Determining Requirements within an Indigenous Knowledge System of African Rural Communities

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ABSTRACT

Eliciting and analyzing requirements within knowledge systems, which fundamentally differ so far from technology supported systems represent particular challenges. African rural communities' life is deeply rooted in an African Indigenous knowledge system manifested in their practices such as Traditional Medicine. We describe our endeavors to elicit requirements to design a system to support the accumulation and sharing of traditional local knowledge within two rural Herero communities in Namibia. We show how our method addressed various challenges in eliciting and depicting intangible principles arising because African communities do not dichotomize theoretical and practical know-how or privilege a science of abstraction and generalization. Ethnography provided insights into etiology, or causal inter-relationships between social values, spiritual elements and everyday life. Participatory methods, involving youth and elders, revealed nuances in social relations and pedagogy pertinent to the transfer of knowledge from generation to generation. Researcher and participant-recorded audio-visual media revealed that interactions prioritize speech, gesture and bodily interaction, above visual context. Analysis of the performed and narrated structures reveal some of the ways that people tacitly transfer bodily and felt-experiences and temporal patterns in storytelling. Experiments using digital and paper-based media, in situ rurally showed the ways that people in rural settings encounter and learn within their everyday experiences of the land. These analyses also demonstrate that own ontological and representational biases can constrain eliciting local meanings and analyzing transformations in meaning as we introduce media. Reflections on our method are of value to others who need to elicit requirements in communities whose literacy, social and spiritual logic and values profoundly differ from those in the knowledge systems that typify ICT design.

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1. INTRODUCTION

Exploring how to extract, depict and analyze technology requirements of rural communities who wish to generate, share and control content on traditional local knowledge can improve technological inclusivity for healthcare as well as other information services, such as e-agriculture. A scarcity of local content and poor ICT infrastructure matched to daily practice and knowledge forms contribute to technology's irrelevance to rural Africans. Different priorities, inaccessibility and perceptions that computers suit only the formally educated [28] contribute to a low usage. However designing appropriate technology which is entwined with practices of Traditional Local Knowledge (TLK) can be used for sustainable development in areas such as agriculture, healthcare and natural resource management. Yet, it requires improving the success of negotiating and analyzing requirements with and for people with profoundly different literacies than those that typify the ones of the technologically saturated world. Appreciating interactions between knowledge systems is important in gathering, depicting and analyzing the requirements of a technologically marginalized one. In the West, we use various graphic, scientific and media literacies to interact with information. These systems may not aim to discount social or metaphysical aspects in narratives; the intuitive, tacit, intangible or vernacular in therapy; or social distribution of knowledge; but, their logics have a selective visibility. Designing for communities that privilege a holistic approach including the social, spiritual and cosmic over a discrete worldview involves realizing these in the analytic lenses use and understanding of requirements. This is particularly challenging for technology designers from the Northern Hemisphere, whose perspective is influenced by their cultural background and prominent

worldview differs from the local one. In these situations underlying systems of knowledge of developers and users may be conflicting thereby increasing the design gap between the participants. Negotiating, depicting and analyzing the technology requirements for currently unserved knowledge systems involves accounting for interactions between the knowledge systems serving ICT design. For our purposes, here, a knowledge system consists of both how the world is and how we come to know about how the world is. That is what kind of entities exist, ontologically, and what makes knowing about their existence possible, epistemologically. While chronologically eliciting, depicting and analyzing requirements may appear as separate steps, they are not; they are mutually constructive processes. Our own knowledge about the social world plays an important role in analyzing the data.

Globally, numerous electronic archives store information about TLK for diverse purposes from preserving oral and intangible heritage to conserving and harvesting ecological resources (e.g. ethno pharmacology). These external curations tend to map knowledge to concepts within scientific narratives [27, 15], using representations emerging within the West's written and hyper-visual media culture. Mappings, such as to codify relationships between spiritual and emotional forces in Yoruba herbalism [23], may omit principles embedded in local practice, oral narratives or ritual. It is well known that methods to bring out and depict requirements are not culturally transportable. For instance, Byrne and Leopoldo show that there is no single algorithmic best practice which is applicable to all situations by drawing on designing health information systems in South Africa, Mozambique and India [9]. In a gradual retreat from the modernization positions, local knowledge is becoming more valued and the need for architectures to be bottom up and demand driven [24].

In South Africa, the Indigenous Knowledge Systems (IKS) Policy, adopted in 2004, includes supporting institutions to assist communities in categorizing and characterizing of their biological resources, innovations, practices and technologies, and creating a formal system to record IK. While numerous initiatives have started with the collection and digital preservation of TLK in Southern Africa, few have realized the loss of precious information by simply channeling the local knowledge system into traditional technological solutions, such as databases. Web 2.0, distributed platforms and less costly devices for recording and sharing media (e.g. cell-phones) offer new opportunities to match how people typically share ancestral and contemporary herb wisdom and know-how. For instance, video and digital storytelling (linking photos to audio) may suit people that emphasize direct, oral communication in every-day life and their specific 'narrative intelligence' [4, 5, 14]. By blending picto-graphic form with meanings audio-visual media may convey the spoken and performed, beyond merely electronically writing features of speech; such as in the way clinical students use video systems to visually compare their own to an expert's first-person perspective [3]. The choices we materialize, about what makes sense to depict and analyze, become absorbed into the narratives that construct knowledge. Various Indigenous communities have appropriated audio-visual media to convey their knowledge to wider audiences [e.g. 5]. However, reconciling media with non-Western episteme must account for the situated nature of information transformation as communities appropriate media. Exploring the gathering of traditional local knowledge has become part of our wider endeavor to design systems to support the transfer of rural wisdom and know-how by local people.

In our current project, we aim to design architectures and interfaces compatible with the ways Herero people in rural Namibia convey and conceptualize traditional local knowledge. In this paper we show how various aspects of our methods and approaches on the one hand support the determination of requirements on the other hand leave many questions open. We begin by describing the research project's context, methodological approach, and data collection. Next we outline our research framework of rural Herero communities' dynamic interactions in recording and viewing videos. Based on these we derive a first set of implicit requirements. A detailed analysis of interactions between people, media, narrative and conceptualizing of TLK, especially in regard to traditional healing reveals the need to further investigate requirements. Thus with a set of developer driven design activities we explore requirements for the knowledge architecture. We demonstrate the challenges immanent to designing the right system with communities propagating a different knowledge system from the one generally supported by technology.

2. RESEARCH PROJECT OVERVIEW

In 2008, a formal research cluster looking into community centered localization of design processes and products was established at the Polytechnic of Namibia. Two research sites in Eastern Namibia were identified for a pilot project aiming at developing an indigenous knowledge management system with the communities.

We draw on a diversity of methodologies for the iterative cycles of requirements identification, design and evaluation. First, we take a dialogical approach [30, 20, 21]. This means our understandings of users and their activities, for the purpose of design, lives in sets of relationships between ourselves, others and the context. We consider any account about users' experience, including those that are analytical and those materialized by prototypes, to be unfinalized productions. As designers we experience these accounts as we 'converse' with multiple perspectives and diverse aspects of settings. Second, we frame our development process following a critical action research approach to introduce technology and design concepts for further evaluation and reflection [6]. Together these positions mean we continuously contemplate our current understanding of users, their needs and our relationship with them and then introduce appropriate tools for data gathering and interpretation and design conceptualization (e.g. from participatory design, ethnography and value-sensitive design). We begin by outlining the research setting and our data gathering activities and then describe in detail selected aspects of our approach leading to new requirements based on insights on TLK.

2.1 Participants & Sites

Our design team includes two researchers from the Herero tribe and five non Herero researchers, three of whom live or have spent prolonged time in Namibia. Participants include pastoralist dwellers in two rural villages, Village-2 and Village-1, which are 50km apart in the Omaheke region near the Botswana border. We linked to the villages via personal relations from the researchers. In Village-2 our point of contact is a professional "Diviner-Herbalists" and pastor (TH1) in the Namibian Apostolic Church, a syncretistic that merges Christian and traditional Herero beliefs. He treats patients using herbs, prayer, intuiting cures from ancestral spirits. In contrast, participants from Village-1 are not professional healers but use herbal medicine in daily life. Many of the 16 participants in Village-1 are kin or family friends of one of our researchers

who was born and lived in the village until 12 years old when he moved to Windhoek with his family. Like many Herero rural-to-urban migrants he returns regularly to Village-1 to maintain their homestead and livestock.

Participants had not depicted their wisdom graphically, by photography or video before, rarely use writing materials and some cannot read. They use few electronic technologies in their everyday rural life. Some listen to the radio or own a cell-phone but cell-phone coverage is limited and there is no TV access or connection to the electricity grid locally. Participants articulated various goals for sharing digital content, as they gained familiarity with media, ranging from the wide benefit of TLK for 'nature and people' to addressing the loss of wisdom and know-how by clan members who, for economic reasons, spend time living in urban areas.

2.2 Data Gathering Activities

Our data gathering and analysis activities were clustered around video recordings of community activities, narrations and requirements elicitation and evaluation sessions. All interactions with the community were conducted in Otjihereo, the mother tongue of the community members. Thus the researchers extracted requirements from the observed in the field and the videos, the translated and interpreted videos. Our aim was to explore together with the community how digital media might serve their knowledge system and can be appropriated. Thus we introduced media adaptively and evolved more complex activities flexibly. We chose video as the first medium because it affords opportunities to record body movement and oral and visual communication, however as activities unfolded we also used thumbnail photos from video, photography and writing materials. We gathered 30 hours of video of activities. The video, recorded during seven 2 -14 day field-trips across a year and in Windhoek is of three main types (Figure 1):

2.2.1 Video of Rural Knowledge Recorded In Situ (V-Situ)

In six hours of video participants' tell, demonstrate and discuss rural knowledge in situ rurally, in the yard or bush around their homesteads. This includes:

3 hours that we recorded. Content included interviews of community activities and group discussions.

40 minutes of video (2 to 180 seconds clips) recorded independently by young and senior villagers, selected by the community. Content included: herbal lore; people undertaking everyday activities in their yards (e.g. women cutting recently slaughtered meat or packing tobacco); livestock activities beyond the homesteads (e.g. milking cows, herding goats). 1 hour recorded by a participant as we concurrently recorded.

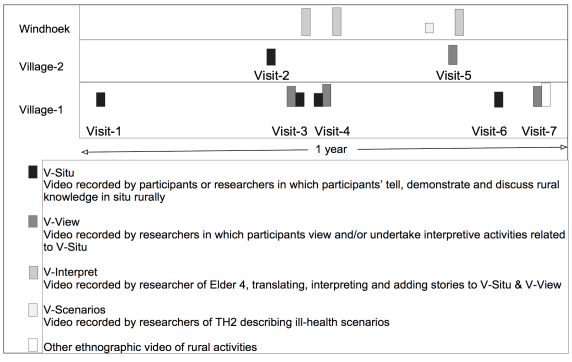

Figure 1 Video sessions

In visit-2 TH1 spent 1.5 hours moving around the bush close to his home in Village-2 self-recording his knowledge, using the 'Flip' camera, while we (two female researchers) observed and filmed him. He made 13 clips from 30 to 120 seconds and after each his wife translated and we discussed his practice. All of TH1's recordings were narrations from a 1st Point of View (POV) as he controlled the camera; while our observational video is a 2nd or 3rd POV.

In Visit-3 & Visit-4 Local men collected 37 short video clips independently of us. We explained how to operate a battery-powered 'Flip' video camera and one middle-aged man; Elder 3, recorded 5 clips and three younger men (age 18 to 25) recorded 8 to 14 clips. These clips are 1st or 2nd POV. In 11 clips the cameraman narrated, co-narrated or participated in the action (1st POV) and in 16 clips the cameraperson interviewed subjects in the clips (2nd POV). In Visit-5 we brought a town based traditional healer (TH2) to Village-2 and gave him the camera to record a walk into the bush with TH1 which we also filmed.

2.2.2 Video of Viewing Activities Recorded In Situ (V-View)

In 9 hours of video participants viewed and/or undertook interpretive activities related to the previously recorded video V-Situ, sometimes involved other media: paper, printed or electronic thumbnail photos. All recordings, like those of V-Situ, were made at the rural sites, and some involved taking rural-to-urban migrant participants with us. Two or three researchers were present during these activities.

2.2.3 Video of Interpreting Recorded In Windhoek (V-Interpret)

In 12 hours of video a 65-year old rural-to-urban migrant from village 1, translated, interpreted and added stories to V-Situ and V-View.

We analyzed all types of videos, translations and transcripts embedded in ongoing unfolding of activities, reflections, ethnography and secondary literature matching.

3. COMMUNITY CENTERED REQUIREMENTS' DETERMINATION

Interactions and communication practices within a 'cultural group' embody knowledge as much as the explicit semantic content of what people say. Thus the determination of requirements takes place at two levels, at an implicit and an explicit one. The context-bound embedded requirements are informed by the underlying values and habits of the community. For this purpose we have studied the theoretical foundation as well as conducted ethnographical observations. Whereas the explicit requirements were determined through community and researcher driven interactions, such as community meetings, contextual interviews, prompted narrations.

3.1 Ubuntu-Sensitive Framework

In rural Africa it is increasingly recognized that it is more useful to think of community-centered design [29]. We have found drawing upon the African (bantu) philosophy of 'ubuntu' helpful in sensitizing us in co-evolving a framework through which, as [32] recommends, user participation appropriates the process of requirements depiction. Ubuntu variously means, "Humanity", "humanness", or even "humaneness", and is the foundation for the paradigm of "connectedness of all", expressed in the aphorism "a person is a person through other

people" [22]. Reasoning in Indigenous frameworks, which recognize the relationship between what meanings and the practices that create meanings [20] motivated us to draw upon local epistemology. Mbiti insists that the cardinal point in understanding the African view of humanity is: "I am, because we are; and since we are, therefore I am" [22]. This is significant for concepts in the health sector and consequently the design of supporting systems. Western knowledge practices reflect and produce concepts about individualized health which relate, the organic dysfunction of 'disease' to a person, objectively separated from others. Biomedicine is characterized by a neuro-culture where the self and experience resides, almost autonomously, in the brain; thus images of organs, genes and electrons represent what it is to be 'somebody'. In contrast, traditional medicine across Africa is characterized by social etiology, or causal relationships between people and symptoms [14]. Thus concepts of personhood interconnect with others, both past generations and contemporaries. The individual does not and cannot exist alone but owes existence to others: kin, clan and ancestors [27]. To be 'somebody' is a product of community actions which integrate a person into the entire society, such as rites of incorporation through which a person passes from one stage of corporate existence to another. Since self in African communities is bound to others, a person would strive for right social relationships. This has major implications on system requirements and interactions between developers and community users. Common participatory design methods, which are based on western communication structures, are incompatible with African user groups' socio-cultural habits [31]. Thus, to integrate ubuntu epistemology into requirements engineering we used methods that absorbed local protocols of participation and consensus-based decision-making.

3.2 Ethnography

Ethnography, now a common approach in human-computer-interaction research, makes an important contribution to our dialogic in terms of the ways that we align understandings about ourselves with users of TLK. It provides insight into the organization of social settings, models for thinking about those settings and, importantly, the relationship between us, as researchers, and the social setting [10]. Our characteristics as researchers unavoidably affect and intervene in the social setting and the way we tackle data. To gather insights on everyday norms and spirituality we took a 'multi-sited' approach to ethnography [17]. Wherever the sensitivity of situations limits full ethnography, like in the traditional healing sessions, we draw on our own and related experiences. We complemented cultural insides in the rural communities with activities in the capital, such as attending basic Otjiherero language lessons and TH2's Church ceremony. Moreover interactions and discussions with the migrated researcher and his family enabled us to obtain a different perspective. Moreover we make use of ethnographic observations not only in the beginning of the project to understand the user context but also during later phases to analyze user-technology interactions and appropriation to derive further requirements.

Together with our indigenous researcher and own interaction experiences in Namibia, accumulating over many years ethnography shaped our 'conversations' and helped to refocus or diffract the logics gained in our own interactions with the communities. The analytical device of reflexivity helped us to 'confess' our own relationships with meanings, beliefs and values within our lived and felt experience and their influence on the research process.

For instance, our ethnography uncovered the inappropriate arbitrary categorization of traditional and modern healing found in the literature. Herbalism became separated from spirituality in Namibia due to Christianity and Apartheid [16]. Yet we observed pluralism exists for narratives about health and etiology. Participants esteemed healers' opinions but these also coexisted with other beliefs they would try diverse practitioners and treatments from either or both Traditional Medicine (TM) and bio-medicine. For instance, within one hour a participant in Windhoek used pharmaceuticals prescribed by a hospital for a serious heart condition, herbal tea and an electronic blood pressure monitor whilst simultaneously arranging a visit from TH2. Equally would the traditional healer make use of collected and bought products, spiritual guidance, and Christian prayers. This suggests an amalgamation of knowledge systems which need to be adequately represented in supporting tools.

3.3 Group Discussions

Inclusive decision making and participatory community meetings are key features in traditional rural African communities.. The Congolese theologian Bénézet Bujo refers to it as the "efficient institutionalizing of communicative action" [8]. In seeking a solution for a problem, community members share experiences, refer to the entire history of the clan community, and consider the interests of both the living and the dead. The procedure can be time consuming as it is carried on until consensus is achieved".

We recorded various discursive activities in Village-1 (Visit-2). We spoke with nine men and one woman (aged 16 to 75) for 1.5 hours on ethics, intellectual property, participation and dissemination in relation to recordings. We discussed these topics first without video and then while and after the group watched, on a laptop, the researcher and participant-recorded videos. We recorded various activities as groups viewed and discussed participant-recorded clips. In Visit-2 four men and two women, who had not yet used the camera themselves, discussed Elder 3's clips and in Visit-4 three men (two elders and a youth) discussed both Elder 3's and the youths' clips. In Village-2 we recorded TH1 and his Windhoek-based apprentice, TH2, as they discussed TH1's clips (Visit-5).

3.4 Prompted Narrations, Contextual Interviews and Walks

All sessions were conducted by our Herero speaking researchers while being recorded. In Visit-2 we filmed 35 minutes in four clips of an interview and narrations of two 65 year old men, Elders 1 and 2. The questions were scenario-based rather than abstract, such as "What do you do if child x gets sick?" The Elders share knowledge by telling a story or giving a scenario (28 minutes) and illustrating knowledge in situ (6 minutes). These clips are a 3rd POV of an interview as those speaking within clips (knowledge tellers and interviewer) did not control the camera.

We also interviewed four women (aged 20 to 50) , independently of group discussions, as they cooked, collected wood and cared for children and discussed technology access, potential value of recording and current and past systems to disseminate local knowledge via kin networks.

We accompanied TH1 a couple of times at plant collecting walks through the bush, at which occasion prompted by the plants found on the way, he would explain preparation and treatments.

3.5 Interpretative discussions

Recorded videos were shown to an Elder rural-urban migrant for rough translations and interpretations (V-Interpret). She provided us with relevant contextual information to be able to understand statements that were made in the village and thereby adjust our interpretations.

4. REFLECTIONS AND INFERRED REQUIREMENTS

4.1 Person bound information trust

The oral and social have primacy. One woman insisted that audio alone would be sufficient to recognize a teller within extensive kin networks even years later and villagers emphasized the importance of recording the identity of those 'making the video' and where they lived. We cannot untangle how social relations between cameramen and subjects, embodied in clips, shaped the responses of particular participants as these are situated in social relations amongst the group viewing (mixtures of Elders and youths). However, recognizing the teller's pedigree is clearly vital for the integrity of knowledge. Participants mentioned close relationships between an Elder and ancestors who used traditional practices regularly and trusted TH1 even though his video did not identify him visually. Perhaps, characteristic's of TH1's speech alone provided validity since Herero custom accentuates the oral, not the visual, in imagery of people's characters, person-hood, societal position and genealogical bonds [7]. Moreover it demonstrates the trust in information source to be person bound. This confirms earlier research results from other projects in which the presented information must be attached to a trustworthy person to be accepted by the community users. Thus this is one of the requirements which were not expressed explicitly in the early development phase. However participants openly discussed issues about who is "qualified" to narrate, the risks of conflicting opinions and erroneous prescriptions, their own lack of familiarity with some plants and their reluctance to offer information that they were uncertain.

4.2 Audience adequacy

Villagers distinguished between sharing stories and teaching a specific person by storytelling. They said even experts do not know that knowledge was distributed according to personal and family interests. For instance, a senior man said he knew little about traditional treatments because he did not 'bother' to learn when he was young. Some herbs have general interest, for instance "anyone can be a victim of a toothache so anyone should be told how to treat it". However, villagers noted that a teller responds to a recipient's interest and would not teach "someone who shows no interest in what you are telling". Participants in Village-1 said they had no particular audience in mind when recording their clips and when we asked TH1 to indicate the audience for specific clips he thought we had requested him to add a warning that the information/herb should be kept from children. Participants had multiple agendas for sharing knowledge via media, beyond teaching knowledge for their own health/survival and unifying clan relations. They seek to display their culture and disseminate wisdom widely, and, as activities unfolded they noted media might raise the awareness, of government and others, to local problems so they "see that we are living this way and help by giving [us] food ..".Thus an important requirement is to support purpose driven information dissemination and retrieval mechanisms to address the appropriate audience.

4.3 Mapping communication patterns

Methods, involving youth and elders, revealed structures in social relations and pedagogy pertinent to the transfer of knowledge from generation to generation. In Herero didactics knowledge tellers are obliged to offer wisdom to recipients. Participants repeatedly demonstrated a 'push' rather than 'pull' approach to transfer; for example, after a gentle scolding by a senior woman for not knowing a herb in a clip, Elder 3 amiably replied: "How will I know it if I wasn't told of it?" Participants' emphasized knowledge holders' responsibility for transfer across generations and that candor was essential in teaching.

This communication pattern is in conflict with modern retrieval technologies in which the user has an active information seeking behavior. Thus if we want to design locally usable systems, we need to take traditional knowledge transfer structures into account. Once more this represents a requirement which is not explicitly expressed but rather extracted based on ethnographic observation. In our first designs we have clearly distinguished narrator and listener roles based on real life scenarios. Requirements for both roles can be derived on this basis, such as the narrator determines the audience, a listener has a number of distinguishable characteristics.

For most in situ clips there was a present listener, whether in view or not. Seventy per-cent of participant recorded clips involved people, other than the cameraman, speaking to camera or off-screen or not speaking but in frame. Interactions with others prevailed over cameramen's use of the camera, shaped by social relations. When participants' recorded (Visit-3, Visit-4) their interviews lasted longer than their own narratives because cameramen waited for subjects to speak and their interactions with the camera were often superseded by the vocal interactions with others. Prevailing social interactions were particularly clear in our observational video of TH1 recording. Over half of his clips include subtle interactions with his wife, in brief translations or questions and he became unconscious of the camera. To begin with TH1 held the camera in front of his face but increasingly he looked at the plant, his wife, towards us or into the distance, spent less time looking at the screen and lowered the camera to chest height. For the first two clips he looked at the screen for the entire recording but by the 6th clip he spent half the time looking away, often for up to 6 seconds at a time, and from the 7th clip would set up his shot and then look at the screen only occasionally. An 'Elder effect' influenced interactions between the cameraman and the camera. Youth's interactions with the camera were often superseded by the vocal interactions with others when they recorded elders. Indeed, TH2 was so absorbed in talking to TH1 he failed to record. When Elder 3 recorded interviews he tended to shift focus between subjects as he asked questions, approached subjects or panned the setting. In contrast, when youth recorded interviews cameramen did not move and the clips present a static view of subjects interacting with artifacts.

A number of recording technology requirements rose out of the above analysis. First thoughts suggest that the active narrator or the concentrated listener should not be disturbed by focusing on filming. On the other hand filming by a third person resulted in shyness. Also the importance of the interaction between a narrator and at least one listener became apparent from the recordings.

5. Multi-modal interactions' video analysis

We accompanied various participants on walks around the bush. From early in our observations we became very aware of the way elders frequently gestured while they spoke, thus we analyzed video of rural knowledge for both oral and multi-modal interactions, including gesture, body- and camera-movement.

Researcher and participant-recorded audio-visual media revealed that interactions prioritize speech, gesture and bodily interaction, above visual context. Further analysis of the performative structures of herb lore reveals some of the ways that people tacitly transfer corporeal and felt-experiences.

Participants tended to visually interact with their surroundings more when recording their own narratives than those of another person and less for herb lore. Cameramen often panned or translated when they narrated but not when recording herbs. A tighter focus, in both participant recorded interviews and cameraman's narratives of herb knowledge, meant herb clips were shorter than those on other rural knowledge and depicted many interactions between camera, bodies and gestures. Strikingly, in participant recorded interviews the camera tended to move in response to interactions between subjects and herbs more than to interactions between subjects and other artifacts in clips recording other rural knowledge.

Over half the recordings made by us and participants on traditional knowledge show gestures. For instance, Elder 3 toyed with plant material in his hand and tied a plant frond around his wrist to ward off bad luck and a cameraman pointed with stick to a bush. Indeed TH1's touched and/or gestured to an herb while filming 70% of his clips. TH1 stood 10 to 150cm from a plant, depending upon its height, and while recording he touched the plant with his foot or hand or explicitly gestured to the plant without touching it. For four clips he snapped a twig or crunched leaves in his palm to show in front of the camera, but often his clips do not show the plant matter but only a branch twitching. In five recordings TH1 swapped the hand holding the camera to permit him to gesture, sometimes twice in a clip. In his first six clips he held the camera in one hand and moved it to show parts of a plant, but increasingly he switched hands and integrated his body in talking. Indeed, by the end of recording he gestured using the camera. Often his gestures to herbs flowed into gestures to his body and/or the surroundings. He made distinct, smooth gestures to his body: sweeping, quivering, cupping his abdomen, limbs or head in a loose tempo, but, these are visible in clips only indirectly, for instance in three clips the camera jolts or shifts. More visible, in over half of TH1s clips, are gestures to the wider surroundings.

In all viewings participants listened carefully and consistently noticed speech and gesture above other visual information. For instance, Elder 1 said a clip about milking lacked the details about whether to milk a cow from the left or right, yet this is visible. Sometimes participants had difficulty recognizing plants visually in clips and finding clips by recognizing their thumbnails even if these were distinctive visually to us. Some herbs were highly familiar and recognized, visually, such a yellow flowered plant which all participants said benefited goats and tooth-ache. In such cases they identified the herb by its Otjiherero name and/or a visual feature and discussed its preparation and use. They recognized a herb visually more easily if they knew the site where it was filmed but recognizing a site was not always easy since the camera focused on herbs. Oral cues consistently contributed to recognition and disambiguated. Participants' more acute attention to person-based visual information is supported by the way they annotated explanations about herb preparation and use with gesture while viewing clips and adding information. For instance, Elder 1 ground his fingers onto his palm as he said "*just make it fine; you just sniff it and you will get rid of your headache*", and later Youth 1 extended to describe herb use by gesticulating as if putting snuff to his nose. Responding to the performative aspects of oral communication embodied in clips, more than other visual context may align with former customs of storytelling around the evening fire.

Possibly intangibility defies oral expression of spiritual elements. For instance, TH1 uses herbalism passed to him by his father and intuitions inherited from his mother and said, as he held one of our hands: "*When the person comes to me, the person doesn't tell me the problem, but I will check the person. I will catch their hand and I check what is in the person's body"*. Thus a healer may link divination to corporeal and other felt-experience. TH1knows what herb to use when he touches and looks at a person via spiritual essences: "*I will know the color of the underwear you are wearing … where you have a birth mark. It is the spirit that is telling me."*. Corporeal interactions in picking, preparing and using herbs may contribute to communicating about felt-experiences of ill-health and healing and touching herbs may enable recall for instance, Elder 1 twirled a plant in his fingers as he tried to remember its name. Both TH1 and Elder 1 learnt about some herbs through their own experimentation and TH1 commented that he tested all herbs on himself before prescribing them, in contrast with formalized Western medical training where novices experimentation on them is highly controlled. Participants sometimes experimented in response to a situation; for instance, Elder 1 remarked that he "*got lost and was hungry and thought of a certain wild food and found this one and ate. And I learnt from that.*" Thus, memory of herbs might entwine with corporeal and affective experiences of a foregoing situation.

6. INTEPRETING ORAL NARRATIVES

Numerous insights suggest that systems' design should respond to people's narrative predispositions in thinking about the world [18]. In TM information on etiology, its manifestations and therapy, is not codified but shared by practitioners with users and apprentices orally. Western culture is vested with value-laden views on oral transfer [11], e.g. propagating, perceptions that literacy alone fosters objectivity, detached analysis or specific cognitive processes, like abstraction, and categorization [11, 25, 26]. A deficit approach can obscure what people achieve orally and social and cognitive processes within cultural-linguistic contexts. African oral story-telling traditions have their own forms and definitions of narrative and roles for imagery; for instance, Herero traditions emphasized representing qualities about people recall places inhabited by their society in 'omitandu' (praise poems), which again represent landscape in relation to people or events [7].

6.1 Narrative elements

Participants expressed information with concrete examples but often used metaphor (e.g. "this plant is growing like alovera plants"). Otjiherero speakers are explicitly aware of the subtleties of their metaphor use in linguistic expression [2]; but, like elsewhere in Africa, their strategies for abstracting from a verbal utterance are embedded in language and philosophy [11]. Amongst Namibia's two million population there are 9 regional, 3 colonist and 16 African immigrant languages. Constant contact with other languages promotes an awareness of language's relativity [12]. Yet simultaneously, multi-lingualism can separate ontologies and representations. African lexicons

tend to use colonial terminology for scientific concepts, rather create interpretations, and few new Otjiherero words are officially documented for Namibia's 200,000 Hereros.

When participants described herb lore and showed herbs (plants, shrubs, trees) in their surroundings (V-Situ), they mentioned: cause/s and symptom/s of ill-health, herb treats; part/s of the herb used; preparation/s of the herb; and use/s in treatment.

When they viewed and commented on V-Situ or discussed the recording process *V-View and V-Interpret) they often added descriptions bringing the collection to 65 herb stories. We distilled and analyzed information categories from all transcripts of participants' descriptions of herbs:

- Preparation, e.g.: put it [the root] on the coals; boil it
- Part, e.g.: using the roots; leaves
- Symptoms, e.g.: people who have leg problems, they are swelling; so the snakes don't come when someone is bleeding
- Treatment use, e.g.: the person bleed on a warm coal from the fire; now once they drink this; put it in the house
- Cause , e.g.: The one who cursed you … it will go back to the person and that person will start bleeding

6.2 Structural Variations

Viewing clips provoked participants' to reflect on gaps in their knowledge, note that they needed to record more detailed explanations and specific dosages for particular people or ailments and suggest design ideas. Indeed, reflecting on our method Elder 1 said "when you take this [video] to the neighboring place and show them they will also come up with their own ideas". Participants' interest in extending their knowledge was often specific and prompted enquiry. For instance, a group asked what a narrator was doing with some seeds in a clip; sometimes, participants said that they would ask another person about an unfamiliar herb; and, Youth 1 gathered a herb in response to Elder 1's curiosity.

Participants ordered information about a herb differently when they watched it in a clip. When they described a herb in situ or added stories about herbs not mentioned in clips they tended to say the symptom of ill-health first. But when they discussed a herb concurrently with, or just after, seeing it in a clip they named or identified it then described preparation and parts to use and finally the symptoms and cause of the ill-health. We speculate that when participants watched clips about the herb, it triggerd an association of action that follows rather than the reason for gathering it. In other words, the herb's representation prompts a logic starting point of the process around the herb rather than the person. This does not mean that narratives, prompted by video, are not replete with tacit relations to the social through other oral qualities. Our analytic categories, interpreted from translation, inherently transform and decontextualize information and omit tacit qualities of performance and bodily experience in narratives. Thus narrations triggered by watching a video seem to alter the logic of narrative.

6.3 Spatio-Temporal Relations

Participants explicitly connect personal and society health, for instance the symptoms of ill-health in over 30% of the herb stories were direct dysfunctions in social relationships and the remainder was symptoms in the body (e.g. infertility) with social causes. Participants usually explained verbally using concrete, metaphoric or prototypical examples and always placed artifacts and settings within relationships between people. Elder 4 referred to a shared experience between her and one of our researchers in an example (below) to interpret TH1's clip about a herb which tackles distrust in relationships. Knowing about the researcher's recent trip she draws a location and their relationship into an imagined situation, rather than abstracting "this herb is for people who want others to believe them".

Say for instance, you told me that you were in Botswana, and this side don't believe that you were there and say 'ah! she is lying to me man, she wasn't there … but I was not with you' this is the type of things they talk about. When you start to tell me, after you have been using that (the herb), I will say 'oh, is that so. And so on'. But in the past it was the opposite."

Participants couple spatial and social relations. They insisted that all clips should identify place and people's names and used spatial reference to describe people and interactions, such as describing people on "*This side*" or, metaphorically, "*looking in opposite directions*". For instance, Elder 4 linked harmony to spatial qualities: "*the person will now start to smile and look at you and you will decide on one thing. Even (after) that he turned away…"*. Such performative representations orient real and imagined relationships; that are they connect spatiality, qualities of social bonds (e.g. harmony, distrust), relationships and the self. Participants used visual and verbal spatial references to describe herbs; for example, commenting on a clip, Elder 1 said he would discuss a particular herb "*only when we are outside*". Narratives often gave spatial references a temporal order and included seasonality and movement; for example, Elder 1 noted discovering a novel herb: "*I went to a second place in the village and was looking after the goats that got lost"*. Customary navigation involved reading signs in the landscape (e.g. cow foot-prints) and temporality as people's and livestock's daily rhythms sequence places across times. But these are not quantifiable dimensions.

We noticed information in temporal aesthetics of oral narrative. For instance, TH1 said herbs were sequenced in '*families*' and explicated the details for a specific herb family, which he said started with a fertility herb and subsequently herbs for post-natal conditions (depression, hemorrhoids), breast-feeding and allergy, respectively. The story he used to explain this herb included conspicuous devices. For instance, he used repetition to emphasize relations between a child's birth and health and community and life-cycles to make associations with other herbs in the family. This story's form conveyed information that we must preserve in designing to serve the logic. Rhythms and patterns, arching across phrases, segments or motifs, contain meta-information about relationships between herbs, healing, personhood and community. The repeating, cycling patterns engage the listener, assist remembering, may invoke emotion and/or relate to relationships between teller and listener [11]. TH1's gestures and physical interactions with the camera and herbs had temporal qualities resonant with his verbal storytelling, but these were not always captured within clips.

7. Exploring Knowledge Architectures

Narrative analyses and insights from earlier activities provoked us to explore ways that those who had recorded and/or had been recorded might associate clips with each other.

7.1 Thumbnail sorting

In Visit-4 and Visit-5 we recorded participants' interactions with clips displayed in iTunes on a laptop. We asked participants' from both villages to group clips along various

dimensions including scenarios or semantic groupings; appropriate audience for clips; the order in which viewers might best understand the clips.

We also recorded TH1's responses when we asked him to make short descriptions of what his clips were about and TH1's and TH2's interactions in matching herbs/clips to recordings of TH1 describing ill-health scenarios (V-Scenarios). At the end of this session we used sketches to aid communication. In Village-1 (Visit-7) we recorded Elder 1 and Youth 1 as they examined 50 printed images from all clips, grouped them by content and sequenced images in each group according to the order in which they should be viewed. In a final activity Elder 1 took us to four places in the village and picked a herb at that location while Youth 1 photographed him and we registered a GPS co-ordinate. On returning to the homestead we recorded Elder 1 and Youth 1 make a spatial map on butchers paper by placing herbs at their relative locations and then select and place printed images from the clips according to where they thought those clips were filmed.

7.2 Insights & Reflections

Experiments using digital and paper-based media, in situ rurally, showed the ways that people in rural settings encounter and learn within their everyday experiences of the land. Our analyses show that our own ontological and representational biases can constrain negotiating local meanings and analyzing transformations in meaning as we introduce media. When we asked how to cluster clips Elder 1 said: "The plants must be together, and the people together", to distinguish herbs from people's daily tasks (e.g. herding, milking). But this 'meta' partition is not straight-forward; for instance, villagers routinely use roots to sour milk (a core food) but only some roots have medicinal properties. Naming conventions sometimes contain information about medicinal roles; as Elder 1 noted a herb "has another name but when you come to use it to heal people, it's called X"

We were concerned that our ontology, of say 'people', 'plants', may not map to participants' logic but met with difficulty in determining semantic, metaphorical or other associations between stories. TH1 could not easily define what might be a similar message between clips of herbs and when asked to summarize what clips were about, to guide TH2 in choosing to watch a clip, he reiterated and/or extended information in the clip or said explanations were "too short". Thus, we adopted a concrete approach inspired by participants' comments, such as "When you got a headache what are you supposed to do?,. We asked TH1 to review some clips of ill-health scenarios that TH2 had recorded (V-Scenarios) and suggest which of his herb clips might assist treatment. TH1 said that it was not simple and that V-Scenarios required herbs he had not recorded or, more complexly, involved situational specifics that must be accounted for in prescription. Thus our interpretation of explicit associations between herbs and between herbs and symptoms disregards core information contained in storytelling which is frustrating to participants and, as one Herero collaborator said, interrupts their narrative.

Participants did not attend to precision when placing images from clips on a visual map they created, but spent more time discussing people and activities in clips than mapping. Further, while they sequenced clips chronologically with ease, they arranged activities with us without absolutes (e.g. 'in the morning', 'later on') and had difficulty in calculating dates. Cultures that prioritize relationships between people tend to construct time polychronically, or relative to others, not as impersonal, fixed elements (e.g. hours, months).

That is our questioning perspectives can alter the logic of narrative, for instance interpretation that healers select herbs in response to symptoms..

8. CONCLUSION

Determining requirements within a knowledge system, which fundamentally differs from the one usually supported by conventional ICT, demands special attention. A theoretical and ethnographic study of African rural communities reveals the need to adjust current paradigms in ICT to cater for local needs. We have derived requirements such as person-bound, audience and purpose driven information presentation as well as narrator and listener user roles. We are currently developing the corresponding prototypes for evaluations with the communities. Further insights emerging from analyzing interactions between media and people, knowledge and narratives influences our approach to the knowledge architecture. We have explored first conceptual ideas with inconclusive results, thus further prototypes will be developed. We are well aware of the danger of influencing communities' perception of requirements through uninformed prototype testing. We became sensitive to the potential of representations to shift the emphasis of meanings and that our understanding of these transformations is limited by our own ontologies and representational biases. We hope recognizing our own bias will avert inappropriate design in the future. While we notice the potential for locational information tagging, we are also conscious of its limitations in regard to the situational perceptions within performance and narration. The inadequacy of timeless spatial inscriptions, such as linking specific, discrete oral items (e.g. Hyper-Speech [1] and mash-ups of stories [13]) became obvious.

Our dialogic approach fused with ethnography and action research seems promising. Phases of ethnographic informed discussions, introductions of technology, followed by joint reflections has so far been fruitful for the discovery of unanticipated requirements thereby leading to new design concepts.

Our project experiences and reflections thereof, demonstrate the particularity of determining ICT requirements with African rural communities. We hope to raise a regional and global awareness among the designer community to recognize possible biases and limitations of common ICT solutions leading to a new conceptualization of requirements engineering in an African rural context.

9. ACKNOWLEDGMENTS

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