ARCHITECTURE AND THE LIFE IN AROUMIATTE,
an oasis village in Morocco

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This research thesis is written as part of the architecture graduation studio of Explore Lab at the Technical University of Delft. We (Maaike and Loes) worked together as a team on the research. We did both have another research question, but those questions complemented each other and resulted into a complete research on architecture and life in Aroumiatte. This research is the foundation of our graduation design assignment, which is also part of our graduation program at Explore Lab. It can also be used as a guiding hand for everyone who wants to design in the area of Aroumiatte, or wants to get to know more about this area, or partly for anyone who wants to design in a Moroccan oasis village or in another oasis village around the world.

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**Berber:** Original people of Morocco. They are converted to the Islam by the Arabs, but still have their own infill of the religion and their own language. Cultural context: The inhabitants common values and habits, related to their culture, religion with its rituals and obligations, architecture, politics and economy.

**Desertification:** Growth of the desert because of dehydration of the land, mostly caused by the world wide change of climate. But in the oasis area it is also caused because the oasis ecosystem that is out of balance, because of the lack of human activity.

**Dsar:** An organically grown village, without any structure, formed by more ihks together.

**Haratín:** From origin this minority was brought into Morocco as slaves from the south of Morocco. They were the former villagers of the oasis and worked in agriculture for the production of food. For the local people nowadays to be called Haratín is highly insulting, they call this group of people the ‘black people’. Most of them live in or near the Kasbahs in the Oasis.

**Igerm:** A settlement which functions as a residence for one or more families, with as main characteristic the grouping around an orthogonal closed court with cattle.

**Ihks:** More families their igerms grouped together.

**Individual behavior:** The manner of behaving of a individual. Which are the actions and reactions of a person in response to a stimuli, internal or external.

**Kasbah:** A Kasbah was a place for the local leader of a city to live. It was the defence when the city was under attack, almost all cities had their kasbah. Kasbahs therefor have high walls with barely any windows. For some families in the city, having a Kasbah was a sign of wealth. Lately the Kasbahs are mainly empty or being used for tourist attractions. The word Kasbah is also used to describe the old part of the city, which is also called a ksour. In this essay we will regard the Kasbah as the ksour.

**Ksar:** The taddart of the semi-ksar type: The house, of urban style, existing of small spaces, grouped around a central space in which the light enters from the roof.

**Ksour:** A fortified village where farmers live, in the case of Aroumiatte mainly the Haratin, it is like an igerm adjusted to the desert. What separates the Ksour from a Igerm is that the Ksour mostly has a straight street plan within the walls, which replaces the court of the Igerm.

**Oasis:** An isolated area of vegetation in a desert, often originated because of a river or other natural water source. Nowadays there are also man made sources, like water wells, that can be the heart of the oasis.

**Oasis village:** A village, in or next to an oasis, founded there because of the access to water and with that the possibility to grow food. In history a strategic and powerful spot because of long trade routes moving through the desert.

**NGO:** non-governmental organization: a legal organization which is operating independently from the government and focused on social issues. This term is mainly used for organization focusing on development.

**Nomads:** The former nomad tribes ruled the trade caravans within the Sahara. They were constantly moving through the Sahara, from oasis to oasis, living in tents. Nowadays they still move with their camps from oasis to oasis to feed their cattle. They come to the villages to trade on markets and search for dates.

**Sahraouian:** Arabian nomadic tribe. They are living in and around the Western Sahara where they once ruled part of the trade caravans. Nowadays they are living in different countries surrounding the Sahara. They are either living permanent in oasis villages on the border of the desert or still moving with their family and cattle through the desert trying to survive the nomadic way of life.

**Social context:** The relations and tension between the different groups and within the families.

**Taddart:** Room which is located around the courtyard of the Igerm.

**Tighremt:** A fortified house with two or more floors around a central space with an opening in the roof or with a patio. This patio or open space has square walls surrounding it with two or four corner towers.

**Touareg:** Berber nomadic tribe. They live around the central Sahara where they once ruled the trade caravans. Now a lot of them are settled in different countries around the central Sahara. Some of them still are moving through the desert with their families and cattle.
I. INTRODUCTION

This thesis is the result of a research on a small oasis village in the desert of Morocco, which is rapidly changing and is threatened by the hot and dry desert. The research has been done in different scales. The cultural context of the architecture and urban setting have been researched as well as the technical side of architecture, what materials are used and in what way.

The results of this research will give an idea of the architecture and life of the local people of Aroumiatte. This results might be used as a starting point for any architect who wants to build in the area of Aroumiatte, but for some parts also for architects who want to build in other oasis villages in Morocco or around the Sahara desert. Besides the historical and contemporary architecture, also some suggestions for the future will be described. Things like the way that the architecture in the village can become more sustainable and a vision on the future growth of the urban setting of the village will be discussed.

Besides architects, the information might also be valuable for other people that want to act in this area, since it also gives an insight view of the contemporary life and history of the people that live in this area. This chapter will give a small introduction on what an oasis village is and why we should act there. It will introduce the reader to the problem of desertification and the change of building methods in this area. Also the personal motivations to do this research will be discussed, which will lead to the choice of location for the research. The next subchapter will describe our personal research goals and research questions, leading to the research methodology that we have used to answer these questions. A short introduction will be given on the family where we have stayed and from where we have done most of our research in Morocco. Finally the structure of the thesis, where the results of the research methods will be described, will be explained.

1. The oasis village

An oasis is an isolated area of vegetation in a desert, nowadays often surrounding a spring or similar water source, in history often close to a river or natural lake. Oases provide habitat for animals and for humans if the area is big enough. Because of access to water, people are able to put agriculture into practice. The reason to get access to the water can be of different reasons and accomplished in different ways, so there is a difference in oases types.

Some examples are oases accomplished because of a river or an artesian aquifer or underground river, where access to water is made possible because of a natural well or sometimes a manmade well. The location of oases has been of critical importance for trade and transportation routes in desert areas. Caravans must travel via oases so that supplies of water and food can be supplemented.

2. Why to act there?

Political or military control of an oasis has in many cases meant control of trade on a particular route. From the seventies the oases are getting poorer. Once they were rich centres of trade and cultures were having golden

The oasis in the desert
periods, now there are often social economic problems and the ecosystems are out of balance due to several reasons. Because of improvement of infrastructure it does not function as a centre anymore and incomes are decreasing. The western habits and health are taking control of the culture and the population in the areas is growing. The population also grows because nomads are often obliged to settle in the oasis villages, since life in the desert has gotten too hard. The increase of population puts an enormous pressure on the area which cannot handle the amount of people; the ecosystem is getting out of balance.

Because of climate change water is getting scarce and oases areas are shrinking. Besides that the date palms, typical for oases, are suffering from deceases and different eating patterns are changing the importance of the palms.

3. Desertification
Desertification seems to be a worldwide problem with the climate change. Also the oasis villages in the south of Morocco are in high danger of desertification. Though this problem will develop slowly, at least hundreds of years, and will not be of direct danger in the coming decades. Looking at the oasis area nowadays a great problem which will develop coming decades is the desertification, but caused by another matter than climate change.

Aroumiatte is one of these oasis villages, once capital of trade between the countries surrounding the Sahara. Nomads ruled the area and used the oasis villages as food source and for storage. Villagers were in charge of the production of food, irrigation systems were well taken care of to make sure all the crops were watered. After the French revolution, the independence of Morocco and with that the change of government and infrastructure, the area lost its power in trade. People needed to find new ways of earning money, which they could only find outside the oasis in northern Morocco or even abroad. At least 70% of men nowadays works outside the oasis, in large cities in Morocco or even in west-Europe, and sends money to their family that is left behind.

With the improvement of infrastructure the import of vegetables and fruits from the north of Morocco has become cheaper than the production of it in the oasis itself. Irrigation systems in the riverbeds are not needed any more and are getting neglected. With the lack of human activity the ecosystem of the oasis is getting out of balance. This means that the oasis will slowly get dryer and the earth is getting less fertile and saltier. The desert will take control and the oasis will shrink within decades. The village is captured in a vicious circle. It needs men activity to keep the oasis alive and have better future prospects, but because the future prospects are not too good now, people are immigrating and activity of men decreases.

Also worldwide global warming will contribute to the desertification of the oasis area. Desertification is a big threat for future life of the inhabitants. The supply of water nowadays is already poor. With the fact of desertification it will get a major problem. For the area to survive inhabitants need to find new ways of earning money within the area to increase human activity one again.

4. Building method
The traditional way of building architecture in Morocco has largely faded by the influence of the colonists. There are several reasons for this: the temporality of the traditional Moroccan mud architecture and the disrespect for this architecture by the colonists. However, in Aroumiatte there still are some traditional igers and there is still a traditional ksour, constructed from mud. The ksour however, is mainly abandoned. There are these days, quickly growing in amount, buildings made from concrete blocks. This concrete buildings are absolutely not adapted to the climate, it for example doesn’t have the thermal mass of mud, which stores the heat of the day and warms up the building in the night. The traditional way of life in rural areas is absorbing modern elements, the inhabitant want to be more modern, they want to life with the comfort and looks of the modern life. Doing so, they often forget about the qualimties of their traditional architecture.

5. Motivation & fascination with Morocco
Loes Goebertus - I have been interested in different cultures, the architecture and ways of living related to this for a long time. A few years ago I have done my internship at the architectural office FBW architects. This office is located in Utrecht, but has a lot of design experience in Africa. Their architecture inspired me.

For my final project for the bachelor of science I had gotten the opportunity to
do a design assignment in Somaliland. Of course I had to take this change, I have worked together on this assignment with NGO Daryeel and another student of architecture. A fieldtrip was an essential part of this assignment, and got me very inspired about the opportunities to work with the local buildings style and materials from this area as well as to work in a completely different cultural setting.

Maaike de Visser – Since I had to chance to leave The Netherlands and travel to experience different cultures after my final exam of high school, I got addicted. For me it seems the best way to learn and understand different cultures and with that the way they think, work and live. Which I think nowadays is very important since the world becomes smaller, and confrontations of cultures and religions are a fact. To live or work together you will need to understand each other and with that respect each other. I have been living, studying and working in several countries to learn about different cultures but also to learn more about myself and my own culture and country. During several years I lived in Spain, Hungary, Ireland and the USA. I decided to stay in these countries for a longer period of time than just travelling through it. This gives you the opportunity to really get into and be part of the people’s culture. Morocco is an interesting country to go nowadays seen the conflicts there are in The Netherlands between the different cultures. For sure one of the major problems is that we do not understand each other and with that you cannot respect each other. I would like to go to Morocco to experience the way they live, work and maybe to get an idea about the way they think.

Loes Goebertus & Maaike de Visser – We both searched for some more projects that were related to different cultures and building methods in Africa. This brought both of us to the first year master of science assignment in Casablanca which we did together with Robbert van de Straatten. The aim of this assignment was to get to understand the public sphere of this different culture and the different way of designing which was related to this culture. After the research of the public streets and squares and the use of those in Casablanca, we have made a design for a multimedia centre. In this design the usage of the public space in combination with the choice of materials and forms were very important.

Decision - This project inspired both of us a lot. We have gotten even more interest in the culture, lifestyle and architecture of Morocco. We decided to do our final research project in Morocco, to explore more about the architecture and culture of this country. We think it is important nowadays to do research and projects in other cultural settings, since this will give you more experience in the ability to understand different cultures, with different values and a different architecture. This is a subject architects are faced with more and more, since, like all businesses, also architects start working behind the borders of the country of their origin.

After the experience of a project in a large city in Morocco, we loved to do some research in a small village in addition. The lifestyle and architecture in a small village is very different from that of a large city, often the life in villages is still more traditional, facing the rapidly changing influence of the large cities.
6. Choice of Location

Loes Goebertus - There is still a lot of traditional mud architecture in these villages. I believe that this mud architecture, which is often associated with poor by the local inhabitants, offers a lot of opportunities. Not only is it much more adapted to the local climate than the concrete architecture, that is rapidly taking over, the mud architecture is also getting increasingly more attention in Europe, since its highly sustainable qualities. Mud is not the only local building material available, there are more opportunities, like reed etc. By using local building materials in the right way, it might encourage the local inhabitants to use it again, instead of concrete!

Maaike de Visser – Besides the cultural fact I think the area is really interesting and also of world matter. The fact of desertification threatens life in this area. People live on the border of two completely different ecosystems. And what does that mean for the architecture and the way of life on this borderland. It interests me a lot and I hope I will learn a lot but also maybe can contribute to a possible solution or improvement for the life and architectural environment of the local inhabitants.

For a good research, visiting the site is very important to get knowledge about the culture, the way they live and think, and the possibilities of the local architecture and building materials and methods. Good contacts on the location are important, especially because we don’t speak the local language. We have gotten in touch with Mia Wiercx van Rhijn, a Dutch artist, married with a Moroccan former nomad. They live together with his second wife and their kids in a mud house in Aroumiatte. She is visiting the village for many years already, and is accepted by the local society. This contact has been very important for our research, in this way we were accepted by the locals and even took part of a local family. Mia has been with us during most of our stay in Aroumiatte, she knows many people in and around the village and she and her contacts have helped us a lot with our research.

The contact with Mia had defined our research location: the village of Aroumiatte, which is an oasis village as we aimed for.

The location for the research and design will be Aroumiatte, a small village on the border of an oasis in the South of Morocco. The village contains about 150 houses and some public facilities. It is connected with other villages by a large concrete road which crosses the village. Six kilometres down the road it is connected with Zagora a large city with a population of about 250,000 inhabitants and many concrete buildings. Aroumiatte exists out of a mix of traditional mud buildings and concrete buildings.
7. **Goal I - Loes Goebertus**

To design in a different culture, one has to understand the different cultural context, to know why the architecture is the way it is and to predict what the development of this area probably will be like.

Architecture can have a lot of influence on social change\(^1\), when accepted and appreciated by its users. A small scale school can have a large influence on individual learning of the children, which helps them to identify themselves as part of a larger community. An example for this is the school in Gando of Diébédo Francis Kéré\(^2\), which largely increased the number of pupils. A complete different example is the new library in Amsterdam, which is always very crowed, which was not the case of the much smaller library which was their before this building. Both project were adapted to the local context as well as renewing in some way.

To design in another culture, besides the understanding of the needs of the community it is also important to understand what building materials and techniques are locally available, especially in small villages.\(^3\)

My research goal is to find out how one can create a building in Aroumiatte, which provides a better chance for inhabitants of Aroumiatte and which can finally help them to identify themselves as part of a larger community. The challenge is to create building which is different from there probable future of the architecture of Aroumiatte, but which is desirable, not only from an European point of view, but also for the local inhabitants. Understanding the cultural context and local possibilities (materials and limitations) is essential to create architecture which is accepted by the local inhabitants. Architecture that ignores the culture context, or interprets it in a wrong way, often leads to failure. The architecture has to be recognizable, accepted, adapted, inspiring and surprising. The design goal is to design a new building in Aroumiatte, which is desirable for their future. This desirable future can be formed by the results of this research in combination with my knowledge gained at the from the Technical University Delft.

8. **Question I - Loes Goebertus**

Designing with mud as building material in a village in Morocco is on one hand a logical choice, but on the other hand a big challenge, since it will not make any sense if the local inhabitants do not accept the building, or associated it with poverty. Designing a building which is accepted by the local inhabitants, but also a building which is adapted to the climate and uses local materials and being renewing and surprising, is the challenge I would like to take.

“How can you create a building in Aroumiatte, which is recognized and accepted by the local inhabitants, while also being surprising and innovative, and being more adapted to the climate than the modern cement architecture and being more durable than the traditional mud architecture?”

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1. Andres Lepik (2010a)
2. Sinclair, Cameron; Stohr, Kate (2008)
3. Andres Lepik (2010b)
The research question can be divided in three goals focused on what there is (context), what possibilities (concept) there are and the function.

**Sub questions:**
I. What was the local architecture in Aroumiatte like (material, construction, form, climate and site, and use and evaluation), how has this changed through the years and what are the future prospects for it? What are the strengths, weaknesses, opportunities and threats of the architecture in Aroumiatte? (context)

II. Research should be done on what the possibilities are with the local crafts and materials for a building and how open minded the local inhabitants are, what their dream houses are like and how they value architecture. How can you make the architecture surprising and innovative, while still being recognized and appreciated by the local inhabitants? (concept & desirable future)

III. What facility can provide a better perspective for the future of the people in Aroumiatte? (desirable programme)

More sub questions have been written down during the research, an overview of the themes and subthemes is given in the research web, shown at the next page.

**9. Goal II - Maaike de Visser**

*Research goal*

For me the research exist out of different parts which need to get explored. To be able to design in an unknown culture it is really important to know for who you are designing. You will have to get to know how the people are living. This means that it is of great importance to get to know their relation with their house, their environment and their social network. So you have to know their habits, their standard and their values. The best way to get to know this is to live a while with the people and mix in their live. So the first goal of my research is to understand the way of living of the local people. The environment of the village is really important for the way that people live but also for the way that people built the use of material and form of the building. So the second goal for me is to get to know the problems, possibilities and limitations of the environment.

A third goal is to get to know the village where we are going to design. This means that it is important to know the structure of the social network, but also the structure of the architecture. What does public space means, how is it used and how does the public space appear.

*Design goal*

The design goal is divided into two, one has to do with the function it should get and the other with the architectural appearance. The local inhabitants of the area have a really big trade spirit. You can also connect this with their history where they have been one of the most important centres of trade in their region. The people try to earn money in every possible way, and they are quite creative in this. Nowadays it is really hard to earn money in the region is every possible way. I think a really important problem is that their network is too small to be able to make this spirit work nowadays. They live on an island in the desert and their network stays on this island while the world becomes more and more one. I would like to stimulate their trade spirit by broaden their network. I think that when their network is broader they will find new ways, their selves, to earn money. (an example is Abdul from the Kasbah of Tizergat).

Secondly, I want to contribute to the sustainability of the environment and the architectural value of the village. Because the environment is in great danger and there is a possibility that people are not able to live in the oasis anymore I would like to contribute on the improvement. Besides I would like to contribute on the architectural value of the village, to make it more interesting for tourists to visit and as well to make it more interesting for the people to live in the village. I hope to be able to make the local people see the beauty of their own architecture.

**10. Research question II - Maaike de Visser**

“What could be a new local material that can be crafted and easily used by the locals, that reinforces the sustainability of the environment and that adds an architectural value to the already existing architecture of the village of Aroumiatte? What function of the building can broaden the locals network and knowledge to stimulate their trade spirit to think of new ways to do business?”
Sub questions:
I. What local materials are getting used, how are they being used and what are the pros and cons? What local materials are available but not used?
II. What are the environmental problems and by what are they caused? What influence do these problems have on the local inhabitants? What will this mean for the future and in what time period are we talking about? What is the relation of the inhabitants with their environment?
III. What is the architecture like in the village, material, form and use? What could be an additional value for the inhabitants as well as in world matter?
IV. What are the social contacts of the people? Are these contacts of great importance and for what are they important, trading, caring etc.? Where and how do they expand their network?

11. Research methodology
We have used many different methods to get the answers to our design questions. Before we have left to Aroumiatte to do research on the site, we have done literature research, had informal talks and did interviews. We have spoken a few times with Mia Wiercx van Rhijn, who introduced us to Aroumiatte, where we would stay with her. We discussed the possibilities for our fieldwork ideas with her. Furthermore we have spoken with Carmen Juffinger, who has lived in another oasis village in Morocco for a few years, she told us about her experience of living there. We also spoke to Samir Bantal, who was born in Morocco and teaches architecture at the Technical University Delft at the department Design as Politics. He could tell us something about the political situation in Morocco and brought in touch with new contacts. Through him we got in touch with Remco Ensel, teacher of anthropological history at the Radboud University of Nijmegen, who we interviewed about the tensions between the different ethnic minorities and the political situation. Furthermore we interviewed Hind Charaffi, recently graduated architecture student at the University of Rabat, about her interest and the attention that the university had for the Kasbah architecture. Finally we made a proposal how to do the fieldwork in Aroumiatte, which we used during our stay there.

We used several research methods during our stay in Aroumiatte. For one we stayed for two weeks at a nomad family’s home, from where we could be a participant observer in their house. A description of this family is given in the next chapter. We wrote down our observations every day. Because
the family life there is very important, we got to know many relatives of the family. Most people of the family only speak Arabic and know some French words, communication was mainly with hands and feet. Because of this, observing was a very important method to use. We could speak about almost everything with Mia, our informant, who speaks Arabic and Dutch, and was already part of the family for over five years. Besides her, Idris was asked to be our second informant. He is nineteen years old and speaks English. The positive thing about having these two informants on our sides during most of our stay is that happenings could immediately lead to questions and discussions with hem, on a more informal way. The positive thing about our contact with Idris is also that there was an interexchange of information, we liked to know more about the Moroccan way of life and he liked to know more about the Western way of life. This way the conversations got more comparative instead of us just questioning him, and thus also interesting for him and more relaxed.

Besides informal talks with people and friends from the family, we also did a formal interview with Jawad Chahid of Réseau Associatif R.AZDED-Zagora, an association in Zagora. This interview gave us an insight of the currently bespoken problems and actions in this area. They also told us about the role that the government will play in the future of this area.

Besides observing the family life in the house, we also observed the life in the village. To arrange these observations we made notes, pictures and did some mapping of certain themes in the village: building materials, building heights and levels, roads, facilities and public activities of the inhabitants in common space. These results helped us to define the village in different neighbourhoods. From each neighbourhood we made more specific analytical drawings of some houses, which showed us the different way of appropriation of their space.

Beside these methods, we gave three people of the family, one of their friends and a tourist a disposable camera, with which we had asked them to make pictures of their house and living environment. The first camera was given to the head of the family, a former nomad. The second was given to a person related to the family and still lived with the camels in the desert. The third was given to one of the daughters of the family, living in a house of mud. The fourth was given to a friend of the family, who lived in a house made of concrete in the nearby city Zagora. The fifth was given to a tourist, visiting the family before us.

The pictures that they had made showed us what is of importance to each of them and what they regard as their living environment.

Besides the house that they live in now and the things they regard important, we also wanted to know what kind of architecture they desired. To get to know this, we took some photos of totally different types of architecture, from a nomad tent to a modern house in a large Moroccan city. The pictures are displayed in chapter II, photo-survey. We asked them to pick their favourite building to live in. We used pictures of buildings that they did not know yet, so they could not link certain buildings to the people who lived in them. The photos raised some discussions and showed us what their desirable future houses may look like.

Finally we asked eight children of the village to draw their favourite place in the village. These drawings are being shown in chapter II, their evaluation of architecture. We intended to do this assignment at the school, but since we could not get permission, we improvised the assignment in the backyard of the house with children of about ten and eleven years old living in the village. Their drawings showed us their perspective of the village and most of all what they regarded as important in the village.

Before returning to the Netherland, we took a sample of the available earth in the village with us. At home we did some tests with this: the smell test, sedimentation test and ball dropping test. This gave us information about the quality of the material. Other information about the way of building and materials they use, we have mainly documented in pictures and text, since we could discuss a lot of this with Idris. We have visited different houses with him and nomad tents to analyse the construction and materialisation.

After returning back in The Netherlands, we have analysed and arranged all the information we gathered. We did more literature studies in addition and did some more research on possible more sustainable solutions for the local architecture. Finally we wrote this thesis to answer our research questions.
12. Introduction of the family where we have stayed

To get an idea of our research environment, a short description of the nomad family where we stayed is being given here.

Mia, our Dutch informant, is married to Abdullah, a Sahraouian nomad, since 2005. By that time Abdullah was already married with his first wife, Karima. Before Mia and Abdullah got married, they met each other in secret places, so no one could see them together. When Abdullah married Mia, it caused some irritations, disrespect and jealousy by Karima. Mia did not speak Arabic so well by that time and was not able to communicate properly with Karima. Mia suspects Karima for putting a scorpion in her bag. By now, Mia her Arabic has improved and the relation between her and Karima as well. This might also have to do with the fact that Mia brings in a lot of money and works with tourists for the family. In return she wants Abdullah to be with her when she is in Morocco. Mia has had a big influence on the house and she and Karima both have their own part.

Karima and Abdullah have eight children, who are all living in the house. The oldest son is mostly away to work in the building industries. He returns when he is needed to work with the tourists, in the house or for other special occasions. When Abdullah, the oldest man of the family, is away from home, the oldest son is in charge of the family.

The second oldest brother, Asad, is married for about half a year. Mia told us that before he got married, he had been partying a lot in Zagora. His family thought it was time for him to get married, to get more serious. He agreed with the marriage. Since then, it looks like his life has gotten better, his wife had just got pregnant.

The oldest girl, Niba, is married since last year. When a girl marries a boy, she normally moves into the house of the family of the boy. Her husband, however, had to leave their house to work. Since she had a bad relationship with the parents of her husband, she moved back into the house of her own family again. She has to return back to his family’s house though as soon as her husband returns home from work.
The second oldest daughter, Najima, just sixteen years old, had her engagement party during our stay in Aroumiatte. The parents of her future husband had seen her walking and thought she could be a good wife for their son. They asked Abdullah for her hand. Her daughter did not look very happy at her engagement party. We think she is afraid to leave her family behind, since she is still very young. The marriage will be in about half a year or a year from now.

The youngest daughter, Zainab, who is fourteen years old, looks like a nice spontaneous girl at first. But when you get to know her better, she turns out to be a very clever girl, trying to manipulate people to get them to do what she wants. Idris told us for example, he liked her in the beginning, but now he had gotten to know her a bit better, not so much anymore. She is acting like they are best friends, but he rarely knows her and does not feel this way.

Samir is eleven years old and goes to primary school in Aroumiatte. When we visited his class however, it turned out that he had missed many classes. He likes the camels and nomad way of life a lot, according to his drawings.

Omar, who is only four years old, is very spoilt by his father. Mia thinks this might have to do with the fact that he has good eyes. Many children of Abdullah are cross-eyed. Since Karima is Berber and Abdullah Sahraouian, it does not seem to be caused by incest in any way. Mia thinks it might have to do with malnourishment. Whatever the case is, Abdullah spoils Omar so much that all the others are complaining about it. He cannot stand hearing the moaning voice of Omar, and always almost gives him what he wants. Even when we left for the desert for a few days and Omar started crying, he was allowed to come with us, missing a few days of kindergarten. Omar likes the camels a lot and his father is proud of this.

Alim is the youngest son of the family. While his older brothers and sisters have to help in the household or go to school, he is still free to play in the house all day. Especially Asad likes him a lot and takes good care of him.

Besides all the children of Abdullah, we have also got to know two of his nephews. One of them is Mustafa, he works a lot with the camels. He joined us into the desert and also stayed with the camels in the palm garden where they have food, while the others were at home. He knows a lot about the camels. Surprisingly enough, he said he prefers to live in a big flat in a large city. Another nephew we have met is Ramadan, he owns a jeep and drove with us through the desert for one day. Conversely Mustafa, who is a very decent man, Ramadan tried to hit on us.

Finally we have had a lot of contact with Idris, the brother of Fadila. Mia had asked him to guide us, since he speaks quiet good English and is closer to our age. He lives with his mother and some more family members in Aroumiatte. His father died, his older brothers have left the house to work or study somewhere else, so he is the only man in the house. He cares a lot about his mother, who we met and have gotten to know as a very warm-hearted woman. His mother tries to make some money by making carpets and gathering dates, that fall on the paths in the palm garden, and selling them. It is clear that this family has less money to spend then the family of Abdullah, who of course have a lot of income through Mia. Idris his dream is to go to America, which he thinks to be impossible.

13. Thesis structure
The introduction of this thesis gives an idea about the subject of this thesis and the research methodology that we used. To get to the answer of the research questions, we will describe several themes throughout time.

The chapter of the architectural and cultural history will describe the history of the architecture in oasis villages in Morocco and the influence of the protectorate of the French on the architecture in Morocco. Furthermore it will shortly discuss the different ethnic minorities that live in the oasis area of Morocco and their religion.

In the chapter architecture and culture today, a more extensive description will be given on as well the architecture as the inhabitants in Aroumiatte, mainly based on our own experience during our fieldtrip. Except for the description of the common architecture in the oasis village Aroumiatte, also the exceptions and the evaluation of the local inhabitants on architecture will be discussed. The inhabitants will not only be describes as different groups, but also on the hierarchy within the family and within the village. Also the landscape and urbanism of the village will be described as we analysed this during our stay, including the vegetation, urban planning and flows of water,
garbage, the building materials etc. Finally the influence of the government and non-governmental organisations will be discussed.

The final chapter describes the probable future of the village. After this, some more desirable sustainable opportunities will be discussed and a desirable future for the village will be described, ending in our plan for a desirable urban development for the village. The thesis will end with a chapter in which the answers to the research questions will shortly be summarized.
II. ARCHITECTURAL AND CULTURAL HISTORY

1. Architecture and inhabitants of Morocco
The architecture of Morocco, which used to be mainly constructed from mud, has changed a lot with the influence of the French during the protectorate after the Second World War. The traditional mud architecture was seen as irrelevant by the French and modern concrete buildings have been introduced. This same way of building modern buildings happened in a lot of places in Africa in this time. Later, some attempts have been done to create conservative vernacular architecture in respect to the traditional architecture, which Hassan Fathy had first introduced in Egypt. Other reactions followed, leading to the idea that an architect has to understand the cultural context to the fullest to make a valuable design. To get some understanding of the cultural context, a short sketch will be given about the architecture and the inhabitants of Morocco through the history.

1.1 Architecture
Before the protectorate came to Morocco, the architecture mainly existed of vernacular mud and stone architecture. A more specific description on the mud type of architecture in the oasis areas will be given in the second part of this chapter (chapter II.2 The oasis in Morocco).

1.1.1. The influence of the protectorate of the French on the architecture in Morocco
After the Second World War, Africa, also Morocco, in the eyes of the colonists, was a great untouched place to try out new ways of architecture and urban planning. Since they regarded the local architecture as irrelevant, they had a free playing field to try out their experiments, based on the ideal Modern Movement. Already before the first World War architects worked with the analytical and functional approach on urban development in Africa. The urban plan for Casablanca was one of the first modernistic urban plans in Africa, designed by Henri Prost. This plan was even more modern then the plans in Europe.

The knowledge gained before the war would make ‘the African welfare state’ possible, everyone on the world would be regarded as the same. Moroccans would take over the western way of living, so their culture was seen as irrelevant. Africa was regarded as a continent without history, which was a very Eurocentric thought. Corrugated steel sheets and concrete stone was introduced on a large scale. Traditional building methods were not suitable for industrial building technology, they were only regarded as exotic or romantic in a sort of fairy-tale way. The influences by the European world would have a large influence on the way most Africans treated architecture in the years coming.

1.1.2. Conservative vernacularism (an attempt to preserve the mud architecture)
Hassan Fathy is recognized as a forerunner of social and ecological planning. He introduced conservative vernacularism, a re-introduction of mud architecture to provide a better life for the poor with great respect for the existing local building traditions, in Egypt. He studied the traditional housing typology and worked with the local villagers to understand their needs. One of the things he realized is that the project would only succeed if he worked with the participation of the future users of the buildings, during the design and construction process.

The AT-movement (Appropriate Technology) and some architects, mainly ADAUA, worked on with this thought in Ouagadougou in Burkina Faso. But in the eighties this AT-movement seemed to be a dead-end. Their solutions reverted to the past, in a aware and non-aware way. Burkina people nowadays want to be more modern and want to live in a modern city. They associated mud with poor. But even though the AT-movement reverted to the past, they introduced a new form expressions, vaults and domes, which weren’t forms Burkina’s people were used to, they were imported from France. The AT-movement was actually a new building technology, developed in Europe, but it was introduced as if it was local, and because of this as an obvious type of architecture.

The vaulted structures and the stabilized mudstones (BTC) were no part of the traditional building culture. So it was an imported product, and needed a good marketing to have a good chance to succeed. Instead there was

1  Fathy, Hassan (1973)
2  Folkers, Antoni (2010)
barely any attention for marketing and training. Another problem was that the
tooling materials to build this were expensive to buy and to preserve.

1.1.3. Bidonvilles – Casablanca (architecture which is not
adopted to the wishes and needs of the inhabitants)
Cities in Morocco are growing drastically. In the late twenties people from
rural areas move to the cities, because they hope for a better job and better
life there. Spontaneous growth of cities in the periphery of the city is the
result, people built their houses from flatten oilcans, ‘bidon’. Which is why this
informal cities are called ‘bidonvilles’.

From 1915 in Casablanca governor Hubert Lyautey wanted to stop this
growth, he set up social building projects on a large scale. But the rural
people didn’t feel comfortable in this type of houses, often they sublet their
house and kept on living in their own house in the bidonvilles, which was
adapted to the modern native building tradition adjusted to the large scale of
the city.3

This still happens, as more social building blocks are introduced, people keep
on subletting their houses.4 Simo confirmed this to us when we passed these
Bidonvilles on the big road in Casablanca.5 Even though the government
tried to make social housing blocks which were based on the traditional
building typologies. Apparently this is not enough.

After WOII Michel Ecochard introduced a large scale social housing project.
Some thousands building were being built in the first ten years after WOII.
Candilis translated the traditional Moroccan type of living (ksar, kasbah etc.) into modern apartments with more levels. European and American
architects, as Aldo van Eijck, the Smithsons and Le Corbusier, got inspired
by indigenous traditional Moroccan architecture. They develop this further for
Morocco and they wanted to integrate some aspects of it in the modernism.
But the Moroccan people didn’t want this, they wanted to live in a modern
environment without formalistic associations with their rural way of living.

1.1.4. Regional reactions in architecture
Ozkan divides regional reaction on the internationalizing architecture
in transforming tendencies. Firstly in vernacularism, which is divided into
firstly conservative vernacularism, the re-introduction of the traditional
building method for the traditional function, as introduced by Hassan Fathy
and later the AT-movement. And secondly neo-vernacularism, which is the
re-introduction of the traditional building method for contemporary functions.

Besides vernacularism she introduces modern regionalism, which is
divided into concrete regionalism and abstract regionalism. Concrete
regionalism is when one is using elements, building parts and form
expressions from the traditional regional building culture in a modern building
technology and functional typology. Abstract regionalism uses the ethic
principals of the Modern Movement, but is gaining more in-depth knowledge
of the continuity. Continuity is being found in elements like mass, space-
experience, rhythm, proportions and light, which is than translated in an
analogous way into the present technology and typology.

Ozkan adds that to design good abstract regionalism, one has to be
able to listen and be modest. This does not fit the idea of the promotion of

3 Folkers, Antoni (2010)
4 Folkers, Antoni (2010)
5 Diary – 22 nov 2010 - p.33
architecture, this is why this type of architecture is quiet unknown. Even though there is not yet a lot of this type of architecture, the interest in this movement is growing. Abstract regionalism might be the solution for the dead-end of modernism and the other post-modern movements. To design this way, one has to understand the cultural context to the fullest.

1.1.5. The cultural context
The modern European resident gives value to a nice view, transparency and a good indoor climate. The luxurious houses build by the colonists have a nice indoor climate, because of the verandas, natural ventilation etc. But when this building method is being used for the Moroccan people, as Candillis and Woods tried in a modern housing block in the periphery of Casablanca, the verandas are being closed off for more indoor space. Antoni Folkers states that Africans add more value to privacy and safety, they use their house mainly for storage and a place to sleep and spend most of their day outdoors. We have discovered that this differs from one ethnic minority to another. But however it shows how important it is to do a research in advance to the cultural context.

All people are very different in their way of valuating things. People in Morocco are very diverse, they have in common that most of them are Muslim (99%), but the way they are living is very different. Even in the small village of Aroumiate, there are many different cultural groups. We have also discovered that the way of living diverse from one group to the other. The nomads were living in tents in the desert, moving every time with their tents to feed their cattle and trade. Some of them are settled in houses in the villages, which are different type of houses then where the Haratin lives, they have a long history of living in a sedentary settings. Within the nomads, there are again different groups: the Berbers, the Sarahoui, the Touareg and more. All this people have a different way of valuating their house, architecture, their environment etc.

When we ignore the difference in cultural context while creating architecture, we make the same mistake as the AT-movement, when they tried to introduce mud-architecture in a new ‘traditional’ way. People there associated mud architecture with poor and sheets of correlated iron as progressive and modern. Neglecting the cultural context leads to failures all over the world.

1.2. Inhabitants & religion
Berbers are the original inhabitants of Morocco. In the 2nd century Morocco became part of the Roman empire and Christianity was introduced. A lot of Berber tribes converted to the Christian religion. But the area also had a big Jewish population. In the 4th century it became part of the Jewish empire until the Arabs conquered the region in the 7th century. They brought their civilization and the Islam, to which many Berbers converted. Although the Berbers converted to the Islam, they kept their own laws and shaped the religion to their own image. Tensions between Arabs and Berbers made that they both lived separate lives in the same area. During a lot of decades they swapped power of the region.

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6 Folkers, Antoni (2010)

7 Folkers, Antoni (2010)
In the 19th century Europe showed interest in Northern Africa. In 1912 Morocco became a protectorate of France and the southern and northern part of Spain. French and Spanish people emigrated to Morocco during these years. Jews, Muslims and Christian lived together.

After the seconds world war a lot of Jews got killed and a lot of Christians moved back to Europe. When the state of Israel was created, almost all Jews that were still living in Morocco moved to Israel.

In 1956 Morocco became independent from France. Berber language was forbidden to talk. Almost all speakers of the Judeo-Berber language left the country in the years following the independence.

Nowadays 37 percent of the inhabitants of Morocco are Berber, 20 percent is Arabic and the rest are foreigners; mostly from France, Spain and Algeria, and Berbers that became Arabic. The Berber population is in majority and mainly lives in the mountains and valleys, though a lot of them decide to emigrate to European countries nowadays. Moroccan Arabic is the main language spoken by all. The 37 percent of Berbers, that do not identify themselves with Arabs, speak their own Berber language next to Moroccan Arabic. To speak the Berber language in public was forbidden for a long time, but nowadays with the new king Omar VI it is allowed to speak Berbers in public again, it is also allowed to be taught in schools again. 97 percent of the Moroccan population is Muslim; the others are Jewish or Christian.

1.3. Conclusion
The French regarded the traditional Moroccan architecture as irrelevant, the same thing happened in many other African countries which were European colonies. As reaction, Hassan Fathy introduced conservative vernacularism in Egypt, others followed, but this did lead to a dead end. Ozkan describes more regional reactions on architecture that followed, ending with the importance of the understanding of the cultural context. Antoni Folkers also states that we have to understand the cultural context in which we are designing. The cultural history of Morocco is quiet complex and has had many influence from abroad over the centuries.
2. The oases area of Morocco

Aroumiatte is located in the oases area of Morocco. The traditional architecture of this area varies from tents, to igermis, ksars and ksours. All of these types of living will shortly be described in this chapter. The oases were important trade centres, many different ethnic minorities used to live together in the oases area, which made it a very complex social system with a strict hierarchy. The different ethnic minorities will be discussed in this chapter, ending with how the hierarchy between these groups has changed.

2.1. Geographic partition of Morocco

Morocco is divided in three geographic parts. The first is 'Le Maroc Intérieur', which is situated northwest of the Atlas, adjacent to the Mediterranean Sea and Atlantic Ocean. Buildings in this part of Morocco are originally build from wood, reed and sometimes mud and stones. People lived in cities and groups living in houses.

The second part is 'Le Maroc Extérieur', situated on the other side of the Atlas. The climate here is dominated by the Sahara, the most regular building materials was mud. Some people lived together in mud houses grouped together, others lived the nomadic life, moving around in their tents. The third part is 'Le Maroc de la Motagne', the area in the mountains, with a cold mountain climate. Traditionally this people lived only in houses made from stones. Around the sixties also mud architecture has found its way in to the mountains. This has probably happened through mud builders that travelled from 'Le Maroc Extérieur' to the mountains. In the north also wood is widely used.

‘Le Maroc Extérieur’ is divided in four different geographic parts: The East-Moroccan steppe, the Sous Valley, Djebel Bani & Djebel Sarrho and the Pre-Sahara. The East-Moroccan steppe is a dry monotonous plateau with a height of 1000-1300m. It had some rare ksar and igerm buildings along the river side (Moulouya), mainly build from mud.

The Sous Valley is situated in between the Hight Atlas and the Anti-Atlas, opening itself towards the sea. It has a semi-desert climate, with about 150mm a year. In the north, east and south the buildings are made from stones, in the sous only from mud. The type of buildings were igermis, often grouped as dchars. An influence from the south oasis architecture is recognizable.

The Sahara in Morocco is mainly a dry stone desert. Djebel Bani & Djebel Sarrho is mountainous, this is the domain of the great nomad tribes, with for example the Aït Atta. This area has some fertile valleys, as the Dra, Gheris and Ziz. It has less than 100mm rain a year, but is does have some agriculture, which can exist from the melt water (from the mountains) in the rivers and the irrigation systems made by the sedentary population. The people who live in the oasis used to live in the shady mud ksars and sometimes in the tightremt.

Only in the Pre-Sahara the sedentary population and the nomads lived closes together. Examples of this are the oases of Skoura, Boumalne, Tinerhir, Ksar-es-souk and Erfoud. Important centres have been Ouarzazate, Zagora, Dra-oasen Lektaoua and Fezouata.

Aroumiatte is situated near Zagora and the Dra river in the pre-Sahara in ‘Le Maroc Extérieur’, the traditional mud architecture, the ksars and tightremt, will mostly be discussed in this thesis.
2.2. Architecture
Traditionally most nomads live in tents. Some nomads have changed their way of living to a sedentary setting, which still has some same spatial scheme as the tents grouped together. Haratín often lived in the old Kasbahs and worked in agriculture in the oasis.

2.2.1. The tent
The type of tent used by the nomads in Morocco is quiet similar all over the country, but they differ in function and size. For example there is a difference between the nomads in the East Moroccan Steppe in the Sahara, for who the tent is their house, they have tents from about 50 or 60m2. The transhumant in central Morocco on the other hand have smaller tents, since they leave a lot of their belongings in the Igerm. They use a tent just for a part of their living.

In 1967 all of Morocco except for the Rif, Anti-Atlas, Sous and Oases in the South, belonged to the nomads living in the tents.

2.2.2. From tent to house
The taddart has come to existence by grouping of the tents, that got a more permanent character. The taddart is an element to build with, the organization of the taddarts is like an already existing organization within the nomad world: the orientation around the cattle, organically grown. Like tents, taddarts were not as permanent as they might have looked. They were made from transient materials, after someone died, the taddart was left. Many years later the mud has turned back into earth. The same happened with Kasbahs and workspaces, nothing was made to last.

2.2.3. Igerm
The igerm, a organically grown settlement, does not exist in or near Aroumiatte, where we would find the ksar types instead. But the igerm is the basis of the ksar and the Berbers in the South wouf even say that an igerm is a ksar. What a igerm really is depends on who you ask this. Other ethnic minorities would say an igerm is like; a storage for wheat, a village in Gue Dmioua, or the Haha would say it is a wall where shooter can hide himself behind. But what is similar within all explanations is that an igerm has a low, little tapered wall of stone, later also made of mud.

Nijst, Priemus, Swets and van IJzeren\textsuperscript{10} would regard a Igerm in their doctoral thesis as a settlement which functions as a residence for one or more families, with as main characteristic the grouping around an orthogonal closed court with cattle. They have described some different igerm types.

The singular Igerm, with just one household and more taddarts around the court with the cattle. And the multiple Igerm, existing of more houses, with a group of related families (ikhs), around a court with the cattle. Both of these types can be grouped into a village.

The taddarts from with the Igerm is built has three different types.
1. The incomplete taddart: just one space, orientated towards the cattle, as part of a house.
2. The elementary taddart: a house with one or more arranged spaces, which as a whole is orientated towards the court.
3. The taddart of the semi-ksar type: The house, of urban style, existing of small spaces, grouped around a central space in which the light enters from the roof.

The organization of the igerm is around a court to create a fencing for the cattle. The igerm can be made from stone, wood, reed, mud or a combination. In the area of Aroumiatte the material of the walls will have been mud, the roof is mostly made from a combination of wood, reed and stone. Stone is often used to create a foundation.

An igerm can be isolated in the land, but often it is grouped with more families together (ikhs). Sometimes it even has a mosque within the walls, shared with more ikhs together. When it forms a village, with some hundreds of people and a mosque, it is called a Dsar. A Dsar is a organically grown village, without any structure. Rarely there is some system, which is radial and developed by a contact pattern. It can grow very big, and become a city, for example Settat has become a city, with the pattern of a medina.

2.2.4. Ksour or Kasbah
In Aroumiatte and all the other small villages around it we can still find the old Ksours, by the locals called the Kasbahs.

\textsuperscript{10} Nijst, A.L.M.T, Priemus, ir.H., Swets, H.L., van IJzeren, J.J. (1967)
The ksour is a fortified village where farmers lived, in this case mainly the Haratín, it is like an Igerm adjusted to the desert. What separates the ksour from a Igerm is that the ksour mostly has an orthogonal street plan within the walls, which replaces the court of the Igerm. It has a, enclosed wall around the village, with towers, from where the city could be protected. The streets inside the Ksour are small and narrow, creating a lot of shade and an as small as possible footprint of the total Ksour to protect.

The Ksar architecture has influenced the forms of the Igerm largely the latest centuries. The mud builders from South Morocco have built Igerms in their own building style all over Morocco, they caused mud to be growing and introduced the taddart of the semi-ksar type in a wide range.

The interaction between the Igerm and Ksar architecture has faded the boundaries between both types.

2.2.5. Tighremt

The Tighremt is a fortified house with two or more floors around a central space with an opening in the roof or with a patio. This patio or open space has square walls surrounding it with two or four corner towers.

2.3. Inhabitants


This centralised function in trade worked on a strict hierarchy in ethnic minorities that were living in the oasis. The nomadic tribes controlled the distribution of the goods. They made agreements with the people in the villages, protection in exchange for water and food. The nomadic tribes were in overall control. The poorest people in the village, Haratín, often were semi

11 de Haas, Hein (1995) p64

Above left: range of distribution of the Ksour. Above right: range of distribution of the tighremt. Left: Ksour, with its protecting wall and towers. (source: A.Adam, Jurgen (1981))
Pictures left: 1. entrance of the Ksour of Aroumiatte. 2. Protecting tower of Ksour in the palmgarden. 3. Small narrow street in Ksour of Aroumiatte.
slaves that were working in agriculture to produce food. The agriculture was positioned around the river bed. To water the fields, one of the most important jobs of the Haratín was to take care of the irrigation system. This system transported water from the river to all fields where it was needed to grow crops.

2.3.1. Haratín
The lowest in the social hierarchy were the Haratín people. They were and still are the majority of the inhabitants of the oasis villages. They have a very black skin and most of them were brought to the oasis as slaves by the nomadic tribes. Slaves were an important ‘product’ in the trade within the Sahara between the northern- and the southern African countries. The slaves’ origin is in the south of Africa. Although the Haratín was the biggest minority in the villages, they were oppressed by the nomadic tribes and worked in agriculture to provide them of food.

Not all of them were brought in as slaves though; the first inhabitants of the oasis area had a very black skin as well and had their origin also in the south of Africa. Berber tribes believe that they have been the first inhabitants of the oasis but research proves that this is not the truth.12

Most of the inhabitants were slaves and during time they mixed with the local inhabitants. So in fact the Haratín people nowadays are a mixture of different minorities. They vary in the color of their skin from very dark to tinted. Haratín people still have their own dances, music and words they use. They nowadays are often called the Black People, since being called Haratín is insulting. The Berbers do not see the Haratín as part of their nation while Haratín often see their selves as Berbers people. They also speak the local language which often is the Berber language.

2.3.2. Mrabtin and Shurfa
The Mrabtin and the Shurfa were the gentry and thus high in the social hierarchy of the villages. They said to be descendants from the prophet Omar and local saints. Their religious status gave them often also a political power, and they often mediate when there were conflicts between people in the village. The Mrabtin has its origin in the Haratín and also have a really dark skin. The Shurfa presume to be descendants from the prophet Omar and see their selves as an Arabic tribe.

2.3.3. Jews
A big part of the inhabitants in the oasis area were Jews. They lived in the south of morocco before the Islam was taking over. They often had their own neighbourhoods within the oasis villages. They played an important role in the economic position and trade of the area. After the independence of Morocco and the founding of the State of Israel, the majority of the Jews emigrated.

2.3.4. Nomadic tribes
The nomadic tribes around the Sahara were essential in the trade market in the Sahara as well as for the inhabitants of the oasis villages. The oasis villages were like an island in the ocean, and the nomads were their ships.13 The nomadic tribes were also dependent on the villagers in the oasis, they were an important source of food, especially dates and grains, and water. There were Berber nomadic tribes and as well Arabic nomadic tribes that

12 Haas, Hein de (1995) p.246
13 Heinemeijer (1980) p.135
were in constant conflict of power. They were plundering each other’s caravans and occupying and plundering oasis villages. The villagers in the oasis were in constant fear and often made alliances with nomadic tribes. In exchange for protection the nomads gained a lot of power over the villages. The villagers produced food and provided the nomadic tribes of access to water. The villages also functioned as storage place for the goods that the nomads were trading. It also happened that when a nomadic tribe occupied a village, some of the nomads settled in this village.

There are also examples where the opposite happened. Because the villagers had complete control over the access of water, the nomadic tribes were dependent on them and in that way under their power. It is clear that there has always been a strict hierarchy of minorities, but power changed between minorities, but the Haratín has always been part of the lower class.

2.3.5. The change

After the French revolution and the independence of Morocco, the position of the oasis on the trade market changed. The king applied for a new infrastructure system all over Morocco to make distribution and trade of goods easier. This means that the caravans of the nomadic tribes are no longer in need. It becomes cheaper to import fruits and vegetables from the north into the desert than producing them there. Also the borders in the Sahara desert between Morocco and its neighbor countries are drawn and getting stricter. Trade to the other parts of the desert is getting harder or impossible. The central position in trade of the oasis villages is all gone, there is no work and the hierarchy system between the ethnic minorities is collapsing.

Fifty percent of men from the minority Haratin, which used to work under the system of the nomadic tribes in agriculture, immigrate to the north of Morocco or to foreign countries to work. Monthly they sent money to their families that are left behind in the villages. The nomads that always had been in power are too proud to leave the area to earn money elsewhere. They are now the poorest minority living in the villages.

Nomads that used to live in the desert, moving with their camp from water to water are nowadays obliged to start living in the villages. They are too proud to leave the oasis area to earn money elsewhere, because of this they are the poorest minority living in the villages now.

Tensions between the different ethnic minorities have been strong. Nomadic tribes will not buy in a shop owned by Haratín and nomadic kids are bullied in schools by Haratín kids. Nowadays the tensions are getting less between the youth, but you can still see a separation of minorities in the division of neighborhoods in villages.

2.4. Conclusion

The oases had a centralimzed function in trade and worked on a strict hierarchy in ethnic minorities that were living in the oasis. The nomads lived partly or only in tents, plundering each other’s caravans and occupying and plundering oases villages, they were in control of the Haratín, the lowest in the social hierarchy. The Haratín lived in the Kasbahs, which is a fortified city close to an oasis, in which they worked on the land. After the independence of Morocco, the position of the oasis on the trade market changed. Nomads are obliged to start a living in the villages and have become the poorest minority, while Haratín earn money elsewhere and send it back to their families. The tensions are getting less however between the youth.
III. ARCHITECTURE AND INHABITANTS IN AROUMIATTE

1. What is the architecture in Aroumiatte like nowadays?

To get an idea of the contemporary architecture in Aroumiatte, the climate will first be explained, since this has a large influence on the architecture, although less on the modern kind of architecture. Secondly the different types of architecture in Aroumiatte will be discussed, as the building materials en construction used for this. Finally the exception in architecture will be discussed. The second part of this chapter will describe the evaluation of the architecture by the inhabitants and the final part will describe how the inhabitants use their architecture and village.

1.1. The climate

The rainfall in Aroumiatte is less than 100mm a year.1 The temperature varies between the 3 and 40 degrees Celsius. This area has a dry tropical climate, the humidity is low, clouds are rare. There is a big difference in temperature during the day, when it is very hot, and during the night, when it can get really cold. While we might have searched for the shade during the day, we wished for a third thick blanket during the night.

The hours of sunshine a day vary between five hours in December to eleven hours in July and August. The rare rain that is falling mainly falls in winter

1.2. Architecture

The architecture in Aroumiatte has changed a lot since the last few years. Architecture in the oasis villages are all build out of mud. This is the local material so the cheapest material as well. There are some disadvantages of the material though and nowadays people start to use other materials. The Kasbahs are mainly abandoned because of a shortage of air and light. Nomads are often forced to live in a building because of shortage in water in the desert. With the introduction of cement, many people chose to build with this material, since it has a modern character, is easy to build with and needs less maintenance. The village is growing rapidly and the government is starting to take more control.

1.2.1. Tents

Many nomads have settled in a more permanent setting in the past years, since life in the desert is hard. The family of Abdullah for example has chosen to build a house. Within the walls of this house however, some tents still form part of the interior. These are used as guestroom and sleeping place for the guests.

Some other nomad families still live in their tents in the desert. They often stay for a longer period at one place. Normally a camp exists out of one family, but sometimes for special occasions they make one big camp all time and comes down in very heavy showers. After a shower the village turns into one big mud pool and the river can get really high. There is not too much wind during the year. But a few times a year there can get a lot of wind, which turns out to become big sand storms.

Rainfall in Aroumiatte (source: www.world66.com/africa/morocco/zagora/lib/climate)
together. To find a good spot for their tent the women search for a place where the ground is flat. From here they remove all the big stones so they have a good place to build their camp. They build more tents that together create the camp. All tents have their functions. For example there is a tent that functions as guestroom and sleeping room. A tent for the kitchen and its oven gets another tent. Often there is also a tent for the cattle and chicken and one to keep the water shaded.

The drawing of Asad shows the important elements of the nomad life: the tea ceremony, the cooking place for couscous and the place to keep the goat milk. Also dates and goats are important to them, since they are their most important food supplies.

Often the women and children in the tents are left behind, while men are working to make money or are trading at the market. It can take days before the men return at the camp. The women are taking care of the kids and the camp. Often they are also making carpets, blankets and scarf’s to sell at the market or to guests that are visiting the camp.

To give an idea about the social contacts and the way that people approach each other we describe what happened when we visited a nomad family. It also tells something about the territory of families around their houses and camps and it shows the way visitors should act in this space.

When visiting a nomad family, it is not polite to just walk in. One person first approaches the tent and asks if the guests are welcome. The women then have some time to cover themselves and spread out the carpet on which the guest can sit. Guests are always welcomed with tea and sometimes some food. When you visit a tent, it is very impolite to leave without drinking tea or eating some of the food they have offered you. Guests are assumed to bring something for the family. Not just a small sweet for everyone, but a whole big bag for the whole family, when you do not bring something you are expected to give some money for the tea.

1.2.2. Tent material & construction

The guest- and sleeping tents are often made of goat's hair and camel wool. When broken, they are repaired with all types of old fabrics and wheat bags. Other tents are also often completely made from old fabrics. Some small tents are sometimes made from reed walls.
The construction of the tent is made from wood of the tamarisk and acacia, stones and pins are used to keep the tent on its place. Sometimes the loom is connected to the construction in the middle of the tent. The tent can easily be divided in two parts, which originally separated the place for the women en the men. On the floor there are two carpets, the first layer was originally made from reed, but nowadays often is made from plastic, it protects the second layer. The second layer is the carpet, often woven by the women. To sit on the first layer only is like sitting on an unfinished concrete floor, the second layer makes it a ‘coach’, since everyone is sitting on this carpet, sometimes with a cushion.

1.2.3. Sedentary nomads
The family of Abdullah is an example of a nomad family that had decided to live in a more permanent setting. Although they live in a building now, they still have an addiction with the nomadic way of life, moving with the camels through the desert and sleeping in the open air or in tents. By taking tourists into the desert, these tourists pay for the food for the camels and themselves, it is still possible for them to wander through the desert. Khalid is hoping for a tourist who wants to make a trip with the camels to Mauritania, so he can join while everything is getting paid for him.

Abdullah and his family had started to build a mud wall around a piece of ground in Aroumiatte, in which they built some small rooms (comparable to the taddarts) or placed their tents. After some years they had enlarged their house, by building a new mud wall around the open spot next to the house. Finally they doubled the total square meters of their house once more by placing another mud wall. Within the house some new rooms are being built one by one. This way of building is common in Aroumiatte. Inside the house there are as well places inside as outside. With the influence of Mia, also some small towers have been built, which soon were copied by some other people from the village.

Within the house of Mia there are some sections, as there is a part for Karima and a part for Mia and the tourists, how strict this distinction is depends on who is at home (see chapter hierarchy).

There are no fixed places for the different activities. Dinner and breakfast can be at many different places in the house, depending on the weather and former activity. Washing and cooking happens at different places as well, the barbeque can be placed anywhere in the house, the oven stands at a fixed place in the house. The house has two kitchens, one in the tourists section and one in Karima’s part. Washing clothes and doing the dishes often happens outside, this can be anywhere in the house. Although it often happens not too far from where the water comes from, and where the clothes can be hung to dry.

Also the place where people sleep is not really defined, they often have a room whit their clothes in a bag, but that does not mean they always sleep there. In winter time they sleep inside, in summer outside under a roof in the shadow. When there is some occasion or happening they might sleep anywhere, all they need is a blanket, like a nomad in the desert. This way of living, without fixed places for certain functions, can be explained by
the fact they used to live as nomads, with no fixed living space at all. Even their house is not fixed, since it is always growing and more rooms have been added one by one. Tents are added in open spaces in the house and are taken down again to build it somewhere else. Someone only builds something when there is an immediate need for.

The house of Abdullah distinguishes itself from the traditional igerm type in several ways. For one the cattle of Abdullah is not kept in the court, but in another place on the other side of the street and sometimes in the back of their house. The rooms that are attached to the surrounding wall of the house are similar to the incomplete and elementary taddarts of the igerm.

The newer part of the village Aroumiatte, where this type of buildings have been build, did not grow in the way a Dsar traditionally grew; organically without any structure. Instead all houses in Aroumiatte are situated the same way, creating a rectangular sort of grid. This is clearly an influence from the way the Kasbah had been built and the big road, which determines the direction of the rectangular grid.

1.2.4. The old Kasbah or ksour
The Kasbah of Aroumiatte has nowadays largely been abandoned. When you enter the Kasbah, you feel the refreshing, humid air and you barely see anything. Slowly your eyes will get used to the darkness and some rarely present silhouettes, that first only might have seen you, slowly get visible. So does the spectacular light that enters to open spaces above the narrow path. This light divers from colour and intensity, depending on the largeness of the opening and the reflection of material, and guides you through the darkness.

Originally the Haratin people lived in the Kasbah. Nowadays the Kasbah does not fulfill the needs of the people anymore, with their new modern living patterns. It once was a place of coolness and safety, nowadays it is a place of desolation, decay and darkness. Local inhabitants do not understand why tourist would want to see the Kasbah, they rather show you the market a hundred times again.

Since no one is living inside the Kasbah anymore, no one is taking care of its buildings. The Kasbah of Aroumiatte and Asrir are slowly decaying. Only on the edge of the Kasbah some people are still living, we even spotted a place on the edge the Kasbah were people had been building a new house of cement blocks. In contrast, in the Kasbah Dar Hiba in Tizergat still more people are living. Some people started to build places for tourists in this Kasbah, and renovated parts of it. In this Kasbah we have found the taddart of the semi-ksar type: the house, of urban style, existing of small spaces, grouped around a central space in which the light enters from the roof. Local organizations now see the relevance of the Kasbah, as a cultural heritage of this place, attracting tourists. They are starting to get interest in renovating the Kasbahs.

The people that once lived in the Kasbah started to build new houses next to the Kasbah, where wider streets became the standard. Most of

![Drawings of the light in a Ksour (source: A.Adam, Jurgen (1981))](image1)

![Different colors of light in the Kasbah](image2)
these buildings have still been made from mud, although cement is getting introduced.

1.2.5. New houses
Since about ten years, cement has been introduced to Aroumiatte. More and more people are starting to build with this material. People that build a new house, but also people that want to extend their mud house, use a lot of concrete nowadays. We have seen a lot of mud houses, which were topped with cement bricks. First some concrete columns had been integrated in the mud wall, on which the new floor and walls could be build. They use the concrete in the same way they use the mud bricks. The concrete is produced in adobe bricks, with which they can continue to build on top of the mud bricks they use to produce their selves.

The analyses of the height of the buildings in Aroumiatte and the materials of which they have been built have some relations. Higher buildings are often made (partly) of concrete. Older buildings, like the Kasbah and the buildings surrounding the Kasbah have often been made of mud.

People often choose cement since it needs less maintenance and is very easy to use. Besides this it has a more modern look in their experience, so it shows wealth and progressiveness. Most of the concrete houses have not been finished with paint. They often still look ‘under construction’. This might have to do with the fact that an unfinished building is free from taxes, but strangely enough, nobody pays taxes at all, so it is an invalid reason. The laziness of the people might also be a reason, since the building already function without paint, the need of paint can be seen unimportant. Besides that, paint costs extra money.

Most buildings that have been painted can be found close to the big road. One of them is the house of a Moroccan who lives in Holland and another is a garage. Also the kindergarten, built by the government, has been finished with painting.

This new houses made of concrete often relatively have more indoor space and less outdoor space within the walls of their house. Almost all of them have a roof terrace, which can be related to the old Kasbah, where the roof terraces were the place to dry you dates, other food and clothes. Outdoor spaces still are important to most people in Aroumiatte, to the former farmers and nomads that are used to open space. While already being less important in the large concrete houses build in Zagora, where the interior of the guest spaces of the house is more important.

1.2.6. Building material & construction
In Aroumiatte several building materials are being used. The local materials have been used since a long history. The most common traditional building material is mud, often used in combination with straw, stones, reed and palm wood and -leaves. Since about ten years also cement, steel, some plastic and wood from the forest of Morocco have been imported and used a lot. All materials will be described one by one, discussing for what they are used, how they are used, and what their strength and weaknesses are. An overview with pictures of all the uses of the materials can be found in de appendix.

1.2.6.1. Mud
It is very cheap to use mud, since you can get it anywhere in the village for free. In Aroumiatte its mud is being used in several ways: as an adobe brick, as a ramped earth wall, as roof and as finishing layer on the wall. All these ways to use mud will be discussed.

In the old Kasbah architecture, some old mud bricks can be found. They are
Mapping of building heights in Aroumiatte.
Mapping of building materials used for the buildings in Aroumiatte.
often much smaller than the mud bricks, that are used nowadays. To make an abode brick, the earth is being excavated, secondly a pile of earth is being created, about 30 centimetres high. It is best to cover this with straw. To create stronger bricks dry manure might be added to the earth. Finally water can be added and when needed mixed, most likely with bare feet. This should be left like this for about three days so the water can be absorbed by the earth. Afterwards a bit more water can be added if needed.

Molds are often made of wood, but can also be made of metal. The wood should be clean and smooth. It's best to make the mold impermeable by applying a layer of a mixture of tar and oil or kerosene, or burnt oil. Before using the mold, it should be wetted with water. The earth mixture should be put in the mold, also filling the corners. The top can be levelled out and smoothened with wet hands. The mold can immediately be removed, the brick should not stick to the side of the mold or bulge, if it does, the mixture of earth and water is not good. It is also possible to use a brick press to make the bricks, if this is available. The brick should finally dry about one or two days. Before using them, they should harden another twenty days. It is best to dry them in the shade, or cover them with leaves or straw and wet them in the afternoon. Deformation and splitting can be caused by letting them dry to fast.

It is also possible to make bricks that can be reinforced, by leaving out a place for the reinforcement in the brick, so by adjusting the mold. This reinforcement can be made of wood, concrete or steel. Abode bricks can also be made in other shape by using other molds. To make adobe bricks that weight less, discarded materials; like cans, bottles, corncobs etc can be used inside the brick. The bricks that we have measured in Aroumiatte all vary a bit in size. The most common measurement where about: 400mm long \times 200mm thick \times 150mm high, the mortal was about 15mm to 40mm thick.

Decoration and patterns can be made with mud bricks, the old smaller bricks have been laid down in several patterns to create decoration. They varied in width of the joints, leave some stones out and order some in diagonal direction, often all of this was done in a symmetrical way. They also varied in the width of the brick itself sometimes.

Besides the adobe brick, much of the old Kasbah and many walls in Aroumiatte that surround the houses are made of ramped earth walls. To make these walls the procedure of excavating the sand and adding the straw and water to it is the same, for this walls you only have to wait for about one day before you can use it. The ramped earth walls are about 40 centimetres thick and built up out of blocks of approximately 200 by 80 centimetres a time. A wooden frame is made, as shown on the image below. The earth is pulled up by a bucket and a robe and is stamped into the framing with some tools and with feet. Before building the second layer, the first have to be harden, this takes several days. To create windows and doors, the wall has to be totally hardened, so it will not crimp anymore. A wooden beam is used to span the opening.

In the ramped earth walls, cement is being attached at places in contact with water, like the tap. Nowadays cement is also often being used around doors and as columns within the mud wall, to be able to create a strong second floor, where they often pursue building with cement. Sometimes the mud walls or columns are being decorated. Khalid, the oldest son of the family, works in de building industry to decorate buildings. He has decorated some parts of the house of Abdullah.

Windows can be made by leaving openings in the walls, these need to be strengthened with a wooden lintel that carries the wall above. Windows are rarely found or found really small in the houses, this because of climate control. They try as much as possible to keep the heat out during the day and keeping the heat in during the night.

Mud is also used in roofs, since its mass keeps most of the heat out. It is quiet heavy though, so the roof needs a strong construction to carry the mud, mostly made of wood and reed. Often there is also a layer of plastic added to the roof, to keep the water out in cases of rain, which is very rare in this area.

Finally mud can be used as finishing. Mostly this is a layer of about 2 centimetres thick, mixed with straw to prevent it from cracking and washing of too soon. This layer is being used on as well adobe brick as on cement bricks, to give it the image of a mud wall. Unfortunately, this layer is quiet sensitive to rain and washes off quickly.

The advantage of mud as a building material is that it is locally available
and thus cheap. It has been used for years, which also has another reason, the thermal mass of the mud stores the heat during the hot day and slowly relieves this during the cold night. A thick ramped earth wall is thus more appropriate for the climate than the abode bricks. Besides this, in this dry climate, mud also balances air humidity. The disadvantage of mud however, is that it washes off with the rain and thus needs maintenance once in a while. The adobe bricks, roofs and ramped earth walls can exist for many years before maintenance is really needed in the climate of Aroumiatte. The mud finishing however is more vulnerable for rain, since it is just a thin layer and not really compressed. Besides this, mud produces a lot of dust inside the house.

The opportunity of mud in the future might be its thermal mass quality, which excludes the need for additional air conditioning. Besides this, the material is widely locally available, so does not have to be imported. Less import means less environmental pollution and in the economic sense less money leaving Zagora. Besides this, mud is re-usable after being used by soaking it into water, it leaves no waste behind. Another advantage is that it is a building material which is easily applicable by local people to make a building themselves, or the local mud man will be asked to build the walls, however no big industries take over this building industry. It has also been proven that mud absorbs pollutants that are absorbed into water. It is also being suspected to clean polluted indoor air.4

4 Minke, Gernot (2006) p.15
The threat however, besides the rain and dust problem, is the association of the people. Most local people associate mud with poverty and cement with modernity and progressiveness. When using this material as a building material, this should be considered.

1.2.6.2. Mud tests
We have done small tests with the local mud from Aroumiatte. The first test is a smell test. Pure mud should be odourless. The smell it has now is probably because the material contains organic matter, which is not strange, since we took some earth from the garden in the backyard of Abdullah’s house. For building, other earth, farther from the garden, should be used.

The sedimentation test can be used to test the proportions of the constituents. The earth is mixed with water in a cylinder glass and is stirred and left for a few hours. The largest particles will fall to the bottom, while the finest stay on top. Many author claims that the height of the materials in the glass correspond to the proportions of the materials: clay, silt sand and gravel. Several experiments at the Building Research Laboratory of the University of Kassel show that this is not true, since you can only find successive strata at sudden changes of the grain-size distribution. Results show that the percentage of clay is often higher than the real percentage of the mass, while the percentage of sand is often lower than the real percentage of sand. The test with the earth we took showed 1/8 clay to 7/8 sand. This is a very low content of clay.

The final test we have done is the ball dropping test. We made a ball with a diameter of four centimetre of the earth, watered just enough to form the ball. Finally the ball has been dropped from a height of 1.5m on a flat surface. The result can be seen on the picture below. This shows a very low clay content, this earth alone will not be a good building material. Earth from a different location, although this might still be very near to the construction site, with a higher clay content should be added.

1.2.6.3. Straw
Straw is the leftover of wheat. It is used as cheap food to feed the cattle, but also to reinforce mud. It prevents the mud bricks and finishing layer from cracking and quickly washing of by the rain. It is also used to cover the mud bricks while drying in the hot sun.

1.2.6.4. Stones
There are two types of stones available in the surrounding of Aroumiatte, there are jagged stones coming from the near mountains and there are rounded stones coming from the river in the oasis. The jagged stones are often used to create the foundation of mud buildings. It prevents the mud from absorbing moisture from the ground. These stones are often mixed with cement.
In some cases these stones, medium in size, are being used to reinforce mud walls or they function as lintel for a small opening which is the leftover of the construction. They are even used to create complete walls, often walls of little sheds but sometimes complete houses are built with these stones. We saw this happening in the area farther away from the road and very near to the mountains; in Oulad Chilal.

Stones are also used for their weight, to keep the nomad tents or other lightweight materials on their place and tighten the strings that keep the tents up.

Finally stones are used to border public space. People use them to surround their gardens in front of their houses or to surround a few meters in front of their door to keep it clear from unwanted public.

Rounded stones, found and sorted next to the river, are being used for small sheds as well. The smaller size of this stone is being used to create roads or reinforce the finishing mud layer on a wall. Bigger stones are being used to span the opening of the construction beams of the framing of the ramped earth walls. Images can be seen in the appendix E.

Both of these types of stones are locally available and thus cheap.

1.2.6.5. Reed
Reed comes from the palm garden and is being dried and often woven. Some years ago, the layer underneath the carpet was made of reed, but they did not last very well, since they could not resist water. Once in a while they needed to be cleaned. They did however had the advantage that they strain the dust which the new plastic variation have some difficulties with. Of course they were more sustainable than the new plastic ones and they could locally be made.

Reed is still being used for other cases, like for roof constructions, often beneath the layer of plastic, which is keeping it dry. It spans about forty centimetres between the wooden beams of the roof construction. It is also being used for fencing, wall decoration or finishing, baskets and separation walls of small tents of nomads.

1.2.6.6. Palm wood and -leaves
Palm wood and -leaves of the date trees in the oasis garden are being used. Wood is scarce, since the date trees are also a very important food supply. Some palm wood however is being used as beam. The leaves can be used in bigger amounts, since the palm leaves have to be cut of every now and then to let the tree grow in height. The leaves get dried in the sun and finally being used for brooms, fences, roofs and sometimes also as fire wood.

1.2.6.7. Cement & concrete
Cement is being imported from the big cities to Aroumiatte since about ten years. In the beginning it was a very expensive building material, but the prices have been dropping a bit. A cement brick costs about 3DH (which is about 25 eurocents) while a mud brick costs about 2DH, according to Idris (note that a mud brick made by the builder himself is cheaper). A 50 kg bag of cement 35 costs about 63DH (about 5,50 euro), this is used for mortal between the bricks. A 50kg bag of cement 45 costs about 70DH (about 6,20euro), this is being used to make constructions. Cement is being used to build concrete lintels, cement bricks, concrete columns and beams, mortal and a finishing layer. An overview can be seen in the appendix.
Many houses that have first been built of mud, are now extended with concrete columns and cement bricks. The columns are often inserted in the existing mud wall, so the topping can be made of cement. Also cement lintels and columns are often built around the doors and windows in the mud wall. The cement brick is quite similar to the mud brick, so the building technique is already well known by the local inhabitants. The cement brick was about 400mm long x 200mm high x 150mm thick.

The strength of cement, as advantage over mud, is that it is more resistant to water and rain. It is used in wet areas in mud houses, like around the water tap. Besides this it is easy to build with cement blocks and people regard buildings made of cement blocks and concrete as modern and progressive, which causes popularity for this material. The disadvantage of cement is that it does not have the thermal mass quality like mud has, so the building warms up quickly during the day and additional air-conditioning is often required. At night the building cools down quicker and a heater might be wanted. Another disadvantage is that it has to be imported, so it does not stimulate the local industry this way. However there are a lot of jobs created in the building industry, which increased with the introduction of cement. In this way cement creates an opportunity for more jobs, however, this is not continuously if the area will not attract new inhabitants.

The biggest threat is that at the moment already about five percent of the CO₂ pollution in the whole world is created by the cement industry. This shows us that cement is not the building material we should build with in the future anymore. Besides this, it leaves a lot of rest materials behind, when a building is being demolished.

1.2.6.8. Steel
Steel is imported from the big cities, it is used for doors, windows, reinforcement and street furniture. Some years ago, a steel door already cost about 700DH (about 60 euro), ten times more than a bag of cement. There is a smith in Aroumiate, making doors, windows and all other parts. The strength of steel is that is last for a long time. Its weakness is that it is expensive and the process of making it is very intensive, contaminants are being created during this process. It has the opportunity to be re-used, but nowadays often is not, which leave it wandering in the desert for years.

1.2.6.9. Plastic
Plastic is being imported to be used for the waterproof layer of roofs and tents and it is imported in the form of a mat, to be used for under layer of the carpet. Besides this, it is also being imported as furniture, for example as a Turkish toilet, which costs about 50DH only. The advantage of plastic is definitely that it is waterproof and that it is flexible and easy to work with. Its disadvantage however is that it often perishes, which happens quiet soon in the desert. Afterwards it is often regarded useless and thrown away in the desert, to wait for about a thousand years to be decayed. Or, when lucky, it is being picked up by a nomad and being used to waterproof one of their tents or roofs.

1.2.6.10. Wood
Locally available wood is wood from the palm tree, the acacia tree and the tamarisk. This wood, however, is scarce, and thus not used a lot. Most other wood is being imported from the Moroccan forest. This is mainly cedar, eucalyptus, cork oak and pines wood. Wood is being used for: beams for roofs, scaffoldings of high buildings, molds for mud walls, doors, windows and lintels mostly in old architecture. Also the nomads use the local wood to make their tents. The advantage of wood is that it is a natural materials and easy to threat. Its main disadvantage is that it is already scarce in the area.
of Aroumiatte and that many forests are being chopped down, stimulating desertification. Some wood nowadays is planted and chopped in a regulated way. When working with wood, it is essential to choose the type of wood carefully, regarding where it comes from and whether it is FSC.

1.2.6.11. Re-used materials
Some materials are already re-used to build tents or buildings. Plastic which can be found anywhere in the desert is used to make tents and roofs waterproof. Old clothes are used to create tents, and carpets. Heavy garbage is used to create a heavier load on the roofs. Old oil barrels are flattened and used for doors.

The threat of re-use is that it is often associated with poverty. The opportunity of re-use is that it might help to clean the desert and stop local people from throwing their waste into the desert. Plastic and steel are the largest opportunities, since it takes such a long time for these materials to decompose, about one thousand years for plastic.

1.2.7. The exception
Some architecture in and around Aroumiatte is different from what regularly is being built and got our special attention. The village Oulad Chilal is one of those exceptions in the building technique. Oulad Chilal is situated closer to the mountains and farther from the big road than Aroumiatte, but still at walking distance. Almost all houses there are not built of mud, but instead completely built of jagged stones, which are all over the place there. Most houses however, are abandoned and partly collapsed, but some people, who probably cannot afford another house, are still living there. Some walls have been built in a quick way, but some walls have been made in a very secure way, creating beautiful stone walls. Stones are more resistant to rain, but the walls might fall down when abandoned for a long time. And surely, in this case, it is a material that is associated with poor, which is also seen by the little sheds that have been built of stones in the villages.

The door is an element that is regarded differently than the rest of the house. Although the houses are often not finished or painted, the modern doors are often nicely decorated and all in a slightly different way, creating identity. The most exceptional door spotted in the neighbourhood of Aroumiatte is the door made of an old oil barrel, which creates a very colourful door. This door however, has been spotted in the palm garden, and not in a rich man’s house.

The former nomad family where we stayed is exceptional. They have a high income because of the money they get from Mia, she is sending them about 150 euro’s a month. They can buy a lot of extra food, but also other food for animals and property. Also Mia has influence on the way the family’s house was built. She wanted the house to be as traditional as possible, because she sees the value of that. She for example introduced the small towers that refer to the old ksour architecture. Because she is providing them from money they listen to her and do a lot of what she wants.

A person that was exceptional was Ibrahim, owning a resort in M’Hamid together with his brother Halimm. He has built the camp himself. It is clear that he does not build what he does not like or does not think he needs. What was striking about him is his care about the relation of the architecture with the environment and his care about the looks of the architecture. He wanted to demolish the water reservoir, standing on high columns, and preferred to use to older lower one again. That reservoir was not popping up from the camp and destroying the nice view on the tents in combination with the sand dunes. The showers, though, would not have enough pressure anymore to be able to work, but he did not care about this. Bucket showers would
perfectly do, he was merely concerned of the high reservoir destroying the looks of the building within its environment.
He also find a nice solution for the interior of the tents to sleep in for the guests. They have the look of a tent, but keep you warmer than a tent during the cold nights and keep you cooler during the hot days. He made the walls of the tent of mud, finishing them with nice colourful fabrics.
The diner room was also made of a mud wall, finished with reed and fabrics. The roof was constructed like a tent, with wooden beams keeping the roof up.

The nicely renovated ksar house of Abdoel in the Kasbah Dar Hiba is also an exception, to the often abandoned and partly collapsed Kasbahs. He had renovated this Kasbah in its traditional way and added a touristic function to it. For a tourist, this Kasbah looks very beautiful and it is great that this heritage can be kept this way. The water well and old kitchen next to the ksar house had not been renovated, the difference was enormous.

**1.2.8. Conclusion**
The Haratin people that used to live in the Kasbah have abandoned the Kasbah, and started to build larger houses with wider streets next to this. Many nomads that used to live in tents have to start a living in the village nowadays and have built a house there, but they still live like nomads in the way that they do not have fixed places for different activities and even built tents within the walls of their house.
The most common building material in the oases area has always been mud. It is widely locally available and its thermal mass makes it very appropriate for the climate. Nowadays, cement is getting more popular, since it is associated with modern life and is resistant to rain, so it does not need the maintenance that a mud house needs. However, it does not have the thermal mass quality that a mud wall has and is much worse for the environment. Where mud can be picked from the ground and becomes mud again when the house is demolished, to create cement a lot of CO₂ is produced, where after it has to be imported by trucks and when the house is finally demolished, a lot of waste is created. Mud has a much higher potential in this area from a Western point of view, only the designer should be aware of the fact that most local people associate mud with poverty.
2. Their evaluation of architecture

To find out how the local inhabitants evaluate architecture, we have done several assignments with them. One is the assignment in which they have been given a disposable camera, second is a photo survey on which we asked their opinion. Finally we have gotten to know about their preference by our observations and informal talks.

2.1. Self-participation photo assignment

To find out what their preferences are, we have done an assignment with disposable cameras. We handed them to some people, asking them to make pictures of their house and environment. The result shows what they regard as important and what they are proud of.

Abdullah, who is the head of the family, mainly made pictures of his valuable belongings, on which he is proud. This was his cattle, his family, the tree and his house. The places he photographed in the house were the important places as the entrance, guest tent, guest kitchen and garden. He also made some overview pictures of the house and street from above. Finally he made some photos of important happenings as eating, drinking and buying fish in the street. Mustafa (not his real name), a nephew of Abdullah who works a lot with the camels, only made pictures of friends, family, himself and camels.

The daughter of Abdullah, Zainab, made many pictures of the children in the streets and of her family. She also photographed the things they use to cook, as the oven and the water well. Finally she made some pictures of the more luxurious elements that differentiate the house from other houses, like the garden, the painting in the guestroom, the tower, coffee for the tourists, the guest tent and the kitchen in the tourist part of the house.

A very different participant on this assignment was the friend of Idris. Who lives in a cement house. Idris and his friend made the pictures together. The things they photographed were very different, instead of many photos of family, they photographed all the luxurious elements of the house. They photographed the washing machine, the western toilet, the sink, the phone and even a fitness bike. Also all decorated spaces were photographed, like the halls, staircase and guestroom. The garden had also been photographed and finally they made a picture of themselves in front of a nice house next to a motorbike, which is not theirs.
The final participants of project were two tourists, who visited Mia before we did. We asked them also to participate, to see the contrast of interest. They mainly photographed the happenings and things they thought were special and different from their regular life, which were: the landscape during their trip in the desert, the camels, tourist activities as showing their souvenirs, the market, visiting a terrace and baking bread. Finally they had made pictures of all different types of buildings.

The outcomes are diverse, but some patterns can be found. The local people prefer to make pictures of their social network and family instead of objects, since this is much more valuable to them. Literature research showed that if someone is not-well-off or prosperous does not only depend on someone’s holdings. The qualitative research of Paul Rabinow in a Moroccan village had shown that someone’s prosperity merely depended on his social status than on someone’s holdings.7 A villager with more land and sheep than most villagers, but with no father, unmarried brothers, a mother who needed support and an uncle who was out to steal land, he still regarded himself as a not-well-off person. This shows that tools to measure someone’s prosperity are very different from our western ideas.

Other outcomes of the disposable camera project are that next to family, cattle are photographed. They are part of their property and regarded as important. When they do photograph their houses, they photograph the parts on which they are proud, which mainly are the guest spaces, often also the most decorated spaces. The cement house is more decorated than the mud house of Abdullah. Also modern elements have been photographed, which were mostly present in the modern house. The biggest difference between the modern cement house and the mud house is that the cement house has more luxurious elements and decoration and less family and other social network has been photographed. A reason for this could be the absence of people in the house at the moment the pictures were taken, but also because the progressiveness towards a more modern world also change the importance of the family.

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7 Rabinow, Paul (2007)
2.2. Photo survey
We have asked several people to choose a picture of the house which they preferred. The pictures had been pictures of houses that they did not know, so no knowledge about who owns a certain building could influence their opinion. They also included buildings that were very different from the buildings in their own village, but all of them were Moroccan.

Three buildings have mainly been chosen. One was the mud house, with a large green garden (second photo below). When we asked why, the answer was because it was freestanding and had a lot of green. The second building that had been chosen was the old Kasbah (below left), although it is a good status. The comment made however was that the interior would be too dark to live in. The final building that had been chosen, had the preference of Samir, the youngest daughter and surprisingly enough of Mustafa, who worked a lot with the camels, was a modern building in a large city in Morocco (below right). Comment made by Asad was that this building had too much stairs, which he would not want to walk. Idris though this building was much too busy, he preferred more silence. Idris asked why no modern villa was included in the survey. He showed us his favourite villa a few days later, when he also explained that he would not want to share one building with more families, like an apartment.

Photos of the photo survey.

Villa that Idris liked, but he did not like the fact that more than one family shared this building, this was too busy for him.

Idris his favourite villa in Zagora, for just one family with a large garden.

Photos of the photo survey.
2.3. Observations and talks
Nothing has to be too complicated or difficult. When something takes too much time to accomplish, most people have lost their interest before it is finished. An example is the small lightweight tent that Mia had brought for the family. They were quiet interested in this tent, but as soon as it took more than a few minutes to build the tent, they had lost their patience and would not wait for it anymore. It might have been much lighter than their own tents, which made it possible to take it and sleep in their instead of outside, but it would take too much effort, so they will not use it. Besides this examples there are many more Mia agreed.

Except for not being patient, they also do not care about throwing all their trash out in the desert. Exept for Idris, who did care a bit more and corrected The youngest daughter when she threw something out, we have seen no one caring about their environment. Garbage was all around, in the desert, but also in the village.

We had already seen an interest in green with the photo survey. This preferences for green was also visible in the village, where some people showed interest in the outside space just outside their own houses, having some small gardens there, in which they kept some plants or tried to grow some vegetables.

2.4. The acceptance of the Ksour in the modern architecture and urbanism
Some elements of the traditional Ksour or Kasbah architecture can still be found in the contemporary architecture of Aroumiatte. The tower of the house of Abdullah is only one of the examples. An overview of some elements is shown it the scheme below.

Besides this element on building scale, also the urban plan is still related to the old Kasbah. Streets and buildings are still built in a regular grid, parallel to the big road. The houses that are built in the village, do not seem to have any other structuring on first sight. But when we take a closer look at the placing of the doors and windows, it shows us the possible future place for the roads and where the other building will be built against the already existing houses. The locals seem to have made their own building rules within the community.
In urbanism, the element of the Ksour that is still being used is that the plan is orthogonal. The streets are however much wider and the houses are bigger and have more open space within them.

2.5. the evaluation by architects in Morocco

Hind is a former student at the National School of Architecture in Rabat, Morocco. She had just been graduated when we asked her some questions. The whole interview can be read in the appendix. When we asked her what kind of building she wishes to live in in the future she answered that she would love to live in a sustainable house which is energetically independent and made of organic materials, since she wants to contribute to the make living less challenging for nature and humanity.

At the university, which is the only university on Architecture in Morocco, they learn more about global and universal architecture than about the traditional Moroccan architecture, although this subject has been dealt with. They had made a trip to “Dadès valley, ait ben haddou kasbah”, where they were introduced to this type of architecture in their first year. She thought this type architecture is beautiful as it is integrated in the environment and sustainable. When she visited the village and saw that some mud constructions had been replaced by concrete, she thought this was concerning, since they do not fit in the environment and are destroying it. She said that she and her classmates are fearful to lose the beautiful heritage of this areas as part of the identity of the country. When we asked her what she thought the reason for the local inhabitants would be to use concrete, she said they probably use it because it is easier and needs less maintenance than mud. Another assignment considering the materiality of this type of architecture was when they had to make a design for a mud house, in which she mixed the traditional techniques with a modern form. They had also learnt about Hassan Fathi, which she considered to be inspiring.

She had not used mud as a building material any more after the first year assignment, since she was afraid it would not fit into the different urban context, like Rabat. Other reasons have been the restrictions by the teachers and because some other “modern” materials that have the same characteristics as mud. If she will find a strategy to integrate mud in the actual context, she will use it in her future design.

We have also found some websites of Moroccan architects that design with mud and are concerned about the heritage, however most local architects make global designs. But I do think it is interesting to hear that this student is also interested in the cultural heritage and in sustainability in her design.

2.6. Conclusion

Social structures are highly valuated by the local inhabitants and should be considered when making a design. Secondly their property as cattle, decorated spaces (often the guest spaces) and luxurious elements are considered to be important. Many inhabitants do have some interest in greenery. Their dream house differentiates, some prefer houses with a large green garden while others prefer a modern flat in a busy city. Even the renovated Kasbah architecture did get some interest, although the darkness inside would cause problems in the usage. Some elements of the traditional ksar architecture can still be found in their contemporary architecture. Furthermore building should be easy and maintenance should be minimalized. Finally sustainability is an upcoming trend globally, already interesting the architecture students and some architects of Morocco. So is the fear to lose the cultural heritage of the traditional villages.
3. Inhabitants
In this chapter first more general information about the social interaction of men and women, education and jobs of the people will be discussed. Secondly the influence of the authorities on the growth of the village will be discussed, this will have influence on the way the inhabitants will live within the village. Continuously there is an explanation of the way that public life functions in the village. What public, private and common space is and how is it used by the inhabitants. We slowly zoom in and discuss the meaning and differences of use of space in different areas of the village and thus of different minorities. Continued with the way a family is using the space within their own house. Finally we will show what people regard important in their own living environment, for which we used different research methods.

3.1. Use of space
The central place in the trade market brought wealth to the oasis area in the south of Morocco. Because of this a lot of different minorities settled in the oasis villages. The crucible and trade of minorities from all different places during time, made that the compilation of the oasis nowadays has a very broad and specific culture. Besides the people that settled in free will, nomads also brought slaves into the villages to work. The oasis became an island with a crucible of minorities living all together under a strict hierarchy. This hierarchy was of great importance for the development and the success of wealth in the area. The hierarchy was needed to be able to organize the work in the difficult agriculture of the oasis.

After the collapse of power and with that restricted borders and improvement of infrastructure, many people moved away, but still people from all different minorities are living together in the oasis. The strict hierarchy suddenly lost its function and disappeared. But the hierarchy still takes place in people’s minds, which has its output in daily life in the public space of the village. This is expressed in the divisions of the village into neighborhoods and in possible conflicts and tensions in public places. Nowadays these tensions are slowly disappearing, starting with the youth, and the village is starting to become one. Neighborhoods are growing together and become a mixture of minorities that live closely together.

3.2. Education and jobs in Morocco & Aroumiatte
The government of Morocco want less students to go to university and more to vocational training, because this is better related to the business in Morocco. This way the students will have more changes in the labour market. Vocational training is little developed in Morocco.

There is no job for all graduated students, mainly not for the higher educated. 40% of Moroccan humanities graduates couldn’t find a job in 2008. So there are no future perspectives and higher educated people often form groups against the government. Lots of them also want to work abroad.

Besides this the government plays with the growing interest in technical studies (computer experts, electro mechanics, fridge repairman, radios, television, video and other technologies).

There are more jobs in tourism and computer science. he UN states that about seven jobs are created locally for every ten tourists visiting the rural areas of Morocco, but the largest market is still modern agriculture, fishing, food industries and the building industry in the technical area.

-56% from the GDP in 2005 comes from services, because of the boost of tourism and the growing middle class in Morocco.
-17% of the GDP comes from industry (textile, food processing, and phosphate mining in the Western Sahara).
-12-20% of the GDP from agriculture and foresting, depending on the harvest.
-40% of the GDP from the country’s workforce. 8

In Morocco 55% of inhabitants of rural areas struggle to earn enough money to sustain life. Rural teens often have to move to larger cities to find work and educational opportunities.9 In Aroumiatte the largest work industry nowadays is the building industry. Another common job is being a taxi driver. Young boys often change occupation a lot. Many of them also leave to work in other cities or countries. With the big fests though, all the family is returning to their families in the desert area to celebrate this together.

Many people, who are leaving the rural areas for the big city, end up in Bidonville’s (squatters). Here they has barely any rights, politicos of

8 Obdeijn, Herman; De Mas, Paolo; Hermans, Philip (2002)
9 25 Obdeijn, Herman; De Mas, Paolo; Hermans, Philip (2002)
large cities don’t care about evacuating thousands of people for their city development projects. They often regarded them as trash. People that didn’t get proper planning approval are forced to leave their homes to live on the streets. Not only money is an issue which makes this difficult, also developers, local and national leaders have no interest to build for the poor. On google maps the Bidonville’s of Casablanca are even erased, because the government doesn’t accept its existence.

In rural areas is 70% illiterate. Only about 12% of the rural boys gets the opportunity to go to middle school. Half-million Moroccan kids under fifteen work instead of getting education, to third of them are girls. An example of this is Zainab, the daughter of Idris his brother, who lives near Casablanca. So far Zainab has gotten the opportunity to go to school and live with her grandmother and Idris in Aroumiatte. But soon, Idris said, she will have to go back to her parents near Casablanca, since she is the only daughter in the family and is needed to help her mother with the household.

The obligated school attendance till the age of fourteen has improved opportunities for education on the rural areas. Still in vulnerable rural families, where getting food for all the children can be difficult, going to school is often not reachable. Child malnourishment has risen from 4% in the mid-1990 to 8% in 2006. Innovative school programs now often provide as well food as literacy to build a brighter healthier future.

In Aroumiatte there is as well a pre-school kindergarten as a primary school. The secondary school is a bit farther away, most children we have spoken went to the secondary school in Tizergat. The school is about 30 minutes on bike and about 90 minutes walking. After secondary school there is the possibility to go to high school in Zagora, this school is a bit closer to Aroumiatte. There are two different types of high school. One has a more technical approach and the other is more focussed on languages. Idris goes to one of these schools; he has to walk there since his younger niece uses their bike to go to secondary school in Tizergat. Idris wants to study after he has finished his high school, he will have to move to Marrakesh or another big cities to be able to study. The reason he has the possibility to go to school is that he is the youngest son; his older brothers are already working in Casablanca and Spain and earning money for the whole family.

When Idris will be leaving the house in Aroumiatte to study, all sons will have left the house. Since his father died already, there will not be any men in the household anymore. His mother will then probably choose one of her sons to live with. Idris hopes that his mother will choose him, so he can take care of her when she will be too old to take care of herself.

10 Neuwirth, Robert (2006)
11 Diary - 6 nov 2010 - p.15
12 Obdeijn, Herman; De Mas, Paolo; Hermans, Philip (2002) & Clammer, Paul (2009)
3.3. Men and Women
The relationship between men and women is a prominent aspect in the way the people live their lives. It also has influence on the way they use the spaces in their homes as well as in the public and common space. It is the tradition that women cook. They often eat separately, men are the first to eat, they will have to have enough food, so the plate should never be finished. The leftovers form dinner for the women. They eat after the men have finished. It does not always go this way, sometimes men and women eat at the same time, but from separate plates and on a separate place. Sometimes when it is the same family they eat together. If the wife leaves the house she is always obliged to tell her husband where she is going and what time she is returning home. She can never be later home than the dinner should be served. When she is too late, she will get punished.

It is the tradition that daughters get married quite young. The person that they marry depends on her and his parents. It could happen that the parents of the boy see a nice girl walking around and they approach the parents of that girl. The parents first talk with each other, after that the girl and boy have a few appointments to get to know each other and see if they like each other. Even if the parents agreed with the marriage the girl or the boy can still refuse, but this happens seldom.

It could also happen that the boy and girl meet each other for example at school, fall in love and want to get married, but still the parents of the boy should ask the parents of the girl for the hand of their daughter. After they get married the girl always moves in with the boy’s family. She becomes part of his family in exchange for a dowry. As soon as they will get their own kids they will move out and form a new household. Before the boys get married they could have a quite wild life. They often go to the city in evenings where they gather in bars. They drink alcohol and prostitutes are selling themselves in those bars. They often have sex before their marriage and drunk alcohol and smoked cigarettes. This all happens without their parents knowing what is going on. Girls are not allowed to go to the city by their selves. They need to stay home to help their mother with daily jobs in the house.

3.4. Influence of authorities on the village
There are some different organizations that try to have their influence on the region of Zagora. One of them is the government of Morocco. Beside the government there are some local organizations, especially fighting for the development of the inhabitants of the area, that function in smaller areas. Furthermore there are global organizations that are active in the region, they try to contribute on the sustainability of the environment, for example because of the desertification.

The government pumps money into the area for the development of the housing and public facilities. Since 2008, they oblige regions to make a six year development plan to force the region to think about their future and to avoid unnecessary building and waste of money. They are trying to control what is being built everywhere in the area. It never really has been clear before who owns the land and everybody could just start building their house anywhere in the village. Since 2008, you need to get permission from the government to be able to build your house. You will have to show your plans before you will get this permission, of course, unfortunately, money is still playing a role. When people build their house without having this permission the government will destroy this house. In Aroumiatte you can see some houses that have been demolished because they did not have any permission while they had to. The government also tries to control the way the villages or cities grow. They want to provide concrete roads, a sewer system, electricity and water. They build road structures with all facilities at places where nothing has been built yet, as shown of the picture. They want to stimulate the people to build their houses on these spots. To improve public facilities the government finances projects for building hospitals and schools etc. The major problem in the region is though that there are no educated people to run and work in these buildings. So in the end these buildings are not used or do not function in the way they should.

The local non-governmental organizations work mainly with women and youth. A lot of people still cannot write or read in the region, because they have never had the chance to go to, or finish school. They stimulate women to learn to read and write and after that to start and run their own small businesses. In this way they try to stimulate the economy in the region. The youth is stimulated to care about their the politics of country and the
environment. This way they learn how they can contribute to a better future. The organization also tries to stimulate the awareness of the importance of the cultural heritage. They want to give new functions to the abundant Kasbahs and renovate them. This will also stimulate tourism in this area which could be an important new way of income.

Because of global importance and issues that are concerning places everywhere around the world, global organizations try to get some control in the development of the area. The global organizations try to help the region to become more sustainable with solutions to protect the environment and to fight desertification. For example there are projects like stimulating eco-lodges or projects for planting trees in the desert. They also fight for the rights of women and try to involve them in the economy of the region. The scale of the projects run from very large projects to the finance of an eco-toilet in a private house. Because of the amount of organizations that want to get some control in the region you can see tensions occurring between them, and the inhabitants do not know how to act any more. It seems that you can get money from everywhere for almost anything from foreign organizations.

3.5. The common space in the village

The village has a lot of open space, which can be seen as public space, but also as common space for the community. In this chapter when we speak of the public space, we mean the outside space in the village.

The public space is of great importance of the inhabitants of the village. This is where people meet each other to socialize especially in the late afternoon till it gets dark. You can see groups of women moving through the village visiting each other and talking. Men are gathered together at places where they sit or stand to talk. Children are playing together in the big open sand spaces and the dusty streets.

Sometimes people are invited inside the house but they are always from outside the village. When they are invited inside the house they always go to the special guest room. The visitors are not going anywhere else in the house. When the men are not home the women visit each other inside the house but they stay in special parts of the house. The families are really introverted, they don’t talk with other people about private issues. Mia, our local informant, told us that problems stay inside the family. This could be a
reason for the houses to be rather closed for outsiders. Social life takes place in the public space.

With the time that the city developed public life has changed. The old village was a wall where the houses were built like a labyrinth within this. Public space took place inside the wall where streets were covered and dark. Small squares and public buildings were situated inside the. When the security and the needs of life changed people started to abandon the old dark village and started to build houses with more air and space around them. Streets got wider, straight and uncovered. Public buildings, like the mosque got bigger space around them to be able to gather together with all people from the village at special occasions. Public life changed with the new way of building their houses.

The last ten years people change again the way they build their houses. You can see a change in individualism. People appreciate the space and openness they have around their houses. They start to build their house detached from other houses. They also start to build their houses in a way they have open private space inside their house. Space and air seems to become more important during years.

Public space nowadays is not more than dusty sand streets and big open sand places. Some trees or spikey bushes can be found in the open spaces but often covered with garbage that got blown in by the wind or washing that needs to get dry. Children play in the large open spaces or in the streets sitting on big stones. In the open spaces they create soccer fields by clearing space from small stones. People use the space for private issues as well. Often you can see women in front of their houses doing the washing. Clothes are drying in public space and rags and carpets are lying on the ground to dry. You can also see carpets filled with dates are cereals lying somewhere in the public space to dry.

Some people built small sheds or make small gardens in the public space to grow weeds and provide shelter for their animals. Social control is really high in the public space. People correct each other and that’s also probably why they are able to use public space for private matters. But it also could have to do with the fact that they have another perception of the public space, they could see it more as a their common space for the neighborhood of the village.

In the very old village inside the wall, streets were a labyrinth of covered very narrow streets. The structure is orthogonal but without any other structure. The part that was built after that, next to the wall of the old village, were blocks that form straight streets in an orthogonal structure determined by the main road that follows the oasis and connects all villages. Streets are not covered any longer this means that the sun is able to cover the streets with heat.

In the newest part of the village where houses or free standing streets are no longer created by buildings. Paths are created that form the shortest routes from neighborhood to neighborhood or to other important places. The paths are created by the amount of people that walked the same route over time. There is a distinction between paths that are used by pedestrians and paths that are used by cars. Because there is almost no structure in the new part you can see that the paths never form a straight path but are bending their ways through the village. Interesting is the fact that the people do built in a kind of structure though, while a lot of houses are free standing they all have the same orientation. Because of this you can see that at places where it is getting denser streets are occurring and even public squares are left open.

With the growth of the village more public functions are dividing over the village. Most functions like small shops are placed along the main road, in the older part of the village. But now you can also find small shops further inside the village divided over the different neighborhoods. Oftens shops are a combination of dwelling and business. People live and start to sell from their house. A lot of these small shops sell the general things you need and are not more than a window in a private house from where they sell their goods. You can find a lot of these shops all around the village, this could have to do with the tensions between the different ethnic minorities. People that belong to one minority don’t want to buy in a shop that belongs to another minority. Than there also are the bigger public functions like schools and the mosque. They are mostly situated along the main road and big open places are left open around these functions. The open space around the mosque functions as place where all villagers can gather together to pray at special occasions. At a few places in the village along the main road there are some public wells. Those can be seen as main gathering points in the village where people meet each other at times the taps run out of water. Also the canal that provides water, at times the authorities allow the water to run down the river (discussed in the coming chapter flows), functions as a gathering place for women to do their daily washings.
Mapping of streets in Aroumiatte.
1. mini supermarket
2. gaz bottles
3. fridge repair
4. bicycle repair
5. car repair
6. garage
7. produce of flower
8. clothing
9. produce of windows and doors
10. plumber
11. shoe repair
12. teleboutique
13. games hall
14. hammern
15. mosque
16. school
17. soccer field
18. prayers field
19. water well
20. water canal
21. cemetery

- sellers in the street
- shop
- shop in combination with living
- public building
- public activity

Mapping of public functions in Aroumiatte.
Activity in the public space (10:30h - 12:30h)

S = sitting
W = washing
SW = sweeping
WK = working
C = cooking
P = playing
WA = waiting
B = buying
DW = drying washing
DC = drying carpets
DF = drying food
Activity in the public space (16.30h - 18.00h)

S = sitting
W = washing
SW = sweeping
WK = working
C = cooking
P = playing
WA = waiting
B = buying
DW = drying washing
DC = drying carpets
DF = drying food
1. Different ethnic minorities are living together in this area. Daily activities often happen inside the houses. The area is getting denced and streets form.
2. Former Berber nomads are living in this area. Daily activities are happening and animals are kept in the streets. The outer ring is demolished by authorities because of illegal activities.
3. See 2.
4. Inbetween area. Chaotic.
5. The people from the old village, Ketatin, started to live here when they moved out of the old village. Shops are situated along the mainroad.
6. Public activities.
7. Public activities.
8. Former village now abandoned.
9. See 5. Shops and public buildings are situated in this area.
3.6. Who lives where?

Due to the poor possibilities to find a job and to earn enough money to maintenance their family, a lot of men emigrate and work somewhere else in the country or abroad. Women and children are often left behind in the village and money is sent every month by their husbands and sons. Nomads are starting to settle in the villages because of the hard life in the desert they cannot resist any longer. People from the north and abroad are investing in the area by building holiday houses, a house for their pension and hotels. The village becomes a mixture of minorities and cultures that live together, Berbers, Arabs, Berber nomads, Arabic nomads, Haratín, foreigners.

In Aroumiatte you can clearly see a difference in people and use in the different neighborhoods that arose. People from the same minorities have been gathering together in the village. They all have a different lifestyle, seen the way they use their houses and the public space. Neighborhoods are created where they start to live mixed together. The difference in the neighborhoods can also be noticed by the fact that there are different people outside in each public, or common space. Common, because you notice that you are entering another area of the village, used by another ethnic minority. Public, because everyone has the possibility to enter those areas.

We have made some maps where we show how the neighborhoods have been divided. We also show the difference in the way the houses are facing the streets and public life as well as how space around their houses is used.

In the first zoomed map (area 1 in the division map on the previous page) we see a neighborhood where all ethnic minorities start to live mixed together. It is one of the biggest and newest neighborhoods of the village. There is a diversity of houses made out of mud and concrete or a combination. Some mud houses get topped or strengthened with concrete. Some concrete houses are finished with paint.

Sand streets in between the houses are about 11.5 meters wide, compared to the old village, the Kasbah, this is very wide. Almost no shadow is created in these streets. Small gardens, mostly positioned at the front doors, are bordered with rocks. This creates a small green private space in front of the front door to keep unwanted public away from the house. The plants do not have any other function than decoration or maybe providing some shade in front of the house. The concrete houses have windows, while the mud houses are rather closed. Windows are positioned at the front side of the house with the door, probably because of unwritten building rules. Someone can always decide to build his or her house connected to yours and close your windows off. South facades are always completely closed, because of the sun and heat.

Most buildings are for living, but all around the neighborhood you can find some combinations of living and business. This is expressed in small shops that sell basic food, bicycle repair or steel manufacturer. Animals are kept in outer spaces inside the wall of the house so you do not see them in the streets.

Their private lives are taking part inside the houses so not really visible for us. People spend more time inside the houses for their daily activities than in other areas. In the afternoon they enter the shared public space to socialize with their neighbors. The people are quite bold in the public space in their neighborhood, but their private lives are in warded at the same time. When we were walking through the neighborhood we were followed by all the kids.
In this area the all ethnic minorities start to live together. There is a diversity of houses made out of mud and concrete. Some mud houses get topped or strengthened with concrete. And even some concrete houses get painted.

Small gardens mostly positioned at the front doors are bordered with big rocks. It creates a small private space at the front door. The concrete houses have windows while the mud houses are rather closed. Windows are positioned at the front side, where the front door is situated. South facades are completely closed. Animals are kept in outerspaces inside the house so you don't see them in the streets. People also are spending more time inside the houses for their daily activities. In the afternoon they get more inside the public space for talking with their neighbours. The people are abandoned.
of the neighborhood. They were bagging for pens, getting really close to us and throwing stones. They are really curious and do not seem to have any limits. However, as soon as we wander too far, into another neighborhood of the village, they stop following us, which seems like we have left their domain.

In the second zoomed map (area 2 in the division map 3 pages back) a lot of former Berber nomads are living. It is a quite new neighborhood with traditional mud houses. The neighborhood is situated on the border of the village connected with the desert. This probably has to do with the fact that the inhabitants are former nomads, used to space around their houses. They used to move through the desert with their family and their cattle, but life got too hard in the desert and they decided to settle. The houses are all made out of mud, sometimes concrete columns are used to strengthen the buildings. Houses are clustered together but there is still a lot of open space around the clustered houses. Streets seem to occur in between the houses, they are more or less around twelve meters wide. Small gardens are created by small mud walls that are placed around the plants and trees. Trees are planted symmetrically along the facades. Some of the plants are used to produce food. Like corn and wheat plants. Trees are mainly planted to create shadow at the places where they work outside, just for decoration or to improve the living space.

Few windows are built in the mud walls, and if built, they are mostly placed on the front side, where the front door is situated. Windows bring the heat inside and deteriorate the strength of the construction, south facades are completely closed for protection against the sun and heat. Most animals are kept outside next to the house. They gather shelter from small sheds made of reed, mud and garbage. Besides these sheds, they also place other things outside, like wood, palm leaves etc., this way they appropriate this outdoor space.

People are spending a lot of time outside in this appropriate but also less appropriated and more public space. A lot of their daily activities happen
In this area a lot of former Berber nomads are living. The houses are all made out of mud, sometimes concrete columns are used to strengthen the buildings. Small gardens are created by making small mud walls around the plants and trees. A lot of trees are planted along the facades. Few windows are built in the mud walls mostly on the front side, where the front door is situated. South facades are completely closed.

Most animals are kept outside the house, in the public space. They gather shelter from small sheds made of reed, mud and garbage.

People are spending a lot of time in the public space. Also a lot of their daily activities happen in the street. The people are quite and detached.
in the street. During the whole day you can find them working, resting, socializing or playing in the streets. The people are quite and withdrawn. When we entered the neighborhood, for example, they watched us from a far distance. Bit by bit they dared to get closer, but they never got too close. The elder people started to ask decent questions while they kept their kids on a distance. We might assume that people from other neighborhoods barely come to this area, and the outdoor space is more a collective domain of the neighborhood then a real public space, when strangers enter, they are being watched.

The third zoomed map (area 4 on the division map) seems to be an in between area. The area is situated between the more dense area, the nomad area and the old village. The houses have a lot of open space between each other. They are mostly made out of mud, but at some places concrete arises as well. It seems that this area does not really know where to belong to, it seems more like a buffer zone, it separates the other neighborhoods and so the different minorities from each other.

Gardens are made in front of the façade with the front door. Some of them are located randomly and occupy a lot of the public space, but others are precisely placed and taken good care off. These gardens create a small private space at the front door. In the gardens people are growing plants.
This area is an in between area. The area lies between the more densely populated area, the nomad area and the old city. Houses have a lot of left space between each other. The houses are mostly made of mud but at some places concrete arises as well. Gardens are made at the facade of the front door. Some of them are chaotic and take a lot place in the public space, but others are well placed and good taken care of. It creates a small private space at the front door. No windows are placed in the houses. The walls are completely closed to the public space. Doors are never placed at the south facade. There is not really a lot of activity in the public space, you rarely see people around the houses.
for food, like corn and wheat, but also trees are planted at front facades for decoration and shadow.

The mud walls that bound the houses and are facing the public space do not have any windows. A reason for this can be that the construction of the ramped earthen wall will get weaker. Inside spaces connected to this wall also have other, lighter constructions walls, where windows can more easily being made for light. Besides this, with the walls completely closed to the public space, the public is kept out. Doors are never placed at the south facade.

There is not really a lot of activity in the public space of this neighborhood, you rarely see human activity around the houses, so we can suggest that daily activities are happening inside the houses.
3.7. Their own experience of their village

Very interesting is to know how the local inhabitants regard their own living environment. What things do they appreciate, what things do they dislike and what do they wish for their future. The right way of communication is important to get to know the clear opinion of the interviewee. Formulating the right question is essential. The answer of the interviewee could be transformed because of wrong way of questioning. Because we do not speak the local language, our only possibility was to interview with a translator. This probably means that a lot of information is lost in the translations and also the right way of questioning will get lost in the translation. This is why we decided to use a method where we would not be depended on speech. We did two projects with the local people, a camera project and a drawing project, where they picture their own house and living environment.

The camera project was more concentrated on the different people and the different way of living within the village and with this the different way to experience their environment. Former nomads and people that have been living all their lives in the village made pictures. As well as people living in a mud house and people living in a concrete house made pictures. Two really different experiencing worlds came out. The former nomads generally made pictures outside their house or in the outer parts of their houses. It means that their life takes place a lot outside their house. Things like their animals and trees or plants seem to be important. They, for example, appreciate a lot the tree that is standing in the public space but in front of their house. Also important are camels that they take care of while they are eating and spending days in the oasis is a major activity in their life and thus important. The environment they seem to care about and find important takes as much place in the public realm as it does inside the house (often outside spaces).

The villagers were more concentrated on belongings and spaces inside the house. Not one picture was taken in the public space. They care about their private spaces and the value and wealth this could show. Public life seems to be less important to show and be proud of. This can also be seen by the fact that their houses are often a lot cleaner that the space around their houses, since garbage and plastic is often thrown outside and taken by the wind. Although the fact they did not photograph the public space could also depend on the way they understood the assignment or the person that participated in the project. Some results of the assignment can be seen in chapter II.2.1 Self-participation photo assignment.

The drawing assignment we decided to work with kids living in the village. Kids are more open minded and are the future of the village. The assignment was to draw your favorite place in the village. We tried to give them an assignment open as possible, so they could draw whatever they would like to draw but still related to their environment and architecture. Also the translator could not mess too much with the translation of the assignment. There were two major outcomes of the assignment. There was one group of kids that drew the oasis and one group that drew the urban setting of the village. Probably this had two do with the fact that there were two different tables where the kids were sitting. One table drew the urban setting while the other table drew the oasis. But the fact that these two drawings were made is already something.

The village as well as the oasis forms an important environment and also a strongly divided environment, they see the two separately from each other. The oasis setting was in all drawings centered by the river. Lots of different trees were drawn, but most of them had fruits. Prominent was the absence of animals and people in the drawings. It seems that the trees and the food that they produce, important are in the way they see their life. Also the river that brings the water into the area seems to be of importance in their point of view. So kids are maybe aware of the importance of food and water in their environment.

The drawings with the urban setting also had some interesting aspects. All drawings were draw without any structure. Houses were drawn randomly. The only structure that could be found was sometimes the mountains that were drawn in the back. Also in these drawings people and animals were not drawn. A few times the main road with cars was drawn, but only by elder people. Another prominent aspect is that all houses and buildings are drawn symmetrical. And all kids drew the mosque. We can conclude that that the mosque functions as a really important public building. The public space is seen as a huge open space around the houses, nothing special is happening there.

The drawings are being shown on the next pages.
Results of drawing assignment in the oasis area.
Results of drawing assignment in urban setting.
3.8. Hierarchy in the family of Abdullah

The hierarchy in the family is in immediate connection with the way space is used. In this way space is constantly changing from user and possible function, it all depends on who is at home. When men are at home they are the prominent users of the house. Women have their own small room and a kitchen in the house where they keep their stuff and where they are staying when men are at home. The house where we stayed had a special part for Abdullah his first wife and her daughters and another part for Mia and sometimes tourists. But this probably because Abdullah, the man of the family, is married with two women, and they both have their own space. As soon as Mia and Abdullah are not present, the women are also using the other parts of the house. They start to do the washing there and they use the kitchen in Mia her part as well. As soon as Abdullah returns home they withdraw to their own part again. In this way the user of the space is changing constantly and the way it is getting used depends on the user. There is a strict hierarchy within the family. The father is the on top and rules over everyone. If he is not home his oldest son will take over his function, if he is also not there the mother will be head of the family. Being head of the family means that everybody is doing what this person wants and he always decides what is going to happen. Everybody is obliged to obey out of respect, and everybody does this, because otherwise he/ she will get punished. Mia gains her respect in another way, she is sponsoring the family with money, so she is of great importance for the incomes of the family. They respect her because of this and she has a big influence on the way things happen. An example is that Mia does not want to have a television in the house. The kids and the other wife really wanted to have this though. When Mia is not there the television takes a prominent place within the household, while when she is there it is placed in a small room in the back of the house.

3.9. Conclusion

It is clear that the inhabitants still live in different neighbourhoods, divided on ethnicity brought by history. The youth starts to think differently and starts to appreciate each other individually. Neighbourhoods have different ways of housing and different ways of using the public space connected with the ethnicity. Public space is in general important for social contacts, but it is nothing more than open, dusty sandy places. Sometimes public space is used as private space for activities that take a lot of space, the high social control in the village makes this possible. The villagers, even the kids, are aware of the importance of the oasis as their environment, it provides water and food. Because of the bad conditions in economy of the area there are not enough jobs and men are leaving to the north to earn money. Authorities are trying to get more control in the area by forbidding building without licenses and evaluating everything that is there now. They try to make plans on longer terms to avoid unneeded building. Family is their most pressures value and is the most important thing they care about. There is a strong division in the world of men and the world of women. Men are independent and women are dependent of men.
4. Flows

The village is rapidly growing in its facilities. Since March 2010 the village is connected to an electrical network and a water network. Every house now has plugs and their own water tap. Life of the inhabitants is changing radically with the facilities that are brought into the village. The different flows like water, electricity, sewage and garbage are from great impact on their lives. In this chapter the different flows and the changes it will bring to the village are being discussed. Continued with the building materials that are used in the village. An idea will be given of the origin of the different materials, what they are getting used for and how they are appreciated by the local inhabitants. Finally an idea about the connection the village has with the rest of the world in form of transportation and digital connections will be given.

4.1. Electrical power

The village Aroumiatte has electricity since March 2010. In Zagora they had electricity for a longer time already. When they started to light the road leading from Zagora to Aroumiatte they decided to provide Aroumiatte from electricity as well. To get the electricity in the homes of the people, many concrete columns have been placed throughout the village. Next to the front doors on the outer wall of the house, a meter is updating the use of electricity per household.

Since there is electricity, many people have introduced electrical lighting, television and radio and plugs to charge their mobile phones to their houses. Before the electricity had come to the village, people used oil lamps for lighting. For cooking people still use gas bottles, charcoal and wood instead of electricity.

4.2. Water

Almost all houses in Aroumiatte have tap water. This water comes with a pipe system from the village Oulad Wchah. Mostly the houses have one or two taps around the house to provide water. Mainly during summer there is no water coming out of the taps though, which means that the big well in Oulad Wchah is out of water. In case that it does not work they have to use the water from the wells in the village.

There are two public wells in Aroumiatte, all people in the village go there to get their water. Some houses have their own well though. The family of Abdullah, for example, has its own well in the backyard of the house. They use the well only for washing big things and watering the garden. When we tried the water of the well, the water smelled like there was a corpse in the well, which could have been the case.

In the house of Abdullah they built a small pool. The first idea of this pool was to have some nice water place for tourists visiting. But this did not work because the water attracted a lot of vermin. They do use it now in the hot summer month, to keep some spare water for watering the plants and cleaning, in case the taps are out of water.

To make the tea or to cook, water is often kept in a jerry can for a few days. In this way they try to make the water nicer. The family of Idris even gets the water for tea from the well in Asrir, which is a village in between Aroumiatte and Zagora. There they get water from the tube system of Zagora, which water they like better. In Zagora, there is one really big well, the water from this well is cleaned with chloride.

The river Draa in the palm garden is mostly out of water. The reason for this is that they use the river to create electricity in cities elsewhere. They have
built a reservoir and a dam, which they only open to get electricity. So the river in the palm garden only gets water when the city opens the dam. If there is water running through, people from the villages use this to do their washings and water their gardens. They built a canal system that brings the water from the river all the way to the village, the canals are surrounding the old village. Women are gathering together around the canals to do their washings.

4.3. Sewage
At the moment, there is no sewage system in Aroumiatte. Most people build their own cesspit, but people with less money, mainly living in the outer area of the village, just share an open hole in the ground. Luckily with the dry climate, the faeces dry out very quickly and don’t spread bad smells and deceases.

In the old Kasbahs, the toilets have often been built in very dark areas. The advantage of this is that flies don’t enter dark spaces, or when they do, they land and go to sleep.

First everyone in Zagora had their own cesspit, nowadays there is a sewer system for the whole city. When the government builds roads, they immediately build in the sewer system. The government is planning to also build roads in Aroumiatte, which will also mean they will be connected to a sewer system in the near future.

The black water is often clean of toilet paper, since many Moroccans do not use toilet paper or throw the paper in a separate bin. Only the big hotels and other places with not informed tourists throw the toilet paper in the toilet.

The grey water is often just dropped on the ground. In some cases it is leaded to a place with plants, as happens in the house of Abdullah. Rarely it is used for anything else.

Let the water back in to the ground isn’t a big issue, won’t it be that the water is often polluted with soaps. Besides that it would be better if there would be some infiltration system, which could just be some stones, which could lead the water back into the ground before it evaporates in the hot sun.

4.4. Garbage
There is no regulated system in Aroumiatte for the garbage. In some houses they do have a bin, but no one is coming to collect the garbage. Everyone is throwing their dirt in the desert, where the wind is taking control. The garbage is gathering at places where there is a slope or where plants are growing. For metal and plastic garbage to decompose, it takes thousands of years. Animals that eat too much this plastic will die.

Nomads sometimes burn their own garbage before they leave their resting place. To do this, they search for a dry plant and burn this, with the garbage; plastic, paper and all other sorts, stuck within the plant. When they do not burn it, they just leave it behind in the desert. Also some people who live in houses burn their plastic at some distance from their house, but most garbage is still left behind.

Most people do not care about throwing garbage everywhere in nature, but
some people start to care. An example is when we walked through the oasis, Zainab threw her plastic bottle away in nature. Idris, who saw this, told her to pick it up and take it with her. Since Idris is older, she is listening to him, although she looked irritated. Why Idris cared and Zainab didn’t might have to do with the fact that Idris is higher educated, but we can’t be sure about this. What it does show is a growing interest in keeping the desert clean from garbage.

Large weight garbage, like old tables or bikes, is also used on roofs of small sheds. The weight keeps the roof on its place. Some second hand stuff is also being sold on the market.

**4.5. Building materials**

From origin people have used local available building materials to build their houses and tents. They made their tents from camel’s wool, goat’s hair and acacia and tamarisk wood and build their houses from mud with stones, some reed, straw and palm leaves and -trunks.

Since the infrastructure has improved, cement, wood from the forest, steel and plastic were introduced in the building industry in this area. These materials are all imported from the big cities and are transported into the oasis by truck. However using local materials is the cheapest way of building.

Some local available materials are already creatively being re-used, as plastic packaging, empty oil barrels and old clothes. This way of re-using however is still very limited and only done by poor people. Reuse is seen as poverty and in that way preferable not to use by locals. Concrete is seen as modern and rich, so preferable in use by locals.

There are no building materials that are being exported from Zagora. The biggest and almost only export product from Zagora is dates.
4.6. Transport
There are several types of transport available in Aroumiatte. They vary from the traditional ways of transport by camel or donkey to the more modern types of transport by car or bus.

Walking is the most common type of transport for near distances, most people are used to walk a lot and walk very quickly. Since some years the bicycle is introduced, which is quicker on longer distances. The bicycle is mainly used on the big concrete road, which goes much quicker. It is also quiet dangerous, since the cars drive very fast on this road. At night the bicycles are almost invisible for the cars, since they don’t use any lighting.

The donkey is mainly being used to walk to and through the oasis, a distance of about one or two hours, but sometime also for farther distances. The donkey can carry a lot of weight on its back, including people. Abdullah for example, rides a lot on the back of the donkey, since he can’t walk so much himself anymore. During our trip in the desert, the donkey often had to carry a heavier load then the camels could carry.

Camels are still used to walk through the desert. They can survive without water for several days. They can carry loads and people. Someone always has to walk in front of the camel to lead it, so it doesn’t go faster to ride the camel than to walk.

Camels are part of the possession of the nomads. Working camels live shorter than camels in freedom. Normally the camels don’t carry people the whole day, since it is too heavy for them. A group of camels always has a leader. This camels walks in front, the others will mostly automatically follow. Sometimes the camels are also connected by ropes to one another.

At night, the camels are free to walk to be able to eat. A rope around their legs should withhold them from walking too far away from the camp. Before the nomads go to sleep, they make sure that the camels are close to the camp, if they can still find them in the dark. The next morning they have to search for them again, when they walked far away this can take hours, in some cases even a few days.

Since the introduction of jeeps in Morocco, this offers an alternative way to travel through the desert. A four wheel drive can move easily and quickly through the stone desert. Riding through the sand dunes is harder, but sometimes they are also accessible. However, these jeeps are expensive, so not affordable to most nomads. It does bring the nomads closer to modern life. Nomads nowadays often have a flash light and mobile phone and are visited by others with jeep.

Beside the jeeps, also regular cars have come to the village. Most cars do not drive through the village, which has only mud road, but stay on the concrete road. In the village there are about four cars in total. The concrete road connects the village to farther cities as M’Hamid, Marrakesh and Tazzarine. People who can’t afford a car their selves can take the bus to Marrakesh and M’Hamid. To travel from Aroumiatte to Zagora, there is a mini taxi. They drive from Zagora to Aroumiatte for 4 DH and from Zagora to Amazraou for another 4 DH. They don’t leave the concrete road. For farther distances there is the opportunity to take the bus, the minibus and big taxi.

The analytical drawings show where different types of public transport travel to. Trucks also use this road, to transport cattle, food, building materials and other goods.
4.7. Digital connection
Digital world is coming up to connect the villagers of Aroumiatte to the rest of the world. Along the big concrete road and in Zagora, there are many teleboutiques. Although many people nowadays own a mobile phone, the teleboutique is still very popular. Calling with a mobile phone is much more expensive per minute and often they run out of credit, so they use the teleboutique to call to the mobile phone of others.

Mobile phones are widely spread, even nomads often have a mobile phone. Since there is electricity in Aroumiatte, they can charge their phone in their houses. Two days walking form Aroumiatte into the desert, we still sometimes had a connection to the mobile network. The network isn’t very stable. It could happen that the coverage is gone for several minutes. So people are not always reachable.

Internet has not yet entered Aroumiatte, but there are a few internet cafes in Zagora. Often these cafes are used intensively since there are not so many of them. Mostly men are found behind the computers, but sometimes there are women too. People skype their relatives that have moved to other cities or they use it to email. Only youth is seen in the internet cafes though. A lot of people have no clue about the possibilities of internet. Even the people that do use the internet don’t have that much knowledge to see the possibilities of using internet in a broader way. One day we met Abdul, he did see the possibilities of internet and used it in a smart way. He was connected to couch surfing, a social digital network where people meet each other to offer a free bed abroad. He was a local crafts man, he made jewelry and other local goods. He invited tourist over and offered them to stay in his house for free. But at the same time he sold all his goods to the tourist and earned money in this way. Internet is a whole new way that connects them easily and quickly to the rest of the world, but of course this is only available for people that can read, write and use a computer. Also the introduction of electricity and with that the television connects the villagers to the rest of the world.

4.8. Conclusion
Water is scarce in the oasis area, as well the water from the big well as the river cannot assure to provide water year round. The government has planned to build a sewage system in the village of Aroumiatte, where a lot of water will probably get spilled with. This could take the water level even further down, and that means that drinking water is getting even scarcer.

The local people do not care about their garbage, they do not see the threats it brings when you throw it in the desert. Garbage like plastic and metal will stay there for thousands of years and causes the death of many animals. Transportation has changed, big roads make it possible and cheaper to import goods, while camels are still being used to walk through the desert. Digital connection in Zagora and the mobile phone network are nowadays connecting the people from the village to the world. Coverage and knowledge of the possibilities of the digital networks is poor, people could take more advantage of the networks if they have more knowledge. It could contribute on a new way of income in the future for the local inhabitants. Also the many illiterate people will not be able to make use of the internet at the moment.
IV THE PROBABLE AND DESIRABLE FUTURE

First the probable future will be described, when nothing would be done differently. After that some possible sustainable interventions will be discussed, ending with our plan for the desirable future.

1. Probable Future if no intervene
People have already started to leave Aroumiatte and its oasis since the changes that have occurred in trade and infrastructure have limited the importance of this area and chances for its inhabitants. The people that stay behind are the women, children and some men that do not leave to study or look for jobs abroad. All people with knowledge leave, which leads to the quality of the education and hospitals growing worse, there are not enough educated teachers and doctors. The government tries to do something about this, but without success, they are building more empty schools, hospitals, an airport, swimming pool and roads. Empty places in the desert are filled with concrete roads, where the houses should be built later. But at the same time, more people are leaving this area, probable leaving many of these roads untouched.

The traditional main occupation in the oasis was agriculture, but nowadays the agriculture in the oasis is more expensive then importing fruits and vegetables from the north. Because of this, people have stopped irrigating the ground, which stimulates the dehydration of the oasis. The river, which is the origin source of the oasis, is empty most of the time, since other cities and villages have built dams to generate ‘green’ electricity. Without water and maintenance, the oasis will shrink, the dates trees, their only export product, will dry out and the oasis will finally totally disappear.

At the same time, the houses that are being built, are being made of concrete. Since concrete is not produced in Aroumiatte, all the building material will have to be imported, which will thwart the local economy. At the same time the tourists are not interested in the concrete architecture, but prefer the Kasbahs, which are abandoned by the local inhabitants and are slowly collapsing. Without tourists, an important part of their income will be lost.

Without the oasis and without any income (no dates, no tourists and only import) all people will finally leave this area. The only thing they will leave behind is all the trash, which is already doling around in the desert, with an addition of all the concrete unused roads, houses and other garbage. The desert will turn into a big garbage dump. The cattle of some nomads that might still have survived, will be dying of the plastic in their stomachs. No way to survive will be left in this area.

The people that did run away from this area will most likely end up in the Bidonvilles of the big cities, which will be growing enormously. There are no better chances in this Bidonvilles, it is too crowded, there are no jobs, the living conditions are worse than they had before, there is malnourishment and there are diseases. The government has turned their back to this areas for years. Who will help these people now? Is it not already to late? Could we not have done something before? It is too late now…
2. Additional research, focussed on a more sustainable future

To create a better future for Aroumiatte, we must think about a way to keep the people there and improve the area. To do so, we must think about water, about the economic chances and about more sustainable solutions, as well economically as environmentally. Some sustainable opportunities will be described, finally a desirable future and a urban vision for Aroumiatte will be described.

2.1. Sustainable opportunities

Sustainability is not a theme that gets the first interest from the local Moroccan villagers. But it is a theme that is concerning the whole world. Desertification is something the local villagers already have to deal with, but we also all know that we cannot keep on using all the soils we are using right now. The first thing which is best to do to reduce the use of electricity, water, gas etc. This can already be done by designing with the right materials in the right way. The second step is to re-use and re-cycle and the third step is to use renewable energy sources. The last step is the step we do not want to take anymore, the step to use non-renewable sources like oil and gas. In this chapter some low tech sustainable solutions which could be used in the design in Aroumiatte will be discussed.

2.2. Form of the building

Besides the use of materials, also the shape of a building can be of great importance for the sustainability of a building. A combination of the right materials and a good shape can keep an building cool in a hot area without a mechanical cooling system.

Traditionally the Kasbah architecture of Aroumiatte has high narrow streets, which keep the hot sun out of the streets, this way almost all exterior walls are shaded and do not absorb the hot sunlight. Many houses have even build an overhang, completely shading the streets. When entering a Kasbah, the cool and more humid air can immediately be felt.

Vernacular architecture in the desert cities in Iran had to handle with the same circumstances as the architecture in Aroumiatte. The hot sun, dry air, possibility of sand storms, and the need for water. In Iran this circumstances have led to an unique vernacular architecture and an important invention.¹ The narrow and height streets keep the sand storms out, slows down the wind speed and create shadow. The buildings are made of adobe, they have thick mud walls, the only available material. The thermal mass of the mud stores the heat for eight hours during the day and warms the house with this heat during the night. In summer, this absorbed heat caused some problems, which has led to an invention of wind catchers, connected to a shaft with a water reservoir to humidify the air.

The wind in a dry tropical climate is stronger higher above the ground.² The higher air also contains less dust, which all together makes it preferable to catch the cool higher and cleaner air. This is what wind catcher do. Wind catchers can be built in many different ways, above the level of the roof. Most easily they can be made of a wood construction, with four pieces of canvas or woven mats attached in a X-shape, joined in the middle. The crossed elements capture the air and descend this into the rooms. The direction of the wind does not matter, what makes this type of catcher preferable in an area like Aroumiatte, with no specific wind direction. This wind catcher can be placed on any part of the roof, it should be placed this way that the wind blows through the most occupied rooms. The openings can be finished off with fence, letting the wind blow through, but preventing it from birds.

¹ May, John (2010)
² Lengen, Johan van (2008)
Wind catchers with a more durable character are called wind towers, they are appropriate for brick or concrete block houses. They have the same form and function as the windcatcher, but the tower also works when there is no significant breeze. The temperature inside the tower is different from the temperature outside, causing air movement. The hot air in the house is continuously moving upwards. Because the wind enters the wind tower on one side and leaves it on the other, it pulls the hot air up from the rooms. In winter the openings between the rooms and the tower can be closed. One wind tower can cool many spaces at once. Finally there is a tower construction, where the tower is built the same way as the building itself. It functions the same way as the wind tower. By narrowing the tower towards the ground, a shaft is being created, creating a stronger wind current. By projecting several rows of bricks out from the shaft, dust can be minimalized. All towers can be combined with water, which can be a jar or small reservoir, cooling the air.

Openings should be placed high to leave the room, since hot air always rises. Always more than one opening are needed to stimulate air circulation, preferable two of different heights. A possibility to have cooler air entering the house, besides the wind tower, is to use the coolness of the ground. The ground is much cooler than the air on a hot day. This can be done by placing an pipe or tube underneath the ground, for a distance of a few meters. The air will be pulled through the pipe, because the hot air leaves the room of the house.

Other ways to improve natural cooling in a dry hot climate can be accomplished by the shape and ordering of the building. Since the sun is very bright, fewer windows are needed to illuminate the interior. Hot air rises, that is why windows should be placed high to let the hot air escape the building. This only works when there are windows on both sides of the room, so the air can circulate. By placing a clay jar filled with water in the window opening, the incoming air is cooled when moving over the water. Windows should be small to prevent heat and dust to enter. Wall openings can be made in many ways and do not all have to function as a window, for example by bricks with premade openings, inclined bricks or with curves tiles openings can be used. Larger openings should be positioned at the courtyard, where they are protected from dust and sunlight by trees and plants. Reflective light can also be very strong.

A combination of courtyards can also increase cooling. In a smaller courtyard, there is more shade than in a big courtyard. When connecting a big courtyard to a small one, the hot air in the big courtyard rises and draws the cooler air from the smaller courtyard through the house. The smaller courtyard can also be a narrow street. Plants and fountains can be placed in any courtyard to create more shade and a more humid air.

The organization of the spaces should also be considered. Organize the

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3 Lengen, Johan van (2008)
spaces this way that you take advantage of the sun’s motion. The sun rises in the east, hitting these walls first, so the west area of the house should be inhabited in the morning. In afternoon, the west wall start to heat up, it is better to use the east area. In summer, the south part should be occupied as little as possible, while in winter the north side should be avoided. Be aware of the amount of sun that hits a wall, because this is heating it up. Light colours should be used for the walls and roofs, since they do not absorb heat. The spaces with the most walls exposed to sunlight need higher wind catchers and larger openings in the wall.

When material is a problem, houses can also be build halfway underground, or slopes can be built around the solid walls to create a bigger mass.

2.3. Mud
Numerous architects have started to design with rammed earth walls. It helps to regulate the temperature in the interiors spaces. Not only does it have a large thermal mass, also does it provide a more humid air. Furthermore this material is fireproof and much more sustainable then for example cement blocks, and after it dries, you can still reshape it.

Martin Rauch has designed many buildings with rammed earth walls in Europe. A highly regarded model is his own house in Schlins in Vorarlberg, Austria. In Europe this example has shown that rammed earth is also applicable within extreme winter temperatures. It has broaden the appreciation for the material from the association with poverty and dirt to a highly sustainable and acceptable technology in Europe.4

However in Morocco, the association of mud with poverty is still there. It might take years before they start to associate mud with an acceptable technology, however, some people already start to get interest in the old Kasbah mud architecture. Another disadvantage of mud is that it is not resistant to rain. Wide roof eaves and an imperious foundation help, but the material often requires maintenance. In Devon the climate is more humid, so the ingredients they used for the mud wall have a special mix of ingredients, more adapted to the humid climate.5 They have given this mix a special name, cob. This is related to the techniques as adobe, rammed earth and earth bricks, it is also easy to construct and has a lot of freedom in design. There are also several materials that can be added to the mud, to make it stronger or more resistant to rain. Some of those materials will be discussed.

2.3.1. Bacteria’s as solidifier
Magnus Larsson, architecture student at the University College London, had put together a team to grow a bacterium and attempt to solidify sand. After

4  Lepik, Andres (2010a)
5  May, John (2010)
talking with Jason De Jong at UC Davis and with Stefano Ciurli, a pasteurii expert at the University of Bologna, his Holcim Award-winning proposal is a complement to the Green Wall Sahara shelterbelt, being planted across the African continent. Larsson is now investigating how to bring the project to the next stage: a 1:1 scale prototype.

“Sand is solidified into a habitable structure that protects from sand; a permacultural anti-desertification network made from the desert itself.”

A particular microorganism, Bacillus Pasteurii, is flushed through the dunescape which causes a biological reaction that turns the sand into solid sandstone. The initial reactions finishes within 24 hours; it would take about a week to saturate the sand enough to make the structure habitable. The bacteria are non-patogenic and die in the process of solidifying the sand. This part of the project relies upon research carried out by professor Jason De Jong’s team at the Soil Interactions Laboratory, UC Davis.

2.3.2. Cactus waterproofing
The addition of cactus juice to mud can make the material more resistant to deterioration from humidity and rain. Cactus juice can be used as wash, when adding more salt to the mix, it is easier to apply it to the wall. The indigenous people of Mexico have used this technique, their temples have gotten impermeable and the walls are still in perfect condition centuries later.

To use the cactus juice, a bucket should be filled up to the rim with cut cactus and water. After one week, the water can be filtered and used. Cactus liquid and fresh lime should be placed in a shallow pit in the proportion of one to two.

2.3.3. Cement and mud
Adding cement to the mixture to create adobe bricks, can make the brick stronger and more resistant to water, this works the best in a soil with a low clay content. A metal mold and heavy hardwood stick are needed for this. To improve the quality of the earth, cement can be added in the proportion 1 part cement for 12 parts earth. Lime can also be added to make it stronger. The proportion than are 1 part cement, 2 parts lime and 24 parts earth. This mixture should not be mixed with the bare feet however, since cement irritated the skin. When the brick is drying, it should be protected against direct sunlight and wind, just like an adobe brick without cement. The curing process can be enhanced and hastened by adding sodium hydroxidy (NaOH) (20 to 40 g for each litre of water).

2.3.4. Lime and mud
Clay and lime react when there is a sufficient humidity. An exchange of the metallic ions of clay and the calcium ions of lime will take place, with lime as a stabiliser. This results in fine particles with stronger agglomerations, blocking the water that tries to penetrate the material. The lime also reacts with CO₂ in the air and forms limestone. However, with just a small amount of lime, the materials may have a lower compressive strength than stabilized mud.
2.3.5. Other additions to stabilise mud
Asphalt can also be used to reinforce the earth, 15 litres of asphalt are needed for two cubic meters of sand. Another option to make the material more resistant to water is bitumen, for which also paraffin is needed and works best when the material is compressed. Finally Soda waterglass (Na2O · 3-4 SiO2) can be added to sandy mud. The soda waterglass should first be thinned with water in a proportion of 1:1, so no micro cracks will occur.

2.3.6. Plaster to a mud wall
The mud plaster used on exterior walls are not suitable if they have cracks and are not water-resistant. It is best not to adjust mud plaster to exposed walls. Cement plasters are too brittle, it should not be used inside or outside. The most common alternative to mud plaster is lime plaster. The surface should be moistened with lime-casein milk before applying the plaster. The plaster is applied in two layers, the first layer can contain some cement to fasten the curing process, the second layer should be applied before the first layer is totally dried. The total thickness of the plaster should not be more than two centimetres. Lime plaster can only harden in the presence of sufficient moisture, it should be sheltered from direct sunlight and wind or it can also be kept with a damp fabric.

Tadelakt, which is a nearly waterproof lime plaster, can be used to make the mud wall water-resistant. Tadelakt is originally used in the interiors of Moroccan mustafams, palaces and bathrooms of riads to waterproof the interior surfaces. It can be used for as well the inside as outside of buildings nowadays. It is traditionally polished with a river stone and treated with a soft soap (often “black” or olive oil soap) to make the surface more water resistant and give it its shiny appearance. Tadelakt can be mixed with any pigment that you like to give it a colour.

2.4. Leftovers in the desert
"The ecological damage produced by a traditional house is not only the consequence of the energy used during its lifetime, but also through the building materials required to construct it."

People through all their garbage in the desert, but a lot of this material has the opportunity to be used or reused. Using garbage and left over materials as building material, is one of the upcoming trends in the vernacular architecture. This happens out of necessity or because people want to design with a smaller carbon footprint.

The poorest people of the world already build houses from trash and left over materials to survive for years. Nomads in the desert around Aroumiatte use old clothes to build their tents. Trash is being used to create a heavy loaded roof, that isn’t blown away. Old oil barrels are being beaten flat to create doors etc.

In the western world using garbage as a building material is a upcoming trend since the sixties and seventies. Mike Reynolds is the creator of the Earthships, he calls his work ‘biotecture’. The goal of his buildings is to create a building out of recycled and natural materials. It gets its energy from sun and wind and has and reuses its own wastewater. Earthships are energy saving and CO₂-neutral. He started with this concept in the seventies, when he first used old car tyres to build walls. Reynolds says:

"Een duurzame woning moet gebruik maken van inheemse materialen die van nature voorkomen in de omgeving. Duizenden en duizenden jaren lang werden huizen alleen gebouwd van gevonden materialen, zoals steen, aarde, riet of boomstammen. Vandaag de dag zijn er bergen bijproducten van onze beschaving die al gemaakt zijn en verspreid over de aarde. Dit zijn de natuurlijke gebruiksmaterialen van de moderne mensheid."
Using garbage as a building material is also sustainable since it is re-using waste materials, without additional industrial, energy consuming processes (which recycling often needs). Secondly it saves using other building materials as concrete, mortar and cement bricks. Five percent of the global CO2-emissions comes from concrete production. After transport and energy production is the highest producer of greenhouse gases. Reusing materials is also a very cheap solution, since people need to get rid of them anyhow.

2.4.1. Plastic
All trash that is produced by the inhabitants ends up in the desert. Families dumb their trash on the border of their villages which than blows through the desert. The trash that local inhabitants produce exists mainly in the form of plastics. The trash of plastic is of high risk for the environment and life in the desert. Because of the climate, dry and high temperatures, it takes thousands of years for plastic to decompose and disappear. It roams all these years through the desert. Nowadays cattle in the villages eat the plastic and get swollen stomachs; they cannot digest the plastic, so the plastic stays in their stomachs which often cause the death.

2.4.2. Plastic as building material
Lawrence Reaveley\textsuperscript{15}, a civil engineer at the University of Utah in Salt Lake City, has come up with a scheme that could reuse trash as a building material. He claims that a blend of waste plastic and cellulose from plant material can make a good building material, once appropriately sanitized. The blended mixture can contain different percentages of material. For example plastic may comprise between twenty and ninety-nine percent of the blended material, while cellulose materials comprise, by weight, between one and eighty percent of the blended material.

The mixture can be heated or not and a binding agent may be mixed into the blended mixture of plastic and cellulose materials. In some embodiments, the compressed, molded, shaped, and/or extruded material can also be cooled as well as cut to a particular size, either before or after cooling. The object can then be prepared for use. Materials can be formed for use as structural members such as: fence posts, building materials, posts, beams, decking, joists, panelling, studs, columns, wall panels, siding, flooring, sheathing, retaining walls, walkways, driveways, landscaping edging, furniture, or any other suitable structural material. The material can also be used as an insulation material or sound attenuation material.

When using the material structurally for walls and other building features it needs to be strengthened and reinforced with a rod, bar, plate, board or beam. These objects can be made of any suitable material for example iron, steel, wood or fiberglass. Such strengthening and/or reinforcement can occur at any time. For example, the object can be reinforced during compression of the object to a desired shape. Or it can be reinforced when being used by the end-user. In any case a groove or hole is formed in the formed object. Such a feature strengthens the material as the groove or hole can then receive a reinforcement structure such as a rod or plate therein. In another example, a plate is affixed within the groove or hole and/or against an interior or exterior surface of the blended object. A reinforcing rod, bar, plate, board or beam can be made of any suitable material, such as iron, steel, wood, or fiber reinforced glass/carbon composite materials.

The material can also be converted into fuel or be used as an energy converter. The energy converter can be combustion based, and can include a heating unit such as a boiler, furnace, stove, or fluidized-bed combustion unit. In another aspect, the energy converter can be a gasifier. In the gasifier, the blended mixture of plastic and cellulose is used to create a synthetic gas. The synthetic gas then undergoes an additional conversion where it is used to create diesel or an alcohol-based product such as ethanol, methanol, or a mixed alcohol.
To reduce any impact on the climate, one or more additional materials can be added to the mixture. For example, a gas suppressant such as crushed limestone, lime, clay materials, burnt clay materials, and/or inorganic fine materials can be added to the blended mixture before the mixture is sent to the energy converter. If the blended mixture is then burned, noxious or toxic gas emissions can be reduced.

2.4.3. Plastic pavements

“For years tonnes of plastic bags have been transforming the Maliman city of Mopti into a giant trash bin. But one year ago a solution was found: collecting and transforming the plastic bags into paving stones.”

The Aga Khan Foundation started a project in Mopti, Malim, to clean the town from all its plastic and use it in economical advantage. It worked out very well and now they are thinking about introducing the project in other villages in Malim.

The plastic trash is collected by the inhabitants that get little money if they bring the trash in. The plastic is melted and mixed with local sand, than poured into molds. Different shapes and colored pave stones can be created. From all the leftover plastic, people make teapots and other small things that they sell on the market.

“One year after the start of the project and the town’s clean-up operation, Mopti has been transformed into a town its locals are proud of: business is booming and tourism is on the increase. Next year, Mopti’s plastic recycling project will be rolled out across other towns in Malim, in a bid to end one of the worst ecological problems in Africa.”

2.4.4. Bottles as a building material

A decisive step in using bottles as a building material was introduced in 1963 with the Heineken ‘World Bottle’ (WOBO). The idea for this project has emerged by beer brewer Alfred Heineken when he travelled through the Caribbean. The beaches were filled with bottles that were washed ashore or left behind, while people in this area had a lack of cheap building materials. Alfred Heineken, together with the Dutch architect John Habraken, developed the idea for a ‘brick that contains beer’. They had produced many bottles and had built a small shed in the ground of Heineken, but nothing more had happened afterwards.

In 1975 the documentary Garbage housing of Martin Pawley had used this idea in the documentary. He suggested that consumption goods should be designed this way that they could easily be reused for other uses afterwards, and so helps the worlds’ housing crisis.

Nowadays there are many buildings made from bottles all over the world. The most impressive building of the world is built by the Buddhist monks of the province Sisaket in Thailand. They had gathered millions of bottles, as well green Heineken bottles as brown locally produced bottles of Changbeer.
With which they have built the Wat Pa Maha Chedi Kaew-temple.\textsuperscript{18}

In Aroumiatte however, there are rarely any glass bottles, since alcohol is prohibited and the lemonade bottles are returnable. Plastic bottles are being used a lot, for water and lemonade, and are left behind in the desert. There are many examples nowadays how glass and plastic bottled have been used to make walls. Plastic walls can create light weight inner walls or, when filled with earth, used for an load baring exterior wall. There are still many ways to use bottles as a building material to explore. Also other materials like cans and car tires can be reused as building material, we do not discuss these materials, since we did not see much of it in the desert around Aroumiatte.

2.5. Solar energy

In Aroumiatte, there is sun for at least five hours in winter to eleven hours in summer a day. The average hours of sun a day is more than eight hours a day. This is a lot of energy which could be used.

Conventional solar panels have the advantage that it does not need the expensive silicon that regular solar panels need. Instead it needs a lot of direct sunlight, ideal for the desert.\textsuperscript{19}

Concentrating solar energy is another way to use the heat of the sun for energy or to heat for example water. A disadvantage of solar energy is that is does not work at night and a solution should be chosen to store the energy, for example with batteries of a water pump system.

During our stay in Aroumiatte we have seen some solar panels, most of them unfortunately broken. Dust is a big killer for all electrical devices in desert areas. It would be best to place the solar cells as high as possible, since there is less dust in the higher air.

2.5.1. Solar cooker

Another way to use solar energy is the solar cooker. To cook food temperatures of about 100 to 200 degrees Celsius are needed.\textsuperscript{20} These temperatures can not directly be reached by the radiation of the sun. This and even higher temperatures can be reached by concentrating the sun in a hollow mirror. Another way is to capture the sunlight in a well-insulated box with a double glazing cap and flat mirror, this mirror reflects the light in the box. The captured light in the box increases the temperature inside.

To cook the food a dull black coated cooking pot is fixed in the focal center of the hollow mirror. The typical solar cooker has a diameter of about 1.3 meters, whit what it can concentrate about 800 Watts onto the pot.

For the solar cooker to work it is necessary to have a sunny cloudless sky, a parabolic mirror (of medium quality, polished aluminum will do) and a simple rack to direct the parabolic mirror to the sun.

The main advantages of solar cooking are the independency from wood. Using wood encourages desertification, which makes it better not to use wood. Besides this it is cheaper than using wood, coal or gas after it is being made. The devices to make them are cheap and robust, they can even be made by the users itself with cardboard, aluminum, foil, glue, tape, string and sticks of material to create a rack.

2.6. Wind energy

There is some wind in Aroumiatte, but not very much. If capturing wind to create energy is considered, the windbelt might be the best way. Frayne's has designed the Windbelt. This is a taut membrane fitted with a pair of magnets. The membrane oscillates between metal coils. Gears transfer the motion of the spinning blades to a turbine, here electric current is induced.

\textsuperscript{18} May, John (2010)
\textsuperscript{19} Jansen, Mark (2010)
\textsuperscript{20} Bockhorst, Michael (2010)
The Windbelt is 10 to 30 times as efficient as the best micro turbine, and much less dangerous.\(^{21}\) One Windbelt costs just a few dollars, it is easy to repair them yourself. In Haiti the Windbelt is being used to light a couple of LED-lights or play a radio, it replaces the kerosene lamps. Larger versions are possible, but the problem of wind noise emerges then.\(^{22}\) The further development has made it possible to make fences of more Windbelts in a row. It has an easy system. Energy can be used for several things, as well for lighting as for example for charging your mobile phone.\(^{23}\)

2.7. Biogas

The government of Zagora is planning to build a road and with this a sewerage system in Aroumiatte in the near future. The sewage system would probably be dumped in the river or in a large cesspit. While at the same time there is a shortage of wood in this dry area, what is now used to cook and heat water. Using human waste might be a great opportunity for heating and cooking in this area.

When bacteria break down waste materials of animals or humans, or of other plant materials a flammable mixture of gases is being formed, which is called biogas. Dung or plant material should be collected in a biogas generator or digester to make use of it and produce biogas. The produced biogas then can enter buildings through a pipe, where it is burned to produce heat, light or refrigeration.

\(^{21}\) Decker, Kris de (2007)
\(^{22}\) Ward, Logan (2007)
\(^{23}\) Humdinger Wind Energy, LLC (2010)

The biogas production works best at a temperature of around 30 degrees. Ideally 10 kg of dry dung produces 3m\(^3\) of biogas, which is enough for three hours of cooking or lighting or 24 hours of running a refrigerator. The waste that the generator produces is a useful fertiliser.\(^ {24}\)

Biogas generators in China show that the mix of animal dung, human waste and waste vegetables create a great fertiliser but provide a relatively low-quality biogas. The biogas generator in India, where only cattle and buffalo dung is being used, produces a very high-quality biogas but the fertiliser is much less good.\(^ {25}\)

The disadvantage of a biogas installation is that a lot of water is needed, which makes it less appropriate for Aroumiatte, where water is scarce.

\(^{24}\) Fullick, Ann (2001)
\(^{25}\) Fullick, Ann (2001)
3. The desirable future

The village of Aroumiatte is now still a small village, it counts about 2000 inhabitants. The last 30 years the village has been rapidly growing. If you follow the big road about two kilometres down south you arrive in the city Zagora. Because Zagora is expanding along the road, it is possible that Aroumiatte soon will be part of Zagora. City facilities enlarge and slowly electricity, public lighting and a sewer system are expanded from Zagora to the village Aroumiatte.

We have made an urban vision for the growth of the village in the future. This vision is based on the knowledge and experience we have gained in the village during our stay combined with our architectural experience, that we have gained during our studies on the Faculty of Architecture in Delft.

We will show our vision on how the village should grow in the future and we will be more specific about the interior of certain streets and squares that should connect the whole village.

The village is divided into two parts by the major road that runs through the village. This road connects many oasis villages and cities with each other, it for example runs to Marrakesh on one side and to Zagora on the other side. All main traffic is passing through the village along this road, mostly without stopping in the village. The road gives a direction to the village, houses used to be built alongside the road, nowadays some people built farther away from the road as well. The direction of the road also defines the position of the buildings, which are all built orthogonal in the direction of the road.
We want to introduce a second direction right-angled on the main road. This should be the main direction in which the village will grow. That means that it should not grow closer to other villages and merge together with those, but stay a independent village. After all it should create its own identity, different from other oasis villages in the area that all look the same at first glance.

The houses that exist at the moment already form kind of neighborhoods with open spaces in between, where nothing is happening except for children playing soccer in the sand of the desert. These open spaces give a nice spacious feeling in the village, which reminded us to the open never ending desert planes. We see the open spaces as a quality of the village, where children can play and paths form according to the people that move from neighborhood to neighborhood. The open spaces also provide a view through the village from the oasis to the desert, which both are connected to the village. We want to keep this quality and the houses can be built within the areas pointed out on the map below. (no buildings have to be demolished for this plan)

We want to add a meeting route that connects all urban areas in the village. Our analyses in the village showed us that the inhabitants spend a lot of time outside, in the common space of the village. They start walking through the village to meet each other and talk. You can see groups of women or men sitting in the common space or walking from area to area to meet others and socialize. By creating this route in the village, we provide a place where people can go to meet each other. Along the route there are three different squares. The first we call the urban square, it is situated in the dense area of houses, this square already exists. The second square we introduce is the meeting and market square. People can go here to meet, socialize, network and trade with each other. The third square is an already existing square, it is the religious square were the mosque is situated.

The meeting route will be closed off for cars. It will get an more interior look. We want to use colored tiles that are normally used in courtyards in Arabic architecture. Along the route spots with trees and chairs will be placed, where people can sit down in groups to chat. The chairs will be made from mud and tiles as well. The color in combination with all the earthy colors of the buildings will give a special look to this meeting route. As soon as it gets dark the lamps that hang from the trees will give light to the sitting spots.
Collages of the 'interior' meeting street during the day and at night.
In the first for maps below we illustrate the way the village has been growing. In the first map you can see the old Kasbah. The second map illustrates that the people moved out of the Kasbah and start to build new houses next to it. They left the old Kasbah to get better living circumstances like air and light. In the third map you can see that the city starts to grow slowly. Many nomads start to live in a more permanent setting and build a house. They appreciate more room and space around their house, as do some former villagers as well nowadays. The fourth map shows the situation as it is today. You can see that neighborhoods have been created with open spaces in the middle.
The following three maps are our vision on the way the village should grow in the future. We designed a road structure for cars, made from recycled plastic pavement. Every neighborhood will have its own connection to the major road. In this way our meeting route can be free from cars. This structure could also be used for a future sewer system. In between the houses sand paths will still make it possible to walk through the houses. The structure of the village will grow right-angled on the major road. This means that as soon as the housing areas are getting denser and there is place needed for further growth. New road structures can be made continuing the end of the old structure. See map 7. If the village will not grow that much and should not be extended, the road will stay like it is in map 6.
The spaces that will be left over in between the dense housing areas will connect the oasis and the desert with each other. From the main road you will have view to the desert through the open spaces. The open spaces will also bring the desert into the village from the west side and bring the oasis in from the east side. The spaces will not get paved but exist out of desert sand, like they do right now. By planting trees from the east side into the village, we would like to bring the green oasis looks into the village. The research has showed us that the inhabitants do appreciate trees and plants in their living environment. People try to plant trees and plants in and around their houses. We would like to do this in the open space to make it more comfortable as a place to stay as they also provide shadow.

With the growth of the village the public water wells will be intensively used at times that water taps do not work. For that reason we will add two new public water wells. Those will be situated in the open spaces along the meeting route. From those wells also irrigation systems will lead to the new planted trees.

Besides water, also electricity and garbage are an issue. We introduce two sustainable factories in the village. This should contribute to a self supply of electricity and an economic input. It will make the village independent from other villages and cities in the area.
In our research we pointed out that the desert is filled with trash. There is no system that collects trash and destroys it. People throw their trash straight into the desert next to their houses, from where it blows to places where it gathers. To make use of this plastic, we introduce the trash catcher factory. This factory will catch trash that blows from Zagora to the village in a long line of plants. This way the village will be clean from the plastic coming from Zagora and the factory will recycle the trash.

People can also collect their trash and bring it to the factory for a little money. The factory will use the plastic and recycle it into a new local building material that can be used for street pavement, flooring, wall covering, furniture and even roofing. We want to replace as much wood as we can with the new plastic material, since wood is very scarce in this area.

Since the old Kasbah is not in use anymore and is slowly becoming a ruin. We would like to give it a new input which will give it a new function and makes sure it will get renovated and taken care off. The inside spaces in the Kasbah will still mainly be empty, but taken care off until another plan is made to reuse it. By placing solar panels on the many roofs of the Kasbah we want to turn it into an electricity factory. At the moment, the village is dependent from Zagora in it electricity supply. In the future it will produce its own electricity and will not be dependent from Zagora any longer. The panels will be self cleaning solar panels, those panels are especially designed for the desert. It means that the dust that will cover the panels will be cleaned by the panels themselves. This will avoid that the panels rapidly go down in their production because of the coverage with dust.
The meeting square and market square will be part of the meeting route. We will design the buildings that surround the square as well, which will be a digital market and a women center. The square will get different levels, there is place for a market, tearooms and as soon as it gets dark there will be film displayed in open air.

The footprint of the square and the surrounding buildings has the proportions 3:4. After researching the area and the houses built in the village, we found these proportions returning everywhere in the buildings in the village.

The complete footprint of the square and the two buildings that we will design will have proportion 3:4. The both squares self will have this proportion and the extension of the square will also have this proportion. The buildings will get designed with guidance of an overall 3:4 grid.

Because of the different function of the building, women center and digital market, we have made a sketch how we think men and women will be represented in our buildings (see image below). The outer part of the women center will be open to men. But not too many men should be interested to enter the building. Men are not welcome inside the building. The digital market will probably get used mostly by men. Women though are not excluded and even carefully introduced in the digital market through a back entrance through the women center. In this way they will have a chance to be part of the trade and networking world and part of society.
Both the buildings will have some sustainable solutions for their passive systems. The buildings will use natural ventilation with the use of wind catchers and solar chimneys in combination with courtyards with trees and water. The use of solar panels will produce all electricity used in the buildings. The heat of the sun can also be used to cook or heat water. Because of the scarcity of water the buildings, we will use dry toilets, which will decrease the use of water.

With the introduction of a new local sustainable material, the recycles plastic, we want to try to use less scarce wood. If there is still the need for the use of wood we will use a sustainable wood. This wood is planted in Morocco especially to take it down again.

Both of the buildings will be materialized with sustainable materials. The sustainable mud, with which a lot of buildings are already built with, will be strengthened, so it will get more sustainable and durable. By adding cactus juice and lime the mud will get more resistant to rain. By introducing the ball ramp machine the bricks you will produce will get more durable and stronger. We will either choose to make the bricks itself more durable or only the covering layer. The use of the thermal mass of the thick mud walls will contribute to a pleasant climate inside the building during the hot day and also during the cold night.

Above: reinforced mud stones, more resistant to water. Below: compressed mud stones, which are less resistant to water with a wall finishing which is resistant to water.
V. CONCLUSION

The previous chapter has shown the probably future when nothing would change, in addition some suggestions for a more sustainable future and finally our vision for the village.
In this chapter the research questions, which were introduced at the introduction, will be answered to conclude this thesis.

1. Research Question I - Loes Goebertus

The conclude with an answer to the research question the three sub question will first be answered.

I. What was the local architecture in Aroumiatte like, how has this changed through the years and what are the future prospects for it? What are the strengths, weaknesses, opportunities and threats of the architecture in Aroumiatte? (context)

The architecture has traditionally been made of mud, but the old Kasbahs have been abandoned since lack of light and space and the change in needs. It is not necessary anymore to live dense together within the walls of a Kasbah to protect the village. Another change is that many nomads have been forced to settle in the village. They have a different way of using space. Cement has largely been introduced, but has many disadvantages, it is bad for the local economy, the climate (less thermal mass) and the environment. By the local inhabitants, however, it is regarded as modern and progressive, while mud, with its high thermal mass absolutely suitable for this area, is regarded as poor. Besides that, the locals want to build their buildings in the quickest and easiest way possible, which often leads to bricks, and they want a building with little maintenance, which automatically leads to cement.

II. How can you make the architecture surprising and innovative, while still being recognized and appreciated by the local inhabitants? (concept & desirable future)

Some architecture in and around Aroumiatte is different from the common architecture. Elements from the traditional ksar architecture can be recognized in modern buildings. Elements that are different, like the tower (also referable to the Ksar) that Mia introduced to their house, are copied by others. Green gardens are being appreciated by the most inhabitants.

The type of architecture they prefer diverse enormous from villa with garden to flat in a large city, but they do prefer a more modern look. Some ways of re-use, like doors from oil barrels, are being used, but only in buildings of poor people. However sustainability is an upcoming trend at the University of Architecture in Rabat, so is the fear to lose the cultural heritage of the traditional villages with concrete as the new building material. The local inhabitants want to live with great ease and preferable in a modern way, although some prefer well maintained mud architecture as well. Some Kasbahs have been renovated into hotels and other tourist related functions. All of this together shows that some exceptions in architecture are begin accepted, as long as they do not differ to much from the common architecture. People prefer more modern looking buildings, but also green is appreciated. Sustainability is an upcoming trend but not yet very popular by the inhabitans op Aroumiatte, so when introduced, this should be done with respect to the habits of the people and preference of modern architecture by the inhabitants.

III. What facility can provide a better perspective for the future of the people in Aroumiatte? (desirable programme)

Many men leave the village, leaving their wives and children behind. Girls often have to stop school early to work in the house hold of the family. Widows do not have much changes, they have to take care of their children and try to make some money by gathering the dates that have fallen on the path and making some carpets. In Zagora, some successful projects have been set up to learn women to read and write and help them to set up a business. The experience of this organization is that women are highly motivated to learn and develop themselves, there is a lot of hidden power within the women. They will have more power if they will have the change to develop themselves and support each other, this would help them to identify themselves as part of the larger community. They could help to give this area a new touch. The women center would create a place for them to do this, with an additional kindergarten, which would take away the load of caring for the children all day long. This center should be easily accessible for women, but at the same time sheltered away from the men, who are often too arrogant to change according to Jawad, who works with them in Zagora.
**RESEARCH QUESTION:** “How can you create a building in Aroumiatte, which is recognized and accepted by the local inhabitants, while also being surprising and innovative, and being more adapted to the climate than the modern cement architecture and being more durable than the traditional mud architecture?”

The former three questions have mainly answered this question. When building with local building materials, which are highly suitable for this location, it should be considered that the inhabitants want to live in a modern building, with little maintenance and which is easy to build. It can be different from what is already there, they might even copy the new inventions, as long as they are not to unknown, to expensive or ask to much effort to make. The way they use their space should be considered when making a design, the Kasbah is too dark and gives to little space to extend. The houses of the nomads often have a lot of open space within the house and the possibility to build new rooms whenever they feel like it.

When creating a women center, the center itself would be a new surprising addition to the village. This should be a place where women feel themselves at ease, away from the dominance and busy life of men On the other hand it should also be recognizable for them in that way that they would go there in the first place and that they have the opportunity to show something of their selves to the public when they feel like it.

2. **Research Question II - Maaike de Visser**

**RESEARCH QUESTION:** “What could be a new local material that can be crafted and easily used by the locals, that reinforces the sustainability of the environment and that adds an architectural value to the already existing architecture of the village of Aroumiatte? What function of the building can broaden the locals network and knowledge to stimulate their trade spirit to think of new ways to do business?”

I will answer the research question with the support of the sub questions.

I. What local materials are getting used, how are they being used and what are the pros and cons? What local materials are available but not used?

II. What are the environmental problems and by what are they caused? What influence do these problems have on the local inhabitants? What will this mean for the future and in what time period are we talking about? What is the relation of the inhabitants with their environment?

The use of local materials is the cheapest and easiest way of building. Form out of history the people are building with mud. Now they get a bit of an idea what modernity can bring and they like to be part of it. Concrete is what they see as modern, and they import this to start building with this. The advantage of concrete is that it isn’t as dusty as mud, it isn’t washed away by rain and it doesn’t cost as much as time as building with mud. The disadvantages are that it doesn’t have the thermal mass that mud has and in the climate, where there are very high temperatures during the day and very low temperatures during the night, this has great advantages. Another problem with concrete is that it is more expansive than the local materials and it isn’t very sustainable because of its high amount of CO2 emission.

There is a big garbage problem in the desert, also around the village of Aroumiatte you can see a lot of garbage wondering around. It takes thousands of years for the plastic garbage to decay. Animals are eating the plastic because there is not so much food to find. Garbage forms a big problem and still is growing fast in the oasis area.

The combination of the needs and advantages of the materials that are getting used already and the garbage that is filling the desert is what I want to use as a new local building material. A trash catcher can catch the garbage that is blown by the wind from the city of Zagora to the village. Also people can bring their garbage to the factory in exchange for some money. The garbage will be converted into a new local material that can get used in an easy way to build, so locals can build with it as well.

III. What is the architecture like in the village, material, form and use? What could be an additional value for the inhabitants? And what are strong habits I can use in my design?

You can see a strong returning structure in the way they built. Their old village as well as their houses as well as their markets always start with just a geometrical wall. Within this wall sections are created by the addition of other walls. The sections are divided by the way of use or by the users. Those sections are filled the way they need it from day to day. The life of the people is really changeable. Function change from place to place from day to day.

I would like to use the way they structure their spaces in my own design. This
means that it will get built up from walls and sections with functions that will fill the section in always changing ways.

IV. What is the network of the people? Is this network important and how do they use the network? Where and how do they expand their network?

Network is really important for the people, social network means a lot in this culture. The go to the market to expand their network and to trade and talk. The local inhabitants of the area also have a really big trade spirit. You can also connect this with their history where they have been one of the most important centers of trade in their region. The people try to earn money in every possible way, and they are quite creative in this. Nowadays it is really hard to earn money in the region is every possible way. I think a really important problem is that their network is too small to be able to make this spirit work nowadays. They live on an island in the desert and their network stays on this island while the world becomes more and more one. The use of internet could broader their network worldwide but now the knowledge is too poor to see the opportunities. I would like to stimulate their trade spirit by broaden their worldwide network. Teaching them the opportunities and possibilities of internet could help. I think that when their network is broader they will find new ways, their selves, to earn money. (an example is Abdul from the Kasbah of Tizergat). I would like to make a ‘digital market’, this means that there is internet facility and people need to learn about the possibilities internet offers.
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**Images**

Image sources are written down below the image, otherwise they are made by ourselves.
A. Summary trip Morocco
B. Interview with Remco Ensel, Dutch anthropologist
C. Interview with Hind Chafari, architecture student of Rabat
D. Interview Jawad Chahid of Réseau Associatif R.AZDED-Zagara
E. Overview local building materials, where they come from and what they
   are used for
F. Vegetation
G. Results of four days’ work in M’Hamid
We made our fieldtrip to Morocco from November the 1st till November the 23th. A diary of our trip has been attached to this document. We flew into Casablanca and took a 13 hours long bus ride to Aroumiatte, where Mia picked us up from the bus station. We stayed at the family of Abdullah, the husband of Mia, for about two weeks. They live in a house made of mud and concrete. From here we have done most of our research.

Before our trip to Morocco we did some preparation for the research we would do on site. For our camera project we handed disposable cameras to Mia (our informant). In this way she could hand the cameras over to several people in Morocco in advance and they could make pictures before we would arrive. We would be able to discuss the results with the photographers on site.

We planned to do the drawing assignment at the primary school in Aroumiatte, this did not seem a problem, all teachers were enthusiastic. We needed permissions from the head of the school though, and this turned out to be more problematic. After some visits, we were not able to get the permission. However, we did not give up and successfully pursued the assignment with some kids we found in the streets of the village, we did the drawing in the backyard of the house.

During our stay with the family, we slowly got to know the family better. People started to act more naturally around us, so we could observe the life of this family quiet well. We had most contact with Idris, a nineteen year old nephew of the family. He went to high school in Zagora and spoke English quite well. Our contact with him gave us a good perspective of the youth in this area. It made us more aware of the fact that the family of Abdullah and the perspective of Mia is not the way all people think and act.

Since we got to know the family better, we also slowly dared to ask more questions. After a few days we introduced the photo survey, which they perceived enthusiastically. They also spontaneously started to tell what they did and did not like about the different houses and what house they missed. They started to ask us questions as well. Note that all conversations we had were quite hard because of language matters. With some French, Arabic, pictures and with hands and feet we were able to communicate a bit.

We had many more informal talks, Abdullah sometimes suddenly started to tell stories, that Mia had to translate for him. Other moments we could react to the things that happened and ask Mia or Idris many questions. Our relation with Idris worked in two ways, we got to know about his life, and he got to know more about our life. Some facts had really shocked him, for example the fact that people could not be married and have children in Europe. His first reaction to this was: ‘But how?’ But he kept his interest and often started to tell more about the Moroccan system when he heard how different it was from Europe.

The last few days, when we had gotten to know the area better, we have made some analytical drawings of the village. Sometimes we walked together; sometimes Idris helped us, for example with finding all the public functions in the village. Some stores where not bigger than just a window, so hard to recognize at first sight.

On our last day in Aroumiatte we have interviewed Jawad Chahid of Réseau Associatif R.AZDED-Zagora. He had given us more knowledge of the plans, ideas and programme of the organizations and the government. The last evening in Aroumiatte we were invited for the engagement party of Najima, the sixteen year old daughter of Abdullah. This was a very nice experience, and also showed us again the big difference between men and women. As the men party was without any music and ended at eight, the women party had lots of music and dancing and ended after midnight.

The next morning we left to M’Hamid, where we did some research and work for Butterfly Works, a Dutch co-design studio with their goal to make a better world. In M’Hamid we stayed at a camp, in the middle of sand dunes, they planned to make more ecological. We have drawn all the existing water systems and other flows of gas, wood etc. for Butterfly Works. We have also made a small design for the new toilets and kitchen, in consideration with Ibrahim. Ibrahim had built most of the camp and is one of the owners. What fascinated us is that Ibrahim does care about the environment; he wants his camp to fit perfectly in the sand dunes. Therefore he doesn’t like the high water reservoir, which is needed to have more pressure for the showers, and...
wants to take it down and work with a bucket system. We have also gotten in touch with Sahara Roots, an organization that is planting trees in the desert, to slow desertification. The results of our time in M'Hamid are attached to the appendix of this document.

After four days in M'Hamid we started our trip back home, with one more day to spend in Aroumiatte. This had given us the opportunity to visit the renovated Kasbah Dar Hiba, that Jawad had informed us about. After again a long bus ride we had two days to spend in Casablanca before we returned to the Netherlands with a lot of information.
**B. INTERVIEW WITH REMCO ENSEL, DUTCH ANTHROPOLOGIST**

Interview with: Remco Ensel
Antropologist eacher at: Radboud University, Nijmegen
contact through: Samir Bantal -> Harry Stoomer -> Jeanneke den Boer -> Remco Ensel
Date: 24 October 2010
Location: Digital interview

**Introductie**

**Welke opleiding(en) heeft u gevolgd?**
“Antropologie geschiedenis”

**Waar heeft u gewerkt en werkt u nu?**
“Vrije universiteit, radboud university, niod freelance gottmer uitgeverij”

**In hoeverre is dit gerelateerd tot Marokko?**
“Via het onderwijs en een reisgids waar ik aan werk.”

**Etnische minderheden in Marokko**

In de dorpen rondom Zagora wonen verschillende etnische minderheden: Berbers, Sarahoui, Touareg en Haratin. Klopt dit?
Wonen er volgens u nog meer groepen in dit gebied?
“Zie het klassieke werk van Jacques-Meunié en mijn eigen Saints and servants in Southern Morocco en literatuur aldaar (o.a. vcia google books).”

“Je classificatie klopt, is ongelijkwaardig. Berber is indicatie van taal en tegenwoordig ook van etnische identiteit (bv ook in Nederland) maar een Hartani kan berber(taling) zijn en onder berbers vind je dus een sociale hiërarchie die iets zegt over betekenis van afkomst relatie tot produktiemiddelen etc.”

“Wel kun je als berbers betitelen de stammen als Ait Atta die van oudsher niet tot oasebevolking behoort maar er feitelijk wel al bijna honderd jaar woont.” (zie David Harts boeken over Ait Atta).”

“Dus:
Shurafa (afstammelingen van de profeet)
Mrabtin (afstammelingen van lokale heiligen)
Harar vrije niet gebonden (zonder verdere nobele afstamming)
Haratin (zie mijn boek)
Abid (afstammelingen van slaven)
Touareg is verraderlijke term: slaat op berbertaling bewoners in Algerije, Niger (zie bv Jeremy Keenan over Touareg en mooie oudere franstaling lit). In Marokko noemen sommigen (vooral jongeren tegenover buitenstaanders als toeristen) zich touareg, maar dan gaat het veelal om arabischtaalige (beni omar, reguiyat). vroeger ook joden!”

**Wat is de verhouding van deze verschillende groepen in dit gebied?**
“Sociale hiërarchie, kaste-achtig, afhankelijk van afkomst en relatie tot waterrechten en landbezit, en huidskleur ook wel. Ook gelijkheidsideaal via islam.”

**Hoe gedragen mensen van dezelfde etnische groep zich ten opzichte van elkaar?**
“Met respect naar boven toe (bv bij shurafa: aansprektitel van mulay, mijn heer, sidi of lalla (bij vrouw), niet vijandig maar soms gespannen of haratin met spot bejegend. Vooral met betrekking tot huwelijk problematisch. Wel wederzijdse afhankelijkheid in tal van opzichten.”

**Hoeveel waarde wordt er gehecht aan het behoren tot een bepaalde groep?**
“Ja, welke groep: als moslims? Marokkanen, etnische categorie of afstammingsgroep. Hoge aanzien is belangrijk, lage aanzien als haratin ligt moeilijker.”
Wat zijn de rituelen van de verschillende groepen?
“Misschien iets over ‘volksreligie’: religieuze bewegingen zijn wel soms naar etnische categorie georganiseerd bv aissawa (studie over meknes) is van haratin en soortgelijke ondergeschikten, gnawa is van abid.”

Waar ontmoeten de mensen uit dezelfde etnische groep elkaar?
Thuis of in het openbaar?
“Werk (bv landbouwwerk irrigatiewerk), openbare domein dorp plein en de moskee! Ook wel prive: soms werken lagergeplaatsten in huis bij hoger geplaatsten.”

Hoe relateren de verschillende groepen zich ten opzichte van elkaar? Accepteren zij elkaar of is er juist een strijd?
“Acceptatie en stille strijd (weet ik niet veel meer over).”

Wat is het verschil in hiërarchie en rijkdom tussen de verschillende groepen?
“Rijkdom: haratin en abid hebben over het algemeen minder grondbezit en waterrechten. Wel via migratiearbeid soms oude ongelijkheden op zijn kop gezet.”

Wonen zij in verschillende type woningen?
“Neen, klassieke segregatie binnen ksarwijken of wonen in twee verschillende ksars (eigenlijk ksour). Nu wordt er veel buiten de ksar gebouwd.”

De culturele context

Is er veel hiërarchie binnen de families? Hoe wordt deze hiërarchie bepaald?

Hoe belangrijk is het geloof voor de inwoners van de dorpen?
“Belangrijk. Over het algemeen is men behoorlijk strikt in de leer. Onder shuraaf is religie ook deel van hun identiteit en aanzien (niet roken en drinken voor hun aangezicht; segregatie vrouwen mannen, participatie religieuze rituelen als voorgangers en recitatoren).”

In hoeverre houdt de bevolking in de dorpen zich aan de religieuze regels en rituelen?
“Daar houdt men zich aan voor zover er met de ramadan er altijd de hand wordt gelicht in privéfeer.”

Woestijndorpen in Marokko

Veel mensen trekken weg van het platteland naar de grote steden. Wat zijn de toekomstperspectieven van de mensen die in de woestijndorpen wonen?
“Dat ligt moeilijk. Watertekort en opbrengsten van dadeloogst ligt altijd moeilijk, is wisselvallig. Tegelijk is leven in Casa duur en moeizaam. Dorpen schijnen wel leeg te lopen. Toen ik onderzoek deed was er geen of net electriciteit via algemene generator. Toen ik er voor het laatst was enkele jaren terug hadden mensen er een mobielte (en ik toen niet!) wat de communicatie al achterblijvend in dorp natuurlijk enorm vergemakkelijkte.”

“Toerisme (zie werk van geograaf Heinemeijer) zou ksour levensvatbaar moeten houden.”

Moet er volgens u geprobeerd worden de bevolking die in de dorpen woont daar te houden, of is het volgens u beter als zij naar de steden toetrekken?
“Misschien zoals nu: half-half. Dankzij migratiearbeid is leven in de oasen leefbaar.”

En waarom?
“Leven geeft wellicht meer betekenis en zelfrespect dan in achterbuurt – krottenwijk in Casablanca.”

Is er een officiële eigenaar van de grond rondom de dorpen?
“Verschilt per dorp. Grond is particulier en waterrechten zijn vaak per familie of eenheid van een stam.”
Mag iedereen zomaar iets bouwen op deze grond?
“Voor zover ik weet niet.”

Wie is verantwoordelijk voor de aanleg van waterbronnen en elektriciteit (en andere mogelijke faciliteiten)?
“Er is overheid maar per ksardorp is er veelal dorpscollectief dat dit organiseert. De rol van lokale overheid is in marokko problematisch (to say the least), reden wellicht waarom goede sanitaire, wegenaanleg elektriciteit in ‘mijn tijd’ niet geregeld werd.”

Wie is er verantwoordelijk voor de openbare weg die door de dorpen richting Zagora loopt?
Overheid. Hier was in mijn tijd altijd discussie over.

Wat moet er volgens u gebeuren in de dorpen van Marokko om de mensen een betere toekomst te kunnen bieden?
“Goede sanitaire, elektriciteit, steun aan lokale landbouw (dadeloogst en zelfvoorzienende tuin en landbouw) goede hoofdwegen, meer lokale inspraak?”

De politiek in Marokko

Wat vinden de inwoners van de dorpen van de vorige koning?
“Respect. Hoofd van de gelovigen, rol als ‘tiran’ mij onbekend.”

Worden alle ethnische minderheden hetzelfde behandeld?
“Vermoedelijk niet. Haratin achtergesteld.”

Wat wil de koning bereiken voor de inwoners van de dorpen?
“Wellicht steun voor zijn bewind zoals koningen altijd plattelandssteun mobiliseerden.”

Hoeveel invloed heeft de politiek op de inwoners van de dorpen?
“Er is wel een soort acceptatie van oude vaste gezagsverhoudingen met bv ait atta en shurafa als belangrijke collectieven.”

Hoeveel macht heeft de politie en hoeveel invloed hebben zij op de lokale bevolking?
“Je hebt politie en militaire politie. In zuiden speelt leger ook altijd een rol. In mijn herinnering is de politie niet degene met de meeste aanzien.”
C. INTERVIEW WITH HIND CHAFARI, ARCHITECTURE STUDENT OF RABAT

Interview with: Hind Charafi
Student of: National School of Architecture, Rabat
contact through: visit to the University in Rabat March 2009
Date: 28 November 2010
Location: Digital interview

About Hind Charafi

Where were you born?
“I was born in Safi, Morocco.”

Where did you grow up?
“I grew up in Safi (except from the time when I moved to Rabat to study)”

Where does your family live?
“My parents are still living in Safi with my little sister, my other sister and brother in Casablanca for studies and work and other sister in Marrakesh where she studies medicine.”

Which schools did you finish?
“I have finished: - elementary school (Safi, 6 years)
          - secondary school (Safi, 3 years)
          - High school (Safi, 3 years) and had the baccalaureate degree.
          - National School of Architecture (Rabat, 6 years education and graduation)”

Where do you want to live in the future?
“I think I can fit anywhere, so far I am checking my options to settle in New Zealand as it has been a dream of mine for sometime.”

In what kind of building would you love to live yourself? And why?
“A sustainable house, energetically independent, made of organic materials, will meet my needs in terms of habitation, for the simple reason that I care about the natural resources and as an architect and citizen of the planet, I think it is of my responsibility to contribute with what I can and know to make living and inhabiting less challenging for the nature and for the humanity.”

About your architecture studies at the University of Rabat

Why did you choose to study architecture in Rabat?
“This is a tough one actually, it was not a full decision but more like a happy coincidence, I “fell in love” with architecture on the first year of the studies, and then I decided to do architecture and become architect, it has this impact to control individuals and can strongly contribute in changing the future.”

“If the question is about why the choosing the university of Rabat specifically, the answer is that, by then it was the only school in the country.”

Did you learn a lot about the mud architecture from the villages? Or more about the modern architecture in the cities? Or more about global architecture?
“I’d say we learnt more about global/universal architecture.”

What did you learn about the architecture from the villages in the oasis of Morocco?
: It was a first year assignment; we made a trip to “Dadès valley, ait ben haddou kasbah” and were introduced to this type of architecture, the history, the different techniques used and how the population were benefiting from it.”

Did you ever do a design assignment about this? Can we see a picture or drawings of this?
“Yes we did, we had to design house of mud and made a model of it too, it was fun to work with it, unfortunately I don’t have any picture or drawings as it was a very early work. I remember trying to adapt the concept to the actual modern architecture, by designing a house that was made traditionally (mud techniques and concepts) and designed in a modern way from the inside where the facades were more like Kasbahs.”

About what types of architecture in the oasis villages did you learn? (ksour/igherm/Kasbah etc.)?
“We learnt about the Kasbahs, as the “ait ben Haddou Kasbah” was the case of the study, so we were more focused on that. We also studied about “Hassan Fathi”’s mud architecture in Egypt that was inspiring too.”

Did you learn about the concrete houses in the villages in the oasis?
“We knew that some mud constructions were replaced by concrete, it is concerning and we are fearful losing this beautiful heritage that is part of the identity of the country.”

Did you ever use mud as a building material in you design assignments? Why not or why did you chose for it?
“After the assignment I didn’t use mud as a building material, it has crossed my mind few times in the design process though didn’t dare using it because I was concerned about the integration of the mud building in the different urban context, like in Rabat, and also there was a concern around that the teacher will have some restrictions for such a project for some reason and because there are several other “modern” materials that have the same characteristics as mud.”

Do you want to choose mud as a building material for your future designs?
“Yes definitely, if I can find a strategy to integrate it in the actual context.”

About architecture in the villages in the oasis

Have you ever been to the villages in the desert of Morocco? If so, to which one?
“Ait Ben Haddou Kasbah, Valley of the Dades.”

What type of architecture from the villages do you think are beautiful?
“They are all beautiful, integrated to their environment and sustainable.”

Do you know people who live in the oasis villages? In what kind of house do they live and in what kind of house do they want to live?
“I don’t know people from those villages, I heard few times on tv how some of those villages are being deserted because many of their inhabitants decided to move to city houses and more urban areas.”

What do you think of the concrete houses in the villages in the oasis?
“I think they are destroying the image and the identity of the villages and that they are not fitting into the environment.”

Why do you think people choose to build their house from concrete and not mud?
“Probably because it is easier to build in concrete and because it needs less maintenance.”
D. Interview with Jawad Chahid of Réseau Associatif R.AZDED-Zagora

The organization

Does your organization work together with other organizations?
Before they were just one organization, but now they have a partnership with many organizations, that is also related to NIMAR with Cynthia Plette in the Netherlands. They work for development this area of Morocco, Zagora.

Do you build a lot in this environment with the organization?
“Building is of secondary importance. Our first priority is to help the people and mainly the women.
But preserving the traditional architecture in this environment is getting more important now, although we don’t take action within this subject jet we are talking with people about this issue. There are more than 400 Kasbahs with an important cultural history that are part of this area. Many people don’t see the importance of preserving this Kasbahs, the demolish parts an rebuilt new houses of concrete.”

Many Kasbahs we have seen are empty, the living standard has changed and people don’t want to live in there anymore. What is it that you want to do with these Kasbahs?
“It is important for the tourist sector, many tourist come here to see the Kasbahs. I have no problem with the building houses from concrete, but we have to respect the building method of the Kasbah. It is a very good method, the mud they used to use is very suitable for this climate. It is very cold in the winter and very hot in the summer, but when we use the traditional building method, we don’t have to heat or air-conditioning our buildings.”

“People leave the Kasbahs, but after this, the Kasbah may have a new function as for example the Kasbah of tourists. For example there is this hotel Kasbah Dar Hiba in the small village Tizergat near Aroumiatte, this hotel is a modernized Kasbah for tourists, it is built in respect for the Kasbah. It is a good idea, it respect the building method of the Kasbah and it is a progress.”

Except for keeping the history, what kind of projects are you doing and what do you think is important in this area?
“We are especially concerned with the youth and women. They should both empower their capacity and women should get more rights. They don’t build as an organization, but empower people to build.”

“38% is analphabetic, this is not improving. Their association has a project for this for 9000 people, especially women, because there are more women illiterate than men. They are fighting against illiteracy.”

“There are about twelve small hospitals in this area, but they are not in use, since there are no doctors. Their organization has stimulated the government to provide educated doctors who could work in this buildings. They for example get doctors from other places in Morocco to work in the hospitals in this area. There is a same problem with teachers. Last year there was a big shortage on teachers, now the state has provided teachers for this area and there is improvement.”

Projects for women

What kind of projects do you do with women?
“They are fighting illiteracy and think about what happens after women have learned to read and write. The projects they provide take about three years. The first year is to learn to read and write. The second year is to empower them to use what they have learned and integrate in the society. The third year they work with them on how they can create their own projects by discussing possibilities with them, this way they motivate them to stay and carry on.”
What kind of projects could this be?
“An example is that we have provided lambs for forty women. Because this is an area of nomads and cattle the women know a lot about cattle. They will let the lambs grow and get lambs from this sheep, which will provide the women larger cattle. But this is an easy example, the bigger projects are just coming known, they are more difficult to accept.”

Why do women need to learn to write and read for this?
“The majority of women are illiterate. The women need motivation to do something, to fight to get something. How can they manage the project without knowing the read and write? The first year we learn them the basics. When they do the project they will be able to make their own account about what they have, they will be able to count and trade. The philosophy of our association is that the women have to learn it step by step, starting with this basics.”

Do the men allow the women to join or do they want to join themselves?
“In Zagora men don’t come for education, since they are too proud. We have one class with about 25 men. Women are often more motivated to learn and their husbands mostly allow them to join, in some other regions of Morocco this is more difficult, since the men has more control over the women, but here that is not such a big problem.”

“Women are happy with small things, like learning to write, they want to learn and empower themselves and make effort. Men often want everything at once, but they don’t have the capacity for this and then they fail.”

How do the women for this project get in touch with you?
“The women are not all the same. We have eight representatives for the women in our network. To mobilize women we just have to call the one that represents the women, the representative person will go to the village to talk with the women. It is easy and quick to reach them this way. It is most easy to gather women in villages, but it is very hard to get the women from the village to the city.”

Projects for the youth

What kind of projects do you do with the youth?
“We are working together with local and national associations for the youth. We are now working in this area on a program that is called ‘one hundred hours of success’. Within this programme we educate the youth for three major parts. The first part is to learn about life skills, about how to make relations to other people etc. The next step is about how to manage their money. The third step is to empower people and help them to make their own projects.”

“We also work with another national organization called ‘youth action’, that is active in Zagora since 2004. Yesterday we have had a meeting with this organization to make a strategy plan for 2011, 2012 and 2013. This plan is not yet finished. With this organization we are working on empowering youth capacities and political participation of the youth. Because there is the problem in Zagora that the youth does not vote, they bring themselves out of the circle of policy. With this program we are motivating the youth to vote and to participate in politics. We are working with about 25 youth of the age between 18 and 35 (both boys and girls) and with ‘youth action’ to make a strategy plan for three years away. Because we want to evaluate after this three years what we have done and what we have not done yet.”

How do you find the people to participate with your programme?
“It is difficult to find people who want to join. We have to motivate the youth to join. When they come we tell them that what they do is very different from what politicians do. We have a committee on every high school. The youth is critical with the government, they have a lack of confidence with everyone who wants to help them. There is so much they can do or participate in. The youth is more critical and it is more difficult to convince them to join them the women in Zagora. Sometimes more girls than boys participate with the programs.”

“There are twelve groups of ‘youth action’ in cities in Morocco, now we have the biggest group that participates in Zagora. I thinks this has to do with the fact that Zagora is quiet small, if you ask someone in Aroumita, they will know about ‘youth action’. In big cities like Casablanca it is much more difficult to mobilize the youth.”
Future prospects and the government

What could be a new input in this region to provide a better future?

“I don’t know, but I think the future will be good. Because if we compare the situation now with the past, it is better now. If we compare here with the West, I think for me it is also good. If we compare Morocco with the other Arabic countries the situation in Morocco is very good.”

Many people from this region leave Zagora to earn money at another place and send it to their families. Aren’t you afraid that when the people have better education, that they leave Zagora?

“I think it is not a problem that higher educated people leave Zagora. If someone can find better conditions in Casablanca, it is better to go to Casablanca. We have another problem here, we have big families with about 18 or 20 people with just one bread owner in the Kasbahs, but this is changing now. Still it is difficult to stay here and earn money, although I think the problem of people leaving this place is going to blow away. Alim for example has lived in Casablanca for three years, but now he has come back, because he has discovered there was something to do here now. Many people who have left come back later. The authorities work to create better circumstances in Zagora.”

“In some villages there is also the problem of how to earn money. The majority of villages live of agriculture. Since about eight or ten years they are suffering from drought. Despite this, many people stay here. Since 2002 many people come back to Zagora. For example now with the big fest, everyone is coming back to visit their families.”

Do you also need permission to build a house?

“Since 2008 it is also obligated to have a license to build a house. Before this everyone could build, but this was a problem. All houses that have been built after 2008 without a license have recently been demolished. To get the license you have to show what you want to build, you cannot build everything. Before 2008 the commune of the village decided what could be build.”

What kind of building, like a school or hospital, do you think should be build? What do the people need? Or do you think there are enough building already?

“There is just one hospital and there are two high schools and two colleges in the centre of Zagora. We need more than that, we need another hospital. But the problem is, we can build, but the experts that should work in there are not here.”

Is a lot of money of the government spent in this area, or do they spent it more in other regions?

“There is quite a lot of money of the government spend in this area. They raise the budget for health and education.”

Where does de money for the projects come from?

“The money comes from the government and organizations. But only if we have the same strategy as they have. The government only provides money if it is written down in their planning. We can work in national and international partnerships with organizations that have the same principles as we have. We refuse the partnership if they have different strategies. Especially the American organization have very different ideas. They are looking for another thing, not really to help.”
E. OVERVIEW LOCAL BUILDING MATERIALS, WHERE THEY COME FROM AND WHAT THEY ARE USED FOR

The next pages will show an overview of the building materials that are currently being used in Aroumiatte. It will show where they come from, how they are treated and what they are used for. The materials that are being discussed are: Mud, jagged and rounded stones, acacia & tamarisk, palmwood and -leaves, reed, straw, wool, wood, plastic, cement, steel and the re-used materials: fabric, heavy garbage, empty oil barrels and plastic.
MUD

Earth / desert 

Mixed with water at least one day in advance

€ free

Mud stones / old type and new types

Ramped earth walls

Roofs

Mud finishing
STONES // jagged

mountains → assorted

foundation
(reinforcement) walls
tent pins

€ low / free
STONES // rounded

river → assorted

simple walls

roads

ug

reinforcement mud finishing and walls

€ low / free
ACACIA & TAMARISK

Trees in the desert
Acacia / Tamarisk

chopped

bowed wood structures
columns of nomad tents
other structures

€ free / medium
PALMWOOD & LEAVES

palmgarden ➔ dried in the sun

E low

beams of tree-trunks
fences
roofs
REED

palm garden

$\text{low}$

dried & woven

fences

roofs
STRAW

palm garden → left over of wheat → reinforcement mud stones

€ low → reinforcement mud finishing
WOOL

sheep → woven or skinned → carpet → praying mats

medium
CEMENT

big cities

imported

€ medium / high

concrete lintel

cement blocks

concrete columns and beams

cement between bricks

finishing walls
STEEL

big cities

imported / treated in Aroumiatte & Zagora

€ high

doors

windows

reinforcement

street furniture
FABRIC // re-use

old clothes  →  collected

€ free / low

carpets

tents

roofs
HEAVY GARBAGE // re-use

heavy things → thrown away → roofs of sheds

€ free
EMPTY OIL BARRELS // re-use

oil barrels → empty → dike reinforcement & doors

€ free
PLASTIC // re-used

garbage → collected

€ free

rests → tents

roof
F. VEGETATION

The desert is famous for its special climate, hot during the days and cold during the nights. Because of this outstanding climate and the lack of water, vegetation is rare. At places where there is access to water, vegetation starts to grow, this want we call an oasis. Still only particular plants and trees grow in this desert climate. This chapter will explain and introduce some of the vegetation that is growing in the area of Aroumiate and what possibilities there are regarding vegetation in the village.

Vegetation we saw in the oasis
The oasis is from origin the fertile land in the desert. People use it for agriculture, in history it was their main source of food. Nowadays most food is imported, but people still have their fields of crops and it is still one of the main incomes of the inhabitants of the villages. Although the importance is less since the import of food from the north is big. To have agriculture in the oasis is really intensive. It requires a lot of work to get the water into the fields. A whole irrigation system has to be constructed and is intensive to conserve. Crops that they grow in the fields are Lucerne or Alfalfa, Barley, Sorgum and Millet.

Lucerne or Alfalfa
This plant is quite easy to grow. It can survive long dry periods because of its strong and deep reaching roots. The plant can germinate all year long so it can get reaped whenever during the year. It is used to feed animals but the seeds, the alfalfa, also are used as food for humans.

Barley
Barley is a cereal grain and is family of grass. Barley is used as an animal fodder but also is soups and bread.

Sorghum
Sorghum is an important food crop in Africa. It is a grain that functions as main ingredient to make bread. It can also be used as animal fodder, alcoholic beverages or even to produce bio fuels.

Millet
The peeled millet grain is used to make couscous. It is one of the most important food sources.

Carrot, Corn and Parsnip
Those are some of the few vegetable they eat. They are eaten in the tagine or with couscous. Corn you only see rarely though.

Date palms
The date palms are all over the oasis. There are male and female palm trees, only the female palms produce dates. There are also a lot of different kinds of palms. Some of them produce dates that only can be used as animal fodder, others give really sweet and soft dates. The palms are standing clustered and sometimes farmers have agriculture around the trees in the land. Dates are the most important export product of the oasis. Besides that, it also is one of the most important food sources for own use. Nomads can walk for a long time through the desert only eating dates, it gives a lot of energy they say. Because of the high value of the dates in the region, it is really intensive to own date palms. In the period that the dates are ripe farmers and their family need to be around the palms to protect them from robbers. Nomads are coming to the oases to pick all dates that fell from the tree on the ground. There is an unwritten rule that allow nomads to pick all fallen dates from the
ground. Dates still hanging from branches are not allowed to touch. When the farmers reap the dates they put a blanket underneath the tree and start to shake the tree. Dates will fall down on the blanket, all dates can get picked up in once by closing the blanket. Besides the important value of food source and economic reasons, the palm leaves and wood is also used for buildings.

Henna
Henna is used to dye skin, hair, fingernails, leather, silk and wool. They use it actually only with special occasions, like marriage or engagement parties. They grow henna plants in fields in the palm garden. After reaping the plants, leaves need to dry and pulverize. When using the powder, it is mixed with water and often a little gasoline and functions as paint.

Vegetation we saw in the village
The village is built on the border of the oasis, the ground is more solid, drier and not so fertile. So better to build on but harder for plants to grow. There are some plants that are able to grow in the dry solid ground though, especially small bushes and trees.

Villagers in Aroumiatte have a special relation with plants and trees. Because the desert does not allow too many plants to grow by themselves, the villagers try to grow them in and around their houses. It gives some shadow in the open spaces in the houses and in front of the door in the public space. But it also gives a nice sight and a comfortable feeling to hang around.

Besides it also attracts life; birds and other animals are lures by the trees and plants. Sometimes villagers also grow food in or around their houses. Because it is hard to grow plants in the dry and hard ground of the village, we saw a few plants that everyone used. So we know for sure that those plants will survive in and around the village.

Trees
There are some trees that are able to grow in the solid dry ground of the area. Still it is hard for the trees to survive their first years. They do not have roots that are going deep down in search for water yet. And there is a big chance they die before the time their roots reach deep.

The tree that you see the most is the Acacia Raddina, or twisted Acacia, it can grow over ten meters high and has a parasol form. Then there is the Acacia Ehrenbergiana wich grows up to four meters and the Maerua Crassifolia that grows up to seven meters high. All those trees were used as fodder for animals, fuel wood and for medicinal purposes. It is used as wood to make tools and parts are used to make tents. Sometimes it is also used to fertilize and stabilize the soil.

The Acacia trees have large spikes, those can be dangerous when walking through the desert. The nomads for that reason make special sandals made of car tires. This rubber is very strong and avoids the spikes stinging into your feet.

Another much seen tree is the Tamarix, which can grow up to fourteen meters. This tree can only grow at places where the reach for water does not go too deep, five meters as a maximum. They use a lot of water and for that reason they are sometimes seen as a weed that takes all water away. They are often used to keep sand dunes in their places.

You can also find small palms in the village, people like this tree and grow them in front of their houses. Also Sorghum is sometimes growing in front of houses, probably because it is a high but narrow plant that can provide some privacy, it functions as a wall.

Furthermore there are some climbing plants that grow in front of the houses, which look very nicely green and provide shade for the façade.

Opportunities
Two opportunities that might be valuable to the local situation will be discussed. One is the Groasis waterboxx and the other the possibilities of Sorghum as a building material.

Groasis
The Groasis waterboxx is an invention of 2010, of a Dutch flower bulb farmer, Pieter Hoff. He founded his company AquaPro Holland, and brought the invention on the market. The Groasis waterboxx is a biomimicry technology, it is an artificial copy of how Mother Nature solves the problem. With the waterboxx, eroded areas like deserts, often caused by human activity, can be
restored with little effort and at low cost.

The Groasis waterboxx is made from 100% recycled plastic. The box is using the climate of the desert, really hot during the days and really cold at nights, in a smart way. It is capturing and producing water from the air through condensation and possible rain. When installing the box you need to water it once when placing it and the rest will do. When the tree grows big enough to get water via its roots, the box needs to be removed and can be re-used. In moderate climates the Groasis waterboxx causes 15 to 30% faster growth and thus more biomass.

<table>
<thead>
<tr>
<th>Planting in the desert with the Groasis waterboxx</th>
<th>Planting in the desert without the Groasis waterboxx</th>
</tr>
</thead>
<tbody>
<tr>
<td>88,2% OK</td>
<td>10,5% OK</td>
</tr>
<tr>
<td>11,8% Weak</td>
<td>89,5% Dead</td>
</tr>
</tbody>
</table>

Tests have shown that the trees, after the Groasis waterboxx is removed, continue to survive. This proves that planting with the Groasis waterboxx and afterwards removing the device is a secure way of planting trees everywhere.1

When we visited M’Hamid for our small project in the camp of Ibrahim and Halimm, the Dutch organization SaharaRoots was doing a project with the Groasis boxes. They installed and planted tamarisk trees around the camp in the middle of the sand dunes. The trees had been planted 3 weeks before we arrived, now they were back to see the progress they had made. They showed us how the boxes worked. It was amazing to see how the boxes captured the water while the surrounding was so dry, the sun was shining on it and the temperature was so high.

Sorghum

The rest stalks of the sorghum, after reaping, can be used to make a decorative millwork material marketed as Kirei board. The stalks are twined together and glued into big particles. Those particles can be sawn into plates for use. It can be used as material for furniture, wall finishing or floors. The produce of the material is sustainable and does not damage the environment.

It is hard to grow plants and trees in the oasis area. Still there are some plants that are adapted to the high temperatures and the often absence of water. The crops that are growing in the oasis used to be very important for the villagers, nowadays they import a lot of food from the north. But still there is some activity in the oasis area.

The villagers do appreciate plants and trees around their houses. They start to grow them to border some space in front of their door or they gather some shadow in front of the house. They are watering them by hand to make sure they will survive.

It is hard for small, new trees to survive because of the lack of water. There are some inventions that made it possible to grow new trees with an 88% survival.

Conclusion

1 www.groasis.com (4th of January 2011)
G. RESULTS OF FOUR DAYS' WORK IN M’HAMID

We have been working for four days in an eco-logde in M’Hamid for the organization Butterfly Works.

One of our assignments was to map the water system, machines and other in’s and out’s of the camp. The other assignment was to help the owner with the design for a new, more open, kitchen and for a new sustainable toilet system. We have made the designs in collaboration with Ibrahim, who is one of the owners of the camp and has designed and built the camp himself.

The next pages will show the results of our four days’ work in M’Hamid.
PLANS & PICTURES OF THE SYSTEMS IN THE CAMP, M‘HAMID

* Plan of the camp with the water system (scale 1:200)
* Plan of the camp with all installations (scale 1:200)
* Plan of the camp with in’s and out’s (scale 1:200)
* Plans of kitchen, incl new proposal (scale 1:50)
* Plans of toiklets & shower, incl new proposals (scale 1:50)

Produced by: Maaike de Visser & Loes Goebertus, architecture students, Technical University Delft
26-11-2010
water system

01. well and pump

02. reservoir

03. tube from filling reservoir

04. reservoir

05. tubes from reservoir, to heater and to showers, toilets and sinks

06. tubes to shower
water system

07. rainwater from roof
08. underground tube from hamam to garden
09. tubes to showers, toilets and sinks

10. tubes to shower
11. tubes to sinks
12. tube over ground to the kitchen, with a leak
water system

13. tube to kitchen, going underground

14. tube to kitchen going into the building

15. gap for new planted trees and grass, surrounding the camp
installations

01. water well + pump
03. water heater
04. old reservoir (not in use)

05. new reservoir (in use, high for shower pressure)
06. wood oven (outside)
07. grand fire place, in the middle of the camp
installations

07. small fire place

08. gas lamp

09. gas for cooking

09. cooking pit, on gas

10. gas oven (inside)

11. grill (outside)
IN's & OUT's

Sewing on 700 guests a year.

In total we are calculating with the new bathroom showers and Turkish toilets. In total we calculated the existing use.

1. Sanitary
   - Water [min] per week
   - Tags
     - Washing hair 21% of bucket with 15 liters is used — 350 liters a year
     - Hair washing 15% of bucket with 2 liters is used — 350 liters a year
     - Bathtub washing 5% of bucket with 6 liters is used — 2100 liters per year
     - Total: 340 liters of hot water and 140 liters of cold water = 1440 liters of water.
   - Walking (fosh 1 & brushing teeth) — 1400 liters of water a year.

2. Outside use
   - Water [min] per week
   - Tags
     - Turkish Water
       - Necessary: 1 liter of water = 750 liters of water a year
     - Foss: 5 liters of water = 45 liters of water a year
     - Total: 119 liters of water a year.
   - Cleaning flushing toilets: 2 liters of water each flush = 1440 liters of water a year.
   - Cleaning 10 liters of water each time (cleaning is once a 2 days during high season and once every 4 days during low season) — 735 liters of water in high season = 860 liters of water during low season.
     - Total: 1695 liters of water a year.
   - Cutting (fosh): 30 liters of water each time (fosh is once a 2 days during high season and once every 4 days during low season) — 735 liters of water in high season = 860 liters of water during low season.

3. Kitchen
   - Water [min] per week
   - Tags
     - Gas: 1 liter of gas = 86 liters of gas a year
     - Cooking: 1 liter of gas = 86 liters of gas a year
     - Total: 165 liters of gas a year
   - Cleaning:
     - Knife: 1 bottle of gas (5 liters) a week — 35 liters of gas a year
     - Ovens: 1 bottle of gas (5 liters) a week — 35 liters of gas a year
       - Total: 165 liters of gas a year
   - Wood [min]
     - Grill: 1 bottle of gas (10 liters) a week — 35 liters of gas a year
   - Total: 300 liters of gas a year

4. Laundry
   - Tags
     - Bathtub washing 5% of bucket with 6 liters is used — 2100 liters per year
     - Total: 1440 liters of water a year.
   - Dishwashing
     - 40% of guests = 280 liters of water a year
     - Total: 280 liters of water a year.
   - Foss: 5 liters of water = 45 liters of water a year.
   - Total: 195 liters of water a year

5. Outside use
   - Water [min] per week
   - Tags
     - Grilling: 1 bottle of gas (10 liters) a week — 35 liters of gas a year
     - Total: 280 liters of water a year

6. Food
   - Tags
     - Food: 1 bottle of gas (5 liters) a week — 35 liters of gas a year
     - Ovens: 1 bottle of gas (5 liters) a week — 35 liters of gas a year
     - Total: 70 liters of gas a year

7. Other Materials
   - Tags
     - Soap: 1 bottle of soap (10 liters) a week — 35 liters of soap a year
     - Total: 35 liters of soap a year

8. Cleaning
   - Tags
     - Cleaning: 1 bottle of gas (5 liters) a week — 35 liters of gas a year
     - Ovens: 1 bottle of gas (5 liters) a week — 35 liters of gas a year
     - Total: 35 liters of gas a year
existing kitchen 1:50

measurements and use

ACTIONs
1. cutting the meat
   on the table
   (sitting on the floor)
2. doing the dishes
   on both sides
3. cooking
4. preparing food
5. baking bread
new plans for kitchen 1:50
changed: a more open kitchen, more kitchen space and an extra door for a better routing.

--> we advise the drawing on the right: the cooking island
existing toilets & showers 1:50

three showers, two toilets and one turkish toilet
new plan: turkish toilets & bucket showers

- Hot water for the bucket shower is being made by heating the steel reservoirs from below with fire (wood) from the outside.
- Cold water comes from the sinks and tap.
- Grey water from the tap and sinks flows to the showers by an open drainage system in the floor.
- Grey shower water can be used for a garden right behind the showers.
- The garden can be protected from sand and animals by a small mud wall and plastic cover.
new plan 2: eco-toilets 1:50
-half of them in use, other half is composting
-old showers and toilet space becomes space for bucket showers, with two heaters (like the showers from the first plan)