, 2002:239).

Sismondo (2010:57) highlights three implications (or 'reminders') which result from the social construction of scientific knowledge, namely:

> First is the reminder that science and technology are importantly *social*. Second is the reminder that they are *active* – the construction metaphor suggests activity. And third is the reminder that

science and technology do not provide a direct route from nature to ideas about nature, that the products of science and technology are *not themselves natural*.

Collins and Evans (2002:239) note that ideas about the social construction of scientific knowledge had huge implications for the notion of expertise as it showed that social factors such as scientists' personal goals around recognition and status, and the fact that some scientific subjects are more likely to get funded than others, all play a role in the scientific knowledge that gets produced. These factors could influence the reliability of the knowledge that gets produced. Studies in this vein focussed a lot on 'the attribution of the label "expert", and on the way the locus of legitimated expertise is made to move between institutions' (Collins & Evans, 2002:239).

According to Maasen and Weingart (2006:2), the demystification of science, together with 'new forms of broadened public participation' in the form of 'round-tables, moderated discourses and other conflict resolution mechanisms involving policy-makers and citizens' and a revived push toward further democratisation in industrialised countries led to the 'democratisation of expertise'. Maasen and Weingart (2006:2) state that the democratisation of expertise is characterised by a shift from 'legitimation through knowledge' to 'legitimation through participation' and 'the dispersal of the sites of knowledge production outside of the established universities and research institutions'.

Other bodies of literature such as the 'public understanding of science' (PUS) also reflected these changes in the relationship between science and society. Although PUS research retained the deficit model as its underlying principle for much longer than science studies, a new understanding of the relationship between science and society eventually came to underlie PUS research in the 1990s, termed 'science and society' (Bauer et al, 2007). During this time, the scientific community came under much closer scrutiny. The shift in focus from the public to the scientific community reflects a greater effort to be more reflexive about scientific institutions' basic assumption that the public's scientific knowledge is deficient (Bauer et al, 2007:85). 'The diagnosis of "institutional neurosis" has been widely heeded: the deficit is not with the public, but with the scientific institutions and expert actors who harbour prejudices about an ignorant public' (Bauer et al, 2007:85). Bauer et al (2007:85) state that this has led to widespread mistrust on the part of the public and that up-stream public engagement has become 'the new royal-road to rebuild public trust'.

Up-stream public engagement entails informing the public about research and asking for their participation in the early stages of techno-scientific developments. According to Sismondo (2010:170), many scientists view the popularisation of science as 'a necessary evil', as making science understandable usually entails some form of distortion. Not only do many scientists consider public engagement as an annoyance, but also as a 'public goodwill exercise', implying that they are doing the

public a favour by informing them about their research (Bucchi, 2013:905). According to Bucchi (2013:905), 'Public communication of science should now be mature enough to pass from a "heroic phase", in which "everything goes" for the sake of communicating science, to a phase in which quality is the central concern for all parties involved'.

Although some scientists see science communication as an important responsibility that forms part of their jobs, others are less enthusiastic about science communication. Weigold (2001:173) uncovers some beliefs scientists hold that impact their reluctance to take part in science communication. According to Weigold (2001:173), 'Fellow scientists may look down on colleagues who go public, believing that science is best shared through peer-reviewed publications', that interaction with the media could 'compromise a scientist's integrity' and that 'scientists should have neither the time nor the inclination to blow their own trumpets'. These views imply certain norms for what it means to be a "good" scientist that directly and indirectly oppose public participation. This also reveals some of the tension in the changed relationship between science and society, where scientists would like to retain some distance from "society", but this is no longer possible, as the extension of scientific knowledge necessarily entails its scrutiny in the fields into which it has extended (Weingart, 1982).

3.2   The democratisation of expertise and its implications

According to Gibbons (1999), as science has filtered through into other societal domains the boundary between science and society has started to merge. 'Indeed, science and society more generally have each invaded the other's domain, and the lines demarcating the one from the other have virtually disappeared' (Gibbons, 1999:12). This has all sorts of implications for the relationship between science and society, of which the democratisation of expertise is arguably the most important.

Gibbons (1999) makes a distinction between 'reliable knowledge' and 'socially robust knowledge' and argues that the democratisation of expertise necessarily entails a movement towards socially robust knowledge. According to Gibbons (1999:13), scientific knowledge can be regarded as reliable knowledge as it is replicable and so it becomes established. Reliable knowledge does not depend on public participation. Socially robust knowledge, however, has a characteristic social element that comes through public participation. He gives the example of how ordinary consumers joined in on the debate on the risks pertaining to genetically modified organisms (GMOs) and demanded more transparency from the scientific community. An equivalent example in South Africa was how public activism and debate on the causal link between HIV and AIDS led to a change in government treatment policy for HIV in the early 2000s and resulted in the release of Antiretroviral Therapy (ART) for HIV-positive people (Nattrass, 2012; Treatment Action Campaign, 2016). Through such public involvement, knowledge of GMOs (or HIV/AIDS) became more 'socially robust' in that knowledge about the public's

concerns, perspectives and needs became included with already existing reliable knowledge (scientific and technical knowledge) (Gibbons, 1999:14).

For Gibbons, the democratisation of expertise also implies the 'contextualisation' of scientific research, meaning that the larger context within which science is produced becomes considered. He defines contextualisation as embracing the '(unknowable) implications as well as the (planned or predictable) applications of scientific research' (1999:15) and states that 'those previously excluded from decisions about research' will be included once research activities' far-reaching implications (which he calls the 'context of implication') are considered (1999:15). Contextualisation of research therefore necessarily entails the production of socially robust knowledge as the public's input should be included.

Different positions exist on exactly who should be included in public participation processes. According to Collins and Evans (2002:238), people who are not generally thought of as scientific experts may have acquired knowledge through experience which renders them 'experience-based experts'; they should therefore be included in decision-making processes on technical issues. Wynne, however, argues that Collins and Evans (2002) misses out on an important point, which is that technical issues are not always *just* technical issues, as it depends on how issues get framed. He therefore states:

> To the extent that public meanings and the imposition of problematic versions of these by powerful scientific bodies are the issue, then the proper participants are in principle every democratic citizen and not specific sub-populations qualified by dint of specialist experience-based knowledge (Wynne, 2003:411).

This speaks to Latour's (2005b) distinction between 'matters of fact' and 'matters of concern'. I return to this issue and the important role power plays in the framing of issues in the following section.

Wynne (1992) and Gibbons (1999) both identify reflexivity as key in the contextualisation of scientific research. Reflexivity means much more than just 'a conventional "forward look" or "technology foresight" exercise' (Gibbons, 1999:16). Reflexivity is necessary to think about who might be affected by research, why and how, so as to 'incorporate future potential implications into the research process from the very beginning' (Gibbons, 1999:16). To ensure socially robust knowledge therefore entails more than just defining problems and assembling the intellectual and financial resources to solve them. If the scientific community is to take Wynne's (1992) and Gibbons' (1999) proposal of reflexivity seriously, one needs to ask to what extent it would be acceptable for scientists to claim ignorance of the effects of their research.

To qualify his plea for reflexivity in the research process, Gibbons (1999:16) claims that 'socially robust knowledge is superior to reliable knowledge' as it has gone through more stages of testing and retesting in more contexts and 'because of its malleability and connective capability'. Gibbons further claims that socially robust knowledge is valid both inside and outside the laboratory and that it is also less likely to be challenged as '"society" has participated in its genesis'.

> [Socially robust knowledge] is not predetermined or fixed, but open to ceaseless renegotiation. Instead of achieving a precarious invariance by establishing strict limits within which its truthfulness can be tested, as reliable knowledge does, socially robust knowledge is the product of an intensive (and continuous) interaction between data and other results, between people and environments, between applications and implications (Gibbons, 1999:16).

He identifies accountability and self-organisation as key factors in the production of socially robust knowledge. He states that self-organisation around issues that affect the public cannot happen without a sense of accountability. He does, however, acknowledge that if citizens were told to be more accountable they might become more defensive than cooperative. Gibbons therefore states that it is necessary that citizens voluntarily internalise accountability for them to be able to self-organise. When citizens self-organise over issues and let their voices be heard, that, together with reflexivity on the part of the scientific community, is the start of socially robust knowledge.

Gibbons (1999:17) argues that the 'contract' between science and society (which renders science as separate and independent of society) protects and sustains the production of reliable knowledge and that a new contract should move to promote the production of socially robust knowledge:

> The prevailing contract is governed by the rules of bureaucratic rationality, with society linked to "people" primarily through representative institutions. A new contract will require more open, socially distributed, self-organizing systems of knowledge production that generate their own accountability and audit systems. Under the prevailing contract, science was left to make discoveries and then make them available to society. A new contract will be based upon the joint production of knowledge by society and science.

This does not mean that the average citizen should design nuclear reactors or river dykes, only that 'more is involved in designing large projects such as nuclear power stations and water management systems than is described in the engineers' handbooks' (Bijker, 2001:32). According to Gibbons (1999:15), 'the deeper involvement of communities' has in fact led to 'better engineering solutions in a number of projects'.

While Gibbons praises socially robust knowledge in the democratisation of expertise, Maasen and Weingart (2006) fear that the baby (reliable knowledge) may be thrown out with the bathwater (the

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outdated notion of the unquestionable authority of scientific expertise) in the democratisation of expertise. They are concerned with 'how reliable knowledge can be made useful for politics and society, at large' (Maasen & Weingart, 2006:3). They are therefore concerned with the epistemic quality of socially robust knowledge, arguing that its legitimacy must be brought in line with its epistemic quality (Maasen & Weingart, 2006:3).

For Gibbons (1999), socially robust knowledge is inherently epistemically sound and adequate, as it *includes* reliable knowledge. It also includes reflections on the implications of reliable knowledge and understands that different ways of framing issues reflect different knowledge claims. For instance, public participation over a radio astronomy project would not be about whether radio waves really exist, but, rather, on the implications of radio astronomy for different constituencies.

Maasen and Weingart (2006), however, take issue with the fact that socially robust knowledge involves the layering of different types of knowledge that should, according to them, remain separate. They hold that 'a fundamental difference between scientific knowledge and political decision-making remains' (2006:3). According to them, science and politics have 'fundamentally different codes of operation'. Science 'primarily adheres to the code of "truth"', whilst 'politics is primarily guided by the code of power' (2006:4). Therefore 'science should produce truth, whereas political decisions should safeguard power' (2006:4); although science and politics do interact in a knowledge-based society, their codes of operation do not intermingle and 'the relationship between science and politics is rather one of "coupling"':

> For example, if decisions are science-based, they strive to rely upon and legitimate themselves with "true" knowledge, yet for politics, the truth of the knowledge in question is not a goal in itself but a means to make lasting decisions that keep the decision makers in power (Maasen & Weingart, 2006:4).

Maasen and Weingart's black and white view does not, however, take into account that science does not always produce truth (as scientists sometimes make mistakes or forge results) and that power also plays a role in the scientific field (Merton, 1957). Furthermore, they do not take into account that truth *should* play a role in politics if it is to better society as a whole. Although at one point they say that 'scientific knowledge is not unequivocal' (2006:2), they also draw a direct link between science and truth. Their argument is therefore inconsistent. Their critique of other literature on the democratisation of expertise (which they do not identify) as 'simplified polarisations, programmatic romanticisation and wishful thinking' (Maasen & Weingart, 2006:3) can therefore also be applied to literature on the democratisation of expertise that sees science and politics as taking place in separate

bubbles, only adhering to the codes of truth and power, respectively. Maasen and Weingart do not take the interconnections between science and politics (and therefore reality) into account.

The view that '[s]cience is taken to go beyond the social world to a reality unfettered by human contingency' is outdated (Akrich, 1992, in Hodes & Schumacher, 2015). Rather, as argued by Hodes and Schumacher (2015):

> The social world, whether accounted for or not, asserts itself in the manifold expressions of scientific endeavour - from the construction of theoretical hypothesis to the design, implementation and analysis of studies, and to the creation, implementation and evaluation of scientific interventions.

3.3   Knowledge and power in a pluralistic knowledge society

In early 2017 *The Brussels Declaration* was published at the annual meeting of the American Association for the Advancement of Science, outlining what was described as a new contract between science, society and policy-making. It was the product of a series of global meetings and consultative processes between 2012 and 2016. It outlines twenty points of principle intended to mediate the interaction between science, society and policy in knowledge-based societies. The purpose of the Declaration is, in its words:

> …to boost understanding of how power operates and to explain why evidence plus dialogue rarely equals (as one might expect) good decisions and laws. Above all, we make the case for a broad, multi-stakeholder and multi-disciplinary approach promoting greater integrity and accountability. Our main recommendation for promoting public dialogue and better understanding is not only greater transparency and scrutiny, but genuine inclusivity (*The Brussels Declaration*, 2017:3).

The Brussels Declaration therefore acknowledges that different actors in decision-making processes may have different agendas and that power is not evenly distributed in society, which impacts on the outcome of decision-making processes. It also acknowledges that often truth does not 'reverberate as strongly as fear or emotion' (2017:3). It is therefore a very contemporary document as it understands the dynamics of policy-making in 'what some call our "post-factual" society', in which 'knowledge is ever more complex, contingent and contested' and '"truth" has today become a moveable feast, a mask of legitimacy often worn by those seeking power, but a mask which often bears no relation to reality' (*The Brussels Declaration*, 2017:3).

Heinrichs (2006:42) uses the term 'pluralistic knowledge society' to point to the heterogeneous forms of knowledge in contemporary society, or, more specifically, contemporary western democracies with market economies. According to him, the end of the 20th century marked the beginning of

information and knowledge societies characterised by 'growing social complexity, as well as a pluralisation of knowledge claims, interests and values' (Heinrichs, 2006:42). He contends that in pluralistic knowledge societies people interpret absolute values such as freedom or human rights differently, according to their social position. Thus many different subgroup-specific meanings and understandings exist for similar things and a variety of knowledge forms are considered relevant for 'social design and decision-making processes' (2006:43).

This leads to a variety of different interpretations of reality, which represents a challenge for socially robust knowledge and decision-making processes. According to Heinrichs (2006:43), there is an understanding that states of pluralised countries should pay special attention to integrate 'so-far insufficiently integrated circles of society'. By focussing on integrating marginalised sectors of society, a deliberate attempt is made to level the playing field. This can be seen as 'deliberative democracy', which Sismondo (2010:183) describes as 'an array of positions in political philosophy that encourage public participation in decision-making' and that 'stand in opposition to positions that emphasise delegation to representative governments'.

The notion of deliberative democracy resonates with some ANT scholars' ideas around decision-making regarding issues of contestation (i.e. politics). In the previous chapter I spoke about ANT's conception of politics and the political implications of some of ANT's tenets, such as ontological equality. According to Müller, ANT scholars have proposed a new mode of politics which he names 'ontological politics':

> It starts from the assumption of the world as multiple and performative, i.e. shaped through practices, as different from a single pre-existing reality. This multiplicity, however, is often disguised when one truth claim, one kind of knowledge, comes to dominate over others (Müller, 2015:31).

As discussed in the previous chapter, ANT scholars are critical of the way some issues, discourses and ideas become 'matters of fact'. ANT's tenet of ontological equality implies that politics 'can and indeed should be shaped by everyone and that knowledge about the world is contingent and not the prerogative of experts [alone]' (Müller, 2015:31). Wynne (2003:402) is also critical of the way the legitimacy of hegemonic knowledge closes down discussions on the meanings attached to issues. According to Wynne (2003:410), science has gained hegemonic status in modern society which means that 'the meaning of public issues' often gets framed through science as 'technical decisions'. This in turn also justifies the view that only scientific experts need to engage such issues. The hegemony of scientific knowledge leaves the public 'thinking that the issues are indeed "technical decision-making" only […] with correspondingly defined core-sets and corresponding "properly" marginal social and

intellectual hinterlands' (Wynne, 2003:410). According to Wynne (2003:410), the legitimacy issue is therefore not only about 'who qualifies as competent to participate by reference to some expertise that relates to the presumed question, but also about how dominant actors have illegitimately excluded people from negotiating what the salient questions are in the first place'.

Callon, Lacoumes and Barthe (2009) acknowledge the importance of public participation (in the form of 'hybrid forums') in policy decision-making processes. According to them hybrid forums can play a crucial role in an increasingly uncertain world. They therefore call for the 'democratisation of democracy' as too many issues and concerns fall through the cracks in representative democracies and it is necessary to be mindful of the hegemony of certain institutions and the way they frame issues to support their own agendas.

Böhm and Brei (2008) also speak to the issue of hegemony and how powerful institutions' development discourses may become salient through marketing practices. They argue that a specific development discourse gets marketed to legitimise specific causes. They describe development as an '"empty signifier", which can be filled in a variety of different ways (2008:341). According to them, companies and institutions frame development in particular ways, so as to 'hegemonize a particular discursive field' (2008:341). They propose that marketing practices play a central role in this process. They focus specifically on the paper pulp industry in South America and argue that it strategically fills the empty signifier, development, with very specific images and text that promise jobs, 'progress and a bright future, while ignoring the manifold environmental, economic and social problems attached with this particular type of development'.

Böhm and Brei also study the way in which marketing can influence 'a country's position in the wider world system' (2008:348). By propagating a specific development discourse, national governments can attract foreign investment whilst making it look as if this will benefit all citizens. They argue that specific power relations lead to specific development discourses. They maintain that:

> …less developed countries are embedded in the heritage of colonial exploitation by more developed countries. As less developed countries are so dependent on foreign capital, technology and other resources, they are considered incapable of internal growth generation, and their dependency is hence the primary cause of their underdevelopment (2008:348).

According to these authors, marketing alone is not enough to hegemonise a specific development discourse as marketing is always 'embedded in and connected to a range of legal, economic, cultural and social practices'. For a specific development discourse to become hegemonic it is thus necessary to know the public's cultural and social contexts so that marketing attempts can be directed and effective.

What is crucial to understand, however, is that this dominance of the economic and legal field is never enough. What the concept of hegemony points to is that the cultural field, which legitimizes this type of development in a wider cultural way, is equally important (Böhm & Brei, 2008:353).

Although certain agendas underlie corporations' and governments' development discourses and they use their power to promote these development discourses, Böhm and Brei argue that that does not make these discourses false. Rather, they contend that many different ideas of progress and development exist (2008:354). At the same time, these corporations or governments promote a 'particular version of economic, social and cultural progress that has real effects in terms of the "real world" …' (2008:354). For Aracruz (a pulp manufacturing corporation) progress means:

…the construction of mega-factories, the plantation of vast eucalyptus areas, the further concentration of land rights, the displacement of many peasants, etc. Equally, when Aracruz claims that it is "really" aiming to be sustainable and environmentally friendly, then we have no reason to doubt the real intentions of the company. The problem is that we are dealing with different versions of sustainability and environmental futures (Böhm & Brei, 2008:354).

While actors may be serious about what their development discourse entails, other actors may oppose it:

We are thus dealing with a struggle for the hegemony of a discursive field, which involves dominant actors as well as a range of resisting actors that continuously embattle the [hegemonic] discourse of development' (Böhm & Brei, 2008:354).

The hegemony of some discourses may cause it to look as if those who oppose it are against progress as the hegemonic discourses are made out to be, in Latour's words, 'matters of fact'. What is necessary, however, is to understand that many different notions of development exist and extra attention should be paid to hear non-hegemonic notions of development.

3.4   Science, astronomy and development in South Africa

Recent controversies in South African universities around 'decolonising science' have thrust the issue of the relationship between science and society and the public understanding of science into the political limelight in this country. These controversies can also be seen at work in major political-policy debates in post-apartheid South Africa on the causes of and treatment for HIV/AIDS (Nattrass, 2012) and the significance of indigenous knowledge systems (on which, see Green, 2012). While these are acknowledged as important debates, constraints on space and time do not allow me to go into them in any depth. In what follows I look briefly at recent protests on university campuses around the decolonisation of science and then review some recent sociological literature on astronomy and development.

According to Joubert (2016), many young, black South Africans feel excluded from science. This was seen in the 2016 'Science Must Fall' movement where some South African students campaigned for what they described as the decolonisation of science. Wild and Nordling (2016) speak about the 'Science Must Fall' movement and how some of the opinions that underlie it, for instance that science is a product of western modernity, disregard African scientists' contributions to the field. For some, the opinion that science is a product of western modernity is reason enough to 'scratch [it] off', but Wild and Nordling warn against throwing out the baby with the bathwater. They contend that science as 'a way of understanding the world' is not the issue at stake and, furthermore, that science belongs to nobody. They do, however, take issue with 'the system which has been created by people' and argue that it is this unequal 'system' that needs to be decolonised (Wild & Nordling, 2016).

Taking their cue from the debates on knowledge and power in pluralistic knowledge societies, Wild and Nordling also point to the dominance of the European or North-American, white, male scientist in science and its consequences for how science has been shaped. 'There is a great weight of history behind science which means that those who have been doing it the longest have had a chance to shape it - sometimes without even realising they are doing so' (Wild & Nordling, 2016). They therefore maintain that the real issues that should be addressed in the decolonising science debate are the way science gets shaped and by whom. They argue that 'science is therefore not unAfrican, but there is a prejudice toward African science'. The power relations within the scientific field need to be re-assessed as certain characteristics (being white, male and European) work to accrue symbolic capital for those who possess them, whereas other characteristics (such as being black, female and African) work to marginalise:

> In many countries, people think that we're still smacking rocks together. Seriously. This filters into decisions about funding; people who review academic papers judge scientific articles based on where they are from. It is often an unconscious bias, sometimes it isn't. This affects minorities, people of colour; hell, women - more than half of the world's population - are still marginalised in what has historically been an old (white) boys club (Wild & Nordling, 2016).

In similar vein Elizabeth Rasekoala (2015), chair of the Pan-African Solidarity Education Network, states that science must give up three things, namely: 'its male dominance, its Eurocentrism and the idea that it is the only answer to all humanity's problems' (cited in Joubert, 2016).

The SKA in South Africa is an interesting case study for the decolonising science debate. While it can be argued, as its advocates strongly do, that the SKA provides the perfect opportunity to prove South Africa's scientific competence globally, this raises certain questions: to whom is South Africa proving its scientific competence and why? And to what extent is South Africa's investment in this field or

"game", in Bourdieu's language, reproducing old structures of inequality? According to Fanaroff (2017), American scientists expressed their surprise and disbelief at the idea that South Africa could host the SKA. Yet by wanting to *prove* its scientific competence to the (prejudiced) west, to what extent is South Africa playing into the idea that there actually is something to prove in terms of its scientific competence? On the other hand, not partaking in international science also sends a message that South Africa is not capable of competing. This catch-22 situation only reinforces the point about the hegemony of the western world in science, as nothing changes the reading of 'the west' as the dominant player.

A further concern is to what extent investment in astronomy reflects a privileged position in an unequal world. From this perspective it is ironic that South Africa, one of the most unequal countries in the world, is spending billions of Rands to uncover new knowledge about space, when the majority of South African citizens are struggling to make a living. Again, advocates of the SKA argue that the investment will bring benefits to the majority. According to Smit, Mbaba and Raynard (2016:37):

> The whole world will benefit from this development in astronomy. Science can contribute to the sustainable development of all in South Africa and improve the quality of life of every citizen. There is confidence in our youth. They will identify and grasp opportunities to contribute to South African inventions and innovations.

This bold claim sums up the justification of astronomy in an unequal world, but whether the SKA will improve 'the quality of life of every citizen' remains to be seen. In a way, this claim also deflects responsibility from the SKA in the event that the project does not better the lives of all in South Africa, as it places responsibility on 'our youth' who have only to 'identify and grasp' the opportunities that the SKA is providing. This claim does not take the social conditions of 'our youth' in small towns like Carnarvon into account.

The development claims of the SKA are beginning to receive some critical attention from social scientists (Atkinson *et al* (2017), Gastrow (2016), Walker & Chinigò, 2017). With regards to the SKA, Walker and Chinigò (2017) show how the SKA project promotes a certain development discourse which links astronomy directly to particular understandings of development. Underlying this is a teleological understanding of progress and science's "natural" role in this process: 'In this schema, western political modernity is normalised as the ultimate model for the developmental trajectory of societies throughout the world' (Walker & Chinigò, 2017:8). This development discourse sees the SKA as the next step in the development of humankind and an endeavour that will benefit 'the whole world', as argued by Smit, Mbaba & Raynard (2016).

Drawing on recent debates in STS, Walker and Chinigò problematise this oversimplified view of the link between astronomy and development and point to the unequal distribution of the benefits of technological innovation across the global, national and local scales. The SKA's simplistic development discourse, 'which serves to justify the enormous financial investment' of the project (Walker & Chinigò, 2017:2), disregards other meanings of development and therefore the contextual nature of such meanings. Power relations underlie the marginalisation of certain notions of development (and therefore the muting of its histories and social contexts). Here Walker and Chinigò find an assemblage lens especially helpful in bringing these power relations within the global SKA assemblage and their impacts on different scales - global, national and local - to the fore.

As with Böhm and Brei (2008), Walker and Chinigò (2017) also point to countries' histories and settings within a global scheme to understand their support for certain development endeavours (in this case the astronomy-development discourse). South Africa's eagerness to support astronomy projects like SALT and the SKA should therefore be understood in the larger context of the country's colonial and apartheid history[12]. Here they cite the 2005 article by Gottschalk on the ambitions behind South Africa's initial SKA bid:

> When the SA Government supports initiatives such as SALT and SKA, the proposed national space agency, and ZA SAT, it does so because it perceives these as having a political importance far beyond their intrinsic importance to us. These project an image of modernity to foreign powers and foreign investors. They project a perception that South Africa is part of "us" and not part of "them" (Gottschalk, 2005:33).

Although South Africa's part in the SKA certainly shows an attempt to be seen as a competent player in the global community, Walker and Chinigò (2017) also point to how South Africa's role in the SKA has 'more narrowly regional applications', more specifically through its link to President Mbeki's 'promotion of a continent-wide "African Renaissance"' and the role of astronomy projects such as the SKA in this agenda. Africa's colonial history has much to do with this focus on "modern" projects and Gottschalk (2005:31) shows that 'Black dignity' plays a role in the decision to partake in global science projects. Africa's buy-in in the "game" (field) of science (seen through Africa's investment in the field, its capital and adherence to its *doxa*) reflects African actors' (decision-makers such as politicians') belief (or *illusio*) in the hegemonic notion of the astronomy-development discourse.

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[12] Sooryamoorthy (2015) provides an account of scientific collaboration in South Africa through the colonial-era, apartheid and the new democratic dispensation.

But Walker and Chinigò also point to how certain socio-material relations within the global astronomy assemblage can result in new formulations of older colonial dynamics:

> Major financial resources and research expertise remain located in northern institutions, while the wonders of contemporary information and communication technologies mean that scientists do not need to travel to the actual observatories to retrieve the data they require. From this perspective, one could argue that far from undermining colonial dynamics, the SKA project is likely to reproduce – 'reterritorialize' – them in new forms (2017:14).

This is but one example of the interaction between different scales (the global and the national) within the global astronomy assemblage, the power relations that underlie it and how its specific "development" discourse justifies the end. Through an assemblage lens the relational nature of scales comes to the fore as well as how new socio-material relations can emerge to reproduce old habits/ideas (reterritorialization).

The hegemony of the SKA's development discourse emerges as such (hegemonic) through 'a myriad of social-material engagements' (Walker & Chinigò, 2017:4). The hegemony of one development discourse necessarily entails the marginalisation of other discourses. Those who then oppose or question the hegemonic notion of development (as is happening on the local scale in Carnarvon) appear 'at best uneducated or ill-informed, at worst enemies of "development"' (Walker & Chinigò, 2017:19). But, the authors argue, local people's understandings of development are incongruent with global notions of development as they are oriented not to the future but towards making a living in the present by 'improving local services and protecting their households and communities in an uncertain even hostile, external world' (2017:18).

Carnarvon's particular history is riddled with unequal social-material relations that have marginalised black people (as seen in the introductory chapter). This history impacts locals' lived realities as well as their perception of the SKA. Many locals understand the prestige attached to the SKA, but do not see how it will positively impact their lives (Wild, 2016:444). In this regard Walker and Chinigò (2017) raise an important question: 'who should be responsible for those who remain marginal and do not directly benefit from the project'? According to Gibbons (1999), who emphasises the importance of citizens' internalisation of accountability, Latour's notion of *dingpolitik* and other ANT scholars such as Callon *et al* (2009), citizens should take responsibility, assert themselves as rightful stakeholders and voice their concerns. This may be easier said than done, but, as I will discuss in Chapter 5, there is evidence for this in Carnarvon.

Whitelock's (2009) account of South Africa's investment in astronomy projects in the post-apartheid era also emphasises the link between astronomy and development, but she regards this in a more

consistently positive light. As a South African astronomer herself, she has a personal stake in South Africa's support of astronomy and is not critical of the astronomy-development discourse that serves to justify the massive expenditure of astronomy projects. She is, however, aware of her stake in South African astronomy and states that 'others would inevitably see things differently and place the emphasis elsewhere' (2009:587).

While positive about the potential of astronomy to contribute to development, Whitelock also raises the concern about the small number of black postgraduate students pursuing careers in astronomy, acknowledging that past inequalities are not that easily transcended. According to her, South Africa's 'lack of astronomers, and the extreme lack of black astronomers was identified as the biggest threat to the future of astronomy in the country' in the planning phases of SALT (2009:593). The National Astrophysics and Space Science Programme (NASSP) was launched to attract new African and African-American students to the field of astronomy but the number of black South African students taking up these opportunities remains very low (Whitelock, 2009:593-4). According to Whitelock, South Africa's poor school system is to blame for black South Africans' low interest in the sciences in general – a legacy of the racially unequal education system under apartheid that meant that black students 'were not allowed to study science to any significant level' but also a consequence of the failure of 'the democratic government […] to put into place effective policies to rectify that legacy' (2009:594).

In her account of astronomy in post-apartheid South Africa, Whitelock promotes the potential of astronomy as a driver of development in the Northern Cape which she describes as 'a poorly resourced and underdeveloped part of the country with almost no science/technology going on and a lot of political pressure to make something happen' (2009:591). She highlights the case of the 'African Flagship' optical telescope SALT, near Sutherland, and shows how the possibility of boosting human capacity development was one of the driving forces behind this venture. (Other considerations included the potential to build international collaborations and benefits to industry.) The 'African Flagship […] should not be underestimated, we need things that show each other and the world that Africa can do high-tech science successfully' (Whitelock, 2009:591).

According to Whitelock, the SALT Collateral Benefits Plan stresses the role of the project as a means 'for a new generation of South Africans to transcend the inequalities of the past and leap over the problems of today'. President Mbeki also emphasised the idea of SALT as more than just an astronomy project in his inauguration speech at its official opening:

> Out of this place, enveloped by the quiet peace of the Karoo and its starlit skies, must and will
> come the message that thought is humanity's stepladder out of Hades - that ignorance is nothing

but condemnation to live for eternity in the world inhabited by the souls of the dead (quoted in Whitelock, 2009:592).

This dramatic statement reflects the teleological understanding of progress and astronomy as humanity's saving grace highlighted in Walker & Chinigo's critique. While Whitelock was aware of her personal position in her account of astronomy in South Africa, President Mbeki appeared less aware of his own bias.

It is certainly easier to combine optical astronomy with local economic development projects than it is in the case of radio astronomy, with its stringent requirements for a radio-quiet operating environment. There is evidence to suggest that SALT's Collateral Benefits Programme has made strides in impacting positively on the lives of local people in Sutherland, in particular through its Community Development Centre and the projects it runs with local schools (SALT, 2017). However, the claim that it will enable a new generation of South Africans to '*transcend*' and '*leap over*' past inequalities is far-fetched.

The idea that astronomy leads to the *transcendence* of past inequalities and that it is a stepladder out of the hell of ignorance is clearly an oversimplification. Statements such as these do, however, reflect the enduring legitimacy of science in modernist development discourse and its authority in South African development debates.

3.5   Conclusion

In this chapter, I have shown not only how the extension of scientific knowledge has led to closer scrutiny by social scientists and the public of the scientific field, but also why that closer scrutiny is warranted, as the overriding legitimacy of science is often used to frame public issues that are open to different interpretations as purely technical issues. Power plays an important role in how certain issues and discourses emerge as salient - or are made out to be, in Latour's words, 'matters of fact'. These issues and discourses rely on the legitimacy of science to back them up and those who then oppose these 'matters of fact' seem '"irrational," "backward" or "archaic"' (Latour, 2005b:30).

These dynamics are strongly at work in the case of the SKA in South Africa. In my discussion of the findings from my fieldwork in the next two chapters, I show how Carnarvon residents and SKA personnel inhabit very different worlds and that the *habitus* of the members of each group is integral to their different understandings of what the SKA means. Furthermore, the hegemonic discourse of development advanced by the SKA organisation, which it makes out to be a 'matter of fact', stands in stark contrast to what Carnarvon residents regard as 'matters of concern' (the outcome of their specific history and social conditions).

Chapter 4: The SKA in Carnarvon: Competing conceptions of its science endeavours

My detailed discussion of my fieldwork findings is divided across two chapters. In this chapter I address the competing conceptions of the science endeavours of the SKA in Carnarvon among local residents on the one hand and SKA personnel on the other. In the next chapter, I focus on the competing conceptions of the SKA's development endeavours among these two groups.

In this chapter I use Bourdieu's notion of *habitus* in providing an overview of *where* first Carnarvon residents and then SKA stakeholders are coming from in their responses to the SKA as a major science project, as I regard this as critical for understanding their different conceptions of the SKA. I start off, in section 1, by discussing Carnarvon residents' *habitus* and its relationship to the specific "place" and environment of Carnarvon before looking more specifically, in section 2, at Carnarvon residents' conception of the SKA's science endeavours. In section 3 I briefly discuss the scientific *habitus* of SKA personnel and end this chapter with a discussion of their conception of the SKA's science endeavours in section 4.

4.1   The small-town *habitus* of Carnarvon residents

In thinking about the *habitus* of Carnarvon I have come to regard the small scale and physical environment of the town as significant. Carnarvon, as already described, is a small town of less than 7 000 people, located in a semi-arid environment far from the major national centres of Cape Town, Johannesburg and Pretoria, as well as far from the provincial capital of Kimberley. On my fieldwork trips it took me some eight hours to drive to the town from Stellenbosch. The closest town to Carnarvon, Williston (which is even smaller than Carnarvon), is some 60 kilometres away, with no system of public transport to link the two towns. In the course of my interviews with local residents one of them, a relative newcomer to the town, spoke of her concern at succumbing to '*klein-dorpie sindroom'* [small-town syndrome], a well-recognised trope in Afrikaans literature which I have adapted to describe the shared *habitus* of Carnarvon residents.

Through the course of my field work four themes emerged as particularly important for understanding the shared small-town *habitus* of Carnarvon residents, namely, the embodiment of "place"; the importance of Christianity and social justice; the values of being down-to-earth and content with very little, and concerns around the vulnerability of youth, linked to the reproduction of hopelessness and

an uncertain future. As discussed in the conceptual framework, Bourdieu (1990:58 & 59) notes that 'homogeneity of conditions of existence' and 'identical histories' create a shared *habitus*. While he recognises that no two individuals share exactly the same *habitus*, he contends that similar conditions of existence, for instance as experienced by a particular class, are likely to lead to a 'non-individual system of internalized structures, common schemes of perception, conception and action' (Bourdieu, 1990:46 & 60). In the case of Carnarvon, certain factors such as the town's smallness and isolation as well as its limited prospects and residents' shared language and religion contribute to the homogeneity of the conditions of existence for its residents. However, as already described in Chapter 1, black and white residents are positioned differently in relation to these conditions, leading to some differences around priorities in their responses to the SKA project.

4.1.1   The embodiment of place

Although the experience of what it is like to be a Carnarvon resident varies across race, age and class, all residents seem to share a very strong connection to the town. Some Carnarvon residents were very aware of how their past and their environment impact their 'schemes of perception, thought and action' (Bourdieu, 1990:54). Margaret, an 84-year-old black *boorling*,[13] who was also a political activist during apartheid, alluded to the importance of place in the shaping of her worldview. She told me:

> *Kyk, as ek die punte maak, dan moet jy weet uit watter hoek ek praat. Ek is gebore in Carnarvon.*
> *Ek het in hierdie selfde gebied groot geword waar ek nou woon. Ons het net in daai huis daar*
> *gewoon voor die dam* (Interview, 2016).

> [Look, when I make these points, then you must know from what angle I'm talking. I was born in
> Carnarvon. I grew up in the same area in which I'm living now. We lived in that house by the dam.]

Many residents expressed a similar need for me to understand that where they are coming from in the literal sense impacts on where they are coming from in the figurative sense (thus their 'schemes of perception, thought and action'). Many residents used the phrase 'born and raised' [*gebore en getoë*] or the term *boorling* when they spoke about themselves in relation to the town. Jonathan, a black resident of Sutherland who works for the SAAO, also described himself to me as a '*boorling in murg en been*' [*boorling* in marrow and bone] to describe the degree to which he sees the town of Sutherland as part of himself (Interview, 2017). His description is strongly evocative of the degree to which people coming from small-town backgrounds in the Karoo embody a sense of place in their *habitus*.

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[13] A *boorling* is a person who was born and grew up in the local town/place.

Thirteen of the Carnarvon residents with whom I spoke are *boorlings,* eight of whom had left the town at some time in their lives to work elsewhere, but had subsequently returned 'home'. Sara, who is a black resident, told a typical story in this regard:

> *Ek is getroud. Ek het vier kinders. Ek het skool geloop tot graad nege. As gevolg van omstandighede moes ek skool los en het ek begin werk. Ek wou graag verder geleer het, maar kon nie daarby uit kom nie. Nou is ek 45 jaar oud. Ek woon al op Carnarvon van geboorte af. Was 'n bietjie uit gewees, het in die Kaap gewerk vir 'n tydjie. Ek het vir Slamse gewerk, maar dit was nie reg vir my nie, so toe kom ek terug. My oudste dogter het in Mosselbaai gewerk, maar het seker ook gevind dis nie lekker nie, so toe kom sy terug huis toe* (Interview, 2016).

> [I'm married. I have four children. I went to school up until grade nine. Because of circumstances, I had to leave school and started working, I wanted to further my studies, but didn't get to it. Now I'm 45 years old. I've been living in Carnarvon since I was born. Was out for a while, worked in Cape Town for a while. I worked for Muslims, but found it wasn't right for me, so I came back. My eldest daughter worked in Mossel Bay and probably also found that it wasn't nice, so she came back home.]

This short biography points to how the place of Carnarvon becomes embodied as part of *boorlings'* inner worlds. Carnarvon is home, the place of residents' enactment of *habitus*, and many experience being in other (larger) places as wrong, unpleasant or uncomfortable. The intimate scale of life in a small Karoo town is an important element in this sense of place. Thus the Sutherland resident that I interviewed described feeling 'claustrophobic' in cities and struggling to stay there for longer than two days at a stretch. In similar vein, Carlo, a young black Carnarvon resident, told of how he had felt out of place when he went to Cape Town for the first time at the age of 16. In addition to the shock of being in such a large, unruly place, he told of how hearing young people in Cape Town speak about what they wanted to study after school made him feel very awkward and out of place, as he had just dropped out of school.

Other participants, including some SKA personnel who originate from small towns, spoke about the awkward adjustment one must go through when moving from a small town to a larger town or city. For instance, one SKA staff member spoke about how Stellenbosch felt like a city to him when he first enrolled at the university. He described his experience as a 'culture shock' and spoke about how strange it was that people on the streets did not greet each other or know who their neighbours were. These awkward experiences point to how certain common-sense behaviours can be bounded by place and to the 'disjunctures' individuals experience 'when habitus encounters' unfamiliarity (Reay, 2004:436).

However, whether residents view the intimate scale of Carnarvon as something positive or potentially negative seems to depend on how long they have been living in Carnarvon, which points to how a place "grows" on individuals over time in forming part of their inner world. Liezel, the informant who first raised the idea of a '*klein-dorpie* sindroom' [small town syndrome] in Carnarvon with me, is a young, white woman who has only been living in Carnarvon for three years. She fears that living in Carnarvon might restrict her worldview. She is originally from a city and her Master's degree renders her highly educated in comparison to most other residents. She is seen as an *inkommer* [literally 'incomer'][14] and her perspective on Carnarvon and place is interesting in relation to the views of *boorlings*. For her Carnarvon's smallness is less comforting than enclosing. In her interview with me she said:

> *Ek sê altyd vir my man ek is net bang ek val vas in daai klein-dorpie-sindroom, omdat dit al is wat mens het. Dan besef mens nie altyd dat, byvoorbeeld, die wêreld is groter as sê nou maar net Carnarvon nie. So, as ons iewers heen gaan dan probeer ek altyd dat dit my beïnvloed sodat ek nie altyd klein bly soos Carnarvon nie* (Interview, 2017).

> [I always tell my husband that I fear I will fall into that small-town syndrome, because that is all that you have. Then you don't always realise that for instance, the world is bigger than Carnarvon. So, when we go to other places, I always try to be influenced by it so that I don't always stay small like Carnarvon.]

The phrase 'so that I don't always stay small like Carnarvon' hints at the way place can become embodied over time and influence the way people perceive themselves and the world around them. The fact that Liezel originally comes from a city and has only been living in Carnarvon for three years impacts the way she thinks about small-town living. She mentions some positive factors about living in a small town, such as no traffic and the feeling of safety, but also fears its impact on her relationship to the wider world. Liezel's fears stand in stark contrast to *boorlings'* experience of small-town living, here captured in the comments by Margaret who reflected on how not simply the small town of Carnarvon but the Karoo is integrally part of her life:

> *Vir ons wat hier groot geword het, ons is verbind aan hierdie tipe klimaat, die vlaktes, die oopheid. Jy kan vroeg opstaan en as jy op een van hierdie koppies gaan staan en jy sien die son kom op... dis iets anders as die gedruis van stede of ander plekke. Daar kan dalk vir mense mooier plekke wees as die Karoo, ek stry nie daaroor nie, maar dis nie my Karoo nie, dis nie my omgewing nie, dis nie my lewe nie* (Interview, 2016).

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[14] A new resident who is not yet seen as part of their new community.

[To those of us who grew up here, we are connected to this climate, the plains, the openness. If you wake up early and stand on one of these *koppies* and watch the sun rise… it's something else than the din of cities and other places. To other people there may be places more beautiful than the Karoo, I don't mean to disagree with them, but that is not my Karoo, that is not my environment, that is not my life.]

This quote introduces another important element of Carnarvon residents' embodiment of place and that is their appreciation of the very particular environment of the Karoo, which is a key part of what makes living where they do so special. For them town and countryside are not two distinct spheres but are intimately linked – the surrounding veld merges with the town and shapes its character. Many residents, black and white, spoke to me of how much they enjoy spending time in the veld. For many being in the veld is also coupled with nostalgia about the past and with spirituality, as the experience of being in the veld is at once reminiscent of childhood days and of being close to God's creation in its purest form - pure nature.

Elsa, a 53-year-old woman who grew up as a farm worker's daughter, spoke of how her connection to the land comes through her family's Khoisan roots. She said:

My familie is mense wat naby die aarde leef, wat baie lief is vir die dinge van die Here. Ons glo aan gebed, dat gebed gee vir jou alles. Ons is 'n geestelike familie, diep gewortel in die aarde, met baie liefde vir die grond (Interview, 2016).

[My family are people who live very close to the earth, who very much love the things of the Lord. We believe in prayer, that prayer gives you everything. We are a spiritual family, firmly rooted in the earth, with lots of love for the ground.]

She spoke fervently about how growing up on a farm and its simple lifestyle influenced her and made her into the 'down-to-earth' person she is today:

Jy kan in watter stad wees en met watter hoë-klas mense gesels, maar jou hart en jou gedagtes waai terug na die aarde toe. Jy het grootgeword op 'n plaas, jy het misvloere gesmeer, jy het hout aangedra op jou rug of op jou kop, jy het water van ver af aangedra na jou huis toe, jy het werf gevee met 'n besem, jy het vuur gemaak op die grond, jy het roosterbrood daar gebraai, jy het potbrood daar in die pot op die vuur gemaak. Jy het alles plat op die aarde gedoen en dit is die liefde wat jy het vir die aarde, want jy het alles van die aarde af gedoen. Ek het plat op die aarde gewerk en dit hou my twee voete tot vandag toe nog plat op die aarde (Interview, 2016).

[You can be in any city and talk to whatever high-class people, but your heart and thoughts return to the land. You grew up on a farm, you smeared the dung floors, you carried wood on your back or on your head, you carried water from afar all the way home, you swept the yard, you made fire on the ground, you braaied bread there, you made pot bread there in the pot on the fire. You did

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everything down to earth and that is the love you have for the earth, because you did everything from the earth. I worked in a down-to-earth way and until this day it keeps my two feet down to earth.]

This points to the important role that place and its many entanglements (such as a specific lifestyle) can have on the formation of *habitus* and how individuals' *habitus* draws them to familiar milieus ('but your heart and thoughts return to the land'). Not only has Carnarvon's natural environment become embodied within Elsa, but she has also attached symbolic meaning to elements in her surroundings:

Ek weet wie ek is en ek weet wat ek uit die lewe wil hê en waarheen ek oppad is. Ek sê altyd ek wil nie 'n rolbos wees nie. 'n Rolbos is 'n baie ligte ding. Die wind pluk hom daar uit en hy rol hom net waar hy wil. Ek wil nie so wees nie. Ek wil standvastig wees, met my voete plat op die aarde. Ek sê altyd, seker omdat ek groot geword het op die plaas.... Jy kry 'n plant, hulle noem dit die Drie-doring bos. Hy is bekend vir groei in die omgewing waarin ek groot geword het, ons noem dit die Kreeberge, nie Kareeberge nie, hulle noem dit die Kreeberge. Nou hy het 'n bos, die Drie-doring bos of dit nou winter is en of dit nou somer is, daai bos groei en hy is geanker in die aarde. En hy staan tussen die yster klippe in die berge. Hy't sukke (sulke) pennetjies wat lyk soos dorings... maar hy staan waar hy staan. Jy kry hom nie maklik uitgeroei nie. Ek sal my anker aan hom, want dan vat jy saam die berge, die Drie-doring bos en die swart yster klippe. Hy's dun, ook so dun soos ek (lag), 'n enkel maer bossie, maar hy is sterk. As ek sulke bossies sien, dan weet ek, ek is in die Kreeberge. Dit is waar ek gebore en getoë is (Interview, 2016).

[I know who I am and what I want out of life and where I'm going. I always say, I don't want to be a tumbleweed. A tumbleweed is a very light thing. The wind plucks it out and rolls it wherever it wants. I don't want to be like that. I want to be steadfast, with my feet flat on the earth. I always say, probably because I grew up on the farm... You get this plant, they call it the Three-thorn bush. It is known for growing in the region where I grew up, we call it the Kreeberge, not the *Kareeberge*[15], but the *Kreeberge*. Now there is this bush, the Three-thorn-bush, whether it is winter or summer, that bush grows and it is anchored in the earth. It stands between iron rocks in the mountains. He has these pins that look like thorns… but he stands where he stands. You can't eradicate him easily. I will anchor myself to that bush, because then you take together the mountains, the Three-thorn-bush and the black iron rocks. It's a thin bush, thin like me (laughs), a single thin bush, but he is strong. When I see those bushes, then I know I'm in the *Kreeberge*. That is where I was born and raised.]

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[15] The Kareeberge is the name for the low mountain range adjacent to Carnarvon, after which the local district municipality takes its name.

These excerpts from my interview with Elsa show how she feels at one with the natural environment of the Great Karoo which is suggestive of her embodiment of the natural environment. In growing up on a farm, she has come to attach meanings to things in her surroundings and over time has also embodied the values associated with the surrounding flora (as seen through her personification of tumble weeds as being fickle and the three-thorn bush as strong and steadfast). Although other residents also spoke of their attachment to the Karoo's natural environment, none spoke as passionately about this connection as Elsa.

A few residents spoke about how they would go to the veld to clear their minds when they are troubled. Jan, a white farmer in his early sixties, recalled how he was troubled by the possibility of the SKA buying the farm between his own and the SKA's core site and the implications of this for predator control on his sheep farm. He told of how he walked in the veld to clear his mind and received confirmation from God that there will be a solution to his problems. A black council member makes praying in the veld part of his daily routine. He spoke to me about the challenges he faced in taking on a new occupational position, with new responsibilities, and of the spiritual comfort he found by being in the veld:

> *Ek het in die berge gaan stap, myself geïsoleer… diep in die veld. Elke dag. En die Here antwoord, want jy word stil […] Word stil en gee die Here 'n kans om te beweeg. Die Here sal vir jou instaan en die werk vir jou doen* (Vincent, interview, 2017).

> [I walked in the mountains, I isolated myself… deep in the veld. Every day. And then the Lord answers, because you become still […] Be still and give the Lord a chance to move. The Lord will stand in for you and do the work for you.]

4.1.2   Christianity, the status quo and social justice

Not only do the above extracts from my interviews with Carnarvon residents point to the importance of the natural environment in shaping what makes Carnarvon a special place. The residents' connection to the natural environment on a spiritual level also speaks to the guiding role of religion, more specifically Calvinist Christianity, in Carnarvon residents' understanding both of daily life and their place in the world and of how the world functions.

The Christian religion and its accompanying values form a critical part of Carnarvon residents' *habitus*, and hence the place from where they have engaged the SKA. The history of the two main churches in Carnarvon that has already been touched on in Chapter 1 plays a key role in how white and black residents think and speak about religion today. While most residents adhere to a conservative theology, in which the Christian Bible is likely to be interpreted literally, rather than figuratively, there

are significant differences in the role played by the 'black' and the 'white' church[16] in the public life of Carnarvon. In this regard the 'black' church has played an important role in Carnarvon's history as champion for black residents' rights against unjust authorities during the apartheid era, and this social activism is still an important component of the church's public identity. Many residents rely on the church not only for spiritual guidance, but to act on behalf of 'those who cannot speak' (Elise, interview, 2017).

For the 84-year-old Margaret this is not a disruptive position to take but one that contributes to order in the town:

> *...as daar iets in ons dorp verkeerd gaan, eerste wat ons doen ons hardloop na ons predikant toe, want ons wil nie hê hier moet* tyres *gebrand word nie. [...] ons het 'n dominee wat luister na ons en wat ons mondstuk is en wat intelligent genoeg is en wat nie 'n man van geweld is nie, wat 'n vredevolle man is en sy woord is sy eer* (Interview, 2016).

> [...if something goes wrong in our town, the first thing we do is we run to our minister, because we don't want tyres to be burnt. [...] we have a minister who listens to us, who is our mouthpiece and who is intelligent enough and who isn't a violent man, he is peace-loving and his word is his honour.]

She spoke about how justice formed part of her upbringing:

> *Ek het al die jare geveg teen ongeregtigheid. Vir my maak dit nie saak of jy wit, swart of bruin is nie. Vir my was dit ongeregtigheid is ongeregtigheid. As daar teenoor jou gediskrimineer word, dan moet ek daarteen opstaan. Verstaan? Ek kom ook uit so 'n huis uit waar ons sterk gestaan het op geregtigheid. Maar my ma was baie oor jy moet staan vir iets wat reg is of teen iets wat verkeerd is... en kwaad geword as ongeregtigheid plaasvind. Dit is my agtergrond* (Interview, 2016).

> [All these years I have fought against injustice. For me it's not about whether you are white, black or coloured. To me, injustice is injustice. If there is being discriminated against you, then I have to stand up against it. Understand? I come from a home where we stood strongly on justice. My mother was all about standing for something that is right or standing up against something wrong… and getting angry if injustice takes place. That is my background.]

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[16] I have adopted this terminology to distinguish between the two churches in question, which, although sharing a common history and the same Calvinistic theological foundations, cater for two separate congregations which continue to be racially segregated in practice though no longer in law.

Other black residents, especially older people who experienced institutionalised racial oppression under apartheid, also spoke about how important the idea of social justice is for them. For Jeffrey (39) social justice is integrally coupled to *medemenslikheid*:[17]

> *Soms moet jy luister na die* call*. Jy kry mense wat sosialisties gebore word, daai waardes en die die die liefde vir die medemens. Dit is waaroor sosialisme gaan en die Bybel praat erg op* social justice*. En vir 'n lang tyd het ek nie geweet hoekom doen ek dit nie, maar ek begin nou besef dat dit gaan oor hoe jy groot gemaak is... die waardes wat binne-in jou is. Jy kan nie ongeregtighede sien nie. Ek gaan nie gereeld kerk toe nie, maar ek leef my Christenskap uit oor wat ek doen vir my medemens* (Interview, 2016).

> [Sometimes you have to listen to the call. You get people who are born socialist, those values and the the the love for your fellow man and woman ['*medemens'*]. That is what socialism is all about and the Bible talks strongly on social justice. For a long time, I didn't understand why I did the things I did, but now I start to realise it is about how you were raised… the values that are within you. You can't take seeing injustices. I don't go to church that often, but I live out my Christianity by what I do for my fellow man and woman.]

The ideal of social justice is also important for the minister of the 'black' church, who believes that it should form an integral part of human spirituality. He thus believes that the church should play an active role in the community life of Carnarvon:

> *Om stil te bly in 'n tyd van onreg beteken jy onderskryf onreg. Jy moet kant kies. Jy moet altyd... en dit is wat ons Belydenis van Belhar sê, jy moet altyd die kant kies van die* underdog. *Jy kan nie anders nie. Die armes, die mense wat uitgebuit word, die mense wat verdruk word... jy moet hulle kant konsekwent kies [...] dit is maar net medemenslikheid om altyd die kant van die swakkes te kies [...] Ek glo dit moet 'n konsekwente tipe van 'n spiritualiteit wees by alle mense, nou praat ek nie net van godsdienstige mense nie. Alle mense het spiritualiteit* (Nicolas, interview, 2016).

> [To keep quiet in a time of injustice means that you endorse injustice. You must choose a side. You always have to... and that is what the Confession of Belhar says, you always have to choose the side of the underdog. You can't choose differently. The poor, the exploited, the oppressed... you must consistently choose their side. [...] it is purely human [*medemenslik*] to always choose the side of the weak. [...] I think it should be a consistent type of spirituality within all people, now I'm not only talking about religious people. All people have spirituality.]

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[17] Directly translated *medemenslikheid* would be co-humanity or co-humanness and implies compassion towards one's fellow human being.

This excerpt speaks strongly to the link between Christianity and social justice in his conception of religion. These excerpts also show how values become embodied and form the foundation for individual action.

The minister of the 'white' church spoke about the difficulties of being the minister of a conservative and traditionalist white congregation. She did not see it as her role to take an activist stance on matters of social justice as this might cause divisions in the church, but she did say that her sermons always preached the principle of social equality:

> *Maar ek sal altyd in my boodskappe sê, want dit is my eerlike opinie, dat ons gelykes is voor die oë van die Here. Of ons nou 'n arm boemelaar is en of ons nou Bill Gates is. Ons is dieselfde. Voor God is daar nie verskille nie. Nie op grond van ras nie, nie op grond van geslag nie, nie op grond van status, geld ... niks* (Liezel, interview, 2016).

> [But my messages will always say, because this is my personal opinion, that we are equals in the eyes of the Lord. Whether we are poor beggars and whether we are Bill Gates. We are the same. Before God there are no differences. Not on the basis of race, not on the basis of gender, not on the basis of status, money ... nothing.]

She also commented on the deep divisions within her congregation as a result of different positions on the SKA. Some congregants have benefited through jobs or enhanced business opportunities but others are losing their farms - a major focus of white antipathy to the SKA in the town. While she was under pressure from her congregants to take sides on the issue of the SKA, she felt that to do so would lead to even greater divisions in the church.

With regard to the views of the other white residents whom I interviewed in Carnarvon, religion featured as clearly important in their understanding of themselves but its significance related to their own lives rather than to public engagement. Plans to retire within a few years, for instance, would be followed by the qualifier '... *as dit die Here se wil is*' ['... if it is God's will'] or worries over an uncertain future would often warrant the comment that '*Die Here sal voorsiening maak'* ['God will provide'] (Jan, interview, 2016).

4.1.3   Being down-to-earth and content with little

The importance of being down to earth in the literal sense is an important element of the small-town *habitus* of Carnarvon as has already been discussed. The value of being down-to-earth in the figurative sense also featured prominently in residents' understanding of what constituted a good person in their context. Its meaning can best be understood in terms of its opposite, what is *not* considered being down to earth, and hence not worthy of respect in the community of Carnarvon. Here a range

of attributes and behaviours qualified. Not being straightforward and hence not trustworthy was one of the features of a person who was not down to earth. People using complex terminology when they speak or choosing to speak in English as well as people who like to adopt 'fancy' titles for themselves were also examples of behaviour that is not down to earth and therefore 'not for the likes of us', to use the descriptive phrase put forward by Bourdieu (1990:56). In this context 'science' was an activity for people who are not down to earth and 'not for the likes of us' for most residents of Carnarvon.

A scientist attached to the SKA also spoke of her experience of Carnarvon residents as being down-to-earth. In her interview with me, Karla, a young engineer, reflected both positively and negatively on the lack of pretence she encountered in her interaction with Carnarvon's townspeople:

> *Ek dink klein-dorpie mense is* cooler*, hulle is baie meer* relational*, hulle* pretend *nie, hulle laat jou in hulle huis in, want dit is nie iets wat hulle altyd kry nie, verstaan, as iemand opdaag dan wil hulle gesels. Maar aan die eenkant kry jy die klein-dorpie mense wat die klein-dorpie* mindset *het op 'n slegte manier. Hulle bly daar, maar hulle het nie regtig 'n toekoms daar nie... maar hulle doen ook nie moeite om uit te beweeg nie en hulle bly in daai klein-dorpie* mindset *hulle hele lewe tipe van ding. Maar dan aan die ander kant kry jy ook mense van klein dorpies wat ook die vermoë het om net soos super groot te droom, wat nie* confined *is deur wat hulle weet nie, verstaan?* (Interview, 2017)

> [I think small-town people are cooler, they are much more relational, they don't pretend. They invite you into their homes, because that's not something that they get every day, understand, if somebody arrives then they want to talk. But on the other hand you get those small-town people that have the small-town mindset in a bad way. They stay there, but they don't really have a future there... but they also don't go to the effort to move out and they stay in that small-town mindset their whole lives type of thing. But then on the other side you get people from small towns who just have the ability to dream like super big, who are not confined by what they know, understand?]

While she approved of local people's hospitality and lack of pretentiousness her views of the negative side of the 'small-town mindset' was similar to Liezel's understanding of '*klein-dorpie sindroom*'.

Other important values that emerged through my interviews as part of the Carnarvon small-town *habitus* were those of being content with little and demonstrating good-neighbourliness. The isolation and harsh semi-arid environment in which Carnarvon is located means that making a living there is difficult, but strong social networks are seen to compensate to some degree for the town's deficiencies in job and schooling opportunities. To improve one's circumstances generally requires looking for opportunities elsewhere, but poverty, Carnarvon's physical isolation and residents' strong connection to the town combine to make leaving the town unthinkable for many residents - something that outsiders like Karla seemingly do not grasp.

According to Aletta, an old white woman in her 80s, 'only people who were born here survive here' ['*hier oorleef net mense wat hier groot geword het*'] (Interview, 2016). This statement not only points to the difficulty of making a living in Carnarvon, but also to how being content with little has become embodied and naturalised over time. What may seem like a strange place to settle for city dwellers is home for Carnarvon *boorlings*. In Aletta's words: '*Al lyk 'n dorp hoe vaal en ellendig, die mense wat daar groot geword het, sê altyd daar is nie 'n lekkerder plek om te bly nie*' ['Even if a place looks ever so dull and wretched, the people who grew up there will always say there isn't a better place to stay'] (Interview, 2016).

What is meant by "little" does, however, vary across race and class. Although the town is not a wealthy one and the living standards of even the most highly ranked residents are generally modest, what "little" entails differs across racial lines. White residents generally have the means to leave Carnarvon when the need arises, but most black residents do not. Most white residents compare their circumstances to friends and family in larger towns and cities rather than to their fellow black townspeople. Black residents, on the other hand, tend to compare their living conditions with that of better-off white residents; they are very aware of the unequal distribution of opportunities and resources among residents and how Carnarvon's history of racial dispossession has played a massive role in this regard.

One black resident, for instance, spoke of how it took her years to accept that all she can do is to live from day to day. She told of how her grandfather had owned a farm a long time ago, but because she has no proof of ownership she cannot put in a land claim. At the same time, although it took her a long time to come to terms with this injustice, she comforted herself by reflecting on how one cannot take one's earthly possessions with one when one dies. This could be seen as a rationalisation of the recognition that her family will never get their land back, but for my informant it is the rather stoic truth she lives by. She also finds that her Christian beliefs make it easier to bear present-day burdens:

> *Maak nie saak of jy swart is en ek pienk is nie, daar is net daai een God wat alles van ons weet. Wat ons gemaak het. En eendag gaan ons weer by God wees, maak nie saak of ons pienk, swart, pers of wat ook al is nie. Ek gaan nie 'n aparte hokkie kry omdat ek pienk is nie (Elise, interview, 2017).*

> [It doesn't matter if you're black and I'm pink, there is only one God who knows everything about us. Who made us. And one day we will be with God again, no matter if you're pink, black, purple or whatever. I won't get a separate place because I'm pink.]

Being content with little is seen as something virtuous. It stands in contrast to being demanding or wanting many things which Aletta described as an illness, one she luckily does not suffer from ['*ek ly gelukkig nie daaraan nie'*] (Interview, 2016). Bourdieu (1990:54) states that individuals are far more

inclined 'to make a virtue out of necessity than attempt to achieve "what is already denied"'. In this setting being content with little becomes a virtue out of necessity while sharing and helping one another is seen as naturally part of what it means to live in Carnarvon. However, Carnarvon's close-knit social network, formed out of necessity, functions to preserve the status quo in two ways: firstly, it makes living in Carnarvon possible and secondly it makes people want to stay in Carnarvon as they feel that good-neighbourliness and compassion (*medemenslikheid*) are missing in other places.

According to Bourdieu (1990:54), 'the objective conditions […] generate dispositions objectively compatible with these conditions and in a sense pre-adapted to their demands'. Carnarvon's limited options in terms of things to do and places to go and even the simple and bare landscape have inculcated a 'sense of limits' within its residents and thus a propensity to be content with little and to sanction this as a positive value.

4.1.4   Vulnerable youth, the reproduction of hopelessness and an uncertain future

The fourth theme that emerged strongly through my interviews reflects a more pessimistic dimension of the small-town *habitus* of Carnarvon. Many older residents expressed concern about Carnarvon's youth and 'what will become of them'. This was accompanied by expressions of hopelessness that things were not getting better and fears of an uncertain future.

Some older residents complained of young people's lack of a work ethic and disinterest in gaining traditional knowledge. Thus Elsa, who is very knowledgeable about indigenous remedies (*boererate* or *kruie rade*), fears that this knowledge will die with her because the next generation is not interested in what she knows:

> *Party nagte word ek wakker beangs en bevrees. My mense is ongeïnteresseerd. Die meeste is nie geïnteresseerd nie. As ek so rond kyk… my suster se seuns, hulle is nie geïnteresseerd nie. Waarnatoe gaan die kennis? En dan kom dit by my, maar my kind is baie lief vir my, verskriklik. Dan sê ek vir haar: "Ek is so moeg. Kom sit op die bed dan kan jy lekker sit en skrywe vir ons, die rate". Die boererate of kruie rade. Dan bly dit behoue [...] Ek probeer haar gedagtes vasvang. Dis so nodig... want eendag kan jy dit wel nodig kry. Maar sy is nie gepla nie. [...] Sy is 'n moderne mens. Huise versier, mooi klere... prente teken van klere. Sy is glad nie soos ek nie* (Elsa, interview, 2016).

> [Some nights I wake up anxious and afraid. My people are uninterested. The most are not interested. When I look around… my sister's sons, they are not interested. Where will the knowledge go? And then it comes to me, but my child loves me very much, very much. Then I tell her: "I'm so tired. Come sit here on the bed and write down all the remedies for us." The *boererate* or *kruie rade*. Then it will stay preserved [...] I try to capture her thoughts. It's so necessary, because

one day you could very well need it, but she isn't bothered [...] She is a modern person. Decorating houses, nice clothes... drawing pictures of clothes. She is nothing like me.]

Other residents spoke to me about the extremely high prevalence of alcohol and drug abuse among young people in Carnarvon and how a sense of hopelessness or 'feeling like a nobody' leads to these issues. While Carnarvon's youth are discontented with the town's lack of development and opportunities, many of them also do not want to leave Carnarvon. Although they may not share their elders' acceptance of being content with little, they find it difficult to leave Carnarvon as they lack skills and the cultural capital to make a new life outside of Carnarvon.

The story of Carlo, who told me how he felt out of place when he went to Cape Town for the first time at the age of 16, exemplifies this predicament – he had never felt more awkward in his life than when the Cape Town teenagers spoke about what they would like to study after school whereas he had just dropped out of school. He started working on a construction site to provide for his baby boy. He also started dealing in marijuana, mandrax (methaqualone) and *tik* (crystal methamphetamine) and this, he says, makes him feel better about not having matriculated because he always has money and can help others out financially. One day, he assured me, he hopes to stop dealing in drugs and to start a 'legit business'. However, a mother whose two sons are both addicted to *tik* said that it is not easy to get out of dealing drugs: 'Kids are forced to hustle, because here are no job opportunities' [*Kinders word geforseer om te* hustle, *want hier is nie werk nie*] (René, interview, 2016).

Alcohol and drug abuse are a huge concern in the community. One white resident spoke of the terrible living conditions of his neighbours and their children:

> *Hier langs my het bruin mense gekoop. Die mannetjie was 'n onderwyser, maar hy het sy voete onder sy lyf ui tgedrink en homself uit sy werk uit gedrink. Hy woon nou hier, maar hy het geen inkomste nie. Ek weet nie of hy dalk SASSA geld ontvang nie. Sy ma was 'n baster vrou. Hy het nou klomp mense van die plaas af hier, maar hulle lewe nou amper primitief. Hulle kook onder daardie boom. Daar word vuur gemaak. En hier is ook vier kindertjies. Hulle het geen heenkome nie en hulle gaan ook nie skool nie. Nou sit hulle daar in die hoek. Dis die dekadensie wat plaasvind hier. Hulle sit daar in die hoek. Die vier is nou net op so opgeskote stadium en hulle het nou al in die hoenderhokkie ingetrek en daar gespeel en ek weet nie wat nog gedoen nie, want dit sal nie lank wees nie dan sal een nou nog weer 'n* baby *produseer.* This is really something to worry about for the future (De Wet Nel, interview, 2016).

> [Coloured people bought the neighbouring property. The guy was a teacher, but he drank his feet out from underneath his body and he lost his job. Now he lives here, but he has no income. I don't know whether he maybe gets SASSA money. His mother was a *baster* woman. Now he has brought a lot of people off the farm here, but they are almost living primitively. They cook underneath that

tree. There they make fire. And here are also four little children. They have no refuge and they don't go to school. Now they sit there in the corner. This is the decadence that is taking place here. They sit there in the corner. They have just about reached adolescence and they have moved into the chicken coop and they play there and I don't know what else, because it won't be long until one produces a baby. This is really something to worry about for the future.]

On the question of why she thinks alcohol and drug misuse are such big problems in Carnarvon, Michelle, a 28-year-old black woman, pointed to 'the problems that we face':

> *Dit gaan hand aan hand, natuurlik. As ek vir my kinders wys ek bly dronk, ek gaan nie werk nie, ek sit op die* bar *se stoep... of jy nou skool toe gaan of nie skool toe gaan nie, of jy nou skoon is en of jy nou vuil is, of jy geëet het en of jy nou nie geëet het nie, hulle gaan mos hopeloos raak. Hulle gaan mos nie vertroue het nie. Is 'n* ripple effect. *Dit begin by my ouers. My ouers het nie vir my gewys jy kan maar dronk wees, jy kan maar op die* bar *se stoep sit en dan gaan dit aan en aan en aan... So dit is nie iets wat nou gebeur het nie* (Michelle, interview, 2016).

> [It goes hand in hand, of course. If I show my children that I'm drunk all the time, I don't work, I sit on the bar's *stoep*... whether you go to school or not, whether you are clean or dirty, whether you have eaten or not... obviously the children will become hopeless. They won't have any trust. It is a ripple effect. It starts with my parents. My parents didn't show me that it is okay to be drunk, you can sit on the bar's *stoep* and so on... So, it isn't something that started happening just now.]

This excerpt points to the reproduction of *habitus* and the role that hope or its absence can play in either breaking or perpetuating its reproduction.

Jonathan also pointed to the importance of hope and motivation in breaking the 'ritual' of reproducing a maladapted *habitus*. After attaining his MBA, he returned to his own town to make a positive change in his community, because:

> *Ek kom uit dieselfde ritueel [...] waar my ma alleen vir ons voorsien het, waar alles teen jou was, jy het 'n sisteem gehad wat vir jou gesê het: "jy is nie goed genoeg nie omdat jy 'n anderkleurige is, jy sal tot niks kom nie, jy sal maar net 'n arbeider wees". Nou daai faktore... gelukkig het ek nie 'n ouer gehad wat drink en rook nie. Sy het ons altyd gemotiveer: " Jy is altyd tot alles beter in staat en jy kan enige iets bereik". [...] So, dit hang maar af van jou omstandighede* (Jonathan, interview, 2017).

> [I come from the same ritual [...] where my mother alone provided for us, where everything was against you, you had a system that said: "you are not good enough because you are coloured, you will amount to nothing, you will only be a labourer". Now those factors... luckily, I had a parent

who didn't smoke and drink. She motivated us: "You are capable of more and you can achieve anything." [...] So, it really depends on your circumstances.]

The word '*ritual'* in this quotation again points to the reproduction of *habitus* and how it can become like a ritual. According to Bourdieu, *habitus* includes a sense of limits, of what is and is not attainable, through which individuals form their expectations of what is possible.

4.2 Carnarvon residents' conception of the SKA's scientific endeavours

4.2.1 'Not for us'

As already discussed in the introductory chapter, for most Carnarvon residents the contrast between the multi-billion-rand SKA project and their every-day realities is striking. In my conversations with residents, I came across only three who showed some enthusiasm for the SKA's science endeavours, all of them educated and two of them white. One of them regarded the SKA as a project of international significance which therefore outweighed Carnarvon residents' concerns. However, the enthusiasm of the other two for the scientific knowledge the project will produce were muted by their criticisms of its advocates' approach to dealing with the people of Carnarvon as well as its possible negative effects on the town's economy. The one reflected on this dichotomy in his thinking thus:

Ek is gefassineerd deur al die teorieë en ek wil saam dink, maar uiteindelik is ek nie 'n wetenskaplike nie. Ek lees dit as 'n stokperdjie hier en daar, maar nie so baie nie, maar natuurlik stel ek belang. Maar wat nou interessant is vir my - praat van die kwantum fisika en die kosmologie – dat die twee soms in botsing kom met mekaar en dan vind hulle maar die goed gedra hulle nie soos wat hulle moet gedra nie en die kosmologie sê, maar dit is veronderstel om so te werk en dan gooi dit die ouens verskriklik deurmekaar. Ek wil graag hê hulle moet uitvind hoe die goed in mekaar in pas. Ek sal altyd navorsing ondersteun, ek is daarom ten gunste van die SKA in beginsel, maar nie van hul onderdrukking en uitbuiting van mense hier nie. Ek is bevrees daar is baie goed wat hulle nie reg doen nie (Nicolas, interview, 2016).

[I am fascinated by all the theories and I want to think with them, but in the end, I'm not a scientist. I read it as a hobby here and there, but not so much, but of course I'm interested. But what I really find interesting - talking of quantum physics and cosmology - that the two sometimes clash with one another and then they find that the things do not behave as they are supposed to behave and the cosmology says but it's supposed to work and then it throws them off completely. I would really like them to find out how the things fit together. I will always support research, I am therefore in principle in favour of the SKA, but not their oppression and exploitation of the people here. I am afraid there are a lot of things they do wrong.]

The other informant told me that she was also interested in the science aspect of the SKA at first, but later lost her interest:

> *Ek het my belange daarby verloor, want wat is die moeite werd om te kyk na die oorsprong van die aarde, van die heelal, maar jy stel nie belang in die kreature wat daar woon nie? Nie net die mensdom nie, maar die omgewing, die diere, die die die... jy het nie 'n waardering vir die ontwikkeling vir daai mensdom nie. Kyk, hierdie klein wêreldjie het mos mense. Is die mense, die kreature wat daar woon vir jou minder belangrik as jou studie na die heelal?* (Margaret, interview, 2016)

> [I lost my interest in it, because what's the use of looking at the origin of the earth, of the universe, but you are not interested in the creatures who live there? Not just humankind, but also the environment, the animals, the the the... you don't have an appreciation for the development of humanity. Look, this tiny world has people. Are the people, the creatures who live there, less important to you than your study of the universe?]

She had come to see the SKA's *libido sciendi* as in conflict with the development of humanity. She and many other residents I spoke with took issue with the SKA because of what they saw as its uncaring attitude toward the people of Carnarvon. To them the behaviour of SKA officials to date contradicts the value of *medemenslikheid*, as they would do anything to push through their scientific agenda, even if it means harm to the people of Carnarvon.

Most residents with whom I spoke were neither interested in nor enthusiastic about the SKA's science endeavours, but, rather, apathetic about it. One woman in her forties asked whether I could explain to her what the SKA wants to do. I told her about radio waves and how they differ from light waves and that people have no sensory organs that "translate" it into something such as vision. I told her that the SKA's radio dishes and computers basically do what our eyes and brains do with light waves to make vision possible, in that they pick up and "translate" radio waves from space into something sensible in order to understand what is going on out there. After this explanation, she said:

> *Haai, ek is nogal nie geïnteresseerd nie. Ek weet nie of sy al agtergekom het nie? Almal sê seker so... hulle is nie geïnteresseerd nie. Dis nie onse vlak daai nie... Hoe kan ek nou sê...? Ek is régtig nie geïnteresseerd nie. Soos vanaand met die maan, ek sal nie eers* worry *om te kyk nie* (Tina, interview, 2016).

[*Haai*[18], I'm really not interested. I don't know if she[19] has noticed? Everybody probably says so... they are not interested. It's not our level. How can I say this...? I am *really* not interested. Like with tonight's moon for instance, I won't even bother to look.]

In this last sentence the resident was referring to the supermoon occurrence of 14 November 2016, the build-up to which had been widely featured in popular media. Her words: 'it's not our level' speaks to how far removed astronomy seems from their lives for many Carnarvon residents.

Vincent, another black council member in his fifties, also expressed disinterest in the SKA's science endeavours, which he saw as a white person's activity:

*Ons mense stel nie belang in sterre of maan toe gaan of son toe gaan nie. Dis nie ons nie. Dis nie in onse kultuur nie of onse belang, of ons droom daarvan nie. Ons sien ook die sterre in die aand, dis baie mooi. Lê op onse rugte in die somer en sê: "Oe! Die sterre is vanaand dam (darem) mooi". Maar daar is mense wat self sê: "*I want to get closer to that star!*" En wit mense veral het daai belangstelling* (Interview, 2017).

[Our people have no interest in the stars or going to the moon or to the sun. That's not us. It's not in our culture or our interest, or we don't dream about it. We also see the stars at night, it is beautiful. Laying on our backs during summer and saying: "Wow! The stars are beautiful tonight". But there are people who themselves say: "I want to get closer to that star!" And especially white people have that interest.]

The phrase 'not for us' is reminiscent of Bourdieu's phrase 'not for the likes of us', the sentiment which arises when *habitus* encounters an unfamiliar field.

4.2.2   Education

These views should also be understood in the context of South Africa's colonial history as well as Carnarvon's unequal educational history, where the high school was strictly for white learners during the apartheid years. In those years many black learners had to leave the town to attend high schools in Beaufort West or Cape Town, depending on where they could find accommodation with family or friends. Many black youngsters, however, did not go on to finish school but dropped out to start working to help their parents carry the burden of caring for younger siblings or other family members.

One such resident, a black man in his late forties, spoke to me directly as a white person on this:

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[18] '*Haai*' is an expression of slight surprise or astonishment.

[19] This is a speech peculiarity whereby some Afrikaans people would refer to those they are speaking to in the third-person.

U hulle se gesinne is nie so groot nie. Julle verantwoordelikheid stop by dit is my kind, of dit is my kleinkind. Ons verantwoordelikheid strek baie verder as dit. My broer werk nie, so ek help sy kind. My ma se suster hulle het dit nie so breed nie, so ek het dit so dat ek darem daar 'n stukkie brood op daai tafel kan sit. Ek moes die skool los omdat ek moet my ouers met die goete moes help. Toe kon ek nie matriek kry nie.... Ek het 'n swart van gehad, maar daai jare toe change *my pa sy van na Van Rooyen, sy ouma se van, want daai jare was die swart mense nie gesien nie. Toe moes ek maar daai van vat. My pa is Xhosa, my ma is* coloured*. So, ek moes skool vroeg verlaat* (Danny, interview, 2016).

[Your families are not as large. Your responsibilities stop at this is my child, or this is my grandchild. Our responsibilities stretch much further. My brother doesn't have a job, so I help his child. My mother's sister, they struggle, so I help them to have a loaf of bread on their table. I had to leave school because I had to help my parents with stuff. So, I couldn't get matric… I had a black surname, but those years my father changed his surname to Van Rooyen[20], my grandmother's surname, because those years the black people weren't seen. So, I had to take that surname too. My father is Xhosa, my mother is coloured. So, I had to leave school early.]

This excerpt from my interview with Danny, who worked for the SKA as a construction worker, shows how racial oppression under apartheid created a backlog for black residents. Not only did black residents suffer socially, economically and educationally, but they also suffered psychologically. As Jonathan put it: 'everything was against you, you had a system that said: "you are not good enough because you are coloured, you will amount to nothing, you will only be a labourer"'. This history has led to the apathy in many residents' minds toward astronomy, as so many are still trying to find their place in the world or have lost hope and resorted to a muted existence through substance abuse.

Until 2014, Carnarvon's high school did not have a qualified science teacher. As mentioned in the introductory chapter, the SKA, in collaboration with TeachSA, has provided the school with a mathematics and science teacher, but the backlog created over time is so big that this step forward represents but a drop in a bucket. The youth's debilitating circumstances also leads to an apathetic attitude as other more important life issues consume their thoughts, time and energy. Gendered stereotypes or beliefs that science and mathematics are difficult may also impact learners' decision to take these subjects in grade 10. For instance, Rachel, an SKA astronomer, spoke about the gendered stereotypes around science: 'I was very isolated in high school because of my interest in science that wasn't a cool thing for girls to do' (Interview, 2017). Older residents' perception of science as 'not our

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[20] Pseudonym

level' or as white people's interest (resulting from the specific social conditions in which they grew up), may also affect their children's perception of science and so reproduce these norms.

Derick, a black parent in his fifties, stated the issues simply as:

> *Al sal dit mos nou 'n wêreldwye voordeel in hou met hulle navorsing oor die astronomie en goed, dit is mos maar 'n plattelandse gemeenskap die. Hulle stel nie regtig belang in astronomie en sterre en planete daar buite nie. Dit gaan oor oorlewing. Kyk waar jy 'n brood kan verdien (Interview, 2016).*

> [Although it [the SKA] will have an international advantage with their research on the astronomy and things, this is a rural community. They aren't really interested in astronomy and stars and planets out there. It's about survival. To see where you can earn a loaf of bread.]

This points to the awkward position of a multi-billion-rand project in a poor community. Again, many residents' apathy toward the SKA's science endeavours become clear as astronomy cannot be appreciated on a chronically empty stomach. This points to the privileged position of astronomy as a field, where those who share its *illusio,* are very unlikely to be concerned about basic things like where their next meal is coming from and thus have mind-space for things like what is dark matter and how dark energy works.

Derick's point suggests that the reasons behind residents' disinterest in astronomy stretches much further than just a deficit in scientific education. Although scientific concepts like gravity, electromagnetism and wave interference that one needs for a basic understanding of radio astronomy never formed part of many residents' education, other social issues that form part of residents' daily lives make the SKA's science endeavours seem a vain project.

4.2.3   Religion

The importance of religion in the small-town *habitus* of Carnarvon has already been discussed. This is another factor shaping residents' lack of interest in the science of the SKA. Two of the residents whom I interviewed were explicit about rejecting the SKA's research programme as suspect, the one more so than the other. For the resident who found the project particularly suspect, a white farmer in his 60s, the SKA's science endeavours conflict directly with his creationist religious beliefs:

> *Ek en my vrou het ons hele plaas gesalf, ons grense, nog voor SKA hier was. Ek voel hulle maak die poorte na die hel toe oop. Dit is wat hulle besig is om te doen. Want wat jy doen is, jy skep 'n medium vir Satan om in te kom… want waarop gaan hulle? Wie kan stry met SKA? Wie kan stry met 'n astroloog, of wat jy hulle ook nou wil noem, die astronomie en die astrologie, die twee hardloop maar saam... Niemand kan sty nie, so hulle sit met 'n wetenskap wat hulle kan sê wat*

hulle wil, want niemand kan met hulle stry nie [...] Ek dink ons maak wye deure oop vir die demoniese wêreld… Dit kan dalk vir jou absurd klink, maar dit is wat ek dink. Ek bespreek nie dit op die straat met mense nie. Ouens wat die geestelike dinge verstaan sal ek dit mee bespreek. So dit is my gevoel van wat aangaan. 'n Ou kan nou kyk hoe ver is sterre en al daai goedjies, ek dink dit is nogal goed, maar die geestelike realm... (Jan, interview, 2016)

[My wife and I anointed our whole farm, our borders, even before the SKA came here. I feel as if they are opening the gates of hell. That is what they are doing. Because what you are doing is you are creating a medium for Satan to enter... because what are they going on? Who can argue with the SKA? With an astrologer, or whatever you want to call them, because astronomy and astrology actually run together… Nobody can argue with them, so they have a science where they can say whatever they want to, because nobody can argue with them. […] I think we are opening wide doors for the demonic world… This may sound absurd to you, but this is what I think. I don't talk about this to people on the street. I'll discuss it with guys who understand the spiritual things. So that is my feeling of what is happening. You can look at how far away the stars are and those type of things, I think that is quite good, but the spiritual realm…]

The other resident, a black woman in her forties, expressed a more conflicted attitude toward the SKA's science endeavours as she herself sometimes wonders where everything started. She is, however, concerned that 'meddling in the heavens' [*krap in die hemelruim*] may have dire consequences, though she is not sure in what way.

Nee, vir my voel dit net hulle moenie so in die hemelruim krap nie. Los die goed daar bo… [Suné: Is dit?] Ek weet ook nie. Dit voel net vir my jy krap die wêreld deurmekaar as jy in die hemelruim krap. Hulle moenie so krap nie, net nou is dit 'n groot nadeel as jy so krap (Tina, interview, 2016).

[No, for me, I feel as if they shouldn't meddle in the heavens. Leave those things up there. [Suné: Is it?] I don't know. To me it feels as if you only upset the world if you meddle in the heavens. They shouldn't meddle like that, what if it leads to something detrimental.]

The difficulty of making a living in Carnarvon, along with a history of racial discrimination and oppression, have inculcated a very strong sense of responsibility toward residents' fellow human being. *Medemenslikheid* is thus of utmost importance for residents and part of that means to see other people's needs. For Carnarvon residents, the SKA's science endeavours seem frivolous compared to their own hardship and needs. Simply put by the 84-year-old Margaret: '*Wat die SKA wil doen is nie 'n behoefte nie*' ['What the SKA wants to do is not a need'] (Interview, 2016).

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4.3   SKA personnel's conception of the SKA's science endeavours

4.3.1   The scientific *habitus*

Not surprisingly, all the SKA personnel with whom I spoke view the SKA's science endeavours in a positive light, but for those not directly involved in the science of astronomy, it is the link between science and development or the idea of working toward a higher purpose that makes the SKA project particularly valuable. This view stands in contrast to the way the personnel who are directly involved in the actual science, such as astronomers and engineers, regard its significance. To them new scientific knowledge is valuable in itself, whether or not it leads to direct development benefits.

This reflects the scientific *habitus* that individuals who are involved in the SKA's science project share. According to Lenoir (2006:27) the scientific *habitus* refers to 'a set of attitudes which structure the *perception* and *practice* of research: this logic of the practice of scientific labour is related to the way in which the problems are set out, explanations developed and tools forged and used'. ('Scientific' here does not refer only to the natural or physical sciences, but to all research fields that follow a certain logic of practice.) In terms of the *practice* of research, the laws of physics and mathematics and associated principles such as 'disinterestedness, universalism, organized scepticism, communism of intellectual property, and humility' (Merton, 1957) distinguish scientific practice from other forms of enquiry and these values are central to the general scientific *habitus*. A shared understanding of the purpose of research is an integral part of the scientific *habitus* and this is certainly present with regards to SKA science professionals. The promise of uncovering new knowledge and pushing the boundaries of knowledge is integral to their perception of the SKA's research agenda and this quest is seen as inherently valuable, independent of any spinoffs that may accrue. In this regard, SKA personnel and Carnarvon residents are poles apart in their expectations of what the SKA project will deliver.

According to Bourdieu (1990:59) 'homogeneity of conditions of existence' are key in the formation of a shared *habitus*. Wacquant (2014:128) points to the role of institutions in forging a collective intellectual culture and hence shaping the scientific *habitus*:

> Briefly put, institutions weed out agents who do not adopt the requisite categories of perception, evaluation, and action; individuals drift away from settings that do not gratify their social libido and gravitate toward settings that do, where they congregate with others more likely to resemble them in their dispositional make-up and therefore reinforce their propensities.

The scientific *habitus* entails '"reasonable, common-sense", behaviours' expressed through common practices and perception of research that are 'likely to be positively sanctioned' (Bourdieu, 1990:55-56). Consequently, all contrary behaviours or all 'extravagances' are negatively sanctioned ('not for

the likes of us') (Bourdieu, 1990:56). Wacquant (2014) points to how the forging of the scientific *habitus* is a collective process. He also highlights the centrality of the concept *illusio* (the sense that a field and its accompanying capital and common-sense ways of doing things are inherently valuable and thus the misrecognition of its arbitrariness) as something common to those individuals who partake in the collective processes through which the scientific *habitus* is forged.

> …categories of perception are discerned and taught through joint activities; the skills are learned by observing and honed by acting in concert with members; the desires are aroused and channelled toward their proper objects in repeated interaction with other participants sharing the *illusio* specific to the universe studied (Wacquant, 2014:126).

In the words of Merton (1957: 639) '… on every side, the scientist is reminded that it is his [*sic*] role to advance knowledge and his happiest fulfilment of that role, to advance knowledge greatly.' Not only is the value of knowledge for its own sake inculcated in scientists, but so is the desire to uncover new, original knowledge. Merton (1957) talks about the premium placed on originality in the scientific field and the prestige that goes with uncovering original knowledge:

> For it is through originality, in greater or smaller increments, that knowledge advances. When the institution of science works efficiently, and like other social institutions, it does not always do so, recognition and esteem accrue to those who have best fulfilled their roles, to those who have made genuinely original contributions to the common stock of knowledge (Merton, 1957:639).

Bourdieu (1975) also raises the issue of originality in the scientific field and how scientists compete among one another to distinguish themselves in it. It is through doing truly original work that is 'collectively recognised' as such that scientists come to accrue symbolic capital in their field. The importance of originalty in the scientific field is illustrated when Bourdieu (1975:26) describes how a scientist who made a discovery some time after another scientist 'has been wasting his [sic] time, and his work is reduced to the status of worthless duplication'.

Bourdieu also shows how the struggle to distinguish oneself in the scientific field through the accumulation of capital and attaining knowledge of the field's *doxa* starts in the early phases of the scientist's life:

> While still in high school the scientist-to-be becomes aware that competition and prestige will affect his future success. He must strive for good grades in order to be admitted to college and later to graduate school. He realizes the importance of attending a college of high reputation not only because it will provide him with a better education but also because it will facilitate his later admission to a good graduate school (Bourdieu, 1975:20).

The forging of the scientific *habitus* is therefore itself an unequal process from the outset, as not all people have equal chances of being admitted to a prestigious university or even to any university for that matter. Bourdieu (1975:26) therefore acknowledges that it is as true in the scientific field as it is in other fields that 'the rich in capital, are the ones who get richer'.

4.3.2   SKA personnel's conception of the SKA's scientific endeavours

Although the individual life trajectories of the SKA scientists whom I interviewed vary quite considerably, through the process of becoming SKA professionals they have developed shared understandings of the significance of the project, which underscores the point about the authority of institutionalised science in forging its social conditions of production. While they did not emphasise personal needs to acquire status in their interviews with me, they were certainly all driven by the idea of uncovering *new* knowledge and spoke enthusiastically of how the SKA was uniquely positioned to do so as the (future) biggest science infrastructure on Earth. Thus Karla, a young, white engineer, spoke about the appeal of astronomy in terms of the amount of new knowledge to be uncovered, noting that 'our understanding of all fields involved just expands at such a rapid pace' (Interview, 2017). She also pointed to curiosity as a central driving force behind the SKA: 'I mean it's just one of those things that humanity has, they just want to continue asking questions and wanting to find the answers. It's that curiosity, you can't get rid of it'.

Rachel, a black astronomer in her thirties, also identified curiosity as the driving force behind astronomers' quest for new knowledge:

> Astronomy advances knowledge about physics in a way that cannot be done on earth. We can't say where everything that we're learning is going, but it is pushing us forward. Physics is basically just a model of the universe. It is a model that works very well to a certain level and then it doesn't and then we can't explain stuff… so there's two parts to it. It's about advancing knowledge and then it's just human curiosity, you know… it's not going to gain you anything to know how the sun works, but it's just curiosity (Interview, 2017).

Here curiosity can be understood in terms of the 'desire' or 'affect' that Müller (2015) has identified as the *tertium quid* of assemblages. The two quotations from Karla and Rachel point to how affect, in this case curiosity or the desire to know more, can set a whole new assemblage in motion. In the case of the global SKA assemblage, however, the effect of this desire stretches beyond its original objects (space and the 'things' in space), into the lifeworld of communities with very different priorities, as in Carnarvon and the other small towns surrounding the SKA core site.

Marius, a white engineer in his late thirties, also alluded to the desire to uncover new knowledge and the premium of originality when he reflected on the contribution of engineering to astronomy:

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...die mens wil net meer en meer kennis inwin [...] en met betrekking tot ingenieurswese, gee hulle [astronome] vreeslike lekker challenges *vir ons ingenieurs (lag). Ek dink dit is die grootste bydra... dat party sê, "nee, dit kan nie gedoen word nie" en dan probeer ons om dit moontlik te maak en dan druk ons die* boundary *net verder en soos wat tegnologie ontwikkel, word die* boundary *nog verder gedruk en dan het ons iets verder en beter reggekry* (Marius, interview, 2017).

[… humans just want to acquire more and more knowledge […] and in terms of engineering, they [astronomers] give great challenges to us engineers (laughs). I think that is the biggest contribution... that some say, "no it cannot be done" and then we try and make it possible and we push the boundary further and as technology develops, the boundary gets pushed even further and then we accomplished something further and better.]

Quoting Einstein to me – 'Scientists investigate that which has always been, engineers create that which has never been' – he continued:

So, ek dink dit is in daai simbiose wat bydra tot die wêreld. Een van die organisasies, die IEEE, in Amerika gebasseer, die Institute for Electrical and Electronic Engineers, *hulle* slogan *is "*advancing technology for humanity"*. So dit is daai, dis nie my eind doel, ek doen nie hierdie werk om die wêreld beter te maak nie, maar in dit wat ek doen om* boundaries *te* push *gaan daar goeters by gebeur. Iemand anders gaan goeters gebruik [wat ons maak] en op die ou end is dit tot die beter van die mensdom. So, dit is nie die direkte doelwit nie, maar dit is een van die by-voordele om dit so te stel* (Marius, interview, 2016).

[So, I think it's in that symbiosis that contributes to the world. One organisation, the IEEE, based in America, the Institute for Electrical and Electronic Engineers' slogan is "advancing technology for humanity". So, it's that, it's not my end goal, I don't do this job to make the world a better place, but through what I do to push the boundaries things will happen. Somebody else will use stuff [we make] and in the end, it's all for the betterment of humanity. So, it's not the direct goal, but it is one of the co-benefits to put it that way.]

Although Marius acknowledges the potential linkages between science, technology and development, here he acknowledges that making the world a better place is not the reason for his being an engineer with the SKA. The fact that he believes that 'somebody else will use stuff [we make] and in the end, it's all for the betterment of humanity' points to the loose connection between science, technology and development in his understanding of the work that he is doing. For SKA astronomers and engineers, the idea of pushing the boundaries of knowledge is seen as a valuable and meaningful activity and an end in itself.

The scientists I spoke to also spoke about the value of science in the abstract and how they appreciated what they regarded as its rational and accurate representation of reality. Here their views on the

relationship between science and religion proved an intriguing mix. For instance, Michael, a black astrophysicist in his thirties, said that he grew up in a very religious family, but that the creationist views of the origins of the universe to which his family subscribed never quite satisfied him. Although he considers himself to be religious still, it is the logic and rationality of the science that holds the most appeal and dominates his worldview.

In contrast Rachel, who also grew up in a religious family, no longer considers herself to be 'religious' as she does not see religion as compatible with her logical worldview:

> …I think my mindset is very logical, you know… I need a root cause. I asked my dad a long time ago, you know, where did things start? And then I'd ask, well what's before that and what's before that? You know… But even if you talk about the big bang, you know… what *was* before that? So, I need a logical structure on which to build my worldview. And having an omniscient being just doesn't fit into my world model. I mean, I'm not disparaging anyone else's views, they have a right to their beliefs. And quite often I envy people who are religious, because, you know, they have this surety that everything is happening for a reason. If you're a physicist, it is all random, it is actually pretty depressing (laughs) (Interview, 2017).

Karla and Marius, on the other hand, both feel that their religious beliefs are compatible with science, so long as one understands the biblical precepts as metaphorical rather than to be interpreted literally. This stands in stark contrast to many of my Carnarvon informants. They both spoke about how the description of creation in the Book of Genesis in the Bible should not be understood literally and pointed to how God's first words ('Let there be light') could be interpreted as referring to the Big Bang. Karla admitted that initially she found it 'a little weird' to be working in a place that looks at God's creation in a strictly scientific way, but was reassured when she spoke to a colleague who said that he did not see anything wrong in spending large sums of money to look at God's creation:

> *Ek meen wat ook al God gedoen het toe hy die aarde geskep het, is presies wat ons gaan sien, verstaan, so daar is nie... jy weet as daar 'n* big bang *was toe hy gesê het: "laat daar lig wees", is dit wat ons gaan sien. Of mense dit wil* connect *aan die Here is hulle eie persoonlike* issue*, daar is niks wat ek daaraan kan doen nie. Maar ek dink... die Christelike element maak dit eintlik vir my meer* exciting*. Om te weet dat wat jy sien is wat hy* actually *gemaak het* (Interview, 2017)*.*

> [I mean whatever God did when he created earth is exactly what we are going to see, understand, so there is no… you know if there was a big bang when he said: "let there be light", then that is what we will see. Whether people want to connect it to the Lord is their personal issue, there is nothing I can do about it. But I think… the Christian element makes it even more exciting for me. To know what you're seeing is exactly what He created.]

In this way, the SKA's scientific endeavours, which she already values as an end in itself, gains an additional meaning and that is that it is uncovering God's work.

An ex-SKA manager had a similar view of the SKA's scientific endeavours. Willem, a white man in his sixties who is not himself a scientist but has worked with various SKA stakeholders over the years, greatly admires the SKA's science endeavours. He identifies himself as Christian but is critical of the way that all religions try to limit God as 'God is too big… for me':

> *My persepsie van God het te groot geword vir my as mens om vasgevang te word in die Bybel of in die Quran. God is in die* universe*. Jy kan nie God vaspen nie, in 'n boks sit nie. Die Christene boks God in die Bybel, die Mohammedane in die Quran. En dit is verkeerd. God kan nie beperk word nie* (Interview, 2017).

> [My conception of God has become too big for me as human to be grasped in the Bible or in the Quran. God is in the universe. You cannot pin God down, put God in a box. The Christians put God in a box in the Bible, the Muslims in the Quran. And that is wrong. God cannot be confined.]

For him, then, science provides a way through which humans can start to understand the greatness of God. He said:

> *Die SKA het 'n* noble *idea. [...] Ek wens ek het die intelligensie gehad om deel te wees van daai wetenskaplike navorsing. [...] Ek glo in wetenskap. Dit is eintlik die enigste vooruitgang wat 'n mens kan bewerkstellig. Hoe meer 'n mens ken hoe meer kan 'n mens doen. So dit is 'n* no-brainer *oor hoekom ek lojaal is aan die SKA.* To unlock the mysteries of the universe *en daardeur kan ons vir ons almal 'n baie beter lewe bewerkstellig* (Interview, 2017).

> [The SKA has a noble idea. […] I wish I had the intelligence to be part of that scientific research […] I believe in science. It's actually the only progress that you can affect. The more you know, the more you can do. So, it is a no-brainer why I'm loyal to the SKA. To unlock the mysteries of the universe and in doing so creating a better life for all.]

From his perspective, astronomy also connects humans by showing their common minuteness and insignificance in comparison with the vastness of the universe. He also believes that there is no such thing as coincidence and that the SKA was destined to happen. For him, the SKA's science endeavours have a higher purpose and may affect how humans perceive their place in the universe. Willem's *belief* in science stands in contrast to the role science plays in Rachel's worldview. She said:

> Ugh! I don't understand it. And those anti-vaxxers. I mean it's like a religious belief… but science is mutable. It is not like a religious belief… I don't *believe* in the big bang, you know… That is currently our best model of the universe and if there is evidence for another model… obviously we're going to look at it and query it a lot (Interview, 2017).

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When I asked about the impact that astronomy could have on society, Karla, interestingly, said that of course science raises big questions for humanity, such as where do we come from and where are we going, but this is not something that she wonders about as she is a Christian. She described those 'big' questions as 'fluffy' (Interview, 2017). In her case, science and the Christian religion are not only compatible but her preferred way of understanding the world.

On the question of what he thought astronomy could mean to society, astrophysicist Michael, said that astronomy is great motivation for people to get involved in the field of science, because astronomy is generally seen as

> …a very cool thing to do. For instance, people usually think astronomy is about looking at stars and beautiful objects in the sky, yes, that is part of it, but that is not all about it. So, when you attract them [school learners] with the beauty of astronomy, they eventually break that inertia to get into sciences. So, you see them taking up physics, math, computer science and some engineering. Which would of course drive science, which would of course drive the development of any society (Interview, 2017).

As this quote makes clear, Michael and other SKA personnel assume a direct link between science and development, whereby science naturally impacts the development of society. This taken-for-granted understanding of the link between science and development was present in all my interviews with SKA personnel. However, while the scientists, seemed to distinguish between the value of scientific knowledge as a good in itself and the value of science for development, staff members who are not directly involved in the SKA's science, such as those who work with stakeholders, are more likely to see science and development as integrally connected. For instance, Francois, a white manager in his thirties, sees the link between science and development as his reason for working at the SKA: '…if we don't leave the community better than what we found it, then what the hell are we doing here? […] I wouldn't have been part of this project if I didn't believe it could make a difference' (Interview, 2017).

The following chapter explores the SKA's science-development discourse and what Carnarvon residents and SKA personnel think of it.

Chapter 5: The SKA in Carnarvon: Contested conceptions of development

Organising my discussion on the views of Carnarvon residents and SKA personnel on the contribution of the SKA to development has proved challenging because of the complexity of the issues. Because Carnarvon residents' views of what "development" means were generally directed at the SKA's development endeavours, I have chosen to discuss the views of the two groups in a back-and-forth manner. As the views of the SKA personnel were much more homogenous, this chapter is more strongly weighted towards unpacking Carnarvon residents' conceptions of development, their concerns with regard to the SKA's plans for "developing" Carnarvon as well as their need for a more inclusive and transparent relationship with the SKA.

I discuss these issues in sections 1 - 3 below in terms of the following overarching themes: education; the local economy; miscommunication, public participation and the use of information. My discussion of these issues leads to the concluding discussion of my thesis in section 4, in which I review my research findings in relation to my overarching research questions and conceptual framework.

5.1   Education

5.1.1   SKA personnel's conception of development and the premium placed on education

SKA personnel's views regarding the SKA's development endeavours were very homogenous as none of them took a critical stance regarding the assumed link between science and development. As seen in Chapter 4, SKA personnel view the SKA's development and scientific endeavours as standing in a causal relationship with each other, where science will 'of course' lead to "development" loosely understood (Michael, 2017). For them, the SKA's development endeavours cannot be understood separately from its scientific endeavours. The sequence is, however, important, as for them the scientific endeavours can be understood independently from the development endeavours, but "development" is dependent on science. This view of the relationship between science and development reflects Walker and Chinigò's (2017) argument about the hegemonic notion of progress as a teleological process among scientists, which inadvertently leads to their disregarding the many different meanings that can be attached to development and the contexts within which they arise.

This hegemonic notion of development and progress drives the SKA's local development agenda, in which investment in the SKA is seen, in Willem's words (interview, 2017) as the next step toward 'a better life for all'. Since SKA personnel truly believe in the causal relationship between science and

development, a great deal of the SKA's development endeavours focuses on science education as, consistent with the science communication literature discussed in Chapter 3, this is seen as the easiest way to spread "development". According to an SKA newsletter, *SKA Northern Cape News* (2016:1):

> SKA South Africa is committed to five focus areas in the communities surrounding the SKA site on an ongoing basis: investing in the youth, supporting community upliftment programmes, developing small to medium enterprises, nurturing learners' talent; and ensuring that communication connectivity is is not compromised.

In its focus on youth investment, community upliftment programmes and 'nurturing learners' talent', the SKA has emphasised the importance of education, as already discussed in my introductory chapter. Among these development endeavours, the SKA is promoting the importance of especially science education. The underlying assumption is that the more people become scientifically literate the more this will lead to "development" (Michael, 2017; Marius, 2017; Willem, 2017) (and acceptance of the legitimacy of the SKA). According to the SKA SA's managing director, Dr Rob Adam:

> SKA SA places a high premium on educating young people and increasing the public understanding of science. The organisation is committed to nurturing learners' talent in the Northern Cape through support at school level and beyond (SKA SA, 2017).

For the SKA, the popularisation of science plays an important role in this regard as it makes science and related fields seem more 'attractive':

> Programmes in schools and communities to popularise science will be a priority. The currently running programs within the SKA communications unit will be supported. Buy-in from the Department of Education will be facilitated. This will ensure science, engineering, technology and innovation as attractive, relevant and accessible in order to enhance scientific literacy and awaken interest in relevant careers (SKA Northern Cape Stakeholder Management Framework).

This reveals the assumption that educational efforts will be sufficient in themselves to evoke an interest in science among local residents. As some PUS literature reveals, this is a faulty assumption. As shown in the previous section, residents' disinterest in science is deeply rooted as other more pressing matters of concern foreclose interest in something as far-removed from their daily existence as astronomy or science in general. The idea that programmes to popularise science will be successful in a town such as Carnarvon is overly simplistic and disregards the historical, social, economic and psychological complexity behind residents' disinterest in the field.

Although the SKA has identified education as one of its most important development focus areas, only nine Carnarvon learners have received bursaries to further their education at tertiary level (SKA, 2016:7). According to a SKA leaflet, *SKA SA se beleggingsimpak in die Noord-Kaap,* [SKA SA's

investment impact in the Northern Cape], a further 72 bursaries have been awarded to 'local' people to study at technical colleges. It is not clear whether the beneficiaries of these bursaries are Carnarvon residents only or whether they include people from surrounding towns, as 'local' is not defined in the document. The SKA's developmental impact in Carnarvon seems small when compared to the number of individuals who have gone through the SKA's national Human Capacity Development Programme (830), especially as Carnarvon is the main host-town of the SKA. In reflecting on these disparities, SKA astrophysicist Michael acknowledged the seemingly small developmental impact the SKA has had locally and noted how their educational endeavours take time to yield results:

> So, the key problem with astronomy and development is not that it doesn't create jobs, it is that it generates more of jobs that require skills. That is why astronomy projects, especially in Africa, focus a lot more on human capital development. SKA spends up to 25% of their annual funding on human capital development. 10 or 25%. YDPs, young people development programs… and SKA spends a lot of money in Carnarvon on teaching kids, so that is the grass roots. Kids who are making paper telescopes can tomorrow be the real dish engineers. But it is only probably five/six years now, we are probably talking about 50 years? People are usually not very patient to wait for the impact. If you ask for the impact now, there'll probably be none, or there'll probably just be little things to see. But the most important indicator to see if there will be development in the future is to see if they are investing in human capital. And yes, astronomy does it a lot (Interview, 2017).

In addition to the point about the investment in education taking a long time for results to be seen and felt locally, other SKA personnel I spoke to emphasised the need to remember that the SKA is an *international* project and that it is impossible for them to please everyone. This points to the schism between investment in development on the local scale and investment in development on the global and/or national scale, where the latter justifies the smallness of the former or even the damage that the project may effect on the local scale. Willem for instance said:

> *Dit gaan nie oor die individu nie. Mens moet die groter konteks sien. Vir elke ontwikkeling wat plaas vind is daar 'n prys wat betaal moet word. Daar is 'n* upside *en 'n* downside*. Die vraag is net gaan jy kyk na die* upside *of die* downside*. Ek dink* fracking *byvoorbeeld is* irreversible*, maar hierdie skottels wat hulle wil op sit is net 'n bate* (Interview, 2017).

> [It's not about the individual. You have to see the larger context. For every development there is a price to pay. There is an upside and there is a downside. The question is just whether you're going to look at the upside or the downside. I think fracking for instance is irreversible, but these dishes that they want to put up is only beneficial.]

5.1.2   The reception of the SKA's educational endeavours in Carnarvon

As discussed in the previous chapter there are many factors that impact Carnarvon residents' disinterest in the SKA's science endeavours and science more generally. These factors also impact on the SKA's attempts to educate young residents in science. The belief that science is 'not for us' is certainly one factor, but as already shown, this belief is anchored in a long history of inequality.

Although many older residents I spoke to commend the SKA's attempts to teach youngsters mathematics and science, they express discontent that deserving learners with other interests and talents do not benefit. The minister of the 'black' church pointed to how the SKA's focus on science and mathematics may dishearten learners who are either not interested or feel they cannot compete in these fields:

> *... dit het 'n keersy ook. Baie van die ander kinders voel dom, want hulle voel "ek kan nie kompeteer nie". Daar is nie vir hulle voorsiening gemaak nie. En as ek nie kan kompeteer nie, dan is ek 'n* nobody *en as ek dink ek is 'n* nobody *dan tree ek op soos 'n* nobody *en die volgende ding is dwelms en drank en al daai soorte goed... so jy moet die totale prentjie in gedagte hou* (Nicolas, interview, 2017).

> […there is a flipside too. Many of the other children feel dumb, because they feel "I can't compete". No provision is made for them. And if I can't compete, then I think I'm a nobody and if I think I'm a nobody, then I act like a nobody and the next thing is drugs and alcohol and those types of things… so you must take the whole picture into account.]

Through the SKA bursaries science and maths become coupled with prestige, opportunity and money. The premium that the SKA places on science and maths and the promise of reward for excellence in these subjects inadvertently make other subjects appear less important. In this way the SKA reproduces the hegemony of the scientific field, which can make learners who do not perform in these subjects feel like 'a nobody'. In this sense, the SKA's attempts at development through education can inadvertently lead to many learners feeling hopeless about their prospects, while only a few benefit.

Residents also wonder about how the SKA's educational endeavours will impact the town's future as they are very aware that learners who receive bursaries may not return to Carnarvon. Jonathan from Sutherland spoke to this issue and said that he was always concerned about the fact that the 'skills go out of town […] The young kids mostly move out of town as they feel there are no real opportunities to come back to' (Interview, 2017). However, he also noted that when young graduates do return, they serve as important role models for other youngsters in town.

5.2   The local economy

5.2.1   Diversifying the local economy

While SKA scientists concentrated on the importance of science education for development, in my interviews with them SKA managers would also talk about the contribution of the SKA to diversifying Carnarvon's local economy. Francois (interview, 2017), for instance, said: 'One of the big ideas behind the project is that it will diversify the economy of this area. That you are not solely dependent on sheep famers, but that you also have engineers and artisans in town'.

In support of community upliftment programmes, the SKA is planning to establish a grant system through which local NGO's and community upliftment programs can benefit (Francois, interview, 2017). As already discussed in Chapter 1, the SKA has also supported local small and medium enterprises by ensuring that a minimum of 14% of the overall contract value of SKA construction projects 'should include participation from local contractors' (SKA, 2016:4).

Carnarvon residents, however, fear the impact of skills drainage and the buy-out of 118 000 hectares of agricultural land on the local economy. Jeffrey, a local council member, expressed scepticism around prospects for diversifying the local economy when he said:

> *Onse ekonomie rus op* agriculture *en onse* abattoir *voorsien werk aan 70 mense, dis maar 'n* estimation, *dit kan baie meer wees. As die plaaswerkers hulle werke gaan verloor en as die* abattoir *mense hulle werke gaan verloor, watse* alternatives *verskaf die SKA? Die* alternative *kan nie wees om vir drie of vier mense beurse te gee nie* (Interview, 2016).

> [Our economy rests on agriculture and our abattoir provides jobs for 70 people, that's an estimation, it could be more. If the farm workers lose their jobs and the abattoir workers lose their jobs, what alternatives does the SKA provide? The alternative cannot be to give bursaries to three or four people.]

Although the SKA has indicated plans to secure the livelihoods of farm workers who will lose their jobs as a result of the buy-out of land (CSIR, 2016, Chapter 3:40), it is not clear what will become of the abattoir workers who may be retrenched as a result of the decrease in business at the abattoir with fewer commercial farmers active in the local economy. Furthermore, it is not clear who the engineers and artisans will be that will diversify Carnarvon's economy. Technical staff rarely stay there on a permanent basis and when they do they do not actually stay in Carnarvon, but on a farm between Carnarvon and the site.

Field work by other members of the SARChI SLESD research team, suggest that residents and especially farmers surrounding the core site fear the impact of the AGA's strict regulations on their use of RFI-

causing technologies such as cell phones, electrical fencing, generators, etc. and how this may impact their livelihoods as they very much depend on these technologies to farm effectively. Residents in town also fear that the AGA may compromise their connection to one another and the outside world.

Nicolas also spoke about the importance of addressing racial inequalities through the SKA's development agenda as *transformation* of the economy is what is most needed. He spoke about the larger context of Carnarvon and how a possible shift into a knowledge economy is not necessarily viable and/or something that is agreeable to the people of Carnarvon:

> *Ons mense is ekonomies uitgerangeer onder apartheid, nou hoe gaan jy hulle terug kry? Want om hulle te bemagtig het jy staat gemaak op 'n demokraties verkose regering om die dinge vir hulle te doen en in tussen kom SKA en hulle koop 130 000 hektaar plus die spirale reg deur die Noord-Kaap. Hulle gaan doodeenvoudig aan bo-oor ons... En in hulle WNNR verslag praat hulle van the* high road scenario, the middle road scenario *en* the low road scenario. *Alles dui daarop dat ons ten beste op die* middle road scenario *is, nie naby die* high road scenario *nie. En die* middle road scenario *praat van* disintegrating communities*, dis die gevolge. Die* low road scenario *is uitgerekte hofsake en sabotasie wat 'n mens nou nooit sal kry nie. En toe vra ek nou vir iemand hier, hy werk ook by die SKA. Hy is 'n kontrakteur of 'n... Toe sê ek vir hom van die* disintegrating communities*, toe sê hy: "*everywhere I go in the the Northern Cape, I see disintegrating communities*. Verstedeliking gebeur maar oral..." Nou daai gevoelose, koue, koue antwoord vir mense wat... jy sal dit ook hoor in jou onderhoude, trek is die laaste ding wat mense wil doen. Hulle het vaag weg drome van terug gaan grond toe, dalk boer met 'n klompie skape, maar net weer terug kom grond toe. Dis vir my ekonomiese transformasie, maar dit is nie eens op die horison nie* (Nicolas, interview, 2016).

[Our people were economically shunted under apartheid; how will you get them back? Because to empower them you relied upon a democratically elected government to do the things for them and in the meanwhile SKA comes and buys 130 000 hectares plus spiral arms right through the Northern Cape. They go right over our heads … And in the CSIR report they talk about a high road scenario, the middle road scenario and the low road scenario. Everything points to that we're at best on the middle road scenario, not close to the high road scenario. And the middle road scenario talks of disintegrating communities, that is the consequence. The low road scenario is prolonged court cases and sabotage, which you will never get. I asked someone who works for the SKA, he is a contractor or a … I told him of the disintegrating communities and he replied: "everywhere I go in the Northern Cape, I see disintegrating communities. Urbanisation happens everywhere…" Now that heartless, cold, cold answer to people who… and you will see this in interviews, moving is the last thing people want to do. They have vague dreams about going back to the land, to maybe farm with some sheep, but just to get back to the land. To me that is economic transformation, but it's not even on the horizon.]

In a meeting between the church council of the 'black' church and two SKA representatives on the 17th of February 2017, the issue of land claims in terms of South Africa's land restitution programme was raised. According to one of the SKA representatives, there are no official land claims on the SKA's 'core or the surrounding land'. He stated that residents may submit claims once the land claims process reopens[21] and if a legitimate claim falls on the SKA's land, then the claimant will be compensated financially, as provided for under the Restitution of Land Rights Act, i.e. the state would oppose claims for the restoration of the land as not being in the public interest. According to a transcript which one of the SKA representatives sent to me, the issue of farm workers' rights to land in terms of the broader land reform programme was also raised in this meeting:

> If a farm worker lives on a farm for a certain time, then you get rights. I don't know what exactly they call it, but SKA at this stage also negotiates with the farm workers who understand and were in this situation, who are claiming, who received rights to the land and SKA has to compensate these guys and the same at, in English "rates", the same … I do not know a good word for this, but the same amount a farmer is paid, or the landowner is paid, is also paid to the worker (Transcript: SKA SA Meeting with the 'black' church, 2017).

Monetary compensation would not, however, make up for some black residents yearning to return to their land. The 'black' church owns a farm on which some congregants farm and which provides a substantial amount of the church's annual budget. The minister of this church spoke about congregants' knowledge of sheep farming:

> *...skaapboerdery is in die murg en gebeente van ons gemeenskap se mense. Ek het 'n vorige keer vir jou gesê ek kan jaar na jaar vir die gemeente vra wie gaan boer hierdie jaar op Rustoord en manne en vroue kom jaar na jaar met kennis oor skape boer, hulle kan dip, hulle kan... hulle het ongelooflike kennis, want hulle het groot geword in 'n skaapboerdery kultuur, nou wil die SKA kom sê, "ja maar julle moet wetenskaplikes word, dan kan julle vorentoe gaan". Hulle sê, "ons wil net boer. Ons wil ons grond terug hê".*

> [...sheep farming is in the marrow and bones of our community's people. I told you a previous time that year after year I can ask who is going to farm on Rustoord[22] and men and women come year after year with knowledge of sheep farming, they can dip, they can ... they have unbelievable knowledge, because they grew up in a sheep farming culture, now the SKA wants to come and say

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[21] The land restitution programme is governed by the 1994 Restitution of Land Rights Act of 1994, as subsequently amended. In 2014 a change in national policy saw the land claims process re-opened to allow for new claims to be lodged but after a constitutional court case this provision was suspended.

[22] Pseudonym

you have to become scientists, then you can move forward. But they say "we just want to farm, we want our land back".]

According to this minister, the black community in Carnarvon is reliant on the support of the democratically elected government for economic transformation, but once again they are being 'shunted' (*uitgerangeer*). He said: 'now all those dreams get crumpled in an instance by the SKA who says, "you're not going to farm with sheep anymore, we have a science project". […] I don't know how we're going to handle this' (Nicolas, interview, 2016).

5.2.2   Carnarvon residents' expectations of employment

The previous quotation points to the experiences of many Carnarvon residents of the SKA as uncaring about their hopes for the future, a theme that emerged strongly through my field work. It appears that residents' initial high expectations of the project have amplified their disappointment, leaving many residents feeling even more hopeless and despondent as the pattern of marginalisation that they have witnessed over time is reinforced.

Many residents I spoke to feel as if the SKA's approach in dealing with local people is one of the main causes hampering development. They point to how those who benefit are not those who necessarily need it. In that way, the SKA only reproduces already existing inequalities. Other residents have also complained that the SKA's development endeavours are half-hearted and that they do not provide the necessary support for effective implementation of their programmes.

Many unemployed Carnarvon residents expected that the SKA would bring much needed job opportunities to Carnarvon, as the DST made these promises when they first announced that Carnarvon would host the SKA (Margaret, interview, 2017; Aletta, interview, 2016). Job opportunities are therefore central to residents' understanding of what "development" should entail locally. Many residents, however, complain that the SKA's job requirements are too strict, which make them feel even more marginalised. According to Michelle (28) and Carlo (21), the SKA only employs people who are under the age of 35 and applicants should also have matric and a driver's licence, which rules out many local people.

Residents also accused the SKA of nepotism and racial prejudice in the allocation of local job opportunities. These accusations are of course about local employment opportunities at the SKA's core site and not about the position at the SKA's national offices or international headquarters. According to Michelle (28):

> *Nepotisme is erg by SKA. Ek ken 'n persoonlike geval van waar 'n pa by SKA werk en al drie sy seuns*
> *het aansoek gedoen en hulle vra vir hom watter een van jou seuns sal hy verkies om daar te laat*

werk... vir die pos... Wat van die ander wat aansoek gedoen het? Hulle het mos klaar besluit. [...] In Schietfontein is daar 'n dame, sy is 'n skoonmaker [by SKA], haar ma is 'n skoonmaker [by SKA], haar pa werk by die MeerKAT, haar verloofde werk by die MeerKAT. Hulle almal... Ek voel, as hulle voel dit is die beste persoon vir die werk is dit iets anders, maar hoe kan hulle vra watter een van jou drie seuns wil jy hê moet daar werk? (Interview, 2016)

[Nepotism is rife at the SKA. I know of a personal case where a father works at the SKA and all three of his sons applied for a job and they asked him which one of your sons would you like to work here… for the job… What about the other people who also applied for the job? They already decided. […] In Schietfontein there is a woman, she is a cleaner [at SKA], her mother is a cleaner [at SKA], her father works at MeerKat, her fiancé works at MeerKat. All of them… I feel, if they feel this is the best person for the job then it's different, but how can they ask which one of your sons do you want to work there?]

Other residents said that they do not even bother applying for SKA jobs as they do not have any family members who work there.

Racial tensions also featured in the criticisms. A few residents accused SKA staff of being prejudiced as they had appointed a white caterer on a long-term basis without advertising the job first. In anticipation of the economic opportunities the SKA was said to bring to Carnarvon, Margaret and two friends had started a catering company but they were unable to compete for the contract which left her feeling very angry: 'They [the SKA] don't think that our people will be able to manage the job. I am really angry, because now people who already have money, benefit'. According to her one of her associates had spoken to SKA representatives about their discontent and they had promised to consider the matter. However, when she was contacted it was not to discuss the catering issue but local SKA concerns about the role of the local minister who was openly critical of the SKA's approach to dealing with the community. What is relevant for my analysis is not whether or not the allegations and counter-allegations are objectively 'true' or not but the level of suspicion and mistrust that they reveal, and how people's understandings of these dynamics are understood through the prism of race. With regards to her business, Margaret commented that the SKA representative 'never came back to me':

Hy het my nog nooit weer gebel nie... en daar was geleenthede. So dit is die beeld wat hy vir my geskep het. Ek stap verby hom nou die dag, hy het my nie eens gegroet nie. Miskien het hy my nie herken nie... sê ek maar vir myself (Interview, 2017).

[He never called me again… and there were opportunities. So that is the image that he created. The other day I walked past him, he didn't even greet me. Maybe he didn't recognise me… that's what I tell myself.]

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An ex-SKA construction worker who claims that he was framed for stealing something and was then unfairly dismissed, spoke about his experience to me and claimed that one of the people in charge of the site victimised him and that this person's wife (who also works on site) would often talk about, in his words, the '*hotnots* that fuck everything up' [die hotnots wat alles opfok]. He said:

> *Nou word jy aangekla van 'n krimineel wees! Jy word net gesê: "bedank, of ek kla jou krimineel aan". Die aanklaer het gesê, "dedank net of ek sal sorg dat jy in die tronk sit, ek gee nie om wat dit my kos nie, ek het geld". Toe sê ek, "maar ek is onskuldig, dit help nie ons mors mekaar se tyd nie. Doen my 'n guns en kla my aan, want dit help nie ek bedank oor 'n ding wat ek nie gedoen het nie". Ek het al by slegte mense gewerk, wat praat van hotnot, kaffer en boesman, maar selfs hulle het my nie so behandel nie* (Danny, interview, 2016).

> [Now you are charged with being a criminal! You are just told: "quit, or I you'll be criminally charged." The prosecutor said, "just quit or I'll see to it that you sit in jail, I don't care what it costs, I have money." Then I said, "but I'm innocent, it doesn't help that we waste each other's time. Do me a favour and charge me, because it doesn't help that I quit over something that I didn't do." I've worked for bad people before, who talk of *hotnot*, *kaffer* and *boesman*, but even they didn't treat me like that.]

According to this man, he was the only on-site SKA employee who would stand up against his superiors' discriminatory ways of doing things. He said:

> *Carnarvon se mense is nie* outspoken *mense nie, want hulle is bang vir die stukkie brood wat hulle daar het, vir die werk wat hulle het. Hulle is bang om te praat oor hulle se regte, want dan word jy sommer gesê "loop"* (Danny, interview, 2016).

> [Carnarvon's people are not outspoken people, because they are scared of the piece of bread that they have there, for the job that they have. They are scared to talk about their rights, because then they just tell you: "go".]

Other concerns of residents about SKA projects during the time I was conducting my field work centred on perceptions of mismanagement or that the projects were 'white elephants' used to project a positive picture of the SKA at public meetings or in the media (Derick, interview, 2016; Michelle, interview, 2016). According to Derick: 'These things get trumpeted (*uitgebasuin*): "we donated this for the school and now the children can go forward", but in reality, nothing happens':

> *SKA het 'n Cyberlab met rekenaars by die skool geïnstalleer. Maar ek sien dit as 'n wit olifant, want daar was nie mense gewees wat vir die kinders kan wys hoe gebruik jy die ding en vir watter funksies dit is nie. Huidiglik, is daar seker van die onderwysers wat dit gebruik, maar dit was eintlik geskep vir die leerders. Daar is nie regtig onderwysers wat die kinders kan leer hoe om die goed te gebruik nie en die een of twee wat daar is, het nie regtig tyd om die kinders te wys hoe om die goed te*

gebruik nie. So dis hoekom ek sê hy is 'n wit olifant. Hy is betekenisloos vir ons. Dis 'n goeie paar

duisend rand wat bestee is, maar dit is nie van nut regtig nie (Interview, 2016).

[The SKA installed a Cyberlab with computers at the school. But I see that it is a white elephant, because there were no people who could show the kids how to use the thing and what functions it has. At the moment, there are probably some teachers who use it, but it was actually created for the learners. There aren't any teachers who can show the kids how to use it and the one or two who can don't have time to show the kids how to use it. So that's why I say it is a white elephant. It is meaningless to us. It's a good few thousand rand that they spent, but it's not really of use.]

Van der Hoef (2016) describes problems with the management of the SKA-supported computer centre in town in 2015/16. Council member Jeffrey raised similar concerns about the effectiveness of the high school's Cyberlab. He told me that he had asked one of the teachers whether the Cyberlab is useful. 'He [the teacher] could not really give me an answer. So, the question that must be asked is, is the contribution the SKA makes the type of thing that really benefits the community?' (Jeffrey, interview, 2016). This points to Jeffrey's understanding that development is not a one-size-fits-all endeavour and that Carnarvon's people have particular needs due to their specific history and social conditions.

5.3   Miscommunication, public participation and the use of information

5.3.1   Miscommunication

Miscommunication plays a big role in the contestations between Carnarvon residents and SKA personnel. Astrophysicist Michael, for instance, pointed out how Carnarvon residents were 'probably' never informed about the SKA until it had already started:

They don't know about your international project before you started it. You probably never consulted them. You probably just went to the site and took your measurement and you thought it was a very radio quiet place, it's very dry… and you went to submit a bid. You didn't integrate them early enough. That is usually the problem… most places that is the problem, because you have a very short time to submit your bid and prepare everything to show that you can do this. I bet it was the same case… (Interview, 2017)

Besides the miscommunication over technical issues such as the location of the SKA's site and its many implications on the people who live nearby, miscommunication over "development" and what it should entail emerged as a critical issue between Carnarvon residents and SKA personnel.

Not all residents of Carnarvon have clear opinions about what "development" should entail in their context, but there was widespread agreement about the importance of open communication and

public participation in this regard. Jonathan, from Sutherland, pointed to the importance of taking the background of a town into account in formulating a development agenda. He identified the following issues as crucial for local development initiatives to succeed: political buy-in, good links with local stakeholders in school and other community structures, setting up a local office, and supporting small and medium business enterprises in the town. He also emphasised the importance of good communication with stakeholders:

> *...vat hulle op 'n* workshop*, verduidelik vir hulle, praat oor hulle verwagtinge, hoe dit geadresseer kan word, sodat mense deel voel van die proses. Betrek hulle by die proses sodat hulle nie voel daar word net planne gemaak en hulle moet net inval by die proses nie. Daar is niks wat 'n man [sic] so uit laat voel as jy uitgesluit is nie. Dan* disconnect *jy totaal en al* (Interview, 2016).

> [...take them on a workshop, explain to them, talk about their expectations, how it can be addressed, so that people feel part of the process. Include them in the process so that they don't feel as if plans are made and they should just comply. There is nothing that makes a man [*sic*] feel so left out like being shut out. Then you disconnect completely.]

As of early 2017, five years after it had been announced (in 2012) that Carnarvon would be hosting the SKA, the SKA organisation still did not have a permanent representative in Carnarvon, nor a local office in the town. According to a local manager, there are plans to set up a permanent office in Carnarvon, but the absence of such a presence through these critically important preparatory stages can be seen as a significant factor in why so many residents experience the SKA as an elusive force.

Carnarvon residents also experience the way SKA stakeholders have dealt with them as very much a top-down affair in which SKA representatives pretend to know what is best for the community. This attitude is exemplified in the response of an SKA staff member who works in the community to this issue: 'The most important thing is that the people realise that the project is to the benefit of the community. I think it is well thought through and the project has massive benefits' (Francois, interview, 2017). Statements like this show that SKA personnel are not open to considering other notions of what development entails, and the fault lies with the community for not recognising the project's benefits.

This informant also told me: 'It is the perfect opportunity for Carnarvon to benefit, but it's kind of as if they don't want to take it'. When I asked him why he thought that was so, he answered: 'Simply because they are told that the SKA is evil, it is from the devil, it's bad' (Interview, 2017). In his view, local people were not able to form their own opinions on the matter but were being misled by outspoken community leaders who were critical of the SKA's local dealings. Although a local church had started a petition against the SKA that demands that it interacts honestly with the community and

be open to negotiate with local stakeholders, the minister of this church has categorically stated that he supports the SKA's scientific agenda. He certainly does not see it as the devil's work, but he is critical of the SKA's approach in dealing with the community. One SKA informant also complained about the spread of rumours and false information about the SKA that was doing the rounds, including by a Karoo environmental activist group that was posting false or outdated information on social media, to put the SKA in a negative light. At the same time, during my field work I was able to observe first-hand the deliberate spreading of counter-rumours, by an SKA staff member, as a means of finding out who in the community was speaking to whom about the SKA.

The extent of the miscommunication and the mistrust that this generates is evident in the contestations around the establishment of a local SKA stakeholders' forum. In June 2017 Carnarvon residents established their own SKA stakeholders' forum, to discuss questions and issues pertaining to the SKA and to serve as a representative body that can interact with the SKA. Initially the SKA had itself established stakeholder forums in Carnarvon but, according to the ex-chairperson of one such forum, the SKA shut them down when local people started asking uncomfortable questions:

> ...*die mandaat van die forum was om die mense* on board *te bring met SKA* related issues *en om die SKA aan die mense te verkoop, maar wat gebeur het, was dat die wat die SKA aan die mense moes verkoop het, het begin ongemaklik raak met die SKA* (Jeffrey, interview, 2016).

> [...the mandate of the forum was to bring people on board with SKA related issues and to sell the SKA to the people, but what happened was that those who were supposed to sell the SKA started becoming uncomfortable with the SKA.]

He said that SKA representatives did not respond to any of their questions and challenges. According to him, an SKA representative had told him that they were in the process of determining the relevance of the forum but, he claims, the SKA never informed them of their final decision in this regard. 'They never said "you are disbanded, you don't exist anymore." We were ignored' (Jeffrey, interview, 2016). However, when I asked a local SKA representative about what Carnarvon residents were asking of the SKA, he said:

> *Hulle vra nie regtig vir enige iets nie. So wat sal gebeur is dat als wat jy doen word gekritiseer. Dis amper soos opposisie politiek. Jy sal byvoorbeeld sien in opposisie politiek dat hulle niks doen nie, hulle kritiseer net alles wat gedoen word* (Francois, interview, 2016).

> [They don't really ask for anything. So, what will happen is that everything you do gets criticised. It's almost like opposition politics. You will always see in opposition politics that they do nothing but criticise that which gets done.]

One of my local informants commented on the discrepancies between the SKA's treatment of local residents compared to their engagement with other stakeholder groups they had identified as speaking for local residents, such as the San Council, around recognition of the /Xam heritage at the SKA core site, and AgriSA, with regard to the buying up of farms at the core site. While the SKA was prepared to enter into discussion with these entities, they did not recognise locally based groups. In his words:

> *Die SKA het twee titel beskrywings met die woord* stakeholder *in, maar ons moet nie dat hulle besluit wie die* stakeholders *is nie. Ons weet wie ons is. Ons identifiseer onsself en sê ons nooi julle uit. "Hier is ons. Kom ons praat"* (Nicolas, interview, 2017).

> [The SKA has two title descriptions with the word stakeholder in it, but we must not let them decide who the stakeholders are. We know who we are. We'll identify ourselves and invite them. "Here we are. Let's talk".]

A church sermon (21 May 2017) by the local minister highlighted the extent of mistrust among local stakeholders in relation to the exclusion of local people from decisions that would impact their future:

> Is that precious freedom that we achieved under threat once again? Can we allow the SKA to negotiate our future with AgriSA, and not with ourselves? Can we simply sit back and allow others to take control of our lives once again? Yes, we hear a lot about all the benefits of the huge investments already done in our area and of the SKA's intended further investments in our future. But do we need to then entrust our futures to this neo-colonialist conquest of our area and of our lives? Where do we fit in, in all the planning and all the national and international contracts that are going to impact on our lives?[23]

This depiction of the SKA project as involving a 'neo-colonial conquest of our area' speaks to the issue of reterritorialization discussed in Chapter 2, in relation the SKA as a global assemblage. From this perspective the people of Carnarvon had no say over the decision to locate the SKA core site outside their town and feel powerless in the face of the SKA's international status and institutional authority. As in the past, contestations over resources, most importantly land, again form part of this encounter between the local and the national/global. Ironically, however, those who are losing their land this time round are white and are being compensated by the state while the descendants of the original (precolonial) land owners are still dispossessed of their land and the most marginalised of all in this

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[23] This church service was held in English because a British film team who was making a documentary was in attendance.

situation. Of further interest is that in this process of 'reterritorialization' the role of religion to 'civilize' local people has been replaced by that of science.

5.3.2 Public participation

During the course of my field work the SKA held a number of public meetings in the local towns directly affected by the development of the SKA, including Carnarvon which I was able to attend. A number of them were required in terms of the Strategic Environmental Assessment (SEA) of the project and the development of an Integrated Environmental Management Plan for the core site (CSIR 2016). For many local people these meetings proved to be a frustrating experience. Danny, the person who lost his job at the SKA, spoke about what he perceived as the problematic attitude of SKA representatives toward Carnarvon residents at these meetings and also recalled how a meeting in November 2016 was boycotted, as residents felt that the meetings only served as an opportunity for the SKA to promote itself and slight residents:

> *Die laaste* meeting *het ek nie bygewoon nie, maar dit het* anyway *nie regtig gebeur nie. Die vorige* meetings *was* tough*, want hulle kon nie bevredigende atwoorde gee nie. En die mense raak kwaad, maar wat maak SKA? Hulle smeer hulle af. Hulle sê, "ons het die regering agter ons, ons het die wêreld agter ons. Maak nie saak wat jy sê nie dit gaan na grondonteiening toe"* (Danny, interview, 2016).

> [I didn't go to the last meeting, but it didn't really happen anyway. The previous meetings were tough, because they couldn't give satisfying answers. The people got angry, but what does SKA do? They couldn't care less. They say, "we have the government on our side, we have the world behind us. It doesn't matter what you say it leads to expropriation".]

Residents are aware that the SKA is legally obliged to hold these public meetings. As Deon, a white man in his forties said, '*Ek was by al die* meetings *gewees. Dis soos… "Ons hoor wat jy sê, maar ons luister nie regtig nie*". *Kyk, hulle moet hierdie* meetings *hou, hulle word geforseer om dit te doen'* ['I was at all the meetings. It's like... "We hear what you're saying, but we're not really listening". Look, they have to hold these meetings, they are forced to do it'] (Interview, 2016). The SKA's public engagement attempts could surely benefit from paying attention to Bucchi's 2013 admonition toward the scientific community, to be 'mature enough to pass from a "heroic phase", in which "everything goes" […] to a phase in which quality is the central concern for all parties involved') (2013:905).

The failure to conduct these meetings in Afrikaans was a major source of frustration for residents. Some of the people I interviewed complained that these meetings were tedious as all questions and answers had to be translated between English and Afrikaans. Residents also complained that the SKA

representatives either did not answer residents' questions satisfactorily or did not know the answers and referred questioners to the Government Gazette. Michelle for instance said:

Wanneer ook al SKA 'n public meeting *het, dan pak hulle die biblioteek vol* Government Gazettes*, dik boeke... En hulle weet ons mense sukkel om te lees en om te skryf. Vra enige iemand 'n vraag dan antwoord hulle, "ons kan nou nie seker wees oor onse antwoord nie, maar kyk maar net in die* Government Gazette"*. Hoe? Ek weet ek kan nie... Daar is hoeveel terme in wat ek nie verstaan nie* (Interview, 2016).

[Whenever SKA has public meetings, they pack the library full of Government Gazettes, thick books… And they know our people struggle to read and write. If anybody asks them something then they say, "we're not sure about our answer, just check the Government Gazette." How? I know I can't… There are so many terms I do not understand.]

5.3.3   The use of information

As shown in the previous sections, many residents are not satisfied with the SKA's approach to using and sharing information. According to farmer Jan:

Hulle stuur mense wat nie Afrikaans magtig is nie. Hulle stuur arrogante mense wat met 'n meerderwaardige houding na ons boere toe kom wat maak asof ons ongeletterd is. En hulle was oneerlik van die begin af. Wat hulle gedoen het, is hulle stuur een keer een person wat 'n sekere ding sê en dan 'n volgende keer stuur hulle iemand anders wat weer iets anders sê. Die openbaarmaking van inligting was of gebrekking of oneerlik. Kyk, gedeeltelike openbaarmaking is dieselfde as om leuens te vertel (Interview, 2016).

[They send people who cannot speak Afrikaans. They send arrogant people who come with superior attitudes to us farmers and they make as if we are illiterate. And they were dishonest from the beginning. What they did was to send one person who would say one thing and the next time they would send somebody else who said something else. The disclosure of information was either deficient or dishonest. Look, partial disclosure is the same as lying.]

In my own review of SKA public meetings, interviews and information sources such as newsletters and brochures, I have found inconsistencies in information and answers to questions that are vague or ambiguous, or potentially misleading about possible impacts of the SKA locally. For instance, an SKA staff member minimised the impact that the buy-out of the 118 000 hectares of farming land would have on the local economy in comparison to the financial injection in the local economy that the SKA would bring:

Obviously *gaan dit 'n effek hê. Dit haal 0.5% van die skaap produksie van die area haal dit uit. Daai skape gaan nooit weer terug kom nie, wat 'n 10-miljoen-rand effek is, verdeel tussen Williston en*

> *Carnarvon. So dis 5 miljoen uit die GDP van Carnarvon. So dit gaan 'n effek hê, ons kan nie weg kom*
> *van dit af nie. Maar die terugploeg in die gemeenskap… ons het 220 miljoen in die gemeenskap*
> *spandeer, so jy haal 10 miljoen uit en jy sit 220 miljoen in… so jy moet dit in perspektief sien*
> (Francois, interview, 2016).

> [Obviously, it will have an effect. It takes out 0.5% of the sheep production of the area. Those sheep
> will never return, which is a 10-million-rand effect, divided between Williston and Carnarvon. So,
> its 5 million rand out of the GDP of Carnarvon. So, it will have an effect, we cannot get away from
> that. But the plough-back into the community… we spent 220 million in the community, so you
> take out 10 million and you put 220 million… so you have to see it in perspective.]

However, agricultural economist Johan Kirsten, who was commissioned to undertake an assessment of the impact of the SKA on agriculture for the SKA SEA, found that the annual output of the farms being bought out was higher than this SKA staff member suggested, at approximately R 16 million (2016:12) and not R 10 million. Furthermore, according to the information in a SKA leaflet, *SKA SA se beleggingsimpak in die Noord-Kaap,* [SKA SA's investment impact in the Northern Cape], the R 220 million the SKA staff member quoted above was referring to was not an annual amount (as his comparison implied) but the total amount that had been spent in the Northern Cape for the construction of KAT-7 and MeerKAT up until November 2016. According to Foley et al (2016:3), the acquisition and construction phases of KAT-7 had already started in 2008, (the leaflet does not state this information). That means that the SKA's average annual expenditure in the Northern Cape, in this period (and not simply the Carnarvon area), was closer to R 27,5 million, of which some fraction would also have gone to national construction companies.

According to the leaflet, R 134 million was spent 'at local suppliers for the construction of MeerKAT and other related projects'. The leaflet does not state whether KAT-7 is part of the 'other related projects', but if it is then the average annual expenditure locally would be around R 16,75 million. As shown in Atkinson *et al* (2017) the actual annual expenditure would, of course, be subject to fluctuation over time, depending on the timing around the completion of some projects and the start of others. Furthermore, the leaflet does not define what 'local' entails, and how the money spent locally has been divided between Carnarvon and surrounding towns such as Williston, Vanwyksvlei, Brandvlei and Loxton.

Thus the promotional material targeting local communities in the Northern Cape does not include vital information that one needs to gain a proper understanding of the SKA's 'investment impact in the Northern Cape'. By leaving out such information, the SKA creates a uniformly positive-looking picture which encourages inflated expectations of job opportunities in the surrounding towns. These leaflets, brochures and newsletters are not designed to inform local people but to serve a public relations

agenda that puts the SKA in a positive light and promotes a certain idea of development. People who then question the value of the SKA come to be regarded as 'uneducated or ill-informed, at worst the enemies of "development"' (Walker & Chinigò, 2017:19). More precision around the definition of the localities which are involved (rather than relying on the looseness of the term 'local') as well as the time frames being used for measuring the developmental impact of the SKA needs to be built into the SKA's information material.

The SKA's promotional material is also rife with ambiguities such as: 'SKA will be as open and honest with you in order to maintain a good relationship with the community - not only the farmers, but the community as a whole' (*SKA Northern Cape News*, 2016:15). This could be read to mean that the SKA will be open and honest unconditionally, or that it will be open and honest insofar as not being so may affect relationships with the community. Böhm and Brei's (2008) cautionary study on the marketing of development discourses is very apt when looking at how the SKA's information sources are designed to promote their specific development discourse. Indeed, it could be argued that the SKA's very strong advocacy around the positive development impacts of the project locally actually points to an awareness on its publicists' part of the awkward position of radio astronomy in this regard.

Ultimately, as previously discussed, the SKA is motivated less by local development concerns than it is by national and global concerns, and the limitations of its local communication strategies can probably be best understood from this perspective. A brochure describing the development benefits flowing from the African Data Intensive Research Cloud (ADIRC), which will form part of the SKA's data infrastructure, makes this clear (DST, n.d.). This brochure states that research is essential to attain the UN Sustainable Development Goals (SDGs) and then goes on to state how research and thus the SDGs can benefit from the ADIRC: the latter will provide a 'powerful distributed IT infrastructure, providing ready access to high performance computing, large dataset visualisation, and high performance, high volume storage facilities for collaborating research groups across Africa'. The link between achieving these objectives and promoting or achieving sustainable development is, however, left implicit rather than explicit; the primary goal behind the establishment of the ADIRC is to store and disseminate the enormous amount of data that will come from the SKA's radio telescopes and not to attain the SDGs.

Although the SKA organisation is not driven by the SDGs, there is little reason to doubt its intention of using their infrastructure to help support research that could possibly lead to the attainment of the SDGs. The point that I am making here is simply that the link between science and development in the SKA's development discourse is not overt and its investment in local development projects is a by-product of other priorities.

5.4   Conclusion: *Habitus*, the SKA and "development"

What my study demonstrates is how very differently local people and SKA personnel understand the significance of the extraordinary science project that is being built around the infrastructure currently being constructed near Carnarvon, in the Kareeberg district of the Northern Cape.

Carnarvon residents' conception of the SKA's science endeavours cannot be understood without taking their history and social context and the way they have come to embody these in their 'small-town *habitus*' into account. As my discussion of my research findings makes clear, the Carnarvon small-town *habitus* is central to my understanding of "where" residents are coming from in their conceptions of the SKA's science endeavours. Generally speaking, Carnarvon residents are not interested in the SKA's science agenda, and experience astronomy as something far-removed from their daily realities. Although many residents subscribe to a traditional religious understanding of Christianity, it is immediate concerns such as 'where you can earn a loaf of bread' that have dominated local people's interaction with the SKA, rather than concerns pertaining to the SKA's 'meddling' in God's creation; these latter concerns did surface in some of my interviews, but they were far less significant than I had initially expected. Although some residents were very concerned about the impropriety of the SKA's research agenda, most would simply like for themselves or someone in their family to get a job from or through the SKA, so as to improve their lives: in this regard, the nature of the enterprise generating the jobs was of far less concern than the getting of a job. The pressing daily concerns of Carnarvon residents thus rendered the actual content of the SKA's research interests as essentially meaningless, as 'not a need'. While on the surface residents may seem disinterested in astronomical science, delving deeper into their social contexts reveals that it is the gravity of their social situation that shapes their priorities in relation to the presence of the SKA.

The legacy of unequal schooling during apartheid also contributes to this position as it shapes many black residents' views of astronomy as a concern of white people and therefore 'not for us' or 'not our level'. Yet although they may view astronomy as a meaningless undertaking, they are also aware that the field of astronomy has emerged as the hegemonic field in their midst and that their cultural capital and *doxa* are unable to hold their ground when it comes to this new "game". This makes residents feel marginalised and powerless in their own home town which in turn may lead to a heightened 'need to create a sense of place as "secure and stable"' (Easthope, 2004:133) and could explain the depth of the animosity many residents expressed towards the SKA during my field work.

In sharp contrast, SKA scientists conceive of the SKA's scientific endeavours as inherently valuable. They are driven by curiosity and the need to push the boundaries of knowledge further. This points to what has been termed the scientific *illusio*, where the field of astronomy and its accompanying capital

and common-sense ways of doing are viewed as inherently meaningful. Although SKA scientists' individual life trajectories vary quite a lot, as scientists they share a scientific *habitus* which accounts for their similar dispositions toward the SKA's science endeavours. At the same time, there are different approaches to the significance of astronomy among SKA personnel.

Whereas the scientists view the SKA's science agenda as extremely important in itself, the non-scientist SKA professionals that I interviewed tend to view the SKA's scientific endeavours as valuable *because* they believe it will lead to loosely understood notions of "development" – but development that is located at a national or global level (for 'all') rather than at a local level. Although they may also be interested in the actual science, they view it in a more instrumentalist fashion, whether this is in terms of its contribution to the "development" of society, or, in some cases, a means to gaining a greater understanding of humanity's place in the universe or of uncovering God's greatness.

Across the board, however, SKA personnel all subscribe to the notion of a self-evidently causal relationship between science and development, one that does not have to be further examined. None of the SKA scientists that I interviewed took a critical stance on the presumed link between science and development. This is understandable as this presumption of development is frequently used to legitimise their field (and secure funding for their field) to people who do not share its *illusio*. This development discourse has been repeated so many times that it has emerged as *the* hegemonic development discourse - part of the *doxa* of the scientific *habitus*.

The legitimacy of the scientific field and the useful goods (such as medicines) and technologies that it has engendered make it seem irrational to scientists and science advocates to question the drive behind this endeavour, but it is exactly because of the immense power accorded to science and scientists that closer scrutiny of their actions and discourses is warranted. When advocates of scientific projects such as the SKA make bold claims that 'The whole world will benefit from this development in astronomy' (Smith, Mbaba & Raynard, 2016:37), then they must expect that they will raise public expectations that will demand further attention.

If a commitment to the betterment of society was the driving force behind scientific projects, then one could expect that the goals of such projects would be set by the challenges that society faces, in order to improve upon them. However, as the discussion of my research findings has shown, the primary driving force behind the SKA is not the betterment of society on terms set by all the members of the society who are impacted by it. One SKA engineer told me: 'I think with the skills we have in this building we can solve almost any problem, I'm not even joking' (Karla, interview, 2017). But this claim leads to the follow-up question: why do you not?

This challenge is particularly acute in the case of astronomy, which is generally very costly to conduct but, unlike the more applied fields of science such as medicine or renewable energy, does not produce knowledge that can be seen to benefit human lives in reasonably direct and tangible ways. Astronomy projects must therefore justify the spending of very large sums of money to learn more about space while starvation, suffering and disease are rampant on earth. By claiming that 'the whole world will benefit' from it and deploying the empty signifier "development" in this discourse, SKA proponents are in effect attempting to justify their enterprise. If inequality and poverty were no longer global issues, the promotion of this discourse would not be necessary and the cause of uncovering new knowledge about space would suffice on its own terms. The fact that this development discourse is promoted so heavily is indicative of its proponents' recognition of the awkward position that astronomy as a publicly funded endeavour finds itself in in an unequal society.

This is not to argue that astronomy should not receive public funding or that developmentally significant products cannot result from projects such as the SKA, but to point out that it is necessary to look critically at what the development discourses of astronomy projects actually mean, i.e. to unpack what "development" means in this instance and who will benefit from it and, in the case of the SKA, to probe who makes up 'the whole world'? Here one also needs to acknowledge that the SKA is a ground-breaking project, with the consequence that those involved in it do not know what exactly it is they will find through it. One of the great attractions for the scientists who are involved with the SKA is the idea of exploring 'the great unknown' (Nicolas, interview, 2016) and in doing so 'pushing the boundaries of knowledge' (Rachel, interview, 2017; Marius, interview, 2017). This points to its scientific *illusio* (i.e. the feeling that the field of astronomy and its accompanying capital and *doxa* are inherently meaningful). The driving force behind the SKA is to gain new knowledge, specifically knowledge about how space works and the nature of mysterious phenomena such as dark energy. There are of course other motives that also drive the SKA, such as the development of new and improved technologies, but in the end gaining new astronomical knowledge is the primary goal of the project for scientists.

Here Latour's distinction between matters of fact and matters of concern is very helpful in clarifying how specific development discourses that are actually matters of concern can be made out to be matters of fact that all should accept as such. According to Latour, the issues (and discourses in this case) that are made out to be matters of fact represent those with the most power. 'This multiplicity [of reality], however, is often disguised when one truth claim, one kind of knowledge, comes to dominate over others' (Müller, 2015:31). In the case of the SKA assemblage, the SKA's science-development discourse is made out to be a matter of fact, as seen in many of the excerpts from my transcripts of my interviews with SKA personnel. The SKA's symbolic power is derived from its global

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and national backing, as well as the legitimacy of the law, science and money that underpin it. This points to the many interconnections within the SKA assemblage and how these connections are conduits for power. The SKA's development agenda is "naturally" related to progress as it piggybacks on the legitimacy of the scientific field and the idea of a global community. The hegemony of the SKA's global vision of development naturalises the link between science and development, but does not take into account the many different notions of development exist, nor that context shapes the understandings of what development means in a specific place.

Carnarvon residents do not subscribe to the SKA's notion of development, not because they are convinced that science cannot play a role in development, but because they are unsure of how exactly it can bring about positive *local* change for them. The contest between the differing development discourses of Carnarvon residents on the one hand and SKA personnel on the other is, however, not simply a contest between development discourses, but a contest between the local and the global, feelings and the law, non-hegemonic knowledge systems and science, and poverty and enormous budgets. Power is central to the uneven nature of this contest.

An approach to resolving this contest that works with 'matters of concern' (*dingpolitik*) helps to uncover the complexities of the tensions between Carnarvon residents and SKA personnel as it recognises the need to create a level playing field and a democratic approach in decision-making. This approach acknowledges 'the world as multiple and performative, i.e. shaped through practices, as different from a single pre-existing reality' (Müller, 2015:31). Although the SKA's "reality" is the hegemonic "reality", it is still just one among many. All entities within the assemblage deserve to be heard and their "realities" (that are linked to their *habitus*) should be acknowledged and taken into account.

Using assemblage thinking to explore the contestation between Carnarvon residents' conceptions of the SKA project and that of SKA personnel has also brought the issue of *desire* (highlighted by Müller, 2015) to the fore. The desire to attain more knowledge about space is the driving force behind the SKA - not "development." This desire is seen in SKA science professionals' striving to uncover new knowledge that they view to be inherently valuable. The desire to know more about the universe has sparked the formation of this assemblage and has affected the formation of relations among a range of human and non-human entities. For national politicians and research managers driving the project it is the desire to be seen as a competent player in the global community as well as the desire to give effect to a modernising discourse of development at the national level.

In terms of South Africa's relationship to the global community, arguments can be made about both the benefits and the costs of the project. While the SKA certainly does provide an opportunity for

South Africa to prove its scientific competence as well as to invest in sorely needed capacity in science and engineering expertise at the national level, the SKA project can also be understood as reproducing older, colonial power dynamics as the country seeks to prove its scientific competence to the west and in so doing implicitly recognises the west as the hegemonic player in the "game" of science.

Finally, although Carnarvon residents and SKA personnel clearly do not value the SKA's science and development endeavours in the same way, my study also suggests that there is scope for an improved relationship at the local level. The SKA personnel who are working directly with the community emerge as committed to bringing positive change to Carnarvon, albeit on their own terms. Carnarvon residents find this unacceptable and demand transparency from the SKA but are also keen to benefit from the investment and to be part of the decision-making around its local community development projects. It is important for both parties to understand that they both want improvement in Carnarvon. What this improvement entails, however, needs to be established through ongoing deliberations and negotiations where both parties are not only present but able to voice their views and feel heard. Effective public participation, in which local people feel fully acknowledged, is key to this process. A greater awareness of the unequal power dynamics between Carnarvon residents and SKA employees and the understanding that development is not a one-size-fits-all endeavour is also needed if Carnarvon residents and SKA personnel are to work together to find common goals for the future.

A new approach is needed where the 'matters of concern' of the people of Carnarvon are not marginalised because they are not consistent with hegemonic notions of development and progress in circulation at the national and global levels. *The Brussels Declaration* of 2017 suggests that new approaches to the relationship between science and society are starting to emerge in important circles within the scientific community, approaches which urge closer attention to people's 'matters of concern' and the recognition that development is a process with many different meanings. Bringing these insights into the SKA's dealings in Carnarvon is an urgent task awaiting its proponents.

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Interviews

Aletta, 10 November 2016

Danny, Carnarvon, 16 November 2016

Deon, Carnarvon, 18 November 2016

Derick, Carnarvon, 17 November 2016

De Wet Nel, 11 November 2016

Elise, Carnarvon, 31 May 2017

Elsa, Carnarvon, 10 November 2016

Francois, Carnarvon, 19 May 2017

Jan, Carnarvon, 18 November 2016

Jeffrey, Carnarvon, 17 November 2016

Jonathan, Bellville, 8 May 2017

Karla, Pinelands, 3 August 2017

Liezel, Carnarvon, 25 May 2017

Margaret, Carnarvon 14 November 2016

Margaret, Carnarvon, 25 May 2017

Marius, Stellenbosch, 4 August 2017

Michael, Pinelands, 18 September 2017

Michelle, Carnarvon, 19 November 2016

Nicolas, Carnarvon, 23 September 2016.

Nicolas, Carnarvon, 10 November 2016

Nicolas, Carnarvon, 18 May 2017

Nicolas, Carnarvon, 25 May 2017

Rachel, Pinelands, 13 May 2017

Sara, Carnarvon, 16 November 2017

Tina, Carnarvon, 14 November 2016

Vincent, Carnarvon, 31 May 2017

Willem, Carnarvon, 31 May 2017

Appendices

Appendix A: Profile of participants in terms of gender, race and age

Carnarvon residents			
Name	**Gender**	**Race**	**Age**
Aletta	Female	White	83
Carlo	Male	Black	21
Danny	Male	Black	40s
Deon	Male	White	40s
Derick	Male	Black	59
De Wet	Male	White	83
Elise	Female	Black	50s
Elsa	Female	Black	53
Jan	Male	White	60s
Jeffrey	Male	Black	39
Liezel	Female	White	29
Margaret	Female	Black	84
Michelle	Female	Black	28
Nicky	Female	Black	23
Nicolas	Male	White	63
René	Female	White	50s
Sara	Female	Black	45
Tina	Female	Black	52
Vincent	Male	Black	54
Yvonne	Female	Black	45

Sutherland			
Name	**Gender**	**Race**	**Age**
Jonathan	Male	Black	37

SKA personnel			
Name	**Gender**	**Race**	**Age**
Francois	Male	White	37
Karla	Female	White	26
Marius	Male	White	40
Michael	Male	Black	39
Rachel	Female	Black	42
Willem	Male	White	57

Appendix B: Approval of study

UNIVERSITEIT·STELLENBOSCH·UNIVERSITY
jou kennisvennoot · your knowledge partner

Approval Notice

New Application

15-Feb-2017

Butler, Suné SS

Proposal #: SU-HSD-003074

Title: **Knowledge relativity: SKA stakeholders' and Carnarvon residents' understandings of the origin of the universe and the significance of the SKA**

Dear Miss Suné Butler,

Your **New Application** received on **10-Aug-2016**, was reviewed

Please note the following information about your approved research proposal:

 Proposal Approval Period: **14-Feb-2017** -**13-Feb-2020**

Please take note of the general Investigator Responsibilities attached to this letter. You may commence with your research after complying fully with these guidelines.

Please remember to use your **proposal number** (**SU-HSD-003074**) on any documents or correspondence with the REC concerning your research proposal.

Please note that the REC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

Also note that a progress report should be submitted to the Committee before the approval period has expired if a continuation is required. The Committee will then consider the continuation of the project for a further year (if necessary).

This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki and the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health). Annually a number of projects may be selected randomly for an external audit.

National Health Research Ethics Committee (NHREC) registration

number REC-050411-032. We wish you the best as you conduct

your research.

If you have any questions or need further help, please contact the REC office at 218089183 **Included Documents:**

 REC: Humanities New Application

 Sincerely

 Clarissa Graham

REC Coordinator

Research Ethics Committee: Human Research (Humanities)

Appendix C: Informed consent (Carnarvon residents)

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jou kennisvennoot • your knowledge partner

TOESTEMMING OM DEEL TE NEEM IN NAVORSING

Titel: *Knowledge relativity: Carnarvon residents' and SKA personnel's conceptions of the SKA's scientific and development endeavours*

Goeie dag. My naam is Suné Butler. Ek is 'n MA student in die Department van Sosiologie en Sosiale Antropologie, Stellenbosch Universiteit, Suid-Afrika. Ek vra u om deel te neem aan 'n studie wat sal bydra tot my MA tesis. Die doel van studie is om te verstaan hoe Carnarvon-inwoners en SKA werknemers dink oor die wetenskaps- en ontwikkelingsondernemings van die SKA projek. Ek sal graag informasie wil versamel van mense wat, soos uself, in Carnarvon woon.

Indien u instem om deel te wees van hierdie studie, sal ek vra dat u 'n paar vrae beantwoord en met my in gesprek tree waarin u relevante ervarings en kennis met my bespreek. Ons gesprek sal ongeveer 45 minute tot 'n uur duur. Voordat ek begin, het ek of u mondelingse of geskrewe toestemming nodig dat u instem tot die volgende:

1. Deelname in die studie is vrywillig, met ander woorde u kan kies of u wil deelneem of nie.

2. As u besluit om deel te neem aan die studie, kan u enige tyd stop en kies om te onttrek sonder enige negatiewe gevolge. U mag ook verkies om nie vrae te beantwoord waarmee u nie gemaklik is nie en steeds deel te neem aan die studie.

3. Daar is geen afsienbare risikos om deel te neem aan die studie nie. Daar sal ook geen direkte voordele wees nie, insluitend betaling van geld vir deelname aan die studie. Die bevindinge van die studie kan egter help om die kommunikasie kanaal van die SKA en Carnarvon inwoners te verbeter, siende dat dit lig kan werp op sommige botsende sienings en doelstellings tussen die SKA en Carnarvon inwoners. Hierdie studie kan ook waardevol bydra tot die blootstelling van kulturele kennis van Carnarvon inwoners.

4. U sal nie geïdentifiseer word as 'n deelnemer in die studie nie, tensy u toestemming gee dat ek u naam mag gebruik of as u in 'n offisiële hoedanigheid reageer (in daardie geval sal die vereistes van u instelling gevolg word). Andersins sal u identiteit konfidensieel gehou word en beskerm word deur die gebruik van 'n skuilnaam.

5. Indien u instem, sal ek graag ons onderhoud/gesprek wil opneem. Dit maak dit makliker vir my om te verseker dat my notas van ons gesprek akkuraat is. Indien u instem om opgeneem te word, mag u steeds vra dat die opnemer enige tyd gedurende ons gesprek afgeskakel moet word. Die opnames sal slegs vir navorsingsdoeleindes gebruik word en sal nie met enige persoon in die gemeenskap gedeel word nie.

6. Alle data wat ek versamel sal veilig gestoor word en slegs gebruik word vir legitieme navorsings-doeleindes.

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7. Ek mag moontlik die resultate van die studie publiseer in 'n akademiese publikasie. Soos met die tesis, tensy u toestemming gegee het dat u naam gebruik mag word, sal u indentieit, deur die gebruik van 'n skuilnaam, konfidensieel bly in so 'n publikasie.

Indien u enige vrae het oor die navorsing, kan u een of meer van die volgende persone kontak.

Navorser: Suné Butler, 0737966944, 16219155@sun.ac.za .

My studieleier: Prof. Cherryl Walker, Departement van Sosiologie & Sosiale Antropologie, Stellenbosch Universiteit, Privaat Sak XI Matieland 7602, Suid-Afrika; (tel: 021 808 2420; e-pos: cjwalker@sun.ac.za).

Navorsingsafdeling: Ms Maléne Fouché, Afdeling vir navorsingsontwikkeling, Stellenbosch Universiteit, Privaat SAK XI Matieland 7602, Suid-Afrika; tel: 021 808 4622; e-pos: mfouche@sun.ac.za .

MONDELINGSE TOESTEMMING/HANDTEKENING VAN DEELNEMER

Die informasie hierbo was deur Suné Butler aan my verduidelik in Engels // Afrikaans //. Ek was geleentheid gegee om vrae te vra wat bevredigend beantwoord was. Hiermee gee ek vrywilliglik toestemming om deel te neem aan die studie. Ek het 'n kopie van hierdie vorm ontvang.

Merk enige kondisies aan (bv. Deelnemer stem in om geïdentifiseer te word):

_____

Naam van deelnemer

_____   _____

Handtekening van deelnemer   Datum

        OF Mondelingse toestemming aangemerk deur navorser [MERK]:

HANDTEKENING VAN NAVORSER

Ek verklaar dat ek al die informasie op hierdie dokument deeglik verduidelik het aan

_____. Hy/sy was aangemoedig om vrae te vra oor die onderhoud prosedure. Hierdie gesprek het in Engels // Afrikaans plaasgevind. Hieride deelnemer het gekies om toesetemming te gee deur:

Handtekening   **OF**   **Mondelingse toestemming** [OMKRING SOOS GEPAS]

_____   _____

Handtekeing van navorser   Datum

Appendix D: Informed cosent (SKA personnel)

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CONSENT FORM AGREEING TO PARTICIPATE IN A RESEARCH PROJECT

Title: Knowledge relativity: Carnarvon residents' and SKA personnel's conceptions of the SKA's scientific and development endeavours

Good day. My name is Suné Butler. I am a MA student in the Department of Sociology and Social Anthropology, Stellenbosch University, South Africa. I am asking you to participate in a research study which will contribute to my MA thesis. The aim of this study is to understand how Carnarvon residents and SKA personnel conceive of the SKA's scientific and development endeavours. As part of this study I wish to collect information from people like yourself who are working for the SKA.

If you agree to take part in this study, I will ask you to respond to some questions and engage in conversation with me, in which you draw on your experiences and knowledge concerning issues related to my study. Our conversation should take approximately 45 minutes to one hour. Before I proceed, I need your agreement, either orally or by means of your signature, that you are aware of the following:

1. Participation in the study is voluntary, in other words, you can choose whether to take part or not.

2. If you agree to take part, you are free to stop and also withdraw at any time, without any negative consequences. You may also refuse to answer any questions that you are not comfortable with and still remain part of the study.

3. There are no foreseeable risks to you in this research. There will also be no direct benefit to you, including no payment of money for agreeing to take part. However, the findings of this study may help to improve the communication channel between the SKA and Carnarvon residents, as it could shed light on issues such as contesting beliefs and goals between the SKA and Carnarvon residents. This study can also prove to be valuable by uncovering cultural knowledge of Carnarvon residents.

4. You will not be identified as a participant in the study unless you give me express permission to use your name or you are responding in your official capacity (in which case the requirements of your institution around this will be respected). Otherwise, your identity will remain confidential and protected through the use of a pseudonym/made-up name.

5. If you agree, I would like to record my interview/discussion with you. This makes it easier for me to be sure my notes from our discussion are accurate. If you agree to being recorded, you may still ask for the recorder to be switched off at any time during the interview. The recordings are intended for research purposes only and will not be given to anybody else in the community.

6. All the data I collect will be stored securely and only be used for legitimate research purposes.

7. I may publish the results of my study in an academic publication. As with the thesis, unless you have given permission for your name to be used, your identity will remain confidential in any such publication, through the use of codes or pseudonyms.

If you have any questions or concerns about the research, please feel free to contact one or more of the following:

Researcher: Suné Butler, 073 796 6944, 16219155@sun.ac.za .

My supervisor: Prof. Cherryl Walker, Department of Sociology & Social Anthropology, Stellenbosch University, Private Bag XI Matieland 7602, South Africa; (tel: 021 808 2420; e-mail: cjwalker@sun.ac.za).

Research Division: Ms Maléne Fouché, Division for Research Development, Stellenbosch University, Private Bag XI Matieland 7602, South Africa; tel: 021 808 4622; e-mail: mfouche@sun.ac.za .

ORAL CONSENT/SIGNATURE OF RESEARCH PARTICIPANT

The information above was described to me by Suné Butler in English // Afrikaans //Xhosa. I was given the opportunity to ask questions which were answered to my satisfaction. I hereby consent voluntarily to participate in this study. I have been given/ have been offered but not accepted a copy of this form.

Note any conditions (e.g. participant agrees to be identified):

_____

Name of Participant

_____   _____

Signature of participant   Date

   OR Oral consent given and noted by the Researcher [TICK]:

SIGNATURE OF RESEARCHER

I declare that I have carefully explained the information given in this document to

_____. He/she was encouraged to ask questions about the interview procedure. This conversation was conducted in English // Afrikaans // Xhosa …. . This respondent chose to give consent via:

Signature   **OR**   **Oral Consent**   [CIRCLE AS APPLICABLE]

_____   _____

Signature of researcher   Date