

# A classification of cultural engagements in community technology design: introducing a transcultural approach

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**Abstract** Community technology design has been deeply affected by paradigm shifts and dominant discourses of its seminal disciplines, such as Human Computer Interaction, Cultural and Design theories, and Community Development as reflected in Community Narratives. A particular distinction of community technology design endeavours has been their cultural stance, which directs the agendas, interactions, and outcomes of the collaboration. Applying different cultural lenses to community technology design, shifts not only practices but also directs the levels of awareness, thereby unfolding fundamentally distinct cultural engagement approaches. Previous community technology design research indulged in cross-, inter-, and multicultural approaches to community engagement; it was occupied with meticulously deconstructing and reconstructing perspectives, interactions, roles, and agendas. We argue that when deeply immersed in joint design activities in long-term collaborations, we look beyond individual cultures and enter a transcultural mode of engagement. A transcultural community technology design endeavour supports a continuous creation and re-creation of new meanings, originating from individual entities yet being diffused and continuously reflected within the existing

design space. We suggest that within community technology design, a context with abundant cultural diversity, a heightened awareness becomes a necessity. We exemplify different instantiations of the cultural engagement approaches within our long-term collaborations and technology design projects with indigenous communities in Malaysian Borneo and Namibia. A transcultural approach to indigenous knowledge preservation and digitisation efforts with indigenous communities opens up a controversial debate about protecting versus integrating local epistemologies.

**Keywords** Transcultural · Multicultural · Crosscultural · Intercultural · Community technology design · Cultural engagement · Penan · OvaHimba

## 1 Introduction

The discourse in community technology design has taken various directions, being continuously influenced by different disciplines, theories, and experiences. While the related disciplines such as Human Computer Interaction (HCI), community development, and design itself, have established different paradigms over the years embedded in a wider socio-political global movement, we have seen fundamental changes of agendas and perspectives deeply affecting technology design with communities. Our previous work on technology design with Namibian communities (Winschiers-Theophilus et al. 2010, 2013) has demonstrated that the success of the design process is dependent on the individual participants' commitment and engagement, as well as on the collective communities' agendas and cohesion (Kapuire et al. 2015).

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As we have navigated through the phases, learning and continuously repositioning ourselves within a fast moving field of research, we reflect back on the past in an attempt to connect the dots across the different narratives. Our point of departure is grounded in some initial thoughts presented by Burstall in 1992 on ‘*Computing*’ as ‘*yet another reality construction*’ and his consequent framing of thoughts, processes, and moderated levels of awareness. Burstall (1992) unfolds the concept of awareness from a Buddhist perspective, as an antidote to ignorance and primitive views of reality, thereby emphasising people’s lack of mindfulness, the situational energy, and atmosphere present at that time. Interestingly, those deficiencies pointed out became the focal points in the so-called three paradigms or waves in HCI. In the first wave the focus is on humans as subjects, which originated from a cognitive science viewpoint; the second wave emphasises interactions and collaborations; while the third wave centres around embodied experiences and new meaning making (Boedker 2015). Each paradigm suggests appropriate methods of analysis, design, and validation of derived knowledge (Harrison et al. 2007), which emphasises fundamentally different aspects within technology development. Thus, generally we associate user-centred design with the first wave, participatory design with the second wave, and embodied interaction design with the third wave. Each of those design paradigms draws upon different theories as a means to create order and justifications within the vast experiences and empirical work. Community technology design is directly impacted by dominant discourses and paradigms in its formative disciplines of community development, HCI, Design, and cultural theories. Applying different cultural lenses to community technology design shifts not only practices but also directs the levels of awareness, thereby unfolding fundamentally distinct cultural engagement approaches.

Considering that the conceptualisation of “culture” remains contentious, we concur with Hakken and Mate (2014) in that a description of a culture of a group of people is an abstract and analytical construct, and not a “unified phenomenon with ontological status” nor an “empirical totality”. However, in the current discourse, we presume that we can theoretically specify a sub-culture through a pre-defined and agreed upon incomplete set of descriptors, such as specific practices, values, and habits of people. We equally acknowledge that each individual can belong to a number of different demarcated cultures, and that a group of people labelled by a culture might have different variations or deviations regarding the descriptors. Contrary to Hakken and Mate’s (2014) suggestion that due to the inadequacy of being a “comprehensive collection of all forms” one should focus on very specific aspects of culture at the time, we argue the opposite, namely to attain

a wider more holistic perspective. Irani et al. (2010) re-emphasise that the dynamic aspect of culture contributes to meaning making of experiences and encounters, while at the same time collectively and continuously reshaping everyday life and technology design endeavours.

Cultural diversity within community technology design projects has become a norm. As He et al. (2015) points out, it “offers both significant benefits and challenges in the design, usage and evaluation of technologies”. Community technology design originated in the first HCI wave, thus much attention has been on studying the communities as entities from a distant developer’s perspective applying a crosscultural lens. This remains problematic, as focusing on dichotomies and ‘othering’ of some participants, often excludes the role of designers and undermines relations and interactions (Winschiers-Theophilus and Bidwell 2013). In line with the HCI paradigm shift, awareness around the need and mode of community involvement in design decisions has led to substantial work in participatory community design. Experiences have uncovered numerous intercultural challenges, such as negotiation of interaction protocols, power relations, levels of participation, and incompatibilities with underlying epistemologies (Puri et al. 2004; Winschiers-Theophilus et al. 2015). Winschiers-Theophilus and Bidwell’s (2013) attempt to shift HCI paradigms towards an Afrocentric and local epistemology, further uncovered weaknesses of mainstream design research and its unsuitability in a multicultural context. Pushing the agenda, we are now introducing a transcultural approach to community technology design engagements based on our experiences with indigenous communities. We propose to widen our awareness and to look beyond culture.

In this article, we follow a multi-threaded narrative scaffolding from the distinct approaches to cultural engagement interlinked with the different paradigms in HCI, Design and Community Narratives. The latter is mirroring trends in Community Development, yet recounting from a community perspective rather than from the outside. Exemplified by our own work in Malaysia and in Namibia, we demonstrate how the variations of focus and awareness throughout the collaborations influenced the methods and techniques deployed as well as altering agendas, motivations, and framing thoughts of all participants.

## 2 Cultural engagement approaches

Practices and methodologies of community technology design have varied across the globe and over time. A particular distinction has been their cultural stance, which implicitly directs the agendas, processes, and outcomes of





the projects and collaborations. Thus, in the following sections, we distinguish crosscultural, intercultural, multi-cultural, and transcultural engagement approaches with communities. We base our conceptualisation on an initial distinction by pre-fixes as adopted by Frame (2009), whereby crosscultural emphasises the differences between cultures, intercultural implies cultures interacting, multi-cultural suggests the coexistence of cultures involved in joint efforts, and transcultural maintains validity across cultures being independent of a specific culture. In an attempt to elucidate the conceptual differences of the cultural approaches of collaboration, we make use of the metaphor of fruit mixes, which can take different shapes depending on the level of processing (Table 1).

### 2.1 Crosscultural engagement

Crosscultural engagement can be depicted as a set of distinct adjacent fruits. Each entity is clearly distinguishable from the other based on obvious differences. Crosscultural studies in technology design deliberately expose the cultural differences between communities, developers, technologies, and other stakeholders. This relates directly to the first wave or paradigm in HCI, which is based on cognitive science, where the human is the subject of study (Boedker 2015). Moreover, the human studied is often reduced to the users only, excluding the designer, researchers, and other stakeholders from the investigation. With this focus, user-centred design has established itself as a paradigm with numerous methods, techniques, and tools supporting the modelling process of users by developers. Early design endeavours with communities, especially in a developing context, were nearly always based on crosscultural theories

embedded in a wider discussion centring on “developing countries”, digital divide, internationalisation, and localisation. The concept of culture was introduced in the Information and Communication Technology (ICT) discourse as a set of parameters and dimensions, which can easily be modelled, and thereby be absorbed in the mainstream software development process (Winschiers-Theophilus 2009). Cultural models, such as Hofstede’s (1997), Hall’s (1969), Victor’s De Munck (2000), and Trompenaars and Hampden-Turner (2011) have established themselves in the crosscultural HCI literature despite much criticism. Smith, Bannon and Gulliksen (2010) point out a number of problems with those models, specifically Hofstede’s. They state that these are based on false assumptions, like the concept of culture being static, a group as large as a nation being homogenous, and a lack of systematic research and empirical evidences. The applicability and relevance of the Hofstede dimensions to HCI have also been questioned. Moreover, Winschiers-Theophilus (2009) expressed a major concern with the principle of developers’ modelling users across cultures, thereby reinforcing their own bias in technology design. In other words, even though differences between cultures are exposed, the intrinsic values of technology and their developers are continuously perpetuated within the design. Thus, if aiming to create locally appropriate technology within a cross-cultural paradigm, it would require the community to validate not only the developed technology but the model used as a basis of design as well as the interpretations. The developer carrying much of the responsibility would need to possess a set of skills that are often not taught as part of the computer science curricula, such as increased awareness of the context in which the model, interpretation, and translation takes place. Further self-awareness and self-

**Table 1** Cultural engagement approaches

Metaphor				
Related disciplines	Cross cultural	Inter cultural	Multi cultural	Trans cultural
HCI	Wave 1: cognitive science, humans as subjects	Wave 2: collaboration and interactions	Wave 3: embodied experience and new meaning making	
Design paradigms	User-centred design: user and cultural models	Participatory design: engagement, empowerment	Interaction design: user experiences, reciprocity	Community-based Co-design: unity of epistemologies, relevance
Community narratives	Narratives by the other	Counter-narrative	Harmonious narrative	Reflected narrative

reflection is required to minimise the induced bias in the perception and interpretation process.

## 2.2 Intercultural engagement

An intercultural engagement can be depicted as a set of processed fruits, arranged in such a manner that they represent something else. This depiction is inspired by the fact that emphasis on the interaction creates different expectations from the parties involved in terms of their expressions. Considering that other social and cultural groups governed many communities, especially marginalised and indigenous communities, their voices were suppressed and their agency of self-expression diminished (Sabiescu 2015). Having been given the voice to express themselves, stories that were previously told by others (as in cross-cultural studies), may result in a responsive counter-narrative. Sabiescu (2015) reports that one Roma group involved in a participatory design study defined themselves nearly exclusively as an alternative to stereotypes, which were created in mainstream narratives before. We observed similar effects with the Penan communities in Malaysia (Winschiers-Theophilus et al. 2015) and the San youth in Namibia (Cabrero et al. 2016). On the other hand, the OvaHerero and OvaHimba communities in Namibia mostly concurred with the alien narratives and even reinforced stereotypical and archetypal self-representations (Cabrero et al. 2016). In either case, the accounts by the communities are constructed in response to alien and mainstream narratives. Participatory Design (PD), with an underlying political agenda of giving voices to the “oppressed” and “marginalised”, originated in the Scandinavian workers’ movement (Bratteteig and Wagner 2016). PD seems like an obvious methodological choice to facilitate community technology design in the context of marginalised communities. However, many challenges of applying the Scandinavian PD within the community development context were identified. The deployment of PD as a philosophy and a set of methods and techniques to the community developmental context have shown that practices needed to be adapted to the context (Puri et al. 2004) but also that the concept of “participation” needs to be redefined (Winschiers-Theophilus et al. 2010). While the early discourse in community participatory design investigated the applicability of established methods and techniques, it was later dominated by the topic of power relations and empowerment framed under “postcolonial computing” by Irani et al. (2010). Based on the assumption that “design research and practice is culturally located and power laden...” Irani et al. (2010) argue “...for attentiveness to the emergence of hybrid practices in information technology design, coupled with sensitivity to how uneven power relations are enacted in design practice”. Overly concerned

with “doing good” and operating within a doubtful “rhetoric of compassion” (Rogers and Marsden 2013) and reminding us of a missionary approach has set the tone for the current community technology design discourse. Intercultural collaborations focusing on the interaction per se have unveiled many conceptual, methodological, and also political challenges in community technology design. Particularly contentious have been the discussions around conflicting protocols. Researchers are requested to “respect the local practices”, yet no direction is given on how to act or re-act in case of conflict (Peters et al. 2014). What if the values and practices are in contradiction with the researchers’ agendas? Which values and practices should be respected? Should they be respected by equal practice or from a distant visitor position? The research into appropriate interactions has raised more questions than ever, yet no sufficiently generalisable answers are found. Even more disappointing have been ethical research guidelines, which have been developed within University settings and are shown to be inappropriate for interventions with communities (Dearden 2013). A major issue has been that community participants are still considered to be informants and subjects, rather than co-designers or participants. As a first step, the community of Long Lamai in Malaysia in collaboration with Zaman and Yeo (2014) has co-developed a cultural protocol guiding novel researcher’s actions within the community. Having observed many failed encounters, the written cultural protocols have been enhanced and transformed into a Sketchbook that is used as a discussion probe in the training workshops organised “in situ” for students and researchers and co-facilitated by community members (Zaman et al. 2016a, b). The community interaction and guiding sessions, co-facilitated by community members, showed effective results in preparing the researchers and community for partnership.

## 2.3 Multicultural engagement

A multicultural engagement is best depicted as a fruit salad, whereby fruits are cut and mixed, producing a tasteful combination of flavours yet with fruits being clearly distinguishable. We consider a multicultural approach as one where we attempt to build bridges to ensure a peaceful coexistence with reciprocity and mutual benefits. Brereton et al. (2014) and Duysburgh (2015) pointed out the importance of reciprocity in engagement processes between researchers and community. They highlighted that reciprocity should be considered first and foremost when starting to work with the community members, both for moral and epistemological reasons. In this phase, both sides are encouraged to acquire a deeper understanding of “the other” and strive for consensus and harmony. Thus, from a developer’s perspective the aim is

to understand the given context and to situate the design at its best in local epistemologies at a conceptual and practical level. On the other hand, the community engaging with the alien researcher team attempts to mostly please and answer as assumed to be “expected”. Relating to the third wave in HCI, the focus is on experiences and new meaning making in coexistence. Thus, the premises to engage in joint technology design endeavours are often based on creating cohesion among researchers, designers, and community members. New roles of individual participants will have to be defined in the process of conceptualising participatory community design.

In a traditional PD approach, the designer kept a professional distance and often acted as a facilitator on the basis of empathy with the community/user group. “A key aspect of our role as designers lies in acknowledging that, as part of a community of participants, we must embrace the experience of ‘being participated’” (Winschiers-Theophilus et al. 2010). In an endeavour of “designing for participation” Sabiescu et al. (2014) rightfully criticised the narrow focus on embedding practices in local epistemologies without considering the role of the alien developers. They conclude that community PD needs to be “located in a space between the designer’s and local views of participation” (Sabiescu et al. 2014). In summary, the discourse of community technology design under a multicultural perspective oscillates between an overly focus on “creating harmony” by “pleasing” the other in attempts to embrace “the other’s” epistemologies, while on the other side finding one’s own place as alien developers within an established community, or vice versa as community members within an established field of technology design.

## 2.4 Transcultural engagement

Having indulged previously in cross-, inter-, and multicultural approaches to community technology design, occupied with meticulously deconstructing and reconstructing perspectives, interactions, roles, and agendas, we would like to suggest a radically different approach. Transcultural engagement is depicted as a “smoothie”, where the fruits are no longer distinguishable entities but have been blended beyond individual recognition to form a tasteful whole. While each entity has contributed with a unique flavour, it is no longer relevant to distinguish the individual entities. Thus, striving for what we frame as a transcultural approach to community technology design, we no longer focus on the individual contributors, their interaction or roles, but on the smooth and tasteful collaboration.

“Transculture is a new sphere of cultural development that transcends the borders of traditional cultures (ethnic,

national, racial, religious, gender, sexual, and professional). Transculture overcomes the isolation of their symbolic systems and value determinations and broadens the field of ‘supra-cultural’ creativity. We acquire transculture at the boundaries of our own culture and at the crossroads with other cultures through the risky experience of our own cultural wanderings and transgressions” (Epstein 2009).

We argue that while deeply immersed in joint design activities in long-term collaborations, where we have passed the stages of attempting to understand each other, defining our roles, positions, and agendas, we can now freely perform in a new space occupied with only the matter at hand. “The differences complement each other and create a new interpersonal transcultural community to which we belong, not because we are similar, but because we are different” (Epstein 2009). We suggest entering a design dialogue, as conceptualised earlier by Bohm (2007), where partners jointly create while suspending judgements and respecting all contributions. Thus, a transcultural community technology design endeavour supports a continuous creation and re-creation of new meanings originating from individual entities, yet being diffused and continuously reflected within the existing design space. Narratives and counter-narratives are freely colliding to form joint reflected narratives. “Viewed from a transcultural perspective, all existing cultures get a broader meaning, as any of their elements is no longer imposed as a tradition but is chosen freely, like an artist chooses colours in order to combine them in a new way in a painting. Transcultural creativity uses the palette of all available as well as possible cultures. It is known that the same physical reality, for example, water or stone, is symbolised differently in different cultures; likewise, elements of the same culture acquire new colourings and multiple refractions in the transcultural space” (Epstein 2009). Such a perspective induces new insights to the dominating discourse of globalisation, internationalisation, and localisation in which community technology design was framed. Thus, within a transcultural technology design endeavour, we heighten awareness in an explorative mode, observant of the odd and the familiar, the close and the far, the past, present and future, the empirical and the abstract at the same time.

## 3 Our cultural metamorphosis

In the following sections, we present ourselves and our context of actions and interactions with indigenous communities in Malaysian Borneo and Namibia, exemplifying different instantiations of the cultural engagement approaches within long-term collaborations and technology design projects.



### 3.1 The plots in a nutshell

#### 3.1.1 Long Lamai

Long Lamai is a very remote Penan village in upper Baram East Malaysia. It is located in some of the last remaining rainforest of Baram region, Sarawak, and is only reachable via boat or by foot. In the 1950s, the nomadic Penan group of the area, under headman Belaré Jabu, was encouraged by the missionaries to settle at the current village site on the Balong River close to the Indonesian border. In the village of Long Lamai, there are approximately 598 individuals in 116 households, inhabiting individual and communal long houses on poles (Zaman, Yeo and Jengan 2016). In terms of gender and age, Long Lamai is a very lively and balanced community. The Penans in Long Lamai periodically return to the forest to hunt and to gather jungle produce. There are still Penans who are nomadic and depend totally on the forests for their livelihood (Siew, Yeo and Zaman 2013). The journey to the forest, called Toro, is undertaken to collect livelihoods for the family. Importantly, it links community elders to members of the younger generations, as the elders groom future guardians of the rainforest (Zaman, Yeo and Kulathuramaiyer 2015). Toro is an activity-based knowledge sharing and mentoring journey in the forest, which can last around a week. An entire family, consisting of parents and children, complete the journey together. Normally, the parents do not bring along children below the age of seven. There are six activities in the Toro journey. The journey begins by leaving the Lamin Toto (house in the village) and finding a place in the jungle that has enough food, such as fruit trees, fish in the nearby river, sago plants, and animals for hunting. In the Toro journey, the Penan family travels in two groups. The journey is led by the young and physically strong members of the family, who find a suitable place and establish the Lamin Toro (a traditional temporary hut in the forest). Subsequently, the elders and children follow the group on the same route and join them at the Lamin Toro. During the journey, the first group communicates with the following group by making signs out of available forest materials such as leaves, barks, and twigs of the trees. This medium of communication through signs made of forest material is called Oroo’.

#### 3.1.2 Institute-community collaboration

The Institute of Social Informatics and Technological Innovations (ISITI) started its first collaboration project with the Long Lamai community in 2008; they aimed to develop a local telecentre, which has been fully functional since December 2009. The telecentre is equipped with

three networked PCs, three laptops, a printer, and a scanner. The telecentre also provides other facilities, such as telephone connection, Internet access, printing, and photocopying services. Meanwhile, a number of community members also have their own devices, such as laptops, tablets, and smartphones. These are connected via Wi-Fi, installed in the telecentre or using low mobile coverage, which can be accessed at specific locations in the village. To ensure that interactions between the local community and researchers run smoothly, the community appointed one of the elders, Garen, as a local champion and a liaison for development projects. Garen is a government retiree, he speaks fluent English and Bahasa Malays, and has vast experience as a community representative in government organisations. Garen is an early adopter and supporter of using ICTs for his community development. His tasks include facilitating researchers’ activities during their visits with the community. Garen has an essential role in the community’s governance structure, comprising the village headman, the pastor of the local church, heads of church, women and youth groups, and the council of elders. It is also Garen’s role to keep the members of the council of elders informed about the development progress.

In 2010, after the successful telecentre project, the second author and a colleague from ISITI had a discussion with Garen about the “next step” within the collaboration. Garen was enthusiastic to digitise the indigenous botanical knowledge of the Penans, which opened the opportunity for the second author to formalise this project as a proof of concept under his PhD where he developed an Indigenous Knowledge Governance Framework (Zaman, Yeo and Kulathuramaiyer 2015). The second author conducted monthly or later bi-monthly visits to the community, in order to establish a strong relationship and to build and maintain trust with the community.

In time, many more projects mushroomed and new researchers started to come to Long Lamai, bringing along new challenges to the collaboration. The community requested that the second author should be one of the entrusted university liaisons. The main tasks of the community and university liaisons are to guide and facilitate organisational, project, and researchers’ interactions during the process of collaboration. Each visit of researchers was led by a university liaison. As mentioned in an earlier section, the research teams and a group of community members co-developed the Penan cultural protocols as a sketchbook for guest researchers (Zaman et al. 2016a, b). The cultural protocols address free, prior, and informed engagement process, as well as the development of mutual understanding and respect for customary laws, values, and decision-making processes, particularly those concerning stewardship of resources and territories.

### 3.1.3 *Otjisa*

Otjisa village is about 55 km north of Opuwo, a town in the Kunene region situated north-west in Namibia. The OvaHimba clan migrated from the Ohandungu village, which is about 15 km from Opuwo, to the Otjisa village as there is a steady access to water. The OvaHimba tribe consists of nomadic cattle farmers that move around from one location to the next searching for better grazing land for their livestock. The number of oxen one owns is seen as a sign of wealth, fame, and respect in the community. The OvaHimba is one of the tribes in Namibia that have maintained their cultural customs. They still wear their traditional attires, like the *omitjira* (loincloth made from animal skin), even when going to the cities. Their attire represents significant details, such as whether one is a teenage boy/girl, or a married man/woman. The female OvaHimba apply *otjize*, a mixture of fat from fragmented milk, red ochre, and aromatic resin to their entire body and hair every morning. While scientists have speculated that it could be for protection from the sun or insects, OvaHimba women say it makes them beautiful. OvaHimba communities are rich in indigenous knowledge and still make use of it. A stochastic strategic grassland management model has been derived from the OvaHimba farmers (Müller et al. 2007). According to Müller et al. (ibid), the grazing system (temporal and spatially heterogeneous use of grazing land) used by the OvaHimba returns a higher productivity and quality of a pasture area than homogenous permanent grazing. The grazing system used by the OvaHimba entails resting the dry land pastures during rainy seasons and an incremental extension of grassing area in drought seasons.

Otjisa village has poor telecommunication network coverage, due to the high mountains in the surrounding area. People in Otjisa have to stand at certain higher grounds to get a semi-reliable coverage to make telephonic calls or send short text messages (SMS), thus there is not much ICT usage with the exception of mobile phones for the above-mentioned purpose.

### 3.1.4 *Indigenous knowledge research cluster: Otjisa collaboration*

In 2008, we created a niche research cluster in Indigenous Knowledge (IK) Technologies, at the then Polytechnic of Namibia, now Namibia University of Science and Technology (NUST). We identified an OvaHerero pilot community in Erindi-Roukambe in Eastern Namibia. We embarked on a project of co-designing tools for community members to empower them to collect, curate, document, and disseminate their indigenous knowledge. We were equipped with then current technological and participatory design knowledge, with an understanding that concepts,

methods, and designs are to be adapted to the local context. In our team, we had a researcher originating from the Erindi-Roukambe community, who had studied computer science. He was thus responsible for linguistic and conceptual translations, as well as technical facilitations, besides conducting his master studies on the conceptualisation of an indigenous knowledge management system. In August 2013, our local core team was joined by the third author, who is from the OvaHerero tribe. He conducted his PhD studies on crowdsourcing 3D graphic requests by indigenous communities in Namibia to preserve indigenous knowledge. In order to evaluate our co-developed tools elsewhere, we went for a validation trip engaging the Otjisa OvaHimba community members. The community members were introduced to us by a relative of one of our students.

Besides sharing a number of customs, the OvaHimba and the OvaHerero speak the same language, allowing the third author to communicate in his mother tongue throughout the interactions. Uaraieke, a village elder, showed particular interest in the technology and the project aiming at preserving their cultural heritage. However, considering the difference of appearances between the OvaHerero and the OvaHimba, many 3D graphics models needed to be created afresh. Interestingly, when asked to select relevant real world items to be modelled, the participants knew exactly what they wanted and took corresponding photos for the 3D graphic designers to start (Stanley et al. 2015). The confidence of the choices and the informative conversations during this exercise was an extremely enriching experience. The community members asked us to come back as soon as possible. Thus, we returned regularly every four months. Over time, we have built up a very close relationship with Uaraieke and his extended family, which have been extremely accommodating to us and other visiting researchers from different joint projects. Uaraieke and his wife recently visited the University (NUST) where they joined a public presentation on their work with us and attended research meetings. He also co-authored a paper, which we fully translated into Otjiherero in order to discuss and adjust with him (Kapuire et al. 2016).

### 3.1.5 *Trans-continental collaboration*

The authors, one based in Borneo and two in Namibia, have been collaborating on a conceptual and practical level, as exhibited through various joint publications based on site exchange visits, debriefing, and reflective conversations since 2011. Although the development contexts seem in many ways different, e.g. one site being in the Rainforest while the other in the Desert, they have a

number of fundamental similarities allowing for transferability of best practices and design patterns (Winschiers-Theophilus et al. 2013). At both sites, long-term collaborations between the university researchers and the community elders and their families have been established and maintained since 2008. Both had the aim to create tools that enable knowledge holders to preserve, document, curate, and disseminate their cultural heritage. We respectively have adopted what we frame to be a community-based co-design approach, which is anchored in an action research paradigm following PD principles. The underlying motivation for digitalising indigenous knowledge at both sites is the fact that the youth no longer assimilate local knowledge through accompanying the elders on instructive walks, listening to the elders' stories, or participating in activities, which have been the previous mode of knowledge transfer. In both rural communities, wise elders embody local practices and knowledge with a strong desire to preserve it for the next generations to come. Under these long-term collaborations, a number of different projects have been founded and prototypes developed.

## 3.2 Community technology design projects

### 3.2.1 *eToro*

*eToro* is an ICT-based platform to support the storage, processing, and distribution of indigenous botanical knowledge of the Penan community. It was developed within a crosscultural approach, whereby the focus of the study was to explore the community's tradition and knowledge about the plants and later to model and translate this into a requirement specification. The explored structures were implemented within mainstream technologies, such as an android-based application for data collection (ODK) and a content management system to support the data management (Siew et al. 2013). Garen is always optimistic about using digital means to preserve indigenous knowledge, so a perceived benefit of *eToro* was to cover the knowledge gap between the young and old generations in the village. The youth, who have ICT skills, were more confident in collecting information for the documentation process, i.e. recording videos of the elders explaining botanics, taking photos, and entering relevant data. Ultimately, they became a part of the learning cycle and fulfilled Garen's hope for the youth to re-engage with the forest knowledge. Within the project mutual learning took place, while the author gained a well-developed understanding of the local culture and traditions, Garen gained technology skills and confidence, which became the basis for the next project.

### 3.2.2 *Oroo' tools*

In 2012, the first author came to Long Lamai for a site visit, to evaluate prototypes and methods, as well as to explore further joint project opportunities. The second author requested Garen to demonstrate the creation of *Oroo'* signs as he had done many times before for other visitors. Fascinated by the power of expression of the sign language, the conceptual challenge and the designerly opportunities the two first authors agreed with Garen to engage in a digitisation process of *Oroo'* without more specifics at that time.

*Oroo'* is a very peculiar jungle sign language of the semi-nomadic Penan in Malaysia, Borneo Island. The *Oroo'* signs consist of one or two sticks of varying length with a cut cleft that can hold a number of folded leaves, twigs, and branches. The leaves, twigs, and branches are like language tokens and their specific arrangements create meaning—much like words in a sentence. The messages can express complex content, including notions of time, space, and states of the traveller.

With settlement, the language is being lost as it is not being used by the younger generation. In 2014, after securing an international grant, a joint project for the digitisation and preservation of the *Oroo'* language was launched. As a first step, we documented the *Oroo'* signs; we collected 50 signs with photos, videos, drawings, and written descriptions. Keeping in view the community interest in digital solutions; we further developed a PC-based *Oroo'* Adventure Game (Zaman et al. 2015a, b) and *Oroo'* Tangibles for an android platform. In the third attempt, we co-designed an innovative communication tool, namely the Penan *Oroo'* Short Messages Signs (PO-SMS) app with a group of Penan youth in Long Lamai (Zaman and Winschiers-Theophilus 2015). Considering that the vocabulary of *Oroo'* did not match the current communicative expressions of the Penan youth, new signs were created following the principles of *Oroo'* sign creation. The app now allows the Penan youth to send each other *Oroo'* messages, by arranging 2D graphical representations of leaves and twigs to create meaningful messages. Its first implementation was an android-based app, which was evaluated at two sites with Penan youth. We are currently addressing usability concerns to ensure the PO-SMS app can be deployed.

### 3.2.3 *Community crowdsourcing platform*

In our on-going collaboration with the Erindi-Roukambe community in Eastern Namibia, we have previously co-designed and developed a tablet-based three-dimensional (3D) visualisation IK preservation tool, called the Home Stead Creator (HSC) (Rodil et al. 2012). The HSC



developed in Unity 3D allows users to build their homesteads and create scenarios of cultural practices by dragging and dropping 3D traditional objects, representing real elements, in the rural surroundings to be placed on a soil look-alike surface.

To evaluate the HSC with the OvaHimba communities from Otjisa, we requested Uraieke and his fellow elders, and later a group of women, to construct 3D homesteads. The 3D models in the HSC were all from the OvaHerero tradition, which differ in many ways from those found in the OvaHimba tradition. For example, huts and fences are square and not round, and the attire of the people is different. The community members could not relate it to their own context (Stanley et al. 2015). The OvaHimba elders expressed that the current OvaHerero version of the HSC would not serve the purpose of preserving OvaHimba cultural heritage. Uraieke commented that, “I am now forced to marry a OmuHerero woman” after he was done with his homestead construction and needed to place a woman at his house (Stanley et al. *ibid*). Noting this, it was a confirmation that the 3D models needed to be replaced with models that adequately represented the OvaHimba traditions. Being part of the national digitisation effort of Namibian Indigenous Knowledge, we asked ourselves: how could we fast track ethnical adaptations of the system, more specifically the fast production of these 3D graphic models even for other rural communities?

We opted to develop a Community Crowdsourcing Platform (CCSP) to allow rural indigenous communities to crowdsource the required 3D models via the Internet (Stanley et al. 2013). The crowdsourcing concept was chosen due to its cost-effective benefits (Kaufmann, Schulze and Veit 2011), creativity and open innovation (Bonabeau 2009), and quality of work (Schenk and Guitard 2009) delivered by the contributors.

The conceptualised CCSP has two front-ends: a web based end referred to as the Community Crowdsourcing website (CCS) and a mobile tablet front-end called Task Request Management (TRM) component. The community member formulates a request via the TRM. The request can consist of a bundle of photos, drawings, audio, video, and/or text. The request is sent to the CCS, and then approved and published for the crowd by an administrator. If the request contains indigenous language (audio/video), then these are first crowdsourced to translators, otherwise graphic designers are targeted straight away. Once the graphic designers are done, the 3D graphic models are forwarded to the community member who requested for it. They then evaluate the 3D models; if not satisfied they provide more details and send it back, creating a feedback loop mechanism with the graphic designers.

Since 2013, we have been co-designing two components, an Indigenous Knowledge Media Collector (IKMC)

(Kapuire et al. 2016) and the TRM application with Uraieke and his family. The IKMC allows indigenous knowledge holders to record media items such as pictures, videos, audios, and text or drawings about a traditional object to be modelled in 3D. Those media items are then selected and bundled into a request within the TRM component as described above. One reason to split the applications into a media collection and a task request management is that the media collection tool also serves to collect media for other projects and applications, such as the national survey on indigenous plants. Furthermore, the assumption was that media is collected throughout the day, while a task request is formulated in a dedicated time and space not normally part of everyday activities.

### 3.3 Cultural engagement transformations

In the following section, we exemplify the distinct approaches to cultural engagement that we have taken within the different phases of the projects.

#### 3.3.1 Oroo’ engagement approaches

The Oroo’ digitisation project came at a time when the Long Lamai community found themselves in a transition phase, trying to come to terms with their attachment to their past nomadic life and their current settled lifestyle which they are still dependent on and deeply connected to the forest. Moreover, the Penans have recently had a number of bad encounters with the government who is pushing for logging and thereby destroying the last remaining rainforest, which is sacred and valuable to the Penan. The Oroo’ language links them to their past as well as to the forest. Hence, one of the first interests of the community expressed was “to preserve” the language. According to Bian Bilare’, the village headman, “The documentation process will not only help our youths to learn and understand Oroo’ signs but will also help the elders to refresh on what they already know”.

Richard Jengan, a Penan elder expressed his interest in the following (directly translated) words, “I want to know how my parents and ancestors lived in this area and all the signs they made and left in the forest during their time. I want to meet outsiders who would like to cooperate with us to document and preserve Penan culture to avoid extinction. It will get lost because only a minority still use and remember it. Sure, I want to preserve these Penan culture and tradition. The main reason that I like the Oroo’ digitisation project is because I want to preserve Oroo’ for upcoming generations. All will know about Penan culture and their origin (forest) if we preserve Oroo’. Penan use Oroo’ in their life to gain knowledge (about forest). Even if they don’t know about books (can’t write and read), they

know Oroo' and by that they understand and communicate in a language. That is what I need to know from my origin".

Encouraged by the strong desire of the elders to preserve Oroo', we (researchers) were further driven by curiosity and the scientific inquiry ahead. With relatively little to no literature to fall back on, we followed a rapid ethnographic approach by systematically documenting all the different single signs known by elders, including their meanings and makings. We compiled a table of signs, taking photos and videos, validating with the elders, and ordered drawings from a community artist illustrating the details of the signs. With a total of 50 signs recorded we then attempted to understand the composition rules. Penans transfer knowledge by showing and doing. The community organised several forest trips for the researchers, led by local elders and Oroo' experts, to demonstrate the Oroo' making process, explain the meanings of the composites, as well as to facilitate questions/answers sessions. We soon realised the limitation of our own cognitive and linguistics framing of language in a desperate attempt to create a position-based rules system, which did not lead to any correct formation of composites. Presenting the elders with random compositions, created through trial-and-error, led to great laughter on their side yet no explicit reasoning on the validity.

It was clear that from a crosscultural perspective new modes of transferring knowledge between our cultures had to be identified, as neither our systematic inquiry nor their showing and doing led to our deeper understanding.

Through continuous engagement in intercultural conversations, we become aware of the significance of the digitalisation of Oroo' for the Penan; it is very specific and thereby helps them to overcome multiple stigmas. The anthropologist Janowski (1996), remarked that the Kelabit, one of the dominant tribes in the region, have labelled the Penan to be "forever children" due to the lack of taking responsibilities in their worldview. A much worse rumour that was spread across Borneo and neighbouring countries, was the belief that Penans have tails. In a recent (January 2016) community meeting in Long Lamai, former Penan penghulu (chief), James Lalo Keso, welcomed the international guests by saying that he is happy that they can see Penan with their own eyes; people are saying that Penans are monkeys, but now the guests can confirm that Penan are actually people like themselves and others. The Penan are to many only known through mass media reports, where they are depicted as a traditional tribe fighting against aggressive timber operations and opposing development. Well acquainted with all those discriminatory depictions, the Penans are very consciously countering the mainstream narrative. One of the leveraging mechanisms has been to demonstrate to the other tribes and the rest of the world that Penans are actually a very progressive tribe, adopting

technologies mindfully and even digitalising their so far "secret" jungle sign language, which has received international recognition.

Tangible and visible technologies such as the telecentre, eToro, and Oroo' tools have become a necessity in their identity building to counter mainstream narratives (Windschiers-Theophilus et al. 2015). Different tools were conceptualised to facilitate the learning of Oroo' by the next generation. First, a traditional concept of digital adventure games was adopted, based on the observation that Long Lamai children happily gather around technology gadgets rather than joining the jungle walks (Zaman et al. 2015a, b). Garen has been re-emphasising over and over again that Oroo' is an essential part of their cultural heritage that it should be remembered by the next generation. Garen stated "if the younger generation loses Oroo', it will be difficult for them to associate themselves with the life in forest [nomadic life]". The development of a digital game seemed to unfold, in our perspective, a contagious and contradictory practice supporting the children's learning of the jungle sign language digitally while still being surrounded by the jungle. This is clearly a misalignment with current pedagogical trends in the northern hemisphere, where children are encouraged to become part of nature, experience embodied learning, and spend less time with technologies. However, at this stage with the pre-dominant desire of the Long Lamai elders to impart the knowledge to the next generation by all means, a technological solution had to be implemented, despite the contradictory opinions. While the Oroo' adventure game showed some immediate positive results, such as attracting the Penan children's attention towards their cultural heritage, it also demonstrated that the learning curve was not as expected (Zaman et al. 2015a, b). The digital Oroo' game showed the community that technology can encompass their cultural content, but also has clear limitations in terms of replacing the knowledge transfer processes. Thus, this phase greatly contributed to the communities learning about and reflecting upon technology, as well as to empowerment in terms of technology implementation decisions.

Based on this, a different approach to teaching and learning was conceptualised, namely the introduction of tangibles; engaging parents and children into the knowledge transfer process by reinstating some local practices and current pedagogical principles. In this phase of the project, mutual learning was facilitated through joint meaning making of a novel approach to digitalise Oroo'. The idea of tangibles was introduced by distant collaborators from New Zealand and Singapore (Plimmer et al. 2015), and first encountered with scepticism by the community representatives. As the project progressed and showed literally tangible results, the community became enthusiastic about this new approach to teaching their

children Oroo'. However, the project was generally overshadowed by technical challenges, such as a lack of integration with other technologies, as well as the composition and durability of the tangibles (Zaman and Winschiers-Theophilus 2015). The community members suggested using tangibles made from artificial material, unaware of the wider discourse in tangible technologies on the use of real materials and their emergence in virtual environments. Overall, the tangible project can be described as an interesting research project, where the different parties were exposed to novel thinking around technologies and context within a multicultural setting. In line with the third wave of HCI, engaging with a tablet-based android tangible system created great user experiences and learning within the community. However, considering the expectations of the community members in the development of a deployable technology to sustain Oroo' across generations, yet another approach needed to be taken.

As conventional attempts to address the issue of preservation, as well as teaching and learning, did not yield satisfactory results, we took a step back and re-evaluated our epistemological framework. The concept of preservation in the form of dictionary-like repositories, framed in a mainstream linguistic paradigm, supported by technology-based teaching and learning platforms detached from every day activities, needed to be questioned. While the focus had been on the interaction and means, little attention was attributed to the relevance of Oroo' in the daily life of the Penan youth. It became clear that if we wanted the language to be sustainably preserved, it needed to be revitalised and be meaningful for the youth, from a youth perspective rather than an elder's nostalgic perspective. Thus, we engaged in a co-design phase with the Long Lamai youth, aiming to develop an Oroo' sign language messaging service similar to SMS or WhatsApp (Zaman and Winschiers-Theophilus 2015). We first established current communication practices among the youth, to explore in which ways Oroo' could be integrated into their daily communications. Like the youth elsewhere, the Long Lamai youth is mostly equipped with cell phones, making excessive use of SMS services to converse. Thus, common SMS texts were established using a persona method, to maintain privacy of chats. We were aware of the limitations of Oroo' in terms of its asynchronous nature and confined vocabulary, which was mostly geared to express activities in the forest and messages relevant within the context of Penan's nomadic movements. Hence, the integration of Oroo' into everyday communications meant major adaptations, such as the creation of new signs as an addition to the "original" language. The Long Lamai elders agreed that it was an acceptable move, so that the Penan youth could feel more connected to the jungle and not undermine the significance and power of Oroo'. A

number of new signs were created by the youth and the elders separately, following the underlying principles of Oroo' creations. For example, the "*death of a man*" was expressed with an Atip na'o' (a utensil used by men for eating starchy sago flour); the elders suggested the "*birth of a baby boy*" (a new sign) should be represented by the symbol of a blow pipe, as he will be the one hunting with it in the future. Similarly, the youth created a sign for "*I am fine*", based on the existing sign of "*I am not fine*"; the later shows a scrapped bark, while the newly created sign is intact (Zaman and Winschiers-Theophilus 2015). Therefore, the language was not preserved in its original state, but the language with its underlying structure and meanings was re-appropriated and re-interpreted in a modern context of the Penan youth. This has opened a very controversial debate among the researchers and Penan community. Fellow researchers and neighbouring villages argue that it pollutes the "original" language. Interestingly, we found that introducing new signs to the Oroo' language is not a new practice for the Long Lamai community. They have shown us recently introduced signs, such as the signs that represent the village Long Lamai, which the neighbouring Penan community labelled as not "original". However, a language by nature evolves around the relevant concepts that need to be expressed by a society at a point in time and therefore the concept of preservation needs to be re-examined. While we originally embarked on developing tools to safeguard the language, we have realised that its appreciation reaches far beyond the few elders who would like their children to master it. The origin of Oroo' will never be lost, yet the language has a chance to evolve within different epistemologies attaining universality; after all the last experts of the "original" language have opted to share it globally after reflecting on its wider impact.

### 3.3.2 Crowdsourcing from Otjisa

Our first encounter with the Otjisa community was with a mixed team of researchers consisting of two OvaHerero and two Namibian domiciled who had been working with the OvaHerero communities before. Hence, much of the crosscultural analysis was reduced to finding out what the differences between the OvaHerero and the OvaHimba practices were. The evaluation of the 3D graphic tool (HSC), facilitated discussions around cultural practices and representations. Through this, the Otjisa community members allowed us to gain a deeper understanding of their context and value system.

Having established a co-design methodology, based on re-contextualised concepts and methods originating from participatory design, much of our focus has been on establishing and maintaining a good collaboration with the community. Communication has been one of the most

important means in forming relationships. Fortunately, there is only a slight dialectic difference between the Otjiherero spoken by the OvaHimba and the one of the OvaHerero. Thus, conversations between the OvaHerero researchers and the community members were near fluent, only occasionally interrupted by single word misunderstandings that were clarified immediately. At times, the other researchers were included in the conversations with a translator. Direct interactions between the community members and the non-Otjiherero speakers were improvised with gestures and single known words. Uraieke possesses a great sense of humour, which left all of us in great laughter many times. This allowed us to jokingly interact, thereby lightening technical sessions. Once Uraieke had finished constructing his homestead on the HSC, he was asked whether there was anything missing to make his homestead complete. He replied that a chicken was missing. One of the researchers politely interrupted him, and asked him whether there was not a woman missing. In agreement, he replied with laughter and poked the two Otjiherero speaking researchers. During the first crowdsourcing simulation workshop Uraieke received a phone call, he informed his caller that he was busy with two OvaHerero and some whites, and that he was busy pressing things that he usually does not do (referring to the tablet with the HSC app). Uraieke commented with excitement, “I have now seen that my culture is not going to die especially if the white people are involved”, he said while pointing to one of the non-Otjiherero speaking researchers from NUST.

Having been welcomed and trusted in the Otjisa community, our collaborations have been dominated by joyful interactions that led to deeper connections beyond the project tasks. During the last visit, the researchers remained in the village for a couple of days; they switched between technology design activities and everyday village activities. This brought the team even closer together and led to major breakthroughs, in the design of the TRM as well as the conceptual and technical understanding gained by Uraieke. He mentioned that having the researchers sleep over at his homestead was fruitful; he could go to sleep with an idea and early in the morning, he could talk to the researchers before he forgot about it. He said he appreciated that the researchers slept over at his homestead with his family, as this showed love and true commitment to the project. At the beginning of the last TRM co-design sessions, Uraieke was shown the overall Community Crowdsourcing Platform (CCSP) diagram, depicting technical details, process flows, and him among others as an actor/user. The third author explained the diagram relating it back to past sessions, which Uraieke clearly remembered. At a later stage during the co-design session, Uraieke pointed at the diagram to confirm that we were “*now*

*talking about the completed 3D model*”, revealing his understanding of the model. The team had meanwhile reached a level where all understood each other’s epistemology and could freely move between the worlds in the creation of a new digital reality.

Prior to this session, Uraieke had been part of a number of user interface design sessions. Starting with mastering simple choices of icons, to the creation of icons related to his cultural practices. For example, saving related to “holding tight” and deleting related to “hiding”, both symbolised by hand gestures (Kapuire et al. 2016). Uraieke demonstrated a deeper reflection and validation of choices. The researchers have at many occasions been surprised by the depth of Uraieke’s contributions to the technical system, in his position as co-designer. Given the opportunity to make decisions, he at times ran out of ideas but often his wife chipped in and together they agreed on specifics. At one of the early user interface design sessions, he had chosen the picture of his son to represent “video” mode. However, remaining with the tablet and the application, he could later not remember all the icons even though he decided on them (Kapuire et al. 2016). At a follow-up visit, we then problematised the choice and he understood that it should be meaningful for him to remember. Thus, it was agreed to replace the symbol with feet (as they move) next to eyes (for picture). Also, the choice to represent a gallery with an old Nokia phone, as that is where they currently keep their images, was questionable though logical from their perspective. Yet from a designerly point it reminds us of the ‘diskette’ symbol for saving, which is long outdated.

Over time, Uraieke made many further interesting design suggestions showing his understanding of technology design, such as one tab on a button shows the first set of media and two tabs the next set. In deciding on a meaningful representation for the tab of 3D graphics models received from the crowd, Uraieke mentioned that this should be an icon representing something good. One of the participants commented that he should remember that not all delivered 3D models might be good, and Uraieke agreed. His wife proposed to use a picture of an OvaHimba woman and looked at her husband for approval. Uraieke replied he would be happy with whatever is used as he will remember it. One of the researchers asked Uraieke and his wife, whether they would prefer the picture of the OvaHimba woman to be represented in a 2D or 3D model. They both replied that it would be a very good idea to have the image represented in 3D, rotating in all angles for full inspection. Everyone agreed that this was the ideal representation.

Overall, the step in step out Action Research reflection cycles proved to be very crucial for all of us. We noticed that one single co-design workshop was not enough to



reach final decisions. We conducted several co-design workshops with longer breaks in between, so that both parties could reflect on what they have created. At times, Uaraieke commented on the selected icons selected in the previous co-design workshop. He stated that they were randomly selected and did not make much sense in relation to the application functionality, but that he had developed a better understanding in the meantime.

## 4 Consequences of cultural stances

While one could argue that designing within a transcultural space seems promising, we however inspect the different cultural stances in more detail for the digitisation of IK, where the matter of design is a local culture and its context. We further argue that it is important to elevate awareness, rather than to continuously narrow down and shift focus within a new approach to cultural engagement.

### 4.1 Reflecting on digitising IK

Approaches to digitising IK and cultural heritage have fundamentally changed over time based on the pursued agendas, different paradigms, cultural theories, and methods. They vary in being more or less sensitive to created tensions as part of the digitisation process and the involvement or exclusion of non-indigenous stakeholders. The different cultural approaches to IK preservation, from a community perspective, can be considered as an issue of positioning and agency, where their adequacy depends on the communities' needs and expectations.

In development thinking and traditional cultural heritage preservation, the mainstream narrative has reduced IK to practical techniques and artefacts. Attempted “scientification” of IK has further cut out important details and contextual information that are critical to indigenous epistemologies (van der Velden 2010). Clearly operating within a crosscultural approach, only practices and techniques that can be perceived and represented from an ethnocentric perspective are represented and digitised. Furthermore, technologies deeply embedded in a western epistemology implicitly replicate and enact the very same biased cultural logics (Dourish and Bell 2011; Christie 2004; Winschiers-Theophilus et al. 2012). Thus, it becomes questionable to what extent IK can even be adequately digitally represented, considering the cultural partiality of developers and current technologies. However, if the aim of digitalising IK is to support commercialisation initiatives or cultural heritage exhibitions for the wider public, a crosscultural approach seems appropriate within a national regulated IK system that acknowledges IK custodians. While South Africa and other countries have an

established IK policy, Namibia is currently in the process of creating an IK policy that recognises indigenous communities' contributions and ensures recognition and benefit sharing. In such cases, a crosscultural lens can serve the communities' immediate needs for rewards, recognition, as well as positioning in the mainstream socio-economical context, through a very selective preservation of IK as a commodity.

Shifting the focus to an intercultural approach, Winschiers-Theophilus et al. (2012) pronounced that they “intend to adjust [their] perspective from ‘somewhere else’ to a local perspective through an on-going dialogue around technology, in order to design a representation which is meaningful to the community”. Much effort was dedicated to ensuring the involvement of indigenous knowledge holders in the digitisation process, as well as to study local practices to enhance the intercultural design process per se. Based on the premises that the designers' values are covertly transferred into the technologies, indigenous knowledge holders now being co-designers could ensure that their values were equally present. However, indigenous communities, often not having had voices and now dwelling in counter-narratives (Sabiescu 2015), have shown little reflection in the representation of themselves or their heritage. Thus, communities tacitly still propagated a biased digital representation. Especially concerning IK, community members are uncertain about its value and position, thereby eagerly reshaping it to fit mainstream technologies being unaware of alternatives. We equally recognise the limitations of the technologies we selected, which substantially constrain the representation of IK (Rodil et al. 2014; Bidwell and Winschiers-Theophilus 2012). Yet considering the urgency of preserving and digitising the IK held by a few elders, many communities appreciate the recording of IK with current technologies and means available, allowing for later interpretations and processing.

Moving the design space to a multicultural context, in which all participants add to the flavours of the outcome, we can no longer strive for a singular perspective. We recognise that the alien developer is the gateway to technological opportunities, which when jointly explored can open up the pathway for innovative IK tools development, such as the tangibles presented above. Thus, the preservation of IK can take novel shapes, enhancing user experiences and without any doubt representing new meanings and interpretations of IK, rather than conserving it. Within an iterative design and evaluation process, a workable solution can be created which embraces the involved participant's values and aesthetics. For example, within the development of the crowdsourcing application, we brought along two 3D models (a hut and a woman) for evaluation by the elders in Otjisa (Stanley et al. 2015). The roof of the



hut was created using a uniform straw pattern, which the elder criticised for being unrealistically perfect looking. Yet they decided that it should be represented in that way, as it shows how a hut should look. The model of the OvaHimba woman lacked too many significant cultural markers to be acceptable, and thus was sent back to the 3D graphic designers. This kind of discussions and developments allow for mutual learning and reciprocity in the creation of new means of preserving and representing IK, which is equally rewarding to the community and the developers. Anchored in philosophies such as Ubuntu, the process itself can be described as harmonious. This has been emphasised as a very important aspect of collaboration by both communities we have been working with (Winschiers-Theophilus et al. 2015; Kapuire et al. 2015). The community elders also expressed their deep appreciation regarding the chance to learn about technologies, which in many African contexts re-establishes their position as a carrier of knowledge and wisdom (Kapuire et al. 2015).

Pushing the boundaries beyond culture and embracing different epistemologies simultaneously casts a new light on IK preservation and digitisation. While aware of its origin, IK per se is de- and re-constructed, re-interpreted, and represented within a transcultural approach. We create a detached design space, where we first elevate local practices to a higher abstraction level from which we then re-instantiate them. This approach is comparable to the derivation of a generic class out of a specific object, which can then instantiate different other objects. For example, in the case of the Oroo' language preservation, we first re-conceptualised preservation, de-constructed and re-constructed the language itself, created new signs, and then re-contextualised it in the youth's daily life. While on the one hand the language has lost its local originality, no longer depending on the forest or nomadic movements, it can instead be used by the youth worldwide. In more general terms, it would facilitate the full integration of IK with the mainstream knowledge system. This has been an important aspect in our recent crowd-sourcing platform development, in which we realised the significance of the community members' communication with the outside world in regard to the representation of their cultural heritage. Through this interaction, they can reflect upon their own meaning making and relevance of their cultural markers. In the transcultural design endeavour of digitising indigenous knowledge, all parties can re-create new meanings and symbols in a conscious decision-taking and negotiation process; deciding on what is relevant and what not, as well as what should be preserved and what not. The technology design process allows the indigenous designers to distance themselves from their own culture, listen to other points of view, and

reflect upon the digitisation of their culture and the newly gained perspective thereof.

The communities' interest in IK preservation was foremost the transfer of IK to the next generation of their own kin and secondly to a wider audience, with technology as one of many means. The various cultural approaches to community technology design fulfil different expectations and needs. While the transcultural approach is promising in terms of operating in a shared space of mutual respect, acknowledgement of epistemologies, and heightened awareness, we also recognise that it is not the solution to all issues associated with the digitalisation of IK. Yet we argue that it provides a new legitimate interpretation and representation of IK, without claiming preservation of its original form.

## 4.2 Elevating awareness

Methodologies and methods have been established for designing within a cross-, inter-, and multicultural paradigm, in line with their theoretical frameworks. Yet with the proposition of a new cultural approach to design, methodologies, and methods first need to be derived based on empirical data, lessons learned, as well as an exploration of theories originating from different epistemologies. Central to the transcultural approach becomes "the principle of exotopy, or extra locality, [which] is applicable to any culture and in fact to any object of study or reflection: by increasing our awareness of it, we distance ourselves from it" (Epstein 2009). Thus, we relate back to our point of departure, where Burstall (1992) encourages us to heighten our awareness about seemingly unrelated phenomena to the immediate technology design, considering the atmosphere and energy flow among participants, rather than dwelling in a state of ignorance or focus on a pre-determined phenomenon. Similarly, we have often experienced in our design sessions that having paid attention to side-remarks and side effects, provided us with important insights that informed further design and research decisions. For example, while the third author facilitated a dialogue in OtjiHerero, the first author (with a very limited vocabulary in that language) could direct her attention towards non-verbal clues and the entire setting within the wider rural design space, observing passers-by and seemingly unrelated interactions.

Contextualised in Ubuntu, an African philosophy, we acknowledge that everything is interconnected at a spiritual, physical, and virtual level; thus, awareness is to be directed at the interrelationships rather than the individual entities. With a growing body of work on community technology design in the African continent, a number of authors have recognised the role of Ubuntu, as embodied humanness transpiring throughout the communities, in

creating a different consciousness (Bidwell 2010; Chmela-Jones 2015; Kapuire et al. 2015). Centred around the concepts of interconnectedness and relationships, Rogers (2014) has briefly introduced the term “mindfulness” into the HCI discourse, where she argues “for a radical rethink of our relationship with future digital technologies. One that inspires us, through shared devices, tools and data, to be more creative, playful and thoughtful of each other and our surrounding environments”. However, the concept of mindfulness, originating in the Buddhist philosophy, has a much more profound meaning than often attributed in its adopted secular domains such as health and psychology. Numerous authors have attempted to clarify the meaning of mindfulness, often entangled in translations and the usage of ill corresponding terms.

“Conceptual issues such as bare awareness, clear comprehension, and discernment between wholesome and unwholesome states are not simply historical, doctrinal, or scriptural details but critical practices that can have an impact on the usefulness of the teachings that occur over such a short period of time in secular programs”. (Monteiro et al. 2015).

Of importance in our context, is the fact that heightened awareness or mindfulness is a skill that needs to be cultivated over time and does not occur automatically. Mill-erand and Bowker (2008) argued that “time is a variable, not an explanatory framework for the phenomenon under consideration”. The partners in the design process need time for engagement and disengagement in the development of the projects and objects. The reality of the collaboration varies over time, in line with the action and reflection of the actors in the partnership.

## 5 Outlook

We acknowledge that each engagement is built on different premises; it unfolds based on choices, intents, agendas, resources, and purposes within a community technology design endeavour. Yet we suggest that the approach to cultural engagement is a conscious choice, which frames the interactions and outcomes of the community collaboration. Based on a major criticism on the early phase of humans, mostly users, being subjectified and classified within crosscultural models, shifting the focus to participation and empowerment seemed like an obvious solution. Participatory Design has since its inception been primarily concerned with power relations, being conscious of the control of the designers within the process and striving to empower users (Bratteteig and Wagner 2016). As it remains narrowly focused on interactions and inter-relations it brings about various socio-political challenges in intercultural and multicultural settings. Although the need

for re-conceptualising Participatory Design methods, techniques and even the notion of participation in non-Scandinavian contexts has been acknowledged, discourses revolving around “postcolonial computing” and “doing-good” unveil constructs of unequal collaborations further fostered through outdated ethics guidelines still considering community members as research subjects instead of co-designers. Thus, we suggest a radical paradigm shift in research and development work, which embraces a blending of epistemologies, recognising contributions from all participants, including the designers, within a collective context. Our thinking is based on our own evolution within our long-term collaborations with indigenous communities in Namibia and Malaysia. We argue that enough spotlights were directed at singular entities, such as the community, interactions, relations, and roles within design endeavours meticulously deconstructing and reconstructing distinct perspectives, thereby losing a holistic view. Thus, we promote a transcultural approach to community technology development, in which we strive for an elevated awareness, which needs to be cultivated over time among participants within the design space.

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