

Going Beyond Empowered Design by Scaffolding Inter-community Engagement

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ABSTRACT

When participatory technological design initiatives are focused on a very specific local context it becomes difficult to scale up their deployment to wider or different contexts. We have therefore extended the notion of empowered design and consequent technology appropriations and show that scaffolding, assistance that fades away, is a viable method to facilitate inter-community engagements with technology. This leads to technology appropriation by communities who did not participate in the original design, and they do this independently of the original academic design team. In this paper we report on our project process over an extended period of time. A collaborator and co-author on this paper is an elder from the original community who is acting to extend and adapt the technology with other, distant, communities from the same ethnic group, the ovaHimba. We particularly focus on the evolving role our collaborator took on over a number of field trips, and how our support, the *scaffolding*, became less and less important. His perspective is shared through translated statements and integrated into the text after our joint paper discussions.

CCS CONCEPTS

- **Human-centered computing** → *Participatory design*.

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KEYWORDS

Scaffolding, Empowered Design, Namibia, Inter-community Engagement, Community-based Co-Design

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1 INTRODUCTION

The difficulty of scaling up an instance of success in community development and empowerment to a whole region or nation has long been recognised[4]. In this paper we present our *scaffolding* strategy and process for achieving scalability. Scaffolding is a form of temporary support to enable performance beyond a person's base expertise which at the same time supports their learning (see Section 2.2).

In co-designing with selected indigenous communities in Namibia we are extending the idea of empowered design. We introduce a technology/infrastructure in a community and use co-design to enable appropriation [32]. Such appropriation is one measure of success. Our ideal outcome is if these empowered community designers then help to spread the technology to neighbouring communities with their differing needs. Therefore *empowered design* enables community members to assist other communities to appropriate a technology for themselves. Our role is limited to providing the necessary scaffolding that allows community co-designers to facilitate designs with other communities.

Our work has always been done within a Participatory Action Research framework that we have called Community-Based Co-Design (CBCD) [5, 19, 48]. This method amongst other things addresses the problem of communication between researchers and the communities within which they work. It does however require an intensive cyclical long-term involvement with the community. We have now reached a stage in this project where we want to move to a way that is sustainable in the long term and where the project can grow more independently of the researchers. In order to do this we want the systems and procedures to support community members in taking over as much as possible.

In this paper, we present and contextualise the role that our indigenous community research collaborator has taken on in scaling the participatory design engagement to other communities of the same ethnicity. Although Mr Mbinge is a co-author, who has contributed to the article verbally via bi-directional translations, we shall refer to him in the third person as a protagonist of this account. Mbinge is a principal collaborator with the academic cluster for many years, who emphatically prefers not to be anonymous. He is strongly motivated to safeguard and expand indigenous knowledge in person and through the technology he co-designs.

2 THEORETICAL FRAMING

2.1 Empowered Design

We view *empowered design* as a way to address the power relationships between co-designers of technology, understanding that design of an artefact happens before use and continues further into its use and appropriation. There are many ways in which to conceptualise what we refer to as empowered design within Information and Communications Technology (ICT) and each has their own emphasis¹. Empowered design aims at designs that allow users to appropriate and perhaps to extend the artefacts on their own for their own purposes [6, 30, 43]. While we prefer the term *empowered design* and the related idea of design for appropriation and scalability, there is in fact a whole constellation of ideas which seem both interrelated and necessary. Buskens [6] emphasises the importance of open social arrangements to enable such a design approach but insists on an “insider perspective” and giving precedence to insider intent to avoid the problems of power differentials between “outsiders” and “insiders”. Marsden [30] pointed out that the needs of the developing world can only be addressed once people are themselves empowered to create systems inside their own community for their own purposes. Storni [43] views this as enabling people to take power on their own terms for the use of the appropriated design. He also looks at the notion of empowerment and the paradox that, in the absence of a consideration of power relations, it can actually be yet another form of colonisation; in this he follows Agre [2].

In the participatory design community the notion of infrastructuring and the related ideas of generativity covers much of the same ground [23]. Generativity is about the way people can extend a system without the assistance of the original designers. Central to this view of infrastructuring is that, while infrastructure is invisible in its normal operation, for extension and alteration of the

design the underlying invisible parts have to be available, visible and understandable.

2.2 Scaffolding

Cozza and de Angeli [8] suggest scaffolding as an enabler for socio-technical infrastructure and as the basis for scaling engagement in participatory design initiatives. Scaffolding is the provision of help which allows people to perform tasks that would usually be beyond their ability, and which falls away when no longer required. They emphasise that the duration of the scaffolding is situational, depending on socio-technical conditions such as the level of engagement of participants and the available technologies.

Wood et al. introduced the use of the term *scaffolding* in supporting learning [50] as a process that allows a person to perform a task beyond their unassisted efforts. More than this, it results in the development of competence at a much faster pace. A paramount condition is however that “*comprehension of the solution must precede production*”. Scaffolding has come to include the assistance provided by a technological artefact that fades away when no longer needed [41]. We are not employing the term in that sense. Our tools do provide support to the users, of course, but this is always available and does not disappear as their expertise improves. The important point here is people gain power over their learning processes by actively constructing their own knowledge. Users are provided with opportunities and incentives to build knowledge themselves. Scaffolding is provided by team members to each other via the mutual learning of the Community-Based Co-Design approach (Section 3). This scaffolding allows team members to grow in both technological and in management capability.

2.3 Knowledge Transfer

Knowledge transfer is the process that involves the dissemination of explicit, implicit and tacit knowledge from a person or organisation to one or several people [12]. We present knowledge transfer from the indigenous knowledge perspective. Indigenous knowledge is what the indigenous people have mastered (*lived experiences*) and done for generations to survive in the ecosystem they live in [18]. Indigenous knowledge is predominately verbally transferred by knowledge holders compared to scientific knowledge that is mainly documented [1] [3]. Theories of communication based on signal transmission [40] scarcely apply in this situation [16]. Instead theories, such as Nonaka’s knowledge-creating company, that accommodate the communication of tacit information, intuitions and hunches provide a better basis [35]. Clearly such theories are culturally embedded (Japan in the case of Nonaka) but they provide a valuable map indicating areas for further exploration [15].

Maluleka and Ngoepe have considered the transfer of knowledge between traditional healers in northern South Africa [27–29]. They find that Nonaka’s theory has application to traditional medical knowledge in South Africa. In their groundbreaking study they do point out that the healers universally believed that the teachings were transferred from ancestors through dreams and visions. As one of the experienced healers put it:

¹We will not be considering the large literature on empowerment in business discourse[2] nor as a sociological concept [13].

My ancestors were mostly guiding me on things to which may come in a form of a dream, I will tell my dreams to my mentor and she will give me interpretations telling me what it means and what I should do. My students get guidance from their ancestors; my job is to help them carry out those duties.

For this reason Maluleka [27, pg. 30] adopt an extended version of Nonaka's SECI model [39]. A key feature of this model is that there is a category of knowledge beyond *tacit* and that is *self-transcending* knowledge. However, in pragmatic terms "this knowledge seems to be transferred through mentorship and apprenticeship, as well as interactions with other healers" [28]. The basis of Nonaka's theory of knowledge transfer through guidance by ancestors has a link to our indigenous knowledge holders. However, these essential elements of respect [21], verbal and pragmatic, are fundamental for transferring indigenous knowledge [17].

2.4 Community Technology Appropriation

Appropriation is the process by which users give technology inherent meaning [34]. The transformation of meaning is aligned to and enabled by human adaptability and ability [42]. [7] state that appropriation penetrates transformation at a level of practise which is deeper than technological customisation. Fundamentally, appropriation refers to users making technology their own [44]. In essence, communities contextualise technology to meet their needs, especially those unique to their environment [24][36]. These needs are generally different for indigenous communities [14]. Through appropriation these needs are understood, and local communities comprehend how technology impacts their actions and practices, in ways that technology designers initially did not think of [7]. The above comprehension enables a social narrative within the appropriation process, in which networks of users interact and share knowledge and experiences amongst each other [25]. Ultimately, technology appropriation is continuous and long-term, as users continually re-purpose, reconfigure and immerse the technology [11][25][32]. The significance of appropriation is further posited by [46].

3 RESEARCH CONTEXT

Since 2008 the Indigenous Knowledge (IK) research cluster, at a local Namibian University, has been co-designing technologies with indigenous communities for safe-guarding their own IK, [22, 37, 38]. A Community-Based Co-Design (CBCD) approach that blurs the boundaries between researchers and community members and emphasises mutual learning has been applied [5]. Over the years various technologies, methods, and the 7C Framework were established [26]. One such technology is the *Media Collection Tool* (MCT) (Figure 1), which allows IK holders to collect and digitise their own IK rather than being documented by outsiders[22].

Our aim is now to scale the research and development from one community to another as a way of enlarging the scope and impact.

The main collaborators since 2011 have been the Otjisa community who live north of Opuwo in the Kunene region. They are members of the ovaHimba tribe (more specifically the Okoto



Figure 1: Media Creation Tool (left to right): Home Screen, Video Capture, Video and Still Camera Save

patrilineal clan whose *ozondaura* cattle have colour on the stomach and the back). The ovaHimba people live in the Kunene region (formerly known as Kaokoland) which is to the north of Namibia and across the Kunene river in the Namibe province of southern Angola (formerly Moçâmedes district). Like the ovaHerero they speak the Otjiherero language. The ovaHimba are (semi-)nomadic with communal dwellings. They have an agro-pastoral lifestyle in which they practice livestock husbandry with small to medium sized herds and dry-land cultivation of crops in small fields for human consumption [33]. A large percentage of the ovaHimba people still practise their traditional culture. Those who live in towns and cities frequently return to their own villages where they also step into traditional roles. Given the richness, depth and variety of their cultural heritage great significance is placed on safeguarding their traditional knowledge and customs.

Mbinge, the community elder, has become a full member of the research team, with joint publications and presentations at conferences. He has contributed to concepts, methodologies and technological advances. He stresses that his main motivation is the transfer of knowledge to 'whoever is interested'. He emphasises that the continual return of the researchers shows respect and a sincere partnership on which trust was built and maintained and The position of reciprocal development was the theme at a workshop at the University. Mbinge was a participant and guest speaker. He endorsed the views and noted that the discussion between us had finally reached a mature stage where sensitive and substantive topics could be covered.

An independent second project concerned with community-based conservation management in Northern Namibia and Southern Angola has run over the past few years. There is some overlap in the research teams whereby Mbinge is involved in both. This paper is an outcome of extensive discussions and field work in both projects. Mbinge speaks Otjiherero while a number of researchers are fluent in both Otjiherero and English. The paper was first written by in English and then verbally translated to Mbinge section by section resulting in a dialogue in Otjiherero. The comments and statements were then worked back into the sections, which resulted in the current version. For readability, we are referring to our co-authoring Elder as Mbinge, in the third person, considering that he is the protagonist of this article.

The research cluster has been actively engaged with a number of communities stretching from the south of Namibia to the far north. An important project has involved interactions with the related ovaHerero and ovaHimba tribes, co-designing and implementing community-based technologies to support the safeguarding of their own cultural heritage. Institutional ethical approval has been obtained.

3.1 Co-Design of Indigenous Knowledge Safeguarding Tools

Over the years various technologies, methods, as well as project guidance frameworks were established that suited the contexts found in Namibia. In accordance with the community-based co-design approach [5, 22, 49] a particular focus was on community involvement and mutual learning. The community members encountered by the researchers at the start of the project were mostly unfamiliar with the use and applications of (information) technologies, apart from mobile phones which have now become quite common place. Community members developed technology skills that currently distinguish them from other community members by virtue of them being users and designers of technologies previously foreign to their locale.

We were told by the elders that what you know via stories is only part of the knowledge and how you are in the world is the rest. Indigenous knowledge is embodied. The knowledge resides in what you wear and the precise meaning of all your apparel tells others about you. The knowledge is also in the behaviours you practise, dancing to express yourself and the forms of politeness in your interactions with others determines your stature.

One of the tools designed ensures IK holders can collect and digitise their own IK rather than being surveyed, interviewed and documented by alien researchers, journalists and other visitors. With the main concern expressed by Mbinge being the falsification of traditional practices, he has been an active co-designer of tools and frameworks [26, 38].

3.2 Community Members' Roles

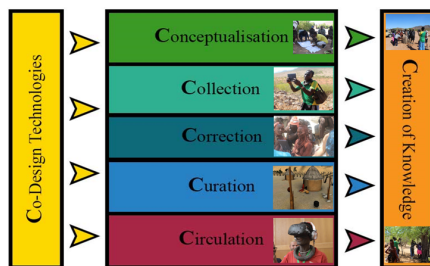


Figure 2: 7C Digitisation Framework [26]

Though much literature reports on the use of participatory approaches and action research, the level of community engagement has varied widely across the described projects. It ranges from being simple informants only, to informed participants, users, validators and testers, as far as co-designers and co-researchers. In our research we deploy a community-based co-design approach which is based on the principles of action research and participatory design yet locally appropriated and informed by values promoted in Oundu (Ubuntu) [5]. Community members from the onset are co-designers. The phases of community engagement throughout the development and research of a content-based technology has further been formalised within the 7C Framework [26] as depicted in figure 2. The various blocks of the 7C framework each formulate

a defined stage in the framework: namely co-design, conceptualisation, collection, correction, curation, circulation and creation of knowledge.

To scale up the project we undertook visits to communities in Northern Namibia and Southern Angola. In these Mbinge worked increasingly independently to introduce the projects and technology to other communities. The support from the rest of team became less necessary.

Mbinge has become confident in his role of supporting the project and can now introduce others to the aims and show them how to use and extend the system.

3.3 Role Evolution

As a project progresses participants' roles can evolve as depicted in Figure 3, carrying different responsibilities. Each step along this evolution is supported by different forms of scaffolding, mostly in terms of tutoring and mentoring.

In order to discard all of the provided scaffolding, community participants need to act as co-designers through the several iterations of design refinement which are needed to make a usable artefact. Then they need to be engaged as researchers to reach an overview and an understanding beyond the project and the technologies themselves in order to become educators and consequently facilitators of new designs in different contexts.

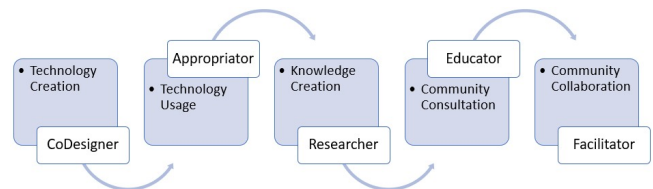


Figure 3: Stages of participants roles: each stage is first scaffolded by other team members who are then able to withdraw.

As time progresses during the co-design of a new technology, participating communities are more exposed to the details of the technology. Appropriation is only possible when a co-designer can appreciate where changes have to be made. At the same time researchers and students are able to come to a view of the community as fellow insiders. This was made easier, scaffolded if you like, by the ovaHimba adherence to a world view where everyone is inter-related [45]. Appropriator is the role assumed after the technology has been completed and used for its intended purpose. Then the tool can be further modified and be integrated in every-day life. As a co-researcher, the community members have a full understanding of the project, as well as the path ways to follow. Equal parts knowledge gained and created during previous joint sessions, as well as reflections can now be shared in academic and community circles. Our community collaborators have changed from co-designers, to appropriators and co-researchers. Once a community member has internalised the new knowledge, she/he can be a dedicated educator, advocating meaningful technology. In this paper we elaborated on the final step where Mbinge was being supported in expressing

his own views of the project in the context of their own aims and worldview. This led to a video (as described earlier in this paper) which could be shown to other communities of the ovaHimba, creating awareness. As a facilitator, the community member can *in situ* demonstrate the existing technology but also facilitate the co-design of adaptations of it. In this step Mbinge accompanied the project members to other communities in order to expose them as further adaptors of the technology.

Co-Designer. Over time, participating in co-design sessions, indigenous community members come to appreciate, firstly, the malleability of technology. This then leads to exposure of the community to the inside of the technology, that is, some of the mechanisms of the infrastructure that would normally not be visible. With this knowledge they can actively participate in the re-design and new designs of technologies. Appropriation is only possible when a co-designer can appreciate where changes have to be made. At the same time researchers and students are able to come to a view of the community as fellow insiders. This was made easier, scaffolded if you like, by the ovaHimba adherence to a world view where everyone is interrelated [45].

Appropriator. Appropriator is the role assumed after the technology has been completed and used for its intended purpose. Then the tool can be further modified and be integrated in every-day life.

Co-Researcher. As a co-researcher, the community members have a full understanding of the project, as well as the path ways to follow. Equally knowledge gained and created during previous joint sessions, as well as reflections can now be shared in academic and community circles. The community will now be probing their own knowledge for digitisation and safeguarding for future generations. Through this process the community member will also be creating new knowledge that will be adopted in everyday means. In this phase Mbinge became a researcher contributing to higher level frameworks and academic dissemination reflecting on his own cultural heritage and the digitisation thereof through exposure to academic interactions.

Educator. Once the community member has internalised the new knowledge, she/he can be a dedicated educator, advocating meaningful technology. In this paper we elaborated on this step where Mbinge was being supported in expressing his own views of the project in the context of their own aims and worldview. This led to a video which could be shown to other communities of the ovaHimba, thereby creating awareness. Mbinge further deployed his own teaching strategies to educate fellow indigenous people.

Facilitator. As a facilitator the community member can *in situ* demonstrate the existing technology but also facilitate the co-design of adaptations of it. In this step Mbinge accompanied the project members to other communities in order to expose them as further adaptors of the technology. Abilities and responsibilities have evolved beyond the project context and hence Mbinge directly contributes to the scaling of the design.

This can be regarded as ways of scaffolding the process [8]. The process in the ideal of the digitisation framework will be a continued process from one community to the next. Spreading the technology out into the indigenous space to maximise the intended impact.

3.4 Inter Community Communication

One of the shortcomings with communication of the research projects has been the focus on academic publications while neglecting the dissemination of project information and findings to fellow indigenous communities who did not participate in the design activities. Although informal conversations among community members do take place, this does not ensure a wider assimilation of the knowledge created nor the appropriation of the technologies. We aim for wide assimilation of the knowledge created by the project and widespread appropriation of the technologies amongst other communities.

In 2017, Mbinge recorded a video describing the project, its benefits and the way forward in his own words. Mbinge started by emphasising the importance of preserving traditional practices and values and of transferring their indigenous knowledge to the next generation. He shared his concerns about traditions and cultures being lost and how the project aims to address these. Commenting, he said “*I have learned to record the culture, with the cameras you brought. To record the cultural things, from people, their attires and the trees in the fields, to traditional herbs, that we use to treat our sickness.*”

In an early example, having introduced ourselves, we played the newly recorded video to Muhapikua, the daughter of a great spiritual leader of the Epupa community on the Angolan border. Muhapikua said that she shared the same concerns, the culture is being lost not only due to rural urban migration but also by the rebellious youth questioning the reasoning underlying their culture. She dreamt of a day where their cultures could be taught in schools by traditional community members in their full traditional attire. When introduced to the MCT she felt able to comment on the icons (e.g., saying that the Voice Recording icon looked funny with all the teeth visible in a mouth; that did not illustrate talking).

The research team gave feedback to Mbinge on the reception of his video in the Epupa community. Mbinge acknowledged his new sense of ownership: “Now I am taught to teach others”. In addition, this identification with his new responsibility guarantees the growth of the project. The ideal scenario is community members will share his enthusiasm and spread the word to all corners of the rural areas.

3.5 Inter Community Technology Transfer

In the second project we engaged with ovaHimba from the Okanguati constituency and southern Angola. Mbinge was invited as a co-designer and to introduce the MCT to the new communities. One of the community livelihood opportunities identified were ethnobotanical walks to document rare and endemic species. In this case the walks identified the traditional practical use of local plants by the people living there. The MCT was adapted to digitise plants with their locations and relevant features and uses, to create specialised ethnobotanical tours, see Figure 4.

A number of consecutive ethnobotanical walks were undertaken during the four-day visit. Throughout the ethnobotanical walks, Mbinge documented the activities using the MCT. He conversed with the locals directly while recording them as they explained the plants. He took videos of activities and in some instances audio



Figure 4: MCT Under Review

recordings and images. He was genuinely interested in expanding his own knowledge while recording, much the same as other visitors. We observed a certain ease in how community members provided the details he requested. At the same time, other community members frequently gathered around him and observed how he was using the MCT. He explained to those who showed interest, and everything happened *in situ* and naturally. The rest of the team's support was no longer needed as Mbinge had become more comfortable as technology promoter and educator.

On the last day a co-design session was held. It started with Mbinge showing his recordings from the joint ethnobotanical walks. He explained in detail how he uses the system and demonstrated the features. He further explained the meaning of each icon (he had previously co-designed) and the logic behind it. In response, the other community members had a lively debate on the applicability of the icons. They seemed to agree for the greater part except on the representation of the gallery (the old Nokia-type cellphone). The participants of Project 2 chose an open book that would remind them of the botanical book they have been using during the ethnobotanical walks as a medium of conversation and reference. Following on from this specific requirements for appropriation were discussed in a focus group co-facilitated by Mbinge.

In this intervention it became clear that Mbinge had not only mastered the use of the technology but also demonstrated his ability to teach others, as well as assist in facilitating co-design sessions with fellow communities.

3.6 Cross-Border Knowledge Transfer

A second trip under the second project was undertaken to ovaHimba communities in Angola. People from Namibia and Angola were brought together to participate in, among other activities, a co-design workshop that was hosted by Mbinge as depicted in figure 5 below.

Mbinge (Figure 5) explained how the technologies were co-designed by him and his community. The discussion expanded into explanations where Mbinge touched on various functional modules of the technology and how they tied into the relevance of the technology. He emphasised that interface designs had to satisfy him and all users. This is tied into the need for the scaffolding of learning by other community members.

This was followed by a demonstration of the system by Mbinge (Figure 5). He led participants on a walk to show the system in



Figure 5: Mbinge demonstrating technology functionality in-situ(Left). Mbinge during technology usage training and discussion (Right).

action. The participants then used the technology to capture data themselves about flora of the region as they wished. Here Mbinge acted as mentor. This was followed by discussions led by the academic team. The new community participants raised their own issues of concern, such as adapting the interface to suit their perspectives.

When we asked Mbinge about the workshop he facilitated in Angola; he said: *"I was not happy how I took the pictures when I was demonstrating how to use the MCT. I was too fast and did not hold the tablet still, and therefore, the quality was bad. Otherwise, I think I did an excellent job, and I know if I did not you guys (referring to the academic co-designers) would have assisted me. My fellow ovaHimba were amazed by my skills with the MCT and my explanations of building it. They know me as an ordinary omuHimba man and asked when did I learn all these technological skills. I answered that I had learnt all these from my colleagues here (referring to the academic co-designers)."*

Mbinge pointed out that the members of the other ovaHimba communities also wanted to be taught the skills to use the technology like him. Mbinge said he is eager to teach others so that they also know and use the system. However it is not easy for him to travel to Angola or Epupa without his own transport or money to do so.

3.7 Technology Promotion

Even though Mbinge is a traditional leader and a respected elder within his community, his role within the circle of technology and co-design changed with the exposure and constant engagement in the research. Mbinge was acknowledged as a co-designer, therefore, this made him part of the activities arranged by the research team. Activities such as co-design, technology explorations, focus group discussions, conferences, workshops, and meetings. Therefore, Mbinge would accompany the research team to various research sites for sessions. On one encounter, Mbinge accompanied the research team to two sites namely Epupa and Okanguati. The two sites are in the Northern part of Namibia, approximately 100 km away from his village Otjisa.

In July 2020 the tools for ethnobotanical data collection were further refined in a two-day workshop at Epupa. It also served to promote the wider use of digital collections. Mbinge was glad to share his latest recordings with the research team and fellow community members. He first listened carefully to community members during initial focus group discussions and allowed people to express their own views.

Two sessions took place in Epupa. For the first session, Mbinge was more of an observer. Listening to the community members

participate in the focus group discussions. It was easy for him to engage with others as they are all ovaHimba. He was assisting community members when they struggled to resonate with matters of discussion. At times, he was eager to speak on their behalf, but he kept saying that the community members should answer for themselves.

Mbinge became more involved during sessions on the following day. Mbinge used his session of over two hours to talk about his exposure and enthusiastically show his IK data collection to the community members. His approach was well-rehearsed, as he explicitly communicated the project aims, before moving to the technical components of his talk. He started the talk with the history and aims of the project. It included how the researchers met and involved him in the co-design of tools. With this explanation he switched on his tablet to show others what he collected, namely a healing session, food processing by his wife, as well as a number of plant knowledge demonstrations.

For example, to create content for young ovaHimba youth and outsiders, Mbinge, together with his son as the videographer, captured footage of 'Okuhuhura', a healing and purification process to banish evil spirits. It was captured on the MCT application. The coordination of the footage capturing process is noteworthy. There was a sequence where M expounded the meaning of each step in the healing process. It was captured from different angles, with a high resolution, good lighting and colour balance and a stable image. This explicitly presents an ovaHimba culture from an ovaHimba perspective with an otjiHerero narrative.

He started to show the knowledge collected in video format. The content of the data was around their IK and traditional practices. The sessions in the video were a practical demonstration with narrated content to explain every process of the data. The educational and informative presentation drew others in. They started asking questions and critically debating the content. This generated high interest and a desire to know more.

Questions asked of Mbinge were such as how he had learned to collect data and use the tablet, with so much confidence. The explanation was that he learned during his years of active engagement in the project. This also demonstrated the success of the scaffolding support built into the system. The session took more than two hours. The community members were intrigued and interested in the content collected and motivated to join the project.

Subsequently the joint research team reviewed his recordings on a large screen. The quality and content of his recordings were such that dissemination via local mass media, such as TV, were explored. Mbinge revealed his bigger plans, namely that he now wants to actively engage in involving fellow community members in digitally collecting IK as well as using his recordings to teach others about IK. The team has now started to operationalise his plans. Mbinge requested team members to assist him with training his fellow indigenous people in the beginning, provide suitable assistance within the system and then proceed independently while reporting progress back to the team.

Prior to this he asked the rest of the team to help him plan ways of creating a supportive environment that can be used for teaching and knowledge sharing. The team took that to include scaffolding for new knowledge collectors as well as project planning assistance.



Figure 6: Mbinge in discussion with communities about the usage and purpose of the technology (Left & Right). Muhapikua making a drawing on Mbinge's request (Middle)

The researchers plan to be part of the initial sessions where Mbinge involves others. If necessary they can help him to facilitate sessions of that nature. According to Mbinge, he would become more comfortable on his own as the sessions progressed. Once he is comfortable, he would enlarge the scope of the project while remaining in touch with the research team. In this way he intends setting up a sustainable environment for the IK gathering.

Mbinge's bigger aim is to be able to let others experience knowledge gathering, co-design and research, in practice. The experience will be especially powerful if facilitated by one of their own. He added that he cannot keep what he knows to himself.

3.8 Fellow Community training

Mbinge rehearsed the MCT application usage by demonstrating it to one of the researchers to ensure that he remembers the application very well for his training workshop as depicted in figure 6. Then he started training Muhapikua by demonstrating how she could switch on the tablet and locate the MCT application's home icon. Mbinge confidently explained each icon of the MCT application's functionality, starting with how to take photos, video and audio recording, make drawings, writing text, and finally browsing through the captured multimedia. Muhapikua was fascinated by the MCT application that it could listen and record her voice with simple taps on the screen. Mbinge showed Muhapikua how to use all functionalities; for example, he made a quick drawing and allowed Muhapikua to do the same. Muhapikua made a drawing of a tree, saved it and used the browse icon to review it.

After going through all the functionalities with Muhapikua, Mbinge gave a group demonstration to all the community members who were part of the MCT training workshop. He noticed that it would take a lot of time to train every member individually, so he informed Muhapikua that it was her duty to train the next person seated beside her. The following person would teach the following. He will only assist if they forget some functionalities. This self-training technique made the community members focus attentively knowing that they have to train the next person.

The community members enjoyed with laughter making video recordings and drawings and previewing these. The multimedia recorded was mostly about primary usage of plants in their region. After an hour of training, Mbinge informed the community members that they should use the MCT to record information about plants near the workshop area. The community members enjoyed this fieldwork. Everyone wanted to get a chance to use the MCT application by performing full recording of specific plants.

One tablet was left with Muhapikua, for her and other community members to make recordings while the research team is not around. During our most recent visit Muhapikua proudly shared

her and fellow community members' recording with us and fellow community members in a media viewing session on a bigger screen. The recordings were of mixed quality in terms of focus and angle, with a number of amazing shots high up in the mountains. Equally great were commentary video recordings about plants where one or two community members presented the plants and their use. This demonstrated that the Epupa community had successfully learned to use the MCT application.

3.9 Technology appropriation

Considering that the Epupa community are expected to be active members in conservation, their focus is on using the MCT for plant data collection and retrieval. Thus, in order to ensure that media are retrievable, categories and metadata are to be added to the recordings. Mbinge co-facilitated the session in which primary categories and metadata were identified, as well as first user interface designs determined and discussed. The following information was requested about plants, such as its name in Otjiherero, whether edible by animals and people or not and its medicinal use and homestead use. Homestead use refers to whether the tree is used in making fencing areas for livestock or used as kitchen utensils. Further refinement sessions have been undertaken meanwhile and the first prototype is being developed.

4 DISCUSSION: REVISITING THE SCAFFOLDING APPROACH

Rural communities have expressed their desire for long-term relationships beyond isolated projects [20] leading to continuous re-negotiations of roles and responsibilities throughout the collaboration [45]. Questions often arise as to what our expected commitments as humans and academics engaged with communities are. Are the numerous informal phone calls part of it, are private financial or logistical help outside the project work reasonable? While the Minimum Ethical Standards for ICTD/ICT4D² [9, 10] has corrected many problematic statements in inapplicable yet common institutional ethics guidelines, it still emphasises "professional" partnership rather than a "human" partnership as promoted in African philosophies, such as Ubuntu, and formalised in the San-Code of research as "care"³.

We have previously addressed participatory development from the point of view of our Community-Based Co-Design method. However, we are now moving towards ending our long-term close involvement towards a more long-distance supportive role that will be more sustainable. Scaffolding is one way to support such distant user communities. One more way of "empowering the community to create and refine its own digital technology" [31].

Examining the aims of scaffolding from those view points leads to fundamentally different perspectives. Is the aim to ensure communities independence from researchers and/or is the aim to foster partnership and increase communities' well-being and recognition [47]? It is in this light that we review our scaffolding endeavours.

²<https://ictdethics.files.wordpress.com/2018/12/Minimum-Ethical-Standards-for-ICTD-ICT4D-Version-2.0.pdf>

³<http://trust-project.eu/wp-content/uploads/2017/03/San-Code-of-RESEARCH-Ethics-Booklet-final.pdf>

We consider scaffolding as a viable method to facilitate inter-community engagements leading to technology appropriation by communities who were not part of the original design team. The starting point for such work is obtaining a social arrangement where an insider perspective is possible for all participants [6]. How this is done depends on the context of the work, in our case it was within a traditional African community and we were aided by their customary social values. Mbinge has been collecting IK for a long time now. He has progressed in the way he collects IK and his use of the tablet. He can now use it with minimal assistance from others. His open approach makes others part of the data collection team and he makes his family members part of the storyline where relevant. In this way he now teaches others about IK and the use of the system: it is something he loves.

He is collecting media independently and he has been confident in presenting the collected IK to both the community and researchers. While he previously asked for assistance when using the tablet this is no longer the case. The high quality of the collected IK media and the standard of the narration also reflects this progress. As the collaboration progressed, and Mbinge and other members of the community gained a better appreciation of the abilities and limitations of technologies they were better able to formulate their own responses and needs in the current situation. They are now also engaging with the direction of the project.

5 CONCLUSION

The desire to achieve sustainable and extensible technology developments with empowered community members places demands on all stages of the co-design activities and collaborative management. With a scaffolding approach, previous co-designers and collaborators are enabled to scale the project beyond the original design context. An intervention can be done in such a way that community members themselves can become advocates of the newly designed system and enable other communities to appropriate the systems for themselves.

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