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Rodil, Kasper; Løvborg Jensen, Kasper; Rehm, Matthias; Winschiers-Theophilus, Heike

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Identifying and Representing Elements of Local Contexts in Namibia

Kasper Rodil[1], Kasper Løvborg Jensen[2], Matthias Rehm[1],
Heike Winschiers-Theophilus[2]

[1] Dep. of Architecture, Design and Media Technology
Aalborg University
Denmark
kr|matthias@create.aau.dk
[2] Mobile Future Lab and Dep. Software Eng.
Polytechnic of Namibia
Namibia
leafcastle@acm.org|heikew@polytechnic.edu.na

Abstract. In an attempt to represent local context in a 3D visualisationfor rural elders in Namibia we have foundmajor differences in theconceptualizationof this context between external and local partners in the co-creation process. Through the evaluation of a mobile context capture tool we found a clear disconnection of community members with both abstract and absolute representations of points, paths and areas. From this we discuss how the local concepts of space and time as frames of reference can not be represented adequately with our current selection of contextual data, and how we are engaging in participatory activities to derive a common understanding of contextual representations.

Keywords: context, indigenous knowledge, Participatory Design, context-aware, re-contextualization

1 Introduction

Rural Herero communities in Eastern Namibia have for many years been self-contained in terms of transfer of local knowledge across generations. Children and youth have been listening to their elders, participating in chores and practical work in the villages, thereby sustaining an often tacit and uncodifiable knowledge. In Wenger's terms it could be considered a 'repertoire' of indigenous knowledge in 'communities of practice' [1]. These rural communities perform actions within their own cultural context. There are obvious local benefits in transferring knowledge on husbandry, herbal lore etc. and the tacit knowledge transferred through intra-personal interaction effectively adds to preserving local culture, customs and traditions. Due to formal education the youths are increasingly detached from their cultural traditions and context. The majority of the youths attend schools often far away from the villages, where many only return on holidays. The curriculum is compliant with international standards inconsiderate of local conditions. Valuable indigenous knowledge is lost day by day,

and future generations could very well suffer from this absence of cultural roots and traditions, such as lack of self-awareness, cultural adaptation and self-worth. Moreover a major risk is the impact on the ecosystem in which the Herero tribe has lived sustainably since their settlement in Namibia in the 17th century.
Since 2008 we have been in close collaboration with a group of Elders (knowledgeable men respected in their community) in a village in Eastern Namibia. The overall objective of the project is to preserve local knowledge, but also find ways to transfer parts of that knowledge to de-situated youths from the region. Early in the process we have come to terms with the different world views of us, primarily Western trained designers, and local Herero elders. We have emphasized a dialogical approach with intensive collaboration and co-design. Our methodological stand is within Participatory Action Research (PAR).
In the ethos of PAR lies the acknowledgment by designers that they are from the onset limited in their understanding of users and the users' context. As reported by Nielsen et al.(2003) [2] one of the principles of PAR is mutual learning. Co-designers (in this case Elders) acquire technological skills meanwhile designers attempts to fine tune their sensitivity to the new setting and the skills and knowledge within that domain. The differences are in particular revealed when the participants (co-designers and designers alike) have their origin in different epistemologies. As Participatory Designers we attempt to understand the context through a shared perspective. Limitations will unavoidably occur, but we must investigate were these cut-offs manifest in the design of context-aware systems. As we have reported earlier, the foundations on which we design interfaces from might have little use in cross-cultural collaborations [3], [4]. Thus one of our approaches has been to substitute traditional (Western) interface metaphors with localized metaphors. Yet we hypothesize that it may still be desirable to explore these differences in the interaction design to overcome HCI issues of both textual and computer literacy and unnatural interface conventions such as folders, menus and files born out of the earlier computing days.

2 What is a Context?

The meaning and use of context in computing systems and HCI has been debated for decades. Abowd et al. (1999) provided an operational definition of context within the scope of context-aware computing as: "Context is any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and applications themselves."[5].

When introducing context-awareness, Schilit et al. (1994) alluded that the notion of context is dynamic and goes beyond static concepts such as location [6], e.g. lighting, noise level, network connectivity, communication costs, communication bandwidth and even the social situation is part of the context. Thus a context is also defined by people and their actions, at least if we include people interacting with artifacts. Dourish (2004) describes context as arising from activity:

"Context isn't just 'there', but is actively produced, maintained and enacted in the course of the activity at hand"[7]. Even just from these three perspectives on 'context' we can establish that the characteristics and description of any context is highly complex. We can consider it to be a temporal state of a changing space influenced by those that occupy and interact with and within it.

Thus it is impossible to capture and represent an entire context or expect to experience the exact same state once again. It is optimistic to think that a system is able to capture the complexity of an 'interwoven' situation of actions performed in space and time, as we always make a choice of which aspects of a context we capture. As Grudin (2001) explains on capturing context digitally:

"The context that is captured is removed from its context, namely the context that is not captured."[8].

This implies varying degrees of implications for artifacts using 'some' of the information available from the context. An application that address users based on identity, their activities and their location might not require extra information from the context they are in to achieve the set objectives. For instance, a mobile application that identifies a user then pulls the user's characteristics, activity and location to then push a suggestion of the route to a preferred dining place. As described by Baldauf et al. (2007) there are a variety of sensors available to further interpret the context (e.g. biosensors, thermometers, cameras etc.)[9]. Though it is of high practical value in mapping and modeling efforts, but the arguably "objective" snapshots of the perceivable space-time continuum often offers a poor reflection of the messy, subjective world of cultural, historical and spiritual meanings attributed to objects, places and situations by human beings. The objective of capturing a context in order to represent it digitally while actually producing a new context is a delicate matter. Especially when engaged in cross-cultural design of artifacts and preservation of cultural knowledge. Instead of taking the pessimistic stance of not being able to capture the whole context, we could examine the affecting elements defining and capturing a context.

3 Context Discussed Through a Case Study

Since 2010 we have investigated the potential of 3D visualizations as means for preserving local knowledge. The main driver for the 3D visualization approach is to capture the local physical context into a visible medium unrestricted from requirements of local literacy and being transformable into digital experiences as virtual worlds or serious games. A cornerstone in the project is to enable rural elders to capture landmarks and objects of significant importance (houses, fenced areas, water holes etc.) at the research site through tagging with external sensors. This data set will represent the contextual backbone of recreating the village as a 3D representation for de-situated youths to explore.

An example of use could be that the youths take an online virtual tour of the village while listening to their grandfathers telling locally collected stories at places represented in a virtual context yet separated in time and space from the recording. A cardinal point is whether the realism of sensor-captured GPS

coordinates and compass bearings can translate into contextually "accurate" experiences. Thus it is fundamental to the research of representing a context, that we can pin-point some of the challenges to facilitate knowledge preservation and knowledge transfer. In this article we refrain from discussing the limitations of 3D visualization. As will be highlighted later, the action of representing a context through an incomplete perspective into a different form is not without implications.

4 CARACAL: A Tool to Capture Context

CARACAL is a context-aware tool designed for mapping and tagging objects and places in the field using sensor-enabled mobile devices [4]. Initially the tool was developed as an aid to the researchers of the project when engaged with re-mapping the spatial layout of the village. It was iteratively designed and implemented over a series of field trips and tuned to optimize the efficiency for the researcher.
Fig.1 shows the flow of interaction from the prototype. As can be seen the main screen allows quick access to capturing the core types of data points and gives feedback to the user as data is entered. CARACAL logs spatial information as either points(e.g. objects), paths(e.g. walking routes) or polygons (e.g. homesteads), which can each be tagged with additional information. It also allows for the capture of rich media through pictures, video or audio which is automatically Geo-tagged using the GPS, electronic compass and further allows entry of meta data by the user.

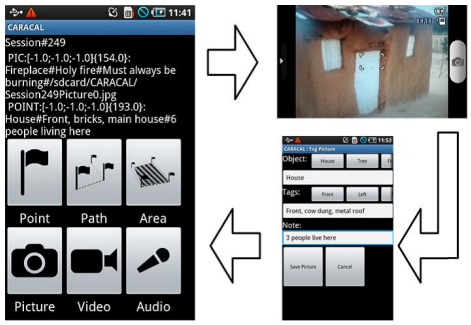

Fig. 1. The figure shows the CARACAL interface and flow of interaction.

While a study showed that this approach was feasible for researchers and that we could indeed gain a lot in terms of efficiency and better data sets, we also found that there were several important shortcomings. Firstly, it would never scale to the level we would want to use it due to the shear amount of information to be captured and tagged in even a relatively small village. Secondly, we

need to capture the "right" data, i.e. the information that has meaning and is important to the local users. It was thus evident that local participants needed to be included and that the optimal solution would be a tool that would enable *them* to capture and map out their own environment according to their local perspective.
We conducted an exploratory field study of the application with a number of participants from different groups in the community and got mixed results.

As it turned out, the best performers were the youngest participants as they were more receptive to the instructions and fast to learn to interact with the application. The elders experienced much more challenges as they had a harder time with the touch screen based phone.

The biggest problems were however of more conceptual nature. It was evident that there were plenty of opportunities to enter 'erroneous' data because the original application was developed from the researchers' understanding and mental model of what the data should be used for. For example, this resulted in wrong Geo-tagging and or missing information about the captured pictures.

We also conducted an unsupervised field trial with a single user traveling to his home village in the North of Namibia. He used the application to track walks in the area while listening to an elder from his local community. The user is an IT master student and fairly proficient with mobile technology, so the fact that he did not report any serious problems with the application was not a surprise. The most interesting result from this part was the data itself, showing a spatio-temporal flow through the environment and context as they walked around. The data was not comprehensive enough that we could actually recreate the environment but simply overlaying it onto a satellite map in Google Earth gave an insight into that space (see Fig.2). What we also found was that the story behind the walk and the points tagged on the way were missing. Thus a limitation of the data is the lack of narration and re-contextualization.

Fig. 2. The figure shows the student's and elder's walk.

5 Discussion of Capturing and Representing the Physical Domain

5.1 Spatial

The coordinates obtained from the CARACAL are supposed to be used for instantiating objects at the 'right' places and with a Cartesian mapping in a 3D world. But as reported in the evaluation of the interface:"The key findings were however, that the conceptual idea of 'points' and underlying purpose of 'tagging' was not well understood by the participants." [4]. The participants (elders) were not: "distinguishing between taking a picture of a landmark from a distance and tagging the very same from close proximity" [4].
Thus within the evaluation of the interface we began questioning if coordinates perceived to be objective were indeed objective, or if local concepts of space are different to the Western concept of mapping a space. Pursuing our conceptualization and representation carries the risk to override a tacit cultural way of understanding space. This might not have severe implications in many other application domains, but within our project the very objective is to represent cultural and local knowledge. Research suggests that there indeed might be a difference in cognition of space across cultures. Haun et al. (2011) describe studies investigating cultural differences of spatial cognition and spatial language between Dutch children and children from the Akhoe Hai//om hunter-gatherer group of Northern Namibia [10]. The Dutch children have a dominant ego-centric cognitive frame of reference, where the participating Akhoe Hai//om children have demonstrated a dominant Geo-centric (absolute) frame of reference. The former preference is to imagine the coordinate system centered in the ego. The latter is where the coordinate system is absolute with cardinal directions (N, E, S, W). This has an impact on how people orient themselves in the world, thus if a mapping into a new 3D geometric space is constructed, the mapping might need re-alignment according to local concepts.
Thus the action of capturing absolute 'points' on a global grid presents the scaled distance between objects and activities as a fixed and measurable length. A fundamental question is whether there are local differences in perception of distance between points. While we have not conducted formal studies as of yet, we ask ourselves if activities, paths or places within the village are locally perceived to be of a different scale? This could relate to differences in considered significance of paths over places, or vice versa. While it remains a speculation for now, we believe that in order to capture a space we must make sure we also represent the distances. Based on some conversations with community members we believe that a local perception of distance is that objects within a homestead are considered being almost at the same place, whereas everything situated outside is considered far away. Thus we attempt to acknowledge this in our representation.

5.2 Temporal

Another, yet unresolved, parameter to be represented is the concept of time. While traditional context-aware systems are easily able to log time of events,

time between events etc. the fundamental question is: do Western academics have a different perception of time than the co-designers and the end-user group? Should time be used as a convenient separation of activities (as in meeting calendars, time tables etc.) or is activity and time even connected and to what extent? Research shows that local concepts of time can have different characteristics. Janca and Bullen (2003) explain that: "the Aboriginal concept of time differs from the Judeo- Christian perception of time in that Aboriginal people do not perceive time as an exclusively 'linear' concept (i.e. past–present–future) and often place events in a 'circular' pattern of time according to which an individual is in the centre of 'time-circles'...". [11]. We have experienced that time is perceived differently in the village than e.g. any random day at our academic institutions. Sometimes we wait hours for the participants in the village although having agreed to meet at a certain place at a specific time. As we put ourselves under pressure to collect data during the relatively short village stays, we often struggle accepting delays relative to our own plans. However, we must remember that our research interferes with their daily routines and activities. It is also important to note that while we can consider ending a meeting due to another meeting pressing on in the calendar, they might not end theirs because there are still important matters to talk about. While time can be a fix point for activities we have experienced that social activities in the village are often defining time in the village. From a methodologically perspective we try to adapt to the local 'rhythm' of doing things. It shows us how we perceive time as a separation of activity. Practically it means that when we design databases, we should be cautious to taxonomically appoint time as the separating factor of events/activities. If we assume a re-contextualization to be truthful we should be careful not to override local perspectives with Western conceptualizations.

The purpose of the examples here is not only to elucidate a potential difference in concepts, but to stress the divergence of the underlying framework of reference. Thus if we as designers presuppose something to be a fact or common ground we might lose sensitivity to the fact that it might not be universal.

6 Participatory Design for Synthesizing the Context

When discussing the use of context in computer systems Dey (2001) provides a description of how humans have some success in transferring concepts to each other:

"Humans are quite successful at conveying ideas to each other and reacting appropriately. This is due to many factors: the richness of the language they share, the common understanding of how the world works, and an implicit understanding of everyday situations." [12].

Most of us are familiar with the saying:"it must be understood in the context that...". This statement implies that individuals in dialogue indeed are talking about the same state if sharing similar perspectives. Yet people having shared experiences can argue about what has happened, or the meaning of something

although they were both part of the same event. This seemingly trivial example on subjectivity is much more prevalent in a cross-cultural project due to the obvious background difference between parties. Differences in language, world-views, value beliefs and a collaboration containing two distinct cultural traits as either collective or individual oriented leads to substantial divergence of perception and desirable representations.
In a classical example Quine (1960, Pp. 29) analyses the difficulties of establishing a common ground and a common understanding about the context of the conversation, when you do not speak the same language [13]. His example is called the Gavagai problem: Imagine walking in the bush with a Herero guide and suddenly he points at a rabbit and says "Gavagai". Quinn's argument about the indeterminacy of the situation (and possible translation of the utterance) takes into account that it is possible to derive several conflicting representations based on the observable data, e.g. Gavagai could mean rabbit, or dinner, or actually the bush under which the rabbit is sitting. Additionally, he states that there is no way to know which of the competing interpretations is the correct one, which poses a slightly ontological problem, when you assume that an objective representation (some kind of ground truth) exists (see [14] for an in-depth discussion). From these examples it might be too ambitious to expect parties to have a similar notion of the context under dissection. Thus, there will consistently be a mismatch on interpretation and representation. While seemingly impossible to resolve we have tried to understand the differing perspectives through Mutema (2003, Pp.5), who explains that the goal for interpretation is by fusing horizons:

"The inter-subjective nature of the research process allows for the researcher's interpretations to be checked, reinterpreted and evaluated by the actors." [15].

This perspective on understanding difference is emphasized in our participatory design approach. The arguably objective nature of the shared interpretation is in the hands of the parties involved. In this example we could explain it like: we attempt to increase our sensitivity to interpret an unfamiliar context through dialogue. Meanwhile the participants acquire skills on technology and design in order to be critical towards the shared representation. We have reached a stage in the project where the elders are indeed critical towards some of the prototypes. But we have experienced in many cases that at the point of critique new knowledge about the context is brought forward. The following example is from recently published work and highlight the value of the local dialogue [3]. We considered the concept of the trash can desktop icon as not being universally understandable. We re-constructed this icon into looking like a hole in the ground which we saw a local researcher from the village used to dispose garbage in. In the evaluation of this metaphor we were made aware by the elders that they do not throw away, but keep those parts for later use. Thus without the local evaluation of an interface action we would probably not have learned about that particular view point of not throwing away. Needless to say which consequence that misinterpretation would have for a knowledge transfer tool preserving cultural viewpoints. The misrepresentation is *our* context unaligned conceptualization. They suggested us to implement that the objects targeted for deletion should

be moved back into the menu from where it came. We argue that the next design iteration being informed from this evaluation is not a representation from either part, but a product of fusing horizons. Although we remain cautious to any impact new concepts might have on their context.

7 Conclusion

We have argued, given the application domain of transferring indigenous knowledge and local culture, that designers should be wary that transfer of partial information from one context to another might have implications on the development and research objectives. We have argued through experiences with a Herero community in Namibia, that perceived value-free and objective measurements might produce a distortion and that those measurements should be investigated further. That interpretation as an activity is in the hands of all actors –participants and designers.Our proposed solution is participation and inclusion in the design process through dialogue.

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