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SCHOOL OF INFORMATION TECHNOLOGY  
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TITLE:

TOWARDS APPROPRIATE USER INTERFACE DESIGN PRESERVING RURAL  
AFRICAN COMMUNICATION PRACTICES: LISTENERS' ROLES IN FACE-TO-  
FACE COMMUNICATION

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REQUIREMENTS OF MASTERS OF INFORMATION TECHNOLOGY AT THE  
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## **Declaration**

I, Shilumbe Chivuno born on the 16<sup>th</sup> September 1973 at Lusaka, Lusaka province, Zambia hereby declare that the work contained in the mini-thesis for my M-Tech thesis, entitled: "Towards Appropriate User Interface Design Preserving Rural African Communication Practices" is my own original work and that I have not previously in its entirety or in part submitted it at any university or other higher education institution for the award of a degree.

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## **ACRONYMS**

AR	Action Research
ATM:	Automated Teller Machine
CSIR:	Council for Scientific and Industrial Research
EAC:	Embodied Conversational Agents
HCI:	Human Computer Interaction
ICT:	Information Communication Technologies
IK:	Indigenous Knowledge

## **Abstract**

This mini-thesis examines different socio-cultural norms and communication behaviours of indigenous communities. In spite of existing Information Communication Technology (ICT) infrastructural challenges, the software solutions that have been designed for rural communities have been a major concern.

In this thesis, qualitative methodologies were used with deliberate sampling of two village populations to investigate verbal and non verbal behaviour.

In order to design appropriate interfaces for Indigenous Knowledge Management systems required to capture, store and retrieve local information, the input from target community members, regardless of their levels of formal literacy education, has to be explored. The fact that in those communities, communication takes place primarily through oral transmission also has to be considered. Oral communication involves both narrators and listeners who engage in an interactive correspondence including verbal and non verbal communication during storytelling. Many researchers focus on narrators but in this thesis, we will concentrate on listeners' contributions during interpersonal communications in rural communities. Non verbal communication such as gestures are prevalent in traditional oral African communities and these can offer rich information that can be infused in interface designs for human computer interaction. The aim of this mini-thesis is to identify general socio-cultural norms, communication behaviour such as non-verbal communication structures (gestures) including general verbal utterances of the rural Otjiherero speaking people to provide a basis for subsequent use in the design of local systems.

The findings in this thesis were that gestures thought to be universal were specific to the rural members. It was also found that there were specific verbal and non verbal gestures that were observed.

This Thesis recommends more research be done in the areas of the correlation between gesture and verbal communication.

*Keywords:* Indigenous Knowledge, Gestures, user interfaces, cultural interfaces

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## Table of Contents

Declaration .....	i
Retention and Use of Thesis .....	ii
ACRONYMS .....	iii
Abstract .....	iv
Acknowledgements .....	vii
List of Figures .....	x
List of Tables .....	xii
CHAPTER 1: INTRODUCTION .....	1
1.1 Introduction .....	1
1.2 Urbanisation .....	1
1.3 Storytelling and oral cultures .....	2
1.4 ICT Interventions .....	3
1.5 Human Computer Interaction user interfaces issues .....	4
1.6 Research Problem .....	5
1.7 Objectives .....	5
1.8 Challenges .....	6
1.9 Motivation .....	7
1.10 Research Scope and Limitations .....	8
1.11 Positive Contributions .....	8
1.12 Thesis Outline .....	9
CHAPTER 2: LITERATURE REVIEW .....	10
2.1 Background and Context of work .....	10
2.2 Indigenous Knowledge .....	11
2.3 Western versus Local system Design .....	12
2.4 Communication .....	15
2.5 Gestures .....	17
2.6 Cross-cultural Communication Theories .....	20
2.7 Low Context and High Context Communication .....	22
2.8 Listener communication .....	23
2.9 Embodied Conversational Agents .....	25
CHAPTER 3: RESEARCH METHODOLOGY .....	27
3.1 Research Approach .....	27
3.2 Research Setting and Participants .....	28
3.3 Methods .....	30
3.3.1 Data Collection .....	30
3.3.2 Ethnography .....	31
3.3.3 Interviews .....	31
3.3.4 Action Research .....	32
3.4 First Community Visit .....	33
3.4.1 Reflections on First Visit .....	34
3.5 Second Community Visit .....	34

3.5.1 Reflections of our Second Community Visit .....	35
3.6 Third Community Visit .....	35
3.6.1 Scenario 1 .....	36
3.6.2 Scenario 2 .....	37
3.7 Fourth Community Visit .....	37
3.8 Height Gesture Experiment .....	37
3.9 Annotations .....	38
3.9.1 Coding .....	39
CHAPTER 4: RESULTS.....	40
4.1 Results .....	40
4.2 Observations and findings from first community visit.....	40
4.2.1 Non verbal observations.....	40
4.2.2 Verbal Results of first community visit.....	41
4.3 Observations and findings from second community visit.....	42
4.3.1 Non verbal observations from second community visit.....	42
4.4 Observations and findings of third Community Visit .....	45
4.4.1 Non Verbal Results of Scenario 1 .....	45
4.4.2 Head Posture Results .....	46
4.4.3 Leg Posture Results .....	47
4.4.4 Arm Posture Results.....	48
4.5 Verbal Results of Scenario 1 .....	50
4.5.1 Time between verbal feedback from listeners “eehees” .....	50
4.6 Results of fourth Community visit .....	52
4.6.1 Gesture recognition Experiment .....	56
4.7 Height Gesture Experiment .....	59
CHAPTER 5: DISCUSSION AND IMPLICATIONS FOR HUMAN INTERFACE DESIGN .....	64
5.1 Discussion .....	64
5.2 Agent design Recommendations.....	68
CHAPTER 6: CONCLUSION .....	71
6.1 Summary .....	71
6.2 Research Questions.....	71
6.2.1 What socio-cultural norms and behaviour should be considered when designing user interfaces for IK capture? .....	71
6.2.2 What are the typical verbal and non verbal communications of listeners during interpersonal conversations?.....	72
6.2.3 How can the socio-cultural and communication behaviour be used to design appropriate user interfaces?.....	72
6.3 General Conclusion.....	73
6.4 Further Work .....	74
7. Bibliography .....	75
8. Appendices .....	83
Appendix A.....	83
Appendix B.....	84
Appendix C.....	90

## List of Figures

Figure 2.1: Overview of Verbal and non-verbal interpersonal communication.....	p.16
Figure 2.2: Gesture space.....	p.19
Figure 3.1: Map of Namibia.....	p.29
Figure 3.6: An interview session with local community members.....	p.37
Figure 4.1: An interview session with local community women.....	p.44
Figure 4.2: Gestures of narrator and listeners during slaughtering narration.....	p.52
Figure 4.3: Listener 1 making a gesture with left hand pointing down.....	p.36
Figure 4.4: Listener 2 making gesture with right hand pointing upward and left hand in the lap with crossed legs.....	p.37
Figure 4.5: Listener 2 depicting gesture with both hands up.....	p.37
Figure 4.6: Narrator gestures with left hand to the side and listener 2 gestures with right hand only.....	p.38
Figure 4.7: Narrator gestures with left hand and listener 2 points downwards with right hand.....	p.38
Figure 4.8: Listener 2 puts left hand towards his face.....	p.39
Figure 4.9: Listener 2 left hand is on the face and the narrator points and looks upwards.....	p.39
Figure 4.10.: Narrator is looking upward with right hand also up and Listener 2 has left hand on the face.....	p.40
Figure 4.11: Gesture Recognition Experiment at Site 2.....	p.56
Figure 4.12: Gesture Recognition Experiment at Site 1.....	p.57
Figure 4.13: Elder lady Showing gesture for height of an animal.....	p.58
Figure 4.14: Showing gesture for height of a child.....	p.58

Figure 4.15: Gesture to depict height of a child.....	p.59
Figure 4.16: Gesture that shows height of a child.....	p.59
Figure 5.1: Spatial proximity of narrator and one of the listeners.....	p.62

## **List of Tables**

Table 4.1: The transitions from one head posture to another for listener 1.....p.47

Table 4.2: Transitions from one leg position to another for listener 1.....p.49

Table 4.3: Transitions from one arm posture to another for Listener 1.....p.50

Table 4.4: Time between verbal utterances of Listeners.....p.54

# **CHAPTER 1: INTRODUCTION**

## **1.1 Introduction**

In rural African communities, local knowledge has been passed on from one generation to another through oral communication practices, with storytelling being one of the most common methods of sharing information (Sherwani, Ali, Penstein, & Rosenfeld, 2009). Local knowledge also recognised as indigenous knowledge (IK) is collectively shared information among local societies' members that is expressed in beliefs, socio-cultural norms, experiences and the village livelihood (Adam, 2007; Thinyane, Dalvit, Slay, Mapi, Terzoli, & Clayton, 2007). Indigenous knowledge has for centuries contributed to sustainable development of communities in many aspects of their livelihoods, including their health, animal husbandry, natural resource management, and agriculture (Adam, 2007; Grenier, 1998; Thinyane et al., 2007; Bidwell, Reitmaier, Marsden, & Hansen, 2010; Winschiers-Theophilus, Bidwell, Chivuno-Kuria, & Kapuire, 2010).

## **1.2 Urbanisation**

Rural-to-urban migration caused by rural members' aspirations for employment and formal education opportunities, population growth, and environmental degradation has generally resulted in a decline in the transference of traditions and cultural knowledge between generations (Adam, 2007; United Nation Population Fund, 2007; Winschiers-Theophilus et al., 2010; Shapi, Cheikhyoussef, Van Kent, Sifani, Mumbengegw, & Matengu,

2011). It is important to capture, and store IK in order to preserve it and make it accessible for the present and future generations (Bidwell, 2011; Winschiers-Theophilus et al., 2010).

### **1.3 Storytelling and oral cultures**

In the African context, storytelling is a primary mode of knowledge transfer, and consequently this generational information risks being lost permanently because it is otherwise not written down or stored for future generations (Bidwell et al., 2010; Winschiers-Theophilus et al., 2010). In order for this body of knowledge to be preserved, digital media, as availed through Information Communication Technologies (ICT) could offer a solution for current and future generations (Adam, 2007; Bidwell et al., 2010 ;Winschiers-Theophilus et al., 2010). ICTs are a “diverse set of technological tools and resources used to communicate, and create, disseminate, store, and manage information. These technologies include computers, the Internet, broadcasting technologies (radio and television), and telephony” (“ICT in Education”, 2011*i*). In storytelling communications, there are the individual(s) who tell the story who we will refer to as the narrator(s) and member(s) who listen to the stories, referred to as a listener(s) in this thesis. The narrator is the storyteller while the listener is the message receiver and the one who gives feedback to the narrator. The narrator and the listener are both important in a storytelling experience (Gardner, 1998). The narrator relies on listeners’ characteristics such as gender as well as on the feedback received from the listener(s) to

contextualise and texture his/her story (Kraut, Lewis, & Swezey, 1982; Gardner, 1998).

## **1.4 ICT Interventions**

In many instances the absence of internet connectivity infrastructure, lack of access to electricity, and the relatively high costs associated with most ICTs compounded by other underlying factors such as poverty have been responsible for the relatively low uptake of ICT in rural communities. In contrast, and in a phenomenon that has been experienced throughout the developing world, ICTs have showed promise in offering concrete solutions to the current challenges faced with the dissemination of IK despite the low formal literacy educational and ICT literacy backgrounds (Sherwani et al., 2009; Bidwell et al., 2010). Most IK management systems utilise database models for storing and retrieval operations however, the interfaces used are usually not appropriate for mapping rural African communication customs. In other words ICT systems are based on western designs and are not suited for African rural societies because the socio-cultural norms and communication behaviours are not considered (Winschiers-Theophilus et al., 2010).

In view of the fact that face-to-face communication is the general communication method in rural African societies for the transfer of IK, appropriate technology can be used to support capture, storage, and dissemination of IK through storytelling as demonstrated by Bidwell et al. (2010). For example, an ICT application was designed by Thomas Reitmaier, for facilitating rural communities' members of the Eastern Cape of South Africa

to record and share their stories (Bidwell et al., 2010). Besides the technology issue, a major problem in ICT IK solution uptake is at the user interface level where human computer interaction design principles are not considered for the targeted community.

## **1.5 Human Computer Interaction user interfaces issues**

Human computer interaction is a field of study that specialises in the interaction between humans and computers.

In the thesis, we will focus on IK capture from one of the Herero village elders for younger people using storytelling and therefore we need to design user interfaces that are aligned to the socio-cultural norms as well as communicative behaviour of this community. Dialog systems are natural interfaces that can be incorporated with human-like virtual characters and would be a proposed interface solution for the project. A conversation agent and is a system that can be used to converse with a human being by incorporating communication methods such as speech, text and other communication behaviour (Cassell, 2001). Various researchers including Cassell et al., (2000), Rehm et al. (2007) propose the use of Embodied conversation agents (EAC) as an alternative interface to depict culture specific interaction. EACs are dynamic, animated, computer interfaces that possess human features and use many of the human characteristics of face-to-face conversations (Cassell, 2001). Most of the research experiments on EACs involve the narrator's contribution in conversation (Rehm et al., 2007; Cassell, 2001). We envisage that the future IK system will capture stories from

narrators. We will therefore explore the idea using a listener agent for the system's interface since the listener is also essential in real life storytelling scenarios. A listener can assist the narrator in forming the context of the story and giving verbal and non-verbal (gestures) feedback in order to encourage conversation (Cassell et al., 2000; Gardner, 1998; Kraut et al., 1982). A gesture is a non verbal body movement that communicates actions that can represent a thought or contribute to a conversation (Cassell, 2001). We will thus explore both verbal and non verbal communications among the Herero speaking communities that with a possibility to inform the agent's interaction.

## **1.6 Research Problem**

The following research questions have been constructed to guide the research in this thesis pertaining to local Otjiherero speaking people are:

1. What socio-cultural norms and behaviour should be considered when designing user interfaces for IK capture?
2. What are the typical verbal and non verbal communications of listeners during interpersonal conversations?
3. How can the socio-cultural and communication behaviour be used to design appropriate user interfaces?

## **1.7 Objectives**

The objective is to investigate appropriate user interfaces for rural African communities by analysing existing communication practices and patterns for

knowledge transference, which are currently not considered in the mainstream design paradigms of ICTs.

The specific objectives of this research project are to:

1. Identify current socio-cultural norms and verbal and non-verbal communication of listeners in two selected Herero rural communities.
2. Identify the listener's communication patterns to encourage the narrator to speak in order to capture stories for a future IK system.
3. Look for patterns between general conversation and its relationship to non-verbal communication (gestures) with specific reference to Bull's posture scoring system.

## **1.8 Challenges**

There were a number of challenges experienced by the author during the data collection phase of this project. Some of the constraints were physical and include the distance between the author's research institution in Windhoek and the target communities, which are between four to five hours away drive on gravel road. This resulted in the author at times being unable to access the community. Some community members sometimes travel away from the community to the nearest town to collect their pensions or to visit relatives in other areas and thus were absent during some visits to the communities.

Another major limitation was the language barrier. The two communities that were selected for the project are Otjiherero speaking and the author is not remotely proficient in either speaking or understanding Otjiherero and

therefore had to rely on one of the research members in the research cluster to do the translation of recordings and interviews.

The target communities do not have access to electricity and neither do they have access to mobile networks in the villages. This posed some challenges for the researchers when using laptops, video cameras and other electronic devices that needed to be charged regularly.

## **1.9 Motivation**

Historically, in the African context, IK has passed on from generation to generation mainly through oral communication. Most ICT systems that are designed are from a western cultural communication perspective (Winschiers-Theophilus et al., 2010) and do not consider oral users. We therefore, want to explore the consideration of socio-cultural and communication norms of the target Herero communities to inform the user interface design so that it can increase the future systems acceptance by rural members for IK capturing, storage and dissemination purposes. We explore ECAs as a possible interface because they would mimic real life storytelling conversation where the verbal and non verbal communication patterns in personal communication interactions are represented. We specifically explore the use of a listener agent that could provide appropriate feedback to aid the narrator in his/her storytelling.

## **1.10 Research Scope and Limitations**

This thesis is part of a research cluster “*Community Centred Localization as a New Approach to Human Computer Interaction*” focusing on informing design for ICTs in rural Herero villages. The research scope of this project was limited to the two selected villages in the Omaheke region of Namibia that were already being used for previous research activities for the cluster.

The purpose of this thesis is not to develop and implement an IK software interface but to come up with with design norms. So, this project merely seeks to contribute to the future planning and possible design of a model that may be developed by software engineers or computer scientists in the future.

This thesis will not include research work into the syntactic and semantic structures in communication patterns because this is beyond the scope of this project and would require insight from psycholinguistic experts. It will not analyse the correlation between linguistic language utterances and gestures.

## **1.11 Positive Contributions**

On a regional and local level, the research is expected to add to the body of knowledge on Africa specifically in Human Computer Interaction by proposing design methods through which relevant, usable, and sustainable software designs specifically aimed at building a knowledge society.

This research work will also contribute to indigenous knowledge preservation in rural communities for sustainable, social, and economic development.

## **1.12 Thesis Outline**

Chapter 1 introduces the motivation for the research as well as an overview of this work. Chapter 2 reviews literature associated with the research topic. Chapter 3 discusses the methodology, data collection methods and the data collected. Chapter 4 illustrates the results obtained from experiments performed. Chapter 5 analyses and discusses the results obtained. Chapter 6 concludes the thesis and considers future work.

## **CHAPTER 2: LITERATURE REVIEW**

### **2.1 Background and Context of work**

Having been initiated in 2004, research in the area of indigenous knowledge representation, appropriation of Information Technology, usability, as well as cross-cultural design and evaluation methods has been undertaken by researchers in the Polytechnic of Namibia's software engineering department. These efforts have yielded results that suggest that there is a need to socially and culturally adapt software development for sustainable systems specifically for non western communities (Winschiers-Theophilus, 2009). Consequently, these findings have spawned a research cluster, namely, "*Community Centred Localization as a New Approach to Human Computer Interaction*" which was created in 2008. After 2008 other research partner institutions such as University of Cape Town, Council for Scientific and Industrial Research (CSIR) Meraka and Aalborg University also joined the research cluster.

Two research settlements were identified in the eastern part of Namibia aimed at developing an indigenous Knowledge management system (Bidwell et al., 2010; Kapuire & Blake, 2011; Winschiers-Theophilus et al., 2010). At both sites personal relations existed which facilitated access, trust building and the communities willingness to participate in the research. In this thesis the author mainly draws from data acquired from the community where one of the research members originates from.

## 2.2 Indigenous Knowledge

Local knowledge also recognised as indigenous knowledge (IK) is collectively shared information among societies' members that is ingrained in beliefs, social norms, culture, experiences and the village livelihood (Adam, 2007; Thinyane et al., 2007). Another definition of IK is that "Indigenous knowledge (IK) can be defined as the unique, traditional, local knowledge existing within communities, indigenous to a particular geographic area and stored in people's memory" (Shapi et al., 2011). In many rural and marginalised African communities, local knowledge has been disseminated from one generation to another through oral communication practices with storytelling being one of the most common methods of sharing knowledge (Sherwani et al., 2009).

According to Shapi et al., (2011), IK is divided into 3 different categories, i.e. i) common; ii) shared; and iii) specialised knowledge. Common knowledge is that which is available and known by all the community members regardless of "social status, gender, or age differences. Shared knowledge is held by many but not all and specialized knowledge which is held by a few people who might have had special training or an apprenticeship; e.g., healers or midwives" (Shapi et al., 2011).

IK is essential to community members as it provides information in everyday living experiences in areas such as "agriculture, health care, food preparation, education, natural resource management, and a host of other activities in rural communities" (Shapi et al., 2011; Adam, 2007; Thinyane et al., 2007). IK is

being lost due environmental degradation including rural-to-urban migration by community members seeking education and job opportunities but also adjustment to new knowledge and innovative practices (Shapi et al., 2011; Adam, 2007; Thinyane et al., 2007).

The contributions of IK are important not only to local communities but also to society as a whole contributing in areas such as agriculture, animal husbandry, medicine, and natural resource conservation and could provide sustainable, national and economic development. Technologies may be used to capture, store and for retrieval purposes, but it is important to design appropriate interfaces for rural communities that will reflect their socio-cultural norms as well as their communication behaviour (Rehm, et al., 2007; Winschiers, 2009; Winschiers-Theophilus et al., 2010, Bidwell et al., 2010; Bidwell, 2011).

### **2.3 Western versus Local system Design**

There is an inadequate amount of research done on designing interfaces for rural communities (Winschiers-Theophilus, 2009).

According to Sherwani et al. (2009) and Winschiers-Theophilus (2009), most ICT systems used in African societies are based on western designed and developed systems imposed universally. These systems rarely present adaptable interfaces that can provide some aspect of 'usability' for the local African user. A good example of this is Automated Teller Machines (ATMs) used in Namibia to deposit or withdraw money, which offers only English and Afrikaans language options to the majority of the Namibian population who are

neither adept in written or spoken English and/or Afrikaans. Some of the users are able to use the machines with the help of those who know how to use them while others have to learn to use them.

There is support to share and store IK data by large organisations such as the World Bank Indigenous knowledge (World Bank, 2005), which are promoting Internet IK databases from various countries including African nations using web interfaces as well as the Internet. Winschiers-Theophilus et al. (2010) argue that IK systems should be designed by mapping the target communities' knowledge system adequately. The authors further suggested that database querying requires some formal education as well as computer literacy by the end user and in many cases this is not considered for the targeted marginalised villages. Computer access, lack of electricity as well as Internet connectivity for the rural society has not been taken into account as this is lacking in most circumstances and consequently the IK knowledge is not accessible to those who have provided the knowledge and possibly to the younger generations to whom the knowledge was intended for (Kapuire et al., 2010). If these IK databases were accessible by rural communities, they would require the community members to adapt and accept software that was designed without their participation (Winschiers-Theophilus et al., 2010).

It is important to note that IK or local knowledge based on storytelling is dynamic due to the fact that a story is never told exactly the same way each time it is narrated and can be adapted according to a specific context depending on who the narrator is as well as the listener(s) group dynamic. Storytelling is generally one of the methods for communicating knowledge

in rural African communities. It is also an important interpersonal and socio-cultural behaviour that is based on internalised memories as well experiences; thus the use of databases without appropriate interfaces for the system users for storing and retrieval purposes of IK can lead to the loss of dynamism and the high context way in which a story is told (Mondo, 2007; Sherwani et al., 2009).

Winschiers-Theophilus (2009) argues that an inadequate amount of research has been done based on Information Communication technology (ICT) literacy rates, language barriers and social communication patterns among rural African communities in relation to ICTs usability. She further says that cultural aspects must be incorporated into interface designs of ICTs for a particular community based on Human Computer Interaction (HCI) principles. Winschiers-Theophilus et al. (2010) have demonstrated using their own community centred requirement's for elicitation methods towards designing systems for rural African people that it is essential to involve the envisioned society, to incorporate methodologies such as ethnography, participatory design, and action research.

Adam (2007); Mondo et al. (2007); Thinyane et al., (2007) have researched on community based systems that are created particular with the local community in mind. Thinyane et al. (2007) propose an ontology-based model designed to integrate and respond to Indigenous Knowledge Systems by integrating local knowledge and social networks such as the internet with the use of authoring, communication, and ontology-management tools as opposed to databases.

Sherwani et al., (2009) asserts that oral communication could be the preferred medium of IK exchange. The indigenous knowledge includes the communities' history, values, beliefs, and way of living (Sherwani et al., 2009). The IK passed on orally is not quoted word for word but is adaptive to the circumstances or situations and may diverge although the general idea remains the same. Designing IK systems should adopt these diverse cultural characteristics as suggests by several authors including Sherwani et al. (2009) and Winschiers-Theophilus et al. (2010).

To design appropriate interfaces and systems for local communities for storage and retrieval purposes of IK, it is necessary to examine interpersonal and cross cultural communication theories.

## **2.4 Communication**

It is important to distinguish western and African communication patterns in order to design appropriate systems that accommodate the natural human interaction styles.

Sherwani et al. (2009) shows that most rural African cultures are oral rather than text based communicators and this has passed on from generation to generation through storytelling (mainly), poems, songs, music, chanting, proverbs, etc. The elderly people, men, and women are the holders of knowledge and they are responsible for communicating traditional information orally to the younger generations. In the social sciences, communication has many different definitions mainly depending on the investigation type but one of the definitions of communication can be said to be messages that are

”intentionally directed to other persons that receive them” (Littlejohn, 2002; Gudykunst, & Mody, 2002).

Interpersonal communication is based on information or a message being passed on to one or more people. During a communication process, both verbal and non verbal communicated either intentionally or unintentionally. Interpersonal communication is depicted in Figure 2.1 (Erasmus-Kritzinger, 2002).

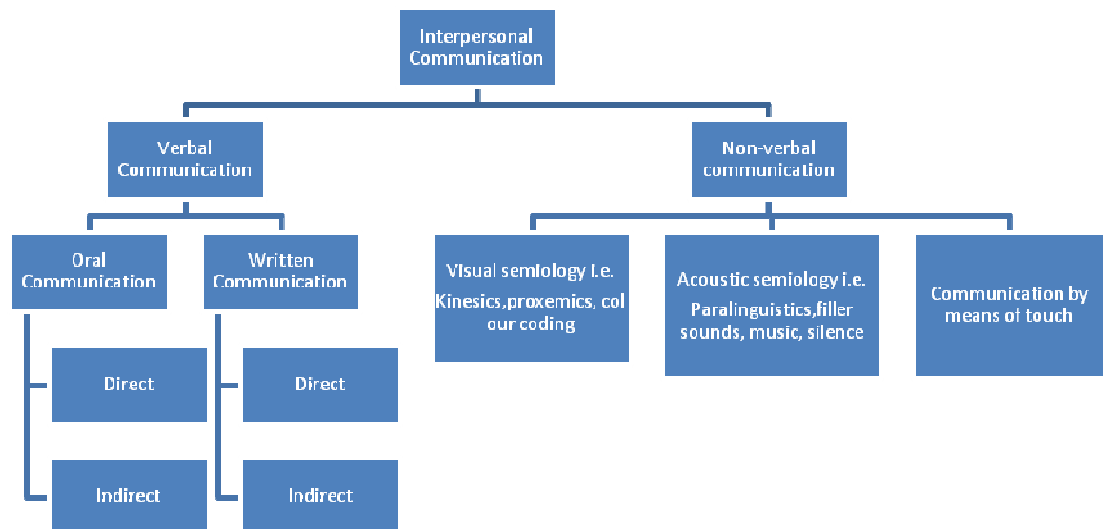


Figure 2.1: Overview of Verbal and non-verbal interpersonal communication Erasmus-Kritzinger, (2002)

Face-to face oral communication consists of verbal and non verbal behaviour (Erasmus-Kritzinger, 2002; Littlejohn, 2002). Verbal behaviour is the language utterances that accompany speech. Erasmus-Kritzinger, (2002) additional declares that oral or written communication can both be direct or indirect.

Directness and indirectness refers to whether the communication pattern is

clear (to the point) or ambiguous (Erasmus-Kritzinger, 2002; Littlejohn, 2002; Gudykunst & Mody, 2002).

Non verbal communication can be used to reinforce or replace speech as evident in sign language (Littlejohn, 2002; Gudykunst, & Mody, 2002). They can be used intentionally or unintentionally by the speaker or listener (Gudykunst, & Mody, 2002). According to Erasmus-Kritzinger (2002), communication can be defined as “a two way process whereby information (message) is sent from one person (sender) through a channel to another (receiver) who in turn reacts by providing feedback”. Erasmus-Kritzinger (2002) classifies non verbal behaviour into three clusters; visual semiology, acoustic semiology and communication by means of touch. Visual Semiology is the study of visual signs, symbolisms, etc and related to linguistics for example kinesics, proxemics, and colour coding (Erasmus-Kritzinger, 2002). Acoustic semiology studies hearing signs for example Paralinguistic’s (spoken sounds that do not involve words), filler sounds (e.g. ‘aaahh’), music, and silence (Erasmus-Kritzinger, 2002). Other non verbal communication classifications are discussed in detail in section 2.10 under Non-verbal communication classifications.

This thesis will investigate the verbal utterances and non verbal communication in form of gestures.

## **2.5 Gestures**

Gestures can aid conversation especially when speech is ambiguous (McNeill, 1992). According to McNeill (1992), gestures are movements that are

observed when a person or people speak, think, and coexist and they consist of actions such as hand signals, head movement. Gestures can accompany verbal communication but they can exist independent of speech as in the case of sign language (Bull, 1987). McNeill (1992) developed a code that classifies gestures into iconic, beat, metaphoric and deictic. These can be aligned to gesture space as illustrated in Figure 2.2. McNeil's coding scheme is used in collaboration with the speech to analyse semantic meaning. Because the experiments were carried in Otjiherero and then translated to English, it was difficult to analyse the semantic aspects of the conversations based on the English translations.

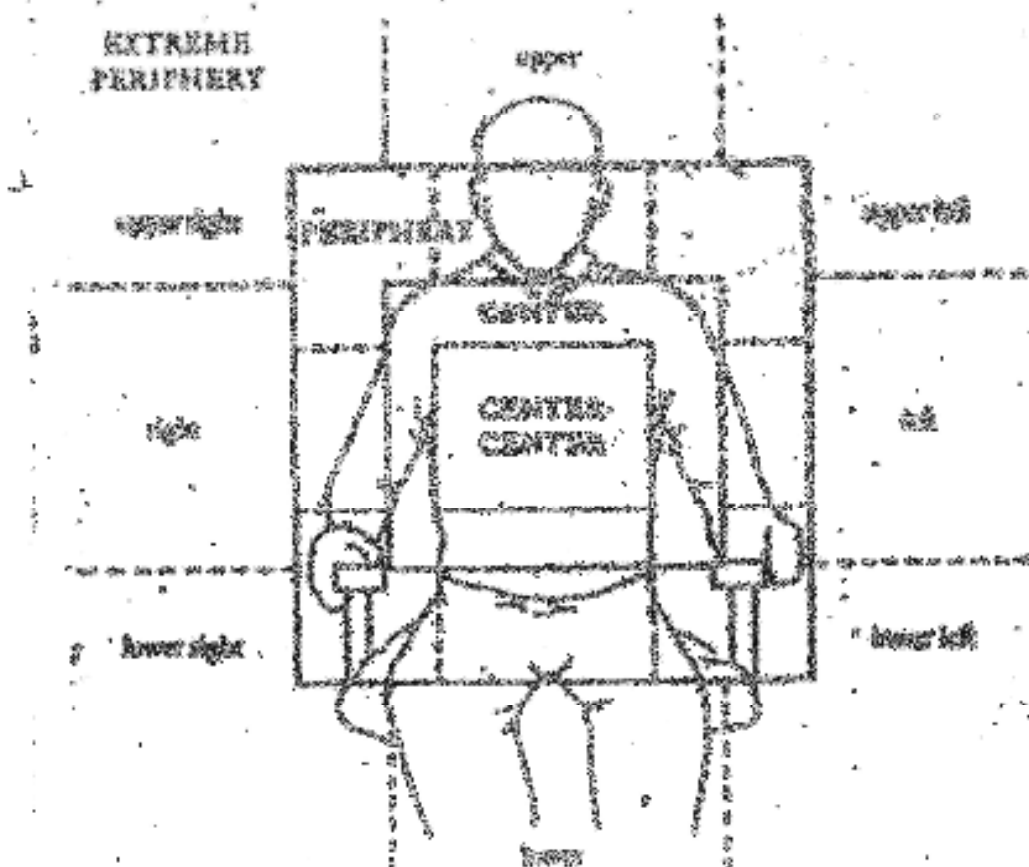


Figure 2.2: Gesture space (McNeill, 1992: 89)

Iconic gestures are linked to speech; illustrating what is being said, for example when a person demonstrates a physical item by using the hands to show how big or small it is (McNeill, 1992). “Iconic gestures are different from other gestures in that they are used to show physical, concrete items” (McNeill, 1992). He further states that beat gestures are “just that, rhythmic beating of a finger, hand or arm (McNeill, 1992). They can be as short as a single beat or as long as needed to make a particular point” (McNeill, 1992). Metaphoric gestures explain a concept (McNeill, 1992). Deictic gestures

according to McNeil (1992) are pointing movements for example pointing with a finger. Unfortunately, McNeill's gesture coding system investigates both the semantic aspects of speech in relation to the gestures. We therefore pursue Bull's (1987) posture movement coding system. Bull's (1987) posture coding system is widely used in gesture and posture studies by various researchers in fields such as psychology, linguistics, and human computer interaction (Rehm et al., 2007). Bull's posture scoring system helps researchers establish correlations between speech and gestures behaviour during interpersonal communication and some of the code is presented in Appendix C. Researchers such Argyle (2007) claim that some gestures can be universal, for example when depicting height but other research work suggests that they are dependent on culture (Rehm et al., 2007). We therefore further explore the cross cultural characteristics of communication.

## **2.6 Cross-cultural Communication Theories**

Theories have been used to study the different way in which communication occurs within as well as across cultures. Anthropologist and Psychologist explain culture and communication from various theories. "Cross cultural theories involve comparisons of communication across cultures" (Gudykunst & Mody, 2002). These theories can be valuable in understanding how human interactions transpire within a cultural environment such as a village setup as well as communications across different traditions. Gudykunst & Mody (2002) examines culture from various psychologists. They further

suggest a complete definition of Culture (as cited by Keesing, 1974, p.169)

as:

Culture, conceived as a system of competence shared in its broad design and deeper principles, and varying between individuals in its specificities, is then not all of what and individual knows and thinks and feels about his [her] world. It is his [or her] theory of what his [or her] fellows know, believe, and mean, his [or her] theory of the code being followed, the game being played, in the society into which he [or she] was born.... It is this theory to which a native actor [or actress] refers in interpreting the unfamiliar or the ambiguous, in interacting with stranger (or supernaturals), and in other settings peripheral to the familiarity of mundane everyday life space; and with which he [or she] creates the stage on which the games of life are played.... But note that the actor's [or actress's] "theory" of his [or her] culture, like his [or her] theory of his [or her] language, may be in large measure unconscious. Actors [or actresses] follow rules of which they are not consciously aware, and assume a world to be "out there" that they have in fact created with culturally shaped and shaded patterns of the mind. We can recognise that not every individual shares precisely the same theory of the cultural code, that not every individual knows all the sectors of the culture... even though no one native actor [or actress] knows all the culture, and each has a variant version of the code. Culture in

this view is ordered not simply as a collection of symbols fitted together by the analyst but as a system of knowledge, shaped and constrained by the way the human brain acquires, organizes, and processes information and creates internal models of reality (p.26).

From Keesing's (1974) definition of culture above, it can be deduced that within every culture, there are customs that are followed that may vary from culture to culture and that are a combination of what the individual has learnt from his/her environment as well as what he or she has internalised. Consequently, interpersonal communication is shaped to a large extent by cultural values, beliefs, norms and the environment one belongs to.

## **2.7 Low Context and High Context Communication**

Hermeking (2005) refers to Hall and Hofstede's cultural communication styles that are commonly referred to in cultural accounts of interactions in user interfaces and reasons that low context relations can be viewed in developed nations such as North America and most European countries that prefer precise and text based communication in form of newspapers, written text, etc. Low context societies emphasis more on language code than context and consequently have characteristics such as being individualists with preference for low interpersonal communication, hence favour conversation that is specific (Hermeking, 2005; Gudykunst, & Mody, 2002). He further notes that high context communication societies are those in the southern hemisphere, which are the developing nations, such as Brazil, and South Africa with

personal interactions (Hermeking, 2005). High context people exchange information informally and indirectly, thus context has meaning entrenched within it; therefore this could be attributed to the oral communication model (Hermeking, 2005; Gudykunst, & Mody, 2002). In low context messages, it is therefore important for the narrator to clearly converse or write accurately the context connotation through language code in contrast to high context messages where the listener has to be able to extract the meaning from the context of the conversation (Gudykunst, & Mody, 2002). Based on Hermeking's, (2005) research, it is therefore necessary to design and create interfaces that are aligned to the cultural communication style which is oral for African communities; thus investigating the communication patterns of listeners is just as essential as that of the narrators.

## **2.8 Listener communication**

In natural face-to-face conversation, interpersonal communication can be highly interactive and fluid with the contribution of both the narrator and a listener(s). The listener is as critical in a face-to-face conversation as a narrator due to the fact that they can provide essential feedback to the narrator of how they may proceed in their speech (Kraut et al., 1982; Gardner, 1998). Gardner (1998) makes suggestions motivated by researchers McGregor and White (1990) that listeners are important in conversations because they "influence the shaping of the discourse" and are not merely unreceptive recipients (p.205).

Feedback that is obtained from listeners can be verbal and non verbal (gesture) responses and ensues without taking over the narrator's discourse (Kraut et al., 1982). Kraut et al., (1982) further claim, that when narrators are refused listener feedback, the narrator's speech becomes "less structured, less efficient, or incoherent" (p.719) as illustrated by experiments conducted by Krauss & Weinheimer (1966) where speakers [narrators] explained objects with complex names to listeners. Results from the experiment showed that speakers who had listener feedback condensed their narrations while those who did not obtain any feedback did not shorten their speech supposedly because they did not know if the listener understood their descriptions (Kraut et al., 1982). Previous research by Kraut and Lewis demonstrated that listener feedback directed the narrator's monologue (Kraut et al., 1982). They further suggest that those narrators who did not receive any listener feedback "developed their monologues in a linear fashion, without backtracking to paraphrase or to clarify their partners' confusions" (Kraut et al., 1982, p.719). The authors additionally claim that the narrator's communications is positively influenced by the more feedback they receive from the listener. The authors furthermore state that narrators may adapt their conversation based on the mental state of the listener e.g. if a listener is a psychologist, a conversation would be different from that of a college student or a younger sister because their social motives might be to convince, inform, or entertain the listener (Kraut et al., 1982, p.729). This can also be assumed for conversations in a local African community where the narrators are usually elders and the listeners are younger community members. The elders adapt their storytelling

based on whether they want to inform, entertain, or convince the listener(s). Based on Kraut et al. (1982), we can also see that the narrator adapts his oral communication to feedback received from the listener(s).

We investigate the use of Embodied Conversation Agents as a possible interface option for an indigenous knowledge management system that will provide appropriate listener feedback for the human narrator.

## **2.9 Embodied Conversational Agents**

For local African communities that interact with one another orally, it is necessary to create interfaces that would accommodate socio-cultural communication methods that depict their human communication interactions (Rehm et al., (2007); Bidwell et al., 2010; Winschiers-Theophilus, 2010) recommend a detailed definition of what Embodied Conversational agents (ECA) are (Cassell, Bickmore, Campbell, Vilhjálmsón, & Yan (2000):p.2) :

“Those that have the same properties as humans in face-to-face conversation, including:

The ability to recognise and respond to verbal and nonverbal input

The ability to generate verbal and non verbal output

The ability to deal with conversational functions such as turn taking, feedback, and repair mechanisms

The ability to give signals that indicate the state of the conversation, as well as to contribute new propositions to the discourse “

Rehm et al. (2007) additionally demonstrate that EACs could be utilised to represent cultural specific interactions for “presenting information,

entertainment and for educative games". Research by Cassell et al. (2007) proclaims that, it is essential to develop EACs that can interact intelligently in a face-to face human-like manner by holding down a communicative behaviour in context. Communicative behaviour can encompass verbal and non verbal communications. ECAs could be used as the interface for the IK system we intend to develop in the future mainly because they can perform human-like aspects of communication that would be ideal for oral rural societies. The agent would represent the listener by encouraging conversation with a human elder who would be interacting with the system to capture IK. ECAs will be best suited as interfaces to capture oral stories because they can prompt the narrator to converse in the same way as they would be used to in a natural conversation.

ECAs are assumed to be intelligent interfaces that have capabilities of working asynchronously and autonomously with any human intervention (Milewski, A.E., & Lewis, S.H., 1997). Another trait of ECAs is the ability to use natural language. ECAs can be programmed to use the language associated with the end users. This is very important for the project because users of the system speak little or no English but communicate in their mother tongue, which is Ojjiherero. Therefore, an agent will communicate with the user in Otjiherero creating face-to-face real time conversations.

## **CHAPTER 3: RESEARCH METHODOLOGY**

### **3.1 Research Approach**

Most interface design research is based on social science methodologies so they can yield qualitative rather than quantitative data (Gallant, 2006). Qualitative research was selected because in this thesis the objective was to investigate fundamental cultural behavioural norms as well as verbal and non verbal human behaviour, which requires a qualitative approach (Kothari, 2008). According to Kothari (2008), qualitative research approaches are based on “subjective assessment of attitudes, opinions, and behaviour” that may result in non quantitative structure.

Some of the results from our previous research work revealed that interpersonal interactions among the participants placed verbal and non verbal communication above visual context in storytelling (Winschiers-Theophilus et al., 2010; Bidwell et al., 2010). It is from these findings that we thought to investigate further the verbal and non verbal communication as well as the socio-cultural behaviours and their link to those involved in dialogue during storytelling, more specifically the listeners.

The choice of methods was based on the research questions discussed in Chapter 1. to investigate the socio-cultural norms and behaviour, which is an unconscious behaviour; we chose ethnographic observations and both structured and unstructured interviews as well as action research. Artefacts and scenarios were also used to strengthen the investigative process during interviews.

The methods are discussed in more detail under data collection.

The techniques used during the research were behavioural recordings using notes, video recordings, and photographs.

Ethnographic action research was used to link to participatory approaches where technology and design ideas were introduced to the participants and the researcher continuously reflected on the research techniques used (Blake, 2010; Winschiers-Theophilus et al., 2010; Bidwell, 2011; Kapuire & Blake, 2011). Four community visits were undertaken of a selected local population aimed at learning more about the socio-cultural interaction as well as communication behaviour of the people in their community. Interviews, videos were used to learn more on the traditions, values, beliefs, and rules within the community.

### **3.2 Research Setting and Participants**

In this thesis, the population was selected using deliberate sampling (Kothari, 2008). Deliberate sampling constitutes choosing a population purposefully by the researcher (Kothari, 2008). The author preferred to use the selected villages that were already being used by the research cluster where the author was participating collaboratively with other researchers.

The participants from the population sample were called the Ovaherero from the eastern part of Namibia that was two hour drive from Gobabis in the Omaheke region, 50km from Otjinene town (see Figure 3.1 below). It was a four hour drive from Windhoek on gravel roads with little or no public transportation systems.



Figure 3.1: Map of Namibia retrieved from

[http://na.essentialtravelinfo.com/index.php?p=accommodation\\_map\\_namibia](http://na.essentialtravelinfo.com/index.php?p=accommodation_map_namibia)

There was no electricity or cell phone coverage within the village so if the community members wanted to communicate with relatives or friends in other parts of the country or abroad, they had to travel to the nearest town Otjinene on foot, on horseback riding, with donkey carts or with their own/other people's private vehicles. Otjinene had the basic communication infrastructures such as fixed line phones and mobile connectivity. Community members relied on

radios as a source of communication from the “outside world.” There were radio programmes available in their mother tongue, Otjiherero, with which they received regional, country, international news as well as information of deaths of relatives or friends.

The Ovaherero who are part of the Bantu Speaking people who make up eight percent of the total population of Namibia according to the 1991 census (Maho, 1998). Bantu refers to the similarities in the language by people in sub-Saharan Africa (Maho, 1998). The Ovaherero are nomadic cattle herders who value their wealth in the number of cattle they possess (Maho, 1998). They also rear other animals such as sheep and goats. At the time of the village visits (between February and November 2011), the community members mostly consisted of elderly men and woman with a substantial number of children under twelve years old. According to previous research, this distribution of community members is based on rural-to-urban migration with some members returning during December when the schools and most work institutions closed down for vacation (Winschiers-Theophilus et al., 2010).

### **3.3 Methods**

#### **3.3.1 Data Collection**

Four village trips were undertaken by the author in order to collect relevant data for the research objectives.

Community visits were undertaken in two selected rural communities of Erindiroukambe and Helena (close to the Botswana border) in the Omaheke

region, which is located near Otjinene (as shown in Figure 3.1). During these visits data was collected using methods such as ethnographic observations, interviews, and action research.

Consent was first acquired from the councillor in-charge of the villages to have access to the local community members for the purpose of the research. One of the research members of the research cluster originated from the Erindiroukambe community and discussed the research project with community elders weeks before embarking on the field trips.

### **3.3.2 Ethnography**

Ethnography is a method used to observe the sample population in their own environment. It was used with the aim of gaining insight in the verbal and non verbal behaviour and used to inform interface design (Shneiderman, 1998).

According to Gallant (2006), "Traditional ethnography starts with the observation of environmental social rules and behaviours to make sense of communication among group members. Technologies were introduced to community members to observe how they interacted with them. "Traditional knowledge and understanding of natural environments can be incorporated with technologies and used to provide a sustainable livelihood in rural societies (Bidwell, & Browning, 2009).

### **3.3.3 Interviews**

Structured and unstructured interviews were conducted during field studies.

All the community members spoke Otjiherero so we relied on one of the Otjiherero speaking researcher in the natural settings (cultural and context) of the villagers i.e. under a tree or while they completed their daily chores such as herding, milking the cows, cooking, etc. so as to minimally interfere with the community members' daily tasks. It also allowed the villagers feel comfortable.

Most interviews were done in a group-setting but individual interviews were also conducted. Interviews in the group setup enabled conversation to flow between the narrator and the listeners and it allowed the observation of various communication behaviours. The interviews conducted were semi-structured and involved elderly men, women, and young adults of the community. All interviews were recorded using video cameras, cameras and audio recording devices by the author, other researcher members as well by as members of the community.

### **3.3.4 Action Research**

Action research (AR) is best explained by Dick, (2002) as “a natural way of acting and researching at the same time” (p.2). He further states that AR accomplishes the research action outcomes by being flexible as well as considerate to people's circumstances. This can be achieved by reflecting on one's actions and correcting any mistakes made in the subsequent plan and the reflecting again and continuing the steps until the desired outcomes are attained (Dick, 2002). AR was all field investigations to improve experiments and help establish answers to the research questions (Blake, 2010).

### **3.4 First Community Visit**

To prepare for the first visit, books and articles on the Herero culture were read and interviews were conducted with some Ovaherero people who were able to share some information on their traditions. Consultations were also conducted with Dr. Mara Mberirua (also from the Herero tribe but from a different village); a psychology lecturer at the University of Namibia who gave some additional information on what questions to ask in order to obtain some insight into the beliefs and values of the Herero people as well as the psychological dynamics of the village.

Information gathered generally implied that it was difficult for the Herero to open up to individuals who were not from their community.

Lists of Questions were designed to find out information related to communication interaction patterns within the community settings (See Appendix A).

On the first visit, three members of the research group embarked on investigation of different areas pertaining to their areas of interest. The research team was new to this type of field investigative work and consisted of two females who were from different cultural backgrounds from those of the community members. The third researcher originated from the community even though he resides in Windhoek. The majority of the village members neither spoke nor understood English and conversed only in their native language. The research member from the said community acted as our interpreter since he knew the locals and spoke the mother tongue (Herero).

Two elders (men) who were seen as those that are knowledgeable by village

members came to the house where the author resided during village visits for the first interview.

### **3.4.1 Reflections on First Visit**

It was realised from the first village trip that there was need to have first created rapport between the community members and the researchers in order to build a trustful relationship. It was concluded that the author did not entirely understand the Ovaherero culture even from earlier research work and steps to communicate the research methods and objectives effectively to the community members was not sufficiently undertaken. It was realised the elders were requested to conduct the interview in the researcher's environment instead of in their own environment at their convenience as suggested by ethnography. This was corrected in the second visit.

### **3.5 Second Community Visit**

The main aim of the second trip was to collect more data about the communication structures that were used in the Erindiroukambe village among the Herero speaking people. On arrival in the village we visited each of the settlements where the participants were residing and explained the research objectives and enquired when we could return to conduct the investigations. The next day we went to different settlements to film the participants in their own environment at a time that they had indicated was suitable for them. We wanted to observe how the local women communicated with one another and with their children as well as to find out their opinions on ICTs intervention. In

the investigation, we planned to find out the effect of introducing technology, whether they embraced mobile phones or not, or any type of ICT and the possible experiences on ICTs influence on culture, beliefs, and values. We visited women in their own settlements and we observed and communicated with them while they completed their chores by filming all their verbal and non-verbal communication. We also encouraged the participants to use some of the cameras and recording devices to obtain user generated videos as well as ICT usage for observation of what was considered important for them to record.

### **3.5.1 Reflections of our Second Community Visit**

The participants were more open to discussions but were still not very comfortable in front of the camera. Filming the participants in their own environment created a natural setting for the observations and interviews. We realised that more information was obtained from the participants in the second trip in comparison with the first trip. This could possibly be attributed to building rapport and performing the filming when it was convenient for the participant in their own environments.

### **3.6 Third Community Visit**

During the third visit, we decided to offer scenarios to the narrators and have him/her narrate how a particular ritual was performed in relation to the scenario given in the presence of listeners from the same community. This was aimed at observing natural conversation that would occur between the

village members. We went to the different settlements of the participants at times that were suitable for them.

### 3.6.1 Scenario 1

The first scenario was for the narrator to communicate how an animal was slaughtered (Figure 3.6).



Figure 3.6: An interview session with local community members

Figure 3.6. shows the narrator (with the blue shirt) and the listeners who were present during the filming session. We filmed from two different positions at the same moment to obtain video recordings aimed at observing the narrator and also focusing on the listeners' verbal and non verbal communication methods. Still pictures were taken during the filming session.

### **3.6.2 Scenario 2**

The second scenario was that the narrator had to discuss how to prepare a meal with an audience. This task was given to one of the younger female participants of the village but unfortunately, during our interview with the participant, there were only small children under the age of six at this session as well as the Otjiherero speaking research partner, so we therefore did not include results from this session.

### **3.7 Fourth Community Visit**

We extracted several still images from video footage from of the narrators' and listeners' gestures that were filmed on previous village visits (scenario 1: slaughter narration) during recordings of the participants' interactions. The still images were laminated and randomly distributed to two community site members at the same time. We asked participants who were not present during conversations on previous visits to try and identify the gestures on the pictures by relating them to what they thought narrator was possibly communicating to the listeners. The objective of this experiment was to establish if gestures could be identified to static images. The still photographs were figures labelled 4.3 to 4.10.

### **3.8 Height Gesture Experiment**

An investigation into how height is gestured in an African setting was undertaken to. Still photographs of the height gestures were taken.

We asked the village members to show a gesture for height. They gestured to show the height of a child (See figures 4.14 and 4.16). They depicted the height of an animal (See Figures 4.13 and 4.15) in a gesture which was not the same as that of the height of a child. They village members illustrated the height of animals by extending a flat hand with ninety degree 'wrist-twist'. There illustration was based on the notion that the height of an animal was demonstrated by placing one's hand on the back of the animal.

### **3.9 Annotations**

After returning back from the research field activities, the video footage of the recordings of the conversations between the participants during village visits was transcribed. A select few were translated into English from Otjiherero. We used the Anvil tool (Kipp, 2004) to annotate the gestures on the videos was undertaken. Some of the videos had poor sound or visual quality so they were not selected in the data analysis. Two videos taken from different angles on the slaughter narration scenario that were approximately twenty-three minutes each were coded using the Anvil tool. Anvil allowed the videos to be played at different speeds (very slow to fast) and allowed gesture coding to be added to the video. Simple transcription using Anvil tool (Kipp, 2004) was used to annotate head, arm, and leg posture. Annotation of gestures according Bull's body movement posture scoring system, which has often used for analysing, gestures, was used for coding (Bull, 1987; Kipp, 2004).

Another video was used to establish verbal utterances in a conversation where only the narrator was filmed but verbal utterances could be heard of the listener.

### **3.9.1 Coding**

The coding was done according to Bull's body movement posture scoring system and the movement were based on the author's interpretation. Some of the movements were not included in the analysis because there was no gesture code to specify the type of gesture. For example, one of the listeners kept picking objects from the ground and moving the object around in his hand.

The coding was separated according to the head posture movements, the leg posture movement and the arm movements according to movement codes in Appendix C.

## **CHAPTER 4: RESULTS**

### **4.1 Results**

This chapter shows the results based on the gesture video annotations as well as verbal and non verbal utterances and observations experienced during the interview sessions with rural community members.

We do not understand nor speak Otjherero so we relied on the translations to English, which would not be an accurate way to relate the content of the speech to the gesture. This could be due to the fact that not all English words have a direct translated equivalent Otjherero word and vice-versa

### **4.2 Observations and findings from first community visit**

#### **4.2.1 Non verbal observations**

During the first visit to the village, two elders (men) were selected by the researcher who originated from that particular community.

The two elders that were interviewed did not have any eye contact with anyone of us or even with one another. When they spoke they looked in opposite directions and sometimes looked downwards. In most southern African cultures no eye contact is considered to be a normal occurrence, but disrespectful especially in situations where younger individual make eye contact with elders.

## **4.2.2 Verbal Results of first community visit**

We used the questions in Appendix A to gain some information on the interpersonal communications within the community. A summary of the interview results obtained from the elders revealed that when there was a requirement to circulate information to the whole community, a meeting was called at one central location usually by the village counsellor (a man) where men and women were both present. The elders further stated that if there were decisions that had to be made, it was done collaboratively during a whole community gathering, and all were allowed to contribute, although men were usually the ones who made the decisions on behalf of their households. If a man was not able to attend a meeting, then he could send his wife to represent him.

We asked the elders who was responsible for the rules that governed the clan and they said the village elders as well as the counsellor were responsible. We also inquired about the roles of men, women, and children with regards to communication and the communication structures within the community. This question was difficult for them to understand and answer. For most of the other questions, the elders found it difficult to understand what we were trying to enquire about. They did say that there were open to new ideas on preserving IK and that there were very few young people to share knowledge with.

### **4.3 Observations and findings from second community visit**

Despite people saying that Herero people are not comfortable conversing with other cultures not from their tribal community, it was found that they were interactive during the interview sessions.

#### **4.3.1 Non verbal observations from second community visit**

During the second visit, it was observed that participants opened up more and were still a bit uncomfortable with the use of video cameras to film them. Most of the women who were attending to their daily chores did so during our interview session (See Figure 4.1). Little or no eye contact was observed even during interactions with the research member from the same village with community members. When asked a question, the elderly lady would glance towards the interviewer for about three seconds and then back downwards.



**Figure 4.1: An interview session with local community women**

### 4.3.2 Verbal Results of Second Community Visit

When we interviewed the elderly woman to obtain information about how she communicated with her children, we had to ask her if she brought up her children the way she was brought up by her own mother to understand if cultural norms were still being passed the same way from her generation to the younger generation. Since she could not understand the question “how do you communicate with your children”, it was directly translated into Otjiherero. She responded by stating that she brought up all her children the same way she had been brought up but she didn’t know why the children these days were not growing up the way she did. She further elaborated that even when the children listened, they just did not behave they had been taught. We subsequently asked her opinion of Television (TV) programmes and radios and what influence they had. She said that sometimes TV programmes were a positive influence because they brought information that was not known that one could learn from. She then expresses that most of the time TV programs were a bad influence especially for the children. She gave an example of the elders who rarely watched TV but watched only when there were important traditional events. The elderly woman further stated that radio was very good because it broadcasted important information and the children also listened in. We asked the elderly lady if she had a cell phone. The elderly lady’s response translated in English was the following:

Elder: “I do need a cell phone, the thing is the is that lady that normally speaks there that I don’t like”

Gereon: “Which lady?”

Elder: "The one that speaks English"

Elder: "Say I do not have cellular phone" (The elder said she had no cellphone)

Gereon: "If you had one, would you use it?"

Elder: "Yes, I will use it"

"I will learn how to use it"

"I will use it, but the problem is the mistress"

"The mistress, the one that say give the phone, do that"

"Then it deduct the airtime units, we do not understand English"

"The mistress (lady) steals our money"

Gereon: "If the lady speaks Otjiherero, will it make a difference?"

Elder: "Yes will be nice, then you would understand what she is saying"

The elderly woman later remarked about how she disciplined the children by not separating them because the rules were generally the same. She however stated that children who were disciplined separately grow up separately so they were only disciplined apart when there was a need to instruct them based on their gender.

Furthermore, she stated how she would like to be filmed to tell stories for future generations but she specifically wanted to be filmed at special occasions such as weddings.

## **4.4 Observations and findings of third Community Visit**

### **4.4.1 Non Verbal Results of Scenario 1**

Two videos were transcribed and translated into English text from Otjiherero (Appendix B). Human movements on the videos were then annotated and tagged in their different frames using Anvil (Kipp, 2004) for the participants who were considered the listeners in conversations. Anvil allowed the videos to be played at different speeds (very slow to fast) and allows coding to be added to the video frames. The gestures were coded according to Bull's gesture code scheme (Bull, 1987) (See Appendix C). We did find that for a few gestures that we were unable to classify since they were not part of the gestures categorised by Bull's code, e.g. listener 4 picked objects off the ground and moved his fingers around the object. All the annotated videos were saved in a image file and the coded gesture text was exported to excel for analysis of the head, arm and leg postures.

## 4.4.2 Head Posture Results

Table 4.1 The transitions from one head posture to another for listener 1

	LHdF	LHdP	RaUHd	DsHd	THdAP	THdP	THdP, LHdF	V-O-I-D
LHdF	3	5	3	3	3	3	3	0
LHdP	4	3	2	2	2	1	0	0
RaUHd	1	4	3	2	1	2	0	0
DsHd	0	2	3	3	1	0	0	0
THdAP	1	7	3	3	1	7	0	0
THdP	3	3	1	0	7	1	1	0
THdP, LHdF	3	3	3	5	2	1	1	0
V-O-I-D	0	0	0	0	0	0	0	0

From the results obtained from the Head postures observed during the slaughtering narration scenario from the listeners, we can deduce the following:

- The head gestures movements involved the listeners leaning their heads towards the narrator during the narration.
- The head gestures involved the listeners turning their heads towards the narrator.
- The listeners head gestures involved looking away from the narrator
- The head gesture movements observed during the narration was that of the listeners leaning their heads forward.
- Listeners dropped their heads during the narration while five percent also raised the head up after being dropped.

### 4.4.3 Leg Posture Results

Table 4.2: Transitions from one leg position to another for listener 1

	MLP	MLAP	LSF	Xls	V-O-I-D
MLAP	0	2	0	2	0
LSF	0	0	0	0	0
Xls	0	0	0	8	0
V-O-I-D	0	0	0	0	0

From the results of the Leg postures, it was observed that most of the listener's leg position remained in a fixed position during the conversation. One of the listeners had his legs crossed for most of the duration of the conversation only one of the listeners close to the narrator moved their leg away from the narrator. Because the listeners and the narrators were seated in a circular position, it was difficult to analyse leg posture movements of all the listeners in comparison to the position of the narrator.

## 4.4.4 Arm Posture Results

Table 4.3: Transitions from one arm posture to another for Listener 1

	PH Hd	PH Nk	PH Fe	PH Sr	PHUA m	PHE w	PHLA m	PH Wr	F As	J H s	PH Ct	PH An	PH B	H P	PHI Pt	PH Tr	V-O-I-D
PHHd	5	0	2	0	0	0	3	4	8	5	0	1	0	0	0	0	0
PHNk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PHFe	5	0	4	0	0	0	3	3	4	5	0	0	0	0	0	0	0
PHSr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PHUAm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PHEw	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PHLAm	2	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0
PHWr	4	0	2	0	0	0	0	0	0	4	0	0	0	0	0	0	0
FAs	4	0	4	0	0	0	0	0	0	4	0	0	0	0	0	0	0
JHs	2	0	5	0	0	0	0	0	0	5	0	0	0	0	0	0	0
PHCt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PHAn	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PHB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PHIPt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PHTr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V-O-I-D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

The results of the arm postures observed in figure 4.2 during the slaughtering narration reveal that:

- The majority of the listeners placed their hand to their face and for one particular listener, this was the position his hand maintained during the conversation with the narrator.
- the listeners arm postures included hands joined together.
- The listeners arm postures revealed that they had placed their hand to their upper arms
- The listener, who was holding a child, placed her hand to her wrist for most of the duration of the conversation.
- The listeners placed one of their hand towards the lower arm of the other hand.
- The listener's arm postures exposed putting the hand to their elbow.



Figure 4.2: gestures of narrator and listeners during slaughtering narration

Figure 4.2 illustrates Listener 1 with white T-shirt leaning forward in his chair, left arm extended from his body showing index rotating in anti clockwise direction from wrist, then using of all fingers; Listener 2 had his legs crossed with head leaned towards the narrator and with his hand on his face. Listener 1 had his hands joined. Listener 3 was holding a baby and had her head turned towards the narrator (in blue shirt). Listener 4 had his head turned towards the narrator and his hands joined together.

## **4.5 Verbal Results of Scenario 1**

The translation of the video recording is in Appendix B. After transcribing and studying the translation of the footage, we recognised that the context presented by the narrator targetted the unmarried research partner who originated from the same village. Therefore the narration was not just directed at how to slaughter a sheep but rather incorporated the rituals of how it was slaughtered for a wedding ceremony. We can thus deduce that the listener can influence the context of a conversation. The listeners gave verbal utterances at long intervals and the other two elderly members contributed to the conversation. The listener who the conversation was directed at asked questions periodically during the narration.

### **4.5.1 Time between verbal feedback from listeners “eehees”**

The videos were further analysed using Anvil to determine the frequency of the feedback given by the listeners to the narrator while he was telling his story. The analysis was based on one 27 minute video track.

Table 4.4. Time between verbal utterances of Listeners

Time (Minutes)	Utterance (eehee)
1.00	5
2.00	2
3.00	4
4.00	3
5.00	2
6.00	3
7.00	2
8.00	0
9.00	5
10.00	6
11.00	3
12.00	2
13.00	4
14.00	6
15.00	4
16.00	5
17.00	4
18.00	6
19.00	5
20.00	0
21.00	4
22.00	5
23.00	3
24.00	5
25.00	4
26.00	2
27.00	3

The total number of 'eehees' that were heard from the listeners giving feedback to the narrator while he was telling this story was ninety seven in the twenty seven minute video. This gives an average of about four 'eehees' utterances in a minute and breaking this down further, reveals that listeners give feedback almost every fifteen seconds. Some limitations experienced

during this investigation was that sound of the recording device was not very clear so further video analysis is required in the future.

#### **4.6 Results of fourth Community visit**

On our fourth visit, we decided to investigate if the community members could identify static gestures from picture images based on the listeners and the narrators. We used participants that had not been present during the conversation shown in the images.



**Figure 4.3: Listener 1 making a gesture with left hand pointing down**



Figure 4.4: listener 2 making gesture with right hand pointing upward and left hand in the lap with crossed legs



Figure 4.5: Listener 2 depicting gesture with both hands up



Figure 4.6: Narrator gestures with left hand to the side and listener 2 gestures with right hand only



Figure 4.7: Narrator gestures with left hand and listener 2 points downwards with right hand



Figure 4.8: Listener 2 puts left hand towards his face



Figure 4.9: listener 2 left hand is on the face and the narrator points and looks upwards



Figure 4.10: Narrator is looking upward with right hand also up and Listener 2 has left hand on the face

### 4.6.1 Gesture recognition Experiment

An experiment was performed at two different sites. The aim of the experiment was to identify if community members could recognise gestures and relate it to the story that was being narrated from static pictures (taken during a previous visit) even when they were not present during for the particular discussions depicted in the pictures.

For the experiment, participants were asked to identify the gestures by relating them to speech based on the pictures; these were the findings from site 1 and 2 after being translated from Otjiherero to English (See figure 4.3 and 4.4).

Site 1

1. Job is telling a story (They can't see what he is pointing at).
2. Gerrard: Doesn't agree with something/ "or is it like that!"

3. Alex: He „like“ emphasizes his story/ big story
4. Gerrard: Points and talks to Alex. Alex: Is like “I did not do it”
5. Alex: Maybe cleaning his hands (Difficult to say for them). They agree that he is not trying to get up, hence his legs are crossed.
6. Alex: He is maybe trying to interrupt.
7. Alex: He is listening (No doubt).
8. Gerrard: Is telling a story about something up there (not physically there).
9. Same as Picture 7.

## Site 2

1. Job: Is telling a story/ or pointing at an object.
2. Gerrard: He is telling and/or showing size. (e.g. the size of cow horns)
3. Alex: Maybe demonstrating through a story that he was picking something up.
4. Gerrard: From here to there/ pointing while telling a story.
5. Alex: Listening to a story being told Gerrard.
6. Alex: Maybe he is pointing. Maybe he wishes to remove a fly.
7. Alex: Listening. Maybe he is sad.
8. Gerrard: Pointing to the tree.
9. Alex: He is holding his head ~ maybe thinking. Looking concentrated.

In both sites, it was found that none of the community members could identify the gestures and relate it to a possible story that was being narrated from the static pictures.

The result of the gesture recognition demonstrates that static gestures may be misinterpreted by those who are not familiar with the context of the conversation. All the interpretations of the gestures were incorrect. From our experiment above, it can be concluded that some gestures go hand in hand

with the context of speech and are therefore difficult to interpret. It is therefore recommended that further research be completed before depicting static gestures in interface designs to prevent misinterpretation or misrepresentation of gestures.



**Figure 4.11: Gesture Recognition Experiment at Site 1**



Figure 4.12: Gesture Recognition Experiment at Site 2

## 4.7 Height Gesture Experiment

The Height gesture experiment revealed that community members used two different gestures to depict the height of a child (See Figure 4.14, 4.15 and 4.16). The community members also had a totally different gesture to depict the height of a cow/animal. (See Figure 4.13).



Figure 4.13: Elder lady showing gesture for height of an animal



Figure 4.14: Showing gesture for height of a child



Figure 4.15: Gesture to depict height of an animal



Figure 4.16: Gesture that shows height of a child

# CHAPTER 5: DISCUSSION AND IMPLICATIONS FOR HUMAN INTERFACE DESIGN

## 5.1 Discussion

The findings obtained in this thesis are not enough to make any conclusions on the socio-cultural norms of the Ovaherero but they do have some implications for interface designs. It can be assumed that it was difficult to translate and find the suitable words for translating from English to Otjiherero and vice versa during the interview process.

It can be unreservedly stated that western communication behaviour does differ from that of the Ovaherero communities.

The research questions for this thesis were:

**What socio-cultural norms and behaviour should be considered when designing user interfaces for IK capture?**

The general socio-norms that were observed based on the interviews and observations with the members of the community were that men generally lead community gatherings and made decisions on behalf of their families but women could represent their husbands if their husbands were not able to attend community meetings. In western communities in contrast, both genders are viewed equally and anyone of the genders members can be considered to lead a community gathering as well as make decisions for their households. It was observed that the narrator was rarely interrupted during his conversation;

questions were asked when the narrator paused. The implication and influence of this socio-norm on User Interface Design (UID) is that gender does play a role and therefore considerations should be made on the interface. This would be consistent with the socio-norms of the community where elderly men do most of the narrations and decision making but women also take part when the men are not available.

Various gestures were observed from the listeners during their interactions with the narrator. The gestures discussed are also based on the video annotations comparing three different listeners in the slaughtering annotation. The differences in postures are discussed based on types of behaviour in Bull's movement scoring system (Bull, 1987).

There is little or no eye contact among the listeners as well as between the listeners and the narrator. In an African setting it is not essential to have eye contact between two or more human communicators. In western societies, not making eye contact is a sign of lack of confidence or trustworthiness. In some African societies, making eye contact is a sign of disrespect, especially if the person gazing is younger. The implication and influence of this on user interface design is that interfaces involving human animations e.g. using an embodied conversation agent should depict little or no eye contact with the user of the system so as to represent the socio-norms of the community members.

Most of the distances between the listeners and the narrator were observed as being at least an arm's length away in most of the videos that were analysed (see figure 4.2). There were however some instances for example during

where the listeners and the narrator were assembled in close proximity (see figure 5.1). One can also see an element of touch in figure where the narrator is touching the listener. This was one of the only times that we observed such a gesture and we thus cannot conclude that this is a norm in the community set up.



**Figure 5.1: Spatial proximity of narrator and one of the listeners**

**What are the typical verbal and non-verbal communications of listeners during interpersonal conversations?**

Observations from the videos and from the interactions between the narrator and the listeners in an interpersonal interaction reveal that listeners contributed to the conversation by providing feedback in form of “eehee” and “eeyee” at regular intervals while the narrator was speaking. This seemed to have encouraged the narrator to continue conversing. This was observed in all

our video recordings. The implication and influence of this norm on user interface design is that verbal feedback from the listener is an essential component that should be included for user interfaces for the community members.

It is also important that the language of communication be Oshihero so the users can better understand what is said and so that they can efficiently use the system.

Responses from the elderly lady suggest that feedback should optionally be offered in various local languages for those that do not understand English.

We also observed that the narrator adapted his conversation based on the (main) listener (unmarried male listener) during the narration process. He included wedding examples in his conversation. (See Appendix B)

Based on Kraut, et al., (1982), we can also assume that the narrator adapted his oral communication based on who the listener(s) were and based on the feedback received from the listener(s) in form of “eehees” at regular intervals.

The implication and influence of this socio-norm on UID is that the interface design should be adaptive and allow for various interactive options for various types of users.

### **How can the socio-cultural and communication behaviour be used to appropriate user interfaces?**

Some of the considerations that designers may have to think about when they are creating interfaces for rural African communities are the socio-cultural dynamics of the target community. This is an important aspect because the culture influences behaviour as a direct result of the cultural beliefs, values,

and norms ingrained within individuals, which may differ in communication structures within the community. We have identified that to some extent, men usually chair the village gatherings. If we consider using ECAs then, the gender of the agent may play a role but this has to be investigated further.

The verbal and Non-verbal communication patterns were examined according to the videos annotations and interview observations of village members with regards to the listeners interactions with the narrator can possibly be incorporated into an EACs because they are able to depict the gestures observed.

Very little eye contact was observed so the implications for design are that if we are using agents, you would have to have an agent that is not constantly gazing at the elder whose IK is being captured. The very little interruption during speech and this must also be considered. Who the listeners are also plays a crucial role in the context as seen in Appendix B of the story so we may suggest that the narrator decide who the listener agents should be in order to shape the story during IK capture.

## **5.2 Agent design Recommendations.**

Based on the interviews we conducted during the research, we can conclude that for the Herero people, gender plays a role for the community. Men are the one who chair community gatherings and seem to be in control of decision makings for their families. We would therefore recommend that the agent be represented by a male character. To adequately create interfaces for the rural

African community with low formal education and English language barriers, we propose the use of ECAs or speech based intelligent interfaces. These can accommodate social cultural norms and behaviour as well as non verbal communication such as gestures. Use of Embodied conversation agents as system interfaces for an indigenous knowledge system can probably enable rural community users to readily accept the system because it is oral in nature and uses the language spoken by the users, which resembles the mode of human to human face to face interactions. This will help the users feel more in control of the system and we presume also lead to better acceptability of the system as well as willingness to interact with the computer device.

An assumption is also that ECAs could require little or no training for the user because of the speech based human computer interaction rather than the use of text based interfaces for rural community members who have little or no formal education.

The assumption is also that the ECAs depict the correct communication patterns in form of turn taking, feedback, semantics, and gesture behaviour as this could present inaccurate information to the user.

From our experiment to determine the frequency of verbal feedback in form of “eehees” from the listeners to the narrator, we can assume that these utterances contribute to the conversation among those involved and thus if we were to use ECAs, then they must at regular intervals contribute “eehees” to the narrator possibly to encourage him to continue with his story.

It is important the agent speak in Otjiherero because this is the language used in conversations among community members.

When the listeners were not giving verbal utterances, silence was observed while the narrator was speaking so it is suggested that the agent is silent while the user is conversing. Little or no interruptions were also observed by the listeners so it would be recommended that the agent interacts accordingly. These are due to the social cultural norms of the community.

Very little eye contact was observed during conversation during our research so we can deduce from our findings that the agent must display little to no eye contact while interacting with the users.

## **CHAPTER 6: CONCLUSION**

### **6.1 Summary**

In this thesis, the specific aim of the research project was to identify current non verbal communication structures (gestures) and general discourse practices of listeners in selected rural communities. Three research questions were formalised to assist with the research project and the summary of the findings are discussed below.

### **6.2 Research Questions**

The following research questions were asked in Chapter 1.6. For each research question, a summary of the findings and analysis are given below.

#### **6.2.1 What socio-cultural norms and behaviour should be considered when designing user interfaces for IK capture?**

Gender played a significant role in decision making within the Ovaherero people. The men made decisions on behalf of their families and therefore this should be considered when designing user interfaces.

The distances between the community members at gatherings were about an arm's length with very little elements of touch.

In the findings, there were socio-cultural norms among the Ovaherero people that influence communication behaviour, which are different from western behaviour; for example with the different gestures for height depiction

depending on whether for a child or an animal among the Ovaherero tribe indicated differences in height categorisation.

### **6.2.2 What are the typical verbal and non verbal communications of listeners during interpersonal conversations?**

Little or no eye contact was also observed among the Oaherero community members.

Little or no interruption of the narration by the listeners was also observed.

Listeners contributed to the conversation by providing feedback in form of “eehees” at regular intervals while the narrator was speaking.

### **6.2.3 How can the socio-cultural and communication behaviour be used to design appropriate user interfaces?**

The socio-cultural dynamics of the target community should be considered before designing interfaces.

Designers should work closely with the users to ensure that the rural village members participate in the interface design process. The interface should use the language of the target community and should be “usable” by even those with little or no formal education. The system could have regular feedback in form of “eehees” that mimics face-to-face conversation with listeners.

## 6.3 General Conclusion

Face-to-face conversation is the common method of knowledge transference in local African communities from one generation to another. One solution for storage and retrieval of IK would be to develop a Knowledge management system. To design appropriate interfaces is good practice to involve the future users of the system according to some HCI theories. A face-to-face conversation includes aspects such as gestures that can offer rich information to user from communities with various levels of formal education.

This thesis has identified very specific social and cultural norms and communication behaviour, specifically gestures that are recognised in the Ovaherero community that are not recognised in western communities. One example is the limited eye contact that is established between the narrators and the listeners.

Socio-cultural values play an important role in communication whether it is interpersonal within a group or across cultures. It is therefore essential to investigate cultural communication aspects further before designing system interfaces for rural African communities.

Verbal and non verbal communication can be observed in African listeners that vary from western literature on listeners. In the African Ovaherero communities, the listeners can play a role in influencing the narrator's conversation.

Gestures accompany speech for the narrators but however, the listeners also produced gestures at random periods with and without speech.

## 6.4 Further Work

Further research work can be undertaken to first of all investigate on a large scale and more comprehensively socio-cultural norms and behaviour among the local Ovaherero people. Analysis of more videos should further be completed to distinguish the correlation between language, gestures, intonation, gaze, and spatial distances between the narrators and the listeners.

Secondly, we can further investigate other posture codes or create an extended coding scheme to include cultural specific gestures due to the fact that the western coding scheme used by Bull, 1987 is not sufficient for use in an African natural environment situation.

Moreover, it is also essential to obtain results based on more than one coder to establish if the gestures and speech results correlate between the different coders so that we can clearly include these gestures to derive interface elements that can be used in our interface design from a digital knowledge system.

Further research could also establish how the Ovaherero experience various aspects related to their socio-cultural behaviour and values that could influence interface design components such as metaphors, mental models, navigation, interaction and appearance.

## 7. Bibliography

Adam, L. (2007). Information and Communication Technologies, Knowledge Management and Indigenous Knowledge: Implications to Livelihoods of Communities in Ethiopia. Retrieved August, 2009 from [www.eictda.gov.et/Downloads/Papers/Knowledge\\_Management\\_and\\_Indigenous\\_Knowledge.doc](http://www.eictda.gov.et/Downloads/Papers/Knowledge_Management_and_Indigenous_Knowledge.doc)

Argyle, M. (2007). *Bodily Communication*. London: Routledge.

Bidwell, N.J., & Browning, D. (2009). Pursuing genius loci: interaction design and natural places. Proceeding From Pers Ubiquit Comput 2010 : *Personal and Ubiquitous Computing*, ( pp. 15-30). Valencia: Spain

Bidwell, N.J., Reitmaier, T., Marsden, G., & Hansen, S. (2010). Designing with Mobile Digital Storytelling in Rural Africa. Proceedings From CHI2010 : *Human Factors in Computer Systems*, (pp.1593-1602), Atlanta: USA

Bidwell, N.J., Winschiers-Theophilus, H., Kapuire, G.K., & Rehm, M. (2011). Pushing personhood into place: Situated media in rural Knowledge in Africa. *International Journal of Human Computer Studies*.(pp. 618-631).

Blake, E. (2010). Software Engineering in Developing Countries. Proceedings from CHASE'10: *Proceedings of the 2010 ICSE Workshop on Cooperative and Human Aspects of Software Engineering*, (pp.1-4), New York, NY : USA.

Bull, P.E. (1987). *Posture and Gesture*. New York: Pergamon Press.

Cassell, J., Bickmore, T., Campbell, L., Vilhjálmsson, H., & Yan, H. (2000). Conversation as a System Framework: Designing Embodied Conversational Agents.

Cassell, J. (2001). Embodied Conversational Agents: Representation and Intelligence in User Interfaces. *Artificial Intelligence Magazine*. 22(4), 67-83

Chivuno-Kuria, S. (2011). Towards Appropriate User Interface Design Preserving Rural African Communication Practices: Agents as Mediators in Knowledge Transfer. Proceedings from IKTC2011: *Embracing Indigenous Knowledge Systems Into A New Technology Design Paradigm*, Windhoek: Namibia.

Dick, B. (2002). *A beginner's guide to action research* [Online]. Retrieved August 2011 from <http://www.scu.edu.au/schools/qcm/ar/arp/guide.html>

Endrass, B., Rehm, M., & André, E. (2009). Culture Specific Communication Management for Virtual Agents. Proceedings From 8<sup>th</sup> International Conference

on Autonomous Agents and multiagent Systems (AAMAS 2009), (pp.281-287), Budapest: Hungary.

Erasmus-Kritzinger, L.E., Bowler A., & Goliath D. (2002). *Effective Communication*. Afritech.

Gallant, L.M., (2006). *Ethnography of communication approach to mobile product testing*. Springer-Verlag London Limited.

Gardner, R. (1998). Between Speaking and Listening: The Vocalisation of Understanding. *Journal of Applied Linguistics*: Oxford University Press, 19(2), 204-224.

Green, L. (2001). *Communication, Technology and Society*. SAGE Publications.

Grenier, L. (1998). *Working with Indigenous Knowledge: A Guide for Researchers*. International Development Research Centre, Ottawa.

Gudykunst, W., & Mody, B. (Eds.). (2002). *Intercultural Communication Theories* (pp. 183 – 205). In W. Gudykunst & B. Mody, *Handbook of International and Intercultural Communication*. Sage Publications.

Hermeking, M. (2005). Culture and Internet Consumption: Contributions from cross-cultural marketing and adverting research. *Journal of Computer Mediated*.

Hymes, D. (1974). *Foundations in sociolinguistics: An Ethnographic Approach*. University of Pennsylvania Press, 26-66.

Kapure, G.K., Winschiers-Theophilus, H., Chivuno-Kuria, S. Bidwell, N.J., Blake, E. (2010). A revolution in ICT, the last hope for African Rural. Proceedings From 4th International Development Informatics Association (IDIA) : *Communities' technology appropriation*, Cape Town: South Africa

Kapure, G.K., & Blake, E. (2011). An attempt to Merge local and Technological Paradigms in the Digital Representation of Indigenous Knowledge. Proceedings from IKTC2011: *Embracing Indigenous Knowledge Systems Into A New Technology Design Paradigm*, Windhoek: Namibia.

Keesing, R. (1974). Theories of Culture. *Annual Review of Anthropology*, 3, 73-97.

Kipp, M. (2004). *Gesture Generation by Imitation – From Human Behaviour to Computer Character Animation*. Boca Raton, Florida.

Kothari, C.R. (2008). *Research Methodology: Methods and Techniques*. New Age International Publishers.

Kraut, R.E., Lewis, S.H., & Swezey, L.W. (1982). Listener Responsiveness and Coordination of Conversation: Contribution from Interpersonal relations and group processes. *Journal of Personality and Social Psychology*, 43(4).

Littlejohn, S.W. (2002). *Theories of Human Communication (7<sup>th</sup> ed.)*. Wadsworth Group, 18-206.

Maho, J.F. (1998). *Few People, Many Tongues: The languages of Namibia*. Gamsberg Macmillan Publishers (Pty) Ltd.

Map of Accommodation in Namibia. Map.[Scale not given]. Retrieved December, 2012 from

[http://na.essentialtravelinfo.com/index.php?p=accommodation\\_map\\_namibia](http://na.essentialtravelinfo.com/index.php?p=accommodation_map_namibia)

McNeill, D. (1992). *Hand and Mind: what gestures reveal about thought*. University of Chicago Press.

United Nation Population Fund. (2007). UNPFA State of world population 2007.

Unleashing the potential of urban growth. New York: United Nation Population Fund. Retrieved July, 2011 from

<http://www.unfpa.org/6billion/ccmc/urbanizationandmigration.html>

McGregor, G. & White, R. (1990). Reception and Response Hearer Creativity and Analysis of Spoken and Written Texts. London: Routledge.

Milewski, A. E., & Lewis, S.H. (1997). Delegating Software Agents. *International Journal of Human-Computer Studies*, 46, 485-500

Mondo, T.M., Baryamureeba, V., & Williams, D. (2007). *Collaborative Framework for Supporting Indigenous Knowledge Management*. ACM Press.

Ong, W. J. (2002). *Orality and Literacy: The Technologizing of the World*. Routledge.

Rehm, M., Nakano, Y., & Huang, H.H. (2007). Creating a Standardized Corpus of Multimodal Interactions for Enculturing Conversational Interfaces. ACM Press.

Rehm, M., André, E., Nakano, Y. (2009). Some Pitfalls for Developing Enculturated.

Conversational Agents. *Human Computer Interactions*. 340–348

Shannon, C.E., & Weaver, W. (1949). *The mathematical theory of communication*. Urbana, I.L.: University of Illinois press.

Shapi, M. K., Cheikhoussef, A., Van Kent, A., Sifani, J., Mumbengegw, D. & Matengu, K. (2011). Evolution of Indigenous Knowledge Systems Data Collection Methods: Approach at the Multi-disciplinary: *Indigenous Knowledge Technology Conference*, Windhoek, Namibia.

Sherwani, J., Ali, N., Penstein, R. C., & Rosenfeld, R. (2009). Orality-Grounded HCID: Understanding the Oral User Inf. *Technologies & Int. Development* (5) 4, 37–49

Shneiderman, B (1998). *Designing the User Interface: Strategies for Effective Human Computer Interaction*. Addison Wesley Longman, Inc.

The World Bank, (2005). *Indigenous Knowledge Program*. Retrieved November, 2010 from <http://go.worldbank.org/CFZJDCEDM0>

Thinyane, M., Dalvit, L., Slay, H., Mapi, T., Terzoli A., & Clayton, P. (2007). An Ontology-based, Multi-modal platform for the inclusion of marginalised rural communities into the knowledge society. *Proceedings From SAICSIT2007: Riding the wave of technology*, (pp.143-151), Cape Town: South Africa.

WikiBooks. (September, 2011). *ICT in Education / Definition and Terms*. Retrieved November 2011 from [http://en.wikibooks.org/wiki/ICT\\_in\\_Education/Definition\\_of\\_Terms](http://en.wikibooks.org/wiki/ICT_in_Education/Definition_of_Terms)

Winschiers, H. (2001). *Dialogical system design across cultural boundaries*. Doctorial dissertation. University of Hamburg.

Winschiers-Theophilus, H. (2009). Cultural Appropriation of Software Design and Evaluation. In Whitworth, B., & de Moor, A. (Eds.), *Handbook of Research on Socio-Technical Design and Social Networking Systems: (2)*. 699-710.

Winschiers-Theophilus, H., Bidwell, N. J., Chivuno-Kuria, S. & Kapuire, G. K. (2010). Determining Requirements within an Indigenous Knowledge System of African Rural Communities. Proceedings From SAICSIT 2010: *Fountains of Computing Research*, (pp.332-340), Pretoria: South Africa.

## **8. Appendices**

### **Appendix A**

#### Interview Questions

How is information communicated to the whole community?

How are decisions made within the community?

Who is responsible for rules that govern the clan?

What are the roles of men, women, and children with regards to communication?

What communication structures does the community have and what is used?

What are the differences between how information is communicated with the clan and what is done traditionally by Herero tribe?

What are the taboos in communication?

How do the people learn and know things?

Is the community open to new ideas?

Are people encouraged to learn new ideas?

When is information passed down from generation to generation?

How does information get classified and when is passed on?

What roles do songs, stories and artefacts play a role in communication?

## Appendix B

Sample translation of one of the videos from Herero to English based on a Scenario of how to slaughter a sheep.

Elder: Matuhungire ohunga no mbazu, omabazu yetu

We are talking about the culture, our culture

Ohunga no mbazu, noNdu

About the culture and the sheep (00;09)

Ondu tjiya kurama nao ya kura otjo Ngombe

The sheep as it stands it stands as Cattle (cow) 00;14

Orondu pumapeungurwa ongombe opumapeungurwa ondu

Because the same way the cow is done is the same the sheep is also done

Ondu itira moMuvanda , mo murungo Muvanda

The sheep is slaughtered in Omuvanda Holy place ( the area between the homestead and the cattle kraal)

...

Ondjimakuzuvi Ondu yo Ndjova (groom's party or feast)

Ondu yOndjova itira mbee!!

Groom's sheep is slaughtered over there!!

Rutenga pari omakutu, namba peya ozo tenda

At first they were using traditional tents but now is modern tents

Okutona otenda yoje mbo

You build your tent there

Kapeno mbindu iwira pehi , tjamua tjina tjundu ndjo tjiogua

Not even a single drop of blood from this sheep should fall on the ground; every little thing of this sheep is collected

Tjimave heraura, omukaendu nozombanda ze ozombapa usekama aveheraura pamwe aveevari

When they are stirring, the bride in here white wedding gowns has to get up and stir with the groom the two of them together

No kuhina kutuna ko nandae okuria

Without touching it or eating

Tjiyapyi tjia manuka no mbindu ooku umba moviyaha

When cooked and ready, with the blood then all is put in a big dish

Aikahitisiwa mo ndjiwo indjo onene

Then it is taken to the main house

Ya ihe na ina, airara mo

His father and mother's house, it over night there

Muhuka omunene tjivapenduka (2:03)

In the morning when they wake up

Avehiti, handje muno tjiyaha tjomeva noho

Then they go in, but there is a bowl of water also

Orundu nao nandaa okanyama nai momayo kakeso kukara mo

Because not even a tiny piece of meat should be in your teeth

Ngwari erikoho mbo uriri,

Whoever eats will just have to wash or clean him/herself there

...

Kutja mbazepere mbo, pomuvanda wetu  
Even if I slaughtered it there in our holy area  
Hina kuterekera mbo kako  
I will not cook it there,  
Metereke esaneke okarama uriri, eeta ponganda  
Will just pretend cooking a leg, then I brings it home here  
Tjimba eta ponganda, mouye wanamba mbwi mauvanga okuyenda  
If I bring it home in this modern world, you want to go  
Onyama ndjo ,okutoora onyungu onene otua mezuko  
You just take a big pot and put in the fire  
Ookutwamo onyama ndji, ookusaneka tjimuna mba ziki  
Then put in the meat and then pretend or make as if I cook (03:35)  
Okutwa monyunguu nao uriri otjiti tjimuna mbaziki  
Just put in the pot and make as if I cooked it  
Etwako omuriro ko nyungu , ookusaneka aayo mbaziki  
Then I add fire to the pot and make as if I cooked it  
Ookutwaerera  
Then you can take it with  
Ombihu uriri kai toorwa  
Raw meat cannot be taken at all  
Ondu, menangarasi ondu mbamana  
...  
Ondeze  
It is secret

Omukaendu nderi uaeta omapanga , kena ousemba okuuyeku haamisa kombete  
ndjo, ondeza

If your wife has friend she is also restricted to let them sit on that bed, it is secret

Ove konousemba okujeta omapanga woe kombete ndjo , ondeze

You also don't have the right to let your friends sit on that bed, it is secret

04:51...

Omatupa uondjova, Onyama ndjo

The bones from the grooms feast (party) Ondjova, the meat

Ove nguwakakupa omukaendu woe, onyama ndji ihita mondjiuo ndjo nene haiho  
na nyoko

You who just got married, this meat is taken in to your mom and dad's house

...

Kuzambo, rukuru ovandu aave kaondja pehi uriri erike

From there people in the older days use to walk to the field

Tjimweya ovihauto nai okuhinga nganduu mokati kovitongo

Now that we have cars you just drive till in the middle of the villages

(07; 20)

...

Kakutja ingo mukaendu ngo woe erero uatjukutjura omeva ngo wouyenda

So by then your wife yesterday had shake the arrival water in her mouth

Ookupitisa , aikomuvanda aravaerwa kovakuru

Then you take her out; take her to the Omuvanda (holy fire place) to be  
introduced to the ancestors

Otjo mukaendu ngwaetwa monganda

As a new wife in the homestead

Omukaendu eengwi korive na korive , mba kaisa kotjiwana tjakatjikuatjike

Here is the wife [lady] from where and where, I got here from that family

Uari no ruzo ro tjipoya nambano mbakatora koNgwatjiya

She had the superstitions of Otjipoya now to that of Ongwatjiya

Ngunda ahiaya kotjunda nao nu,,

That is before she even goes to the kraal

Ok

Oondjo ngombe ndjo ndji uakahungira indi tjiua kaeta omukaendu

That's the cow that you naming when you went to get your wife

...

Mbya pirako uriri, imbo kapezikwa ombimari

Junk food, there will not cooked. She will eat that

Kenakuria imbivio ponganda mbya vazeua mba

She will not eat the food she found at this place

Muka omunene ooku toora oka ravaera ohumo maze

In the morning you take her and introduce her and rub her with the fat

...

Kaondo zo sprej zenu ndu tuarura mo

Not these modern sprays that are used

Maku uondjo omukaendu omuHerero

That's a Herero woman walking there

Nu manuka tjimuna ozongombe tjizarara mondjira

And she smells cattle lying in the road

Manuka tjimuna ozongombe zao

She smell like their cattle

So...

20:05

## Appendix C

Posture Movements using Bull's movement posture scoring system.

Head postures

RaUHd: Raises up head

DsHd: Drops head

LHdF: Leans head forward

LHdP: Leans head to person

THdAP: Turn head away from person

LHdAP: Leans head away from person

Leg postures

MLP: Moves leg to person

MLAP: Moves leg away from person

LSF: Leans sideways on foot

Xls: Crosses legs

Arm postures

(a) Hand-to-head postures

PHHd: Puts hand to head

PHNk: Puts hand to neck

PHFe: Puts hand to face

(b) One-handed postures

PHSr: Puts hand to shoulder

PHUAm: Puts hand to upper arm

PHEw: Puts hand to elbow

PHLAm: Puts hand to lower arm

PHWr: Puts hand to wrist

(c) Two-handed postures

FAs: Folds arms

JHs: Joins hands

(d) Hand-to-trunk postures

PHCt: Puts hand to chest

PHAn: Puts hand to abdomen

PHB: Puts hand to back

(e) Hand-to-clothes postures

HP: Holds pullover

PHIPt: Puts hand into pocket

PHTr: Puts hands to trousers