Designing Social Media for Community Information Sharing in Rural South Africa

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ABSTRACT
We reflect on long trials of two prototype social media systems in rural South Africa and their biases towards certain communication practices on information sharing. We designed the systems to assist people in low-income communities to share locally relevant information. Both involve communal displays, to record, store and share media, and users can transfer media between the display and their cell-phones. MXShare, which we report for the first time, also enables real-time, text-based chat but AR enables sharing only audio files asynchronously. Both systems were located at the same sites for community communication and co-present oral practices effected media recording and sharing. Their use reinforced differentiations in sharing information between older and younger people. We argue that designing social media systems to widen information access must respond to complex interactions between social structures and genres of communication.

Categories and Subject Descriptors
H.5.m [Information interfaces and presentation]: Miscellaneous.

General Terms
Design, Human Factors,

Keywords
Media sharing; Orality; Intergenerational; MXit; Rural Africa

1 INTRODUCTION
Recent efforts to design social media platforms for low-income communities in technology-sparse settings often aim to enable people to exchange information that is relevant to their livelihoods and/or wellness. There are few long-term studies, but analyses of systems deployed for a few months show they do not widen information sharing because of existing disparities, such as inclusion in certain social groups [35], phone ownership and ability to use phone services (e.g. [38]). This aligns with more general insights in the field of ICT4D that technology access and use amplifies people's advantages (e.g. wealth, education) and 'self-efficacy' or ability to change their situation [41]. However, there has been no reflection on the biases of social media platforms towards certain communication practices and the role of these biases in amplifying differentiation in information sharing. We propose that when meanings *about* communication are not situated in the practices of different members in a target community then platforms better support some members, not others. We claim that design processes contribute in biasing social media platforms by introducing meanings external to communities. We support this claim with insights emerging in the design and use of two social media platforms in a long-term study in South Africa's rural Eastern Cape province. The platforms supported different modes and genres of communication and, consequently, reinforced information differentiation between older and younger people. We begin by relating their functionalities to recent studies on social networking and media sharing technologies in ICT4D and introducing concerns that technology design embeds certain communication practices.

1.1 Media Sharing Platforms
This paper juxtaposes two platforms, MXShare and Audio Repository (AR), designed to enable rural inhabitants to exchange locally relevant information. Deploying social media platforms is often part of, what Heeks calls, 'ICT4D 2.0', which emphasises marginalised people's use of technologies to create digital content or services to serve their own goals in their own communities (21:33). Design of MXShare and AR focused on participation through information, not applying ICTs in economic development [43]. We exploited increased access to cell-phones by enabling users to transfer media between a communally owned display and their own phones. MXShare, which we describe here for the first time, permits users to contextualise media uploaded to the display in real-time, text-based chat. AR, which we have already reported [2, 4, 7], does not support remote communication and enables sharing audio files only.

1.1.1 Situated Browsers & Co-present Sharing
Both MXShare and AR involve media browsers running on portable, communal displays to share content between specific users or user groups. They differ from situated browsers on electronic noticeboards that enable people to upload, view and share media publicly, say at local shops (e.g. [11]). The public display concept has been adapted for developing regions before. BigBoard, for instance, enabled users in South Africa (SA) to transfer multimedia across Bluetooth to their phones by interacting with a large display [25]; meanwhile, StoryBank enabled users in rural India to share and browse audio-photo stories, created on camera-phones, via a public display [19]. Like StoryBank, MXShare and AR enable sharing media directly between devices, which is compatible with ways that people in developing regions share phones or media during co-present communication, often within social groups [45] but sometimes between groups for specific purposes [1].

1.1.2 Remote Synchronous Sharing

MXShare allows users to contextualise the media shared with others in real-time, text-based chat. We used MXit, an instant messaging and chat service created in SA in 2005 that had 18 million registered users when we developed MXShare. MXit was the primary draw to the mobile Internet for young people in low-income areas in SA [16] and with 7.4 million monthly active users exchanging 700 million messages daily, was more popular than Facebook [22] until this year. Older people valued the economic benefit of using MXit [12] as each text message is far cheaper than an SMS because they are exchanged over low-bandwidth, cell-phone connections. By offering a fast, data light service over the most basic 2G connection to a wide range of feature phones, MXit has facilitated communication for healthcare, development [12], community empowerment [32] and m-learning [17], and led to stable NGO partnerships focusing on education, empowerment and agriculture. Users can also send rich media (e.g. photos, videos, audio) in chat messages, but this is often too costly because it requires more airtime. Thus, MXShare separates low- and high-cost media. Users can chat in real-time using MXit's service on their own phones, but up/download any associated media from/to their phones over Bluetooth when they visit the display.

1.1.3 Remote Asynchronous Audio

AR does not support real-time, remote communication, but focuses on interacting with audio recordings via a visual interface on a situated display. Earlier media sharing systems allow asynchronous discussion by recording [29] and accessing [23, 30, 35, 38] audio content but cannot support people who do not have access to a phone [e.g. 9] and often involve costly network connections and/or high-end phones. Some Interactive Voice Forums (IVF) use lower cost channels on cell-phone networks (e.g. [34]) but studies also show that people with little formal schooling can struggle with the style of speech required for voice input [13].

1.2 Communication Practices

Needing certain skills to use voice input illustrates how the forms of communication that technologies support arise in certain cultures of communication [17]. Information dissemination is confined when the modes and genres of communication supported by social media are incompatible with some users' literacies and practices. MXit's rise in popularity amongst teens in SA is attributed to the "private spaces" it offered them to write their way into the textual company of social groups they favoured [44]. However, young, urban MXit users also suffered "social erasure" when their slow responses impeded the flow of chat and revealed them to be awkward novices with lower status in peer hierarchies [43]. Lacking skills to use technology to express information effectively (e.g. [44, 36]) impacts people's self-efficacy, which is contrary to ICT4D 2.0's emphasis on designs that enable people to harness technology for their own goals to change their situation. Exclusionary modes and genres also undermine the mutually supportive communications and ethos of co-operation that enable people in low-income communities in Africa to survive (e.g. [45, 31]. In fact, parents' concerns about clandestine communications amongst MXit users [10], and the literacies associated with MXit use, contributed to demonising the platform [13]. The modes and genres of communication supported by technologies are also ill-suited to certain social situations, which might mean they are incompatible with settings in which some information is frequently shared. For instance, women in rural India were not at ease with Interactive Voice Response (IVR) in some circumstances [13], and people in Botswana were uneasy using IVR to access information about HIV but not soccer updates [30].

ICT4D 2.0 learns from many failures of usinga "blueprint" approach to design and deployment (21:33). Such projects implemented inflexible, top-down plans and technologies based on designers', not users', understandings [20] about, for instance, technology needs and usefulness. Increasingly the field promotes user-centered design to optimize technologies to local practices, needs and wants (e.g. [33]). However, it can be difficult to recognise conflicts between the modes and genres that design privileges and the communication practices of target communities because we interpret meanings about communication through non-local communication practices [41]. We argue that the differential use of MXShare and AR in Mankosi illuminates some of the ways that non-local meanings about communication, embedded in design, effect local information sharing. Thus, next, we outline factors that affected information flow in Mankosi prior to our deployments, and explain differences in design approaches to MXShare and AR. Then we detail the design of MXShare and summarise AR. We explain local deployment, interactions with, and appropriation of each system in turn, emphasising how the prototypes reinforced differences in communication practices between generations. We end by discussing how use of the social media prototypes related to generational and intergenerational communication practices and the way meanings about communication were produced in design.

2 COMMUNICATION IN MANKOSI

Mankosi, in Nyandeni municipality, comprises twelve villages spread over 30km^2 of very hilly land and is 30km from the nearest small town. Inhabitants live in 580 households of up to six adults and eight children, consisting of clusters of thatched, mud-brick rondavels, sometimes a tin-roofed two-room dwelling, animal corrals and garden(s) for subsistence crops [8]. Most inhabitants do not have domestic electricity or water and, every day, people walk along paths to communal pasture, forest, taps and dams where they collect water, firewood and grasses, graze animals and tend plots [8]. There is only one bus a day which does not go to all villages and can take 2-hrs to travel the dirt road through Mankosi, en route to Mthatha, a small city 70km away. As men are more likely to temporarily migrate to cities and mines to work, more women live in Mankosi. Household income is about $150 per month, mostly in payments from migrant kin and state pensions [8]. Temporary migration and deaths related to healthcare access and a 29% HIV incidence contributes to a 'skip generation' phenomenon, as clearly shown in Rey-Moreno's survey of households across Mankosi in 2012 [37]. Of 250 people aged 15 to 93 years randomly sampled, 50% were between 15 to 24 years old, but only 16% aged 25 to 34 years and 11% aged 35 to 44 years.

Research activities in Mankosi, outlined in 3.2, produced insights into communication practices and challenges. We have already reported many of these [2, 3, 4, 7, 8]. Inhabitants have a rich oral isiXhosa-speaking culture and phone use is increasingly part of this. At the end of 2010, 76% of men and 56% of women owned a phone and over 50% of owners were aged below 25 years [3]. Most phones were low-end, Java ME keypad-based models and 60% were Nokias. Only 25% were feature-phones, and just 16% of owners used the Internet on their phone. People paid on average ~$0.72 to charge their phones at a shebeen (informal bar), spaza (small shop) or neighbour's home that had a generator or small solar system. Inhabitants favour voice calls, which they keep brief and tend to plan ahead because they spend on average only ~$0.75 a week on airtime; undertake daily tasks in Mankosi beyond phone coverage; charge phones infrequently and conserve charge by switching them off. In late 2010, SMS comprised only 1% of older people's phone-use, and only 7% of phone-owners had used

MXit's text-based chat [3]. In contrast, most phone-owners used a free 'Callback' service that allows subscribers to send a message to up to five recipients per day. The service sends a text that starts with "Please call" followed by 10 characters the senders personalise and then the phone number. Callers are permitted to personalise the text once a day and inhabitants use it in various ways to express or ask for support, organise meetings and pass other information. Some, especially younger, people use a very abbreviated mix of English and isiXhosa and a few use the text in mixing communication channels, such as asking Callback recipients to log onto MXit [2].

Differences in use of phone services between generations and the 'skip generation' phenomenon affect information flows. Custom discouraged conversation between married and unmarried people, encouraged friendship only amongst similar life-stages and learning from immediate seniors in daily life and from elders in more formal mentoring at key life-stages. Some of these practices persist today, for instance initiation school and ceremonies (e.g. *Abakwetha*) are vital to manhood. Men, and some women, are initiated in late teens, often marry by their early 30s and can be financially responsible for parents and siblings before that. However, people younger than 35 years old are rarely considered sufficiently mature to represent their families, although this duty also depends on gender and birth order. Deferring to elder authority means younger people can feel uneasy teaching elders to use cheap services and often interact with phones for them. Many of the 23% of people aged 45 years and older in Rey-Moreno's household survey in Mankosi [37], would be considered elders based on their experience in family decisions and wisdom about community matters. These people are more likely to be amongst the 40% of adults in Mankosi who cannot read and write well, though such people do use PINs on their phones, recognize up to 20 contacts' names or numbers and/or record in diaries, that intermediaries assist them with. Older people find learning to use Callback hard and restrict their use to practical purposes and unambiguous texts. Thus, younger people expect older family members to be alerted by a Callback to call them, but not to read its text [3]. Older and younger people also differ in pursuing a constant remote presence in others' lives. Younger people "buzz", by making deliberate missed calls, for fun and to convey that they are thinking about the recipient; but older people, accustomed to enduring connections despite limited contact, buzz only if they have little airtime and want to talk or meet. MXit also attracts younger people because it enables cheap, frequent communication; for instance, users log on 3 or 4 times daily to leave messages or chat with family, friends or people they do not know in distant cities [3]. In contrast, older people perceive MXit as playful and potentially harmful to education.

Some 30% of phone owners use their phone to take and view photos, listen to music and record audio but lack of storage space limits recording and saving of content [20]. Around 30% of owners shared media between phones using Bluetooth but none shared over phone networks. The cost of sharing via an SMS or MMS message equals at least 5% of most local phone-owners' total weekly spending, few people used MXit to send files and local use of WhatsApp only started six months after we launched MXShare, in mid-2011, by the few people with Internet-able phones.

Most inhabitants prioritise phone use to communicate and exchange support with those they have closest bonds, either in their own villages or far away [7]. This affects information flow between villages and has consequences for governance. Like 36% of SA's population, inhabitants are governed by a Tribal Authority (TA), which in Mankosi consists of the Headman, a Subheadman in each village, and three messengers. Headmen inherit their role patrilineally but can replace Subheadmen and permit women to assume these roles. The Headman receives a government stipend however, like almost all inhabitants, he cannot afford a car. The Headman and Subheadmen's homesteads are sites for local administration, from hosting meetings to notarizing identity papers. Up to 100 people attend the TA's weekly meeting, 60% of whom are male and 60% older than 30 years [2, 8]. Meetings often take over three hours and people sit according to gender and age, listening carefully to each speaker without interrupting. Meetings mostly address Mankosi's internal issues and attending can entail walking for over two hours, which limits turnout. The TA's voluntary secretary writes attendees' details and minutes on paper, but these do not always precisely record what was said and are not circulated. Thus, Subheadmen and Headman's messengers are key conduits for information between villages in co-present talking.

3 DESIGN APPROACHES

Our research in Mankosi was prompted by ethnography in an adjacent area that showed that local Xhosa people have difficulties in communicating between villages, which affected co-ordination [1]. This earlier research introduced A1 to a non-profit organization, Transcape, which enabled us to use their premises, at a guesthouse in south-east Mankosi, for workshops that shaped the design of a mobile digital storytelling application [5]. We linked to Transcape and researchers in the UK for an 18-month project in which we developed MXShare. We engaged with inhabitants to deploy MXShare, which yielded data that later informed AR, designed and developed AR entirely in SA. Thus, as we explain next, design approaches to MXShare and AR were very different.

3.1 Globalized Agenda & HAPs Approach

MXShare involved seven academic researchers based in the UK and three in SA. We aimed to develop and evaluate a toolkit of novel hardware and software designs that could be used by rural communities globally to share digital media [15]. Thus, we sought to test prototypes 'in the wild' and gain insights into their use in Mankosi from "human access points (HAPs)", or people familiar with the locality and with ICTs [24], such as A1.

We launched the project in October 2010 with a four-day meeting in Cape Town, 1300km from Mankosi, to introduce senior project team members and partners. First, two Transcape members described local life and challenges and an SA-based researcher, who had worked on technology projects with Transcape (e.g. [39]) added insights Then UK-based researchers summarised their research, including technologies deployed and evaluated, and information sharing practices elsewhere in the global South (e.g [19]). The meeting was scheduled to UK researchers' constraints, which limited time for A1 to report ethnographic observations. Experiences in Cape Town suggested that the extensible MXit platform offered a way to address a problem, noticed by Transcape, that the recently revitalised Community Association struggled to share information between villages in Mankosi. Thus, we drafted an architecture to support low-cost sharing of digital media across villages, which integrated MXit and communal displays running media browsers. The architecture included solar-powered, cellphone Charging Stations that, we hoped, would promote use of MXShare to people visiting Stations to charge their phones.

While A2 and A3 developed MXShare in the UK, A7 constructed Charging Stations in Cape Town, and A1 began studies in Mankosi. A1 explained to inhabitants that we sought to experiment with new systems that could benefit rural communities glob-

ally and started to generate detailed data on local communication practices [3] that was reported to the other academic researchers when we met in the UK in December 2010. We were concerned that MXit was much less popular in Mankosi than elsewhere in SA [10] and the Callback service might offer a more locally appropriate platform, since older people used it for alerts and youngsters for free messaging [3]. However we settled on the MXit-based design as inhabitants at least used cheap texts in some way and coding for the MXit platform had already begun. MXShare enables users to send texts and metadata associated with media using MXit across mobile connections, but up/download media from/to their phones over Bluetooth to a communal situated display.

For the next three months we finished developing MXShare and the Charging Stations in the UK and Cape Town, respectively. A1 was consulted over email and Skype on some design decisions, such as the media browser and, as outlined in Section 5.1, we modified aspects of the interface based on inhabitants' initial interactions with it. However, we critiqued major conceptual and interaction design decisions for MXShare against the teams' experiences of technology endeavours in low-income areas of Cape Town and India in order to maximize the benefit of designs for low-income communities other than in Mankosi. We envisaged that MXit would be widely accessible as it offers very cheap, text-based chat to many phone models over low-bandwidth connections; has been successful in several developing countries where mobile data costs are low; and, 12% of MXit users live outside of SA [17]. Thus, cross-national experience and interests oriented key decisions for MXShare in a globalising agenda.

3.2 Localised Agenda & EAR

Deployments unfolded in a more localised context for academic researcher A1, who lived in Mankosi for over two years in total from 2010. This inclined her to use Ethnographic Action Research (EAR) [40] – an approach that aims to detect, articulate and solve communication problems in the community affected and emphasizes the role of inhabitants as fellow researchers. So, shortly after the Cape Town meeting, A1 recruited a team of Local Researchers (LRs) in Mankosi, aged 17 to 27 years at the time, to deploy prototypes and mediate insights into local practices and issues.

We asked LRs and Community Association members to suggest sites for prototype systems but all insisted we consult the Tribal Authority (TA). Thus, we sought approval from the TA to experiment with platforms that might assist communicating between villages, and subsequently met the TA over 20 times, often as part of community meetings, to discuss ideas, plans and problems in designing, trialling and maintaining systems. We verbally explained MXShare as best as we could, given it was being developed in the UK, and that we had budget for LRs to operate it for a year. We asked inhabitants to account for accessibility and sustainability, without further monetary support, in deciding on deployment sites and operation. They were most concerned about the equipment's security and access for community-oriented communication. Six weeks prior to deploying MXShare, the TA confirmed two sites for the Stations that were 2.5km apart or 25-mins walk: in the Headman's homestead in Ridge, and the homestead of a Subheadmen in Mankosi's poorest area, Ncgobo [2, 8].

After A1's first meeting with the TA we began to generate data on communication practices. We used mixed methods including observations; contextual inquiry; interviews; diary studies; and, auto-ethnography. Few local people speak English, and in most activities A1 spoke in English, others spoke in isiXhosa and LRs translated. We recorded these activities in handwritten notes and, sometimes, photos and video. LRs and other people began by video-recording their own interviews, conversations, storytelling and presentations, which included 20 items featuring some 40 people, aged 14 to 80 years. After recording these items each LR video recorded themselves watching, listening to an item and pausing the item every few minutes, to translate its contents aloud. We gave all the original items and the translating videos to UK researchers, who transcribed words spoken into English text. Before A1 met other academics in the UK we interviewed 141 people about phone ownership and use [3]. Three months before UK researchers visited Mankosi, we interviewed another 16 people about their use of Callback [3] and conducted diary studies with a further 22 people to gain insight into the ways they manage communication in their daily routines. Diary studies involved individual or group interviews at the start and end of periods of 4 to 10 days and 72 short individual interviews in between. We interviewed twelve older low-end phone owners, half of whom are illiterate, and ten younger, literate owners. We interviewed some younger people over MXit, which enabled LRs to practice their newly acquired skills in using MXit. UK-researchers also interviewed 23 people about use of feature phones when they visited [20]. During data generation, A1 used descriptive statistics to analyse responses to questions in interviews and thematically coded data after activities, cross-linked themes between activities and revised themes hermeneutically as new insights emerged.

Insights and experiences in studies before and during the trial of MXShare informed designing AR to run on the tablets already deployed. Design decisions included focusing on audio to respond to local preferences for voice and constraints on owning and using phones [2, 4, 7]. AR enables users to record, share and listen to voice files, directly on the shared tablet or via their own low-end Bluetooth enabled phones. UK-researchers were not involved in AR, rather A1 sent a technical specification to A6 in Cape Town. We discussed this over the phone and an LR (A4) visited A6 to talk about experiences in designing and evaluating our original digital storytelling prototype [5] and trialling MXShare, interact with provisional UIs and explore design opportunities [7]. Thus, local experience and interests oriented design decisions for AR.

4 PROTOTYPES

Both MXShare and AR aimed to enable users to share and archive media without substantial funds for phone services, technological literacy or domestic electricity. As inhabitants share many resources, we situated an asynchronous social network and display together with a community-managed phone Charging Station [8].

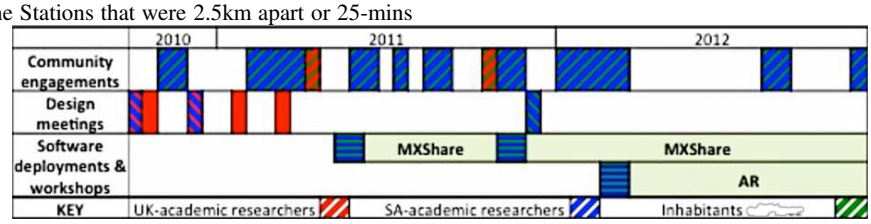

Figure 1. Timeline of co-present design and deployment activities for MXShare and AR

Figure 2. MXShare's client enables real-time chat (b) and synchronises media between users' phones and the browser (a). MXShare's browser to find users' accounts (c) and media (d). AR's interfaces to find users' accounts (e) and, record (f) and share voice-files (g) [2]

4.1 MXShare

MXShare comprises a MXit client and tablet-based media browser. The client is an asynchronous social network application for users' own low-end, Java-capable phones to send and receive text (Fig. 2a, b). The browser displays media archived and/or shared using the client (Fig. 2c, d). Initially we aimed to use WiFi to synchronise media across the sites, automatically, but the potato mesh infrastructure to support this was completed only recently [37].

4.1.1 MXit client: an asynchronous social network

At less than R0.001 per kB, the MXit service is economically viable for Mankosi's inhabitants for text messaging over cell-phone networks, but prohibitive for sending photos, videos or audio. Thus we repurposed the MXit client for real-time chat and low-bandwidth textual meta-data. When we developed MXShare the MXit platform supported 3000 mobile handset models, but we concentrated on low-end, Java-capable devices in order to enable wider access than would be possible by dispensing smart devices, which also have less predictable features and capabilities. We developed the client as a Java ME application using MXit's public API. It uses the phone's data connection to send and receive text messages and has a similar interface as the standard MXit client (Fig. 2a). The client does not, however, send media across the data connection but, instead, notifies recipients that the media will be available on the display. The client synchronises content between a recipient's phone and the media browser, via Bluetooth, on a user's next visit to the Charging Station, which includes media files in the chat session if the sender has already visited. That is, the client uploads media from the sender's phone and downloads media the browser has received from other chat participants.

Limited storage space on low-end phones restricts generating local content and inhabitants often delete media they value [19]. Thus, the client backs-up all media on users' phones to the browser when synchronizing. Users can delete archived content from their phone to free space and view or replay it on the browser or send it back to their phone later.

4.1.2 Browser: multimedia archiving & sharing

The media browser runs on touchscreen Android tablets and manages all content synchronised using the MXit client. The browser's interface accounts for mixed textual literacy and avoids unfamiliar representations (e.g. maps). A user identifies his/her account according to a homestead, located in relation to an egocentric view from the site where the tablet is stored (Fig. 2c). Thus, the main

screen is a panorama that users drag to view a full circle of their surroundings, attached to which are small rondavel icons that move with the panorama. This suits the sites chosen for the Stations as the Headman's and Subheadman's homesteads are on the highest hills in their respective villages. When users select a rondavel icon the display changes to a grid of photos of occupants registered with the system. When a user selects an occupant's photo the browser displays a grid with the account owner's photo and a small "lock" icon. The presence of the phone linked to the account is the key and the grid displays uploaded media if that phone has been synchronised with the browser in the past 10-mins (Fig. 2d). This limits browsing private content without requiring passwords or other login tokens.

When users select an item the browser presents or plays their photo, video or audio in full-screen. The browser shows most recent media first in a column, enables users to filter by media type and highlights items that a user has shared publicly in their media grid (Fig. 2d). All users who select an icon in the top right of each screen can access public media. The browser displays media that is shared from the MXit client as selectable thumbnails in a chat-like view to users who uploaded or received it via the client.

Users of the media browser can choose to register with the system and download the MXit client or synchronise and upload media from any Bluetooth phone without registering for MXit or using the client application. Both options require pairing the user's phone with the system but to limit exposing users to extra complexity, due to Bluetooth's idiosyncrasies for different devices, we designed one initial process to register and pair phones.

4.2 Audio Repository (AR)

We did not extend MXShare's functionality for AR due to funding constraints instead, as already reported [2, 4, 7], we designed a very simple system to enable inhabitants to record and listen to voice files, even if they do not own a phone. All users can create and listen to public recordings. Registered users can also store audio files; send/receive files to/from other registered users, and/or their own phones; and, create and enable access to 'groups' of registered users. Users register with their name, a photo taken using the tablet, and a password. They scroll vertically through profile photos to find their account (Fig.2e) and horizontally through profile photos to find other users' accounts to share voice-files (Fig.2g). We designed slow touch gestures to share files, rather than aiming for fast interactions, so a user 'long-presses' on a tape icon and drags a small copy of the tape over a target user's photo, a collage of group members' photos, or the public icon (Fig. 2g). The tape drops onto the corner of the photo when the user lifts his/her finger, where it stays to show that file is shared. To assist identifying files we used a basic folksonomic strategy by displaying users with whom a file is shared [7].

5 DEPLOYMENT, INTERACTIONS & USE

Three UK-based researchers (including A2, A3) visited Mankosi for two weeks in April 2011 to set up two Charging Stations and tablets at inhabitants' chosen sites and install MXShare, which has stayed on the tablets ever since. In February 2012, A1 installed AR, developed by A6, on the tablets, and this remained until January 2013 when we replaced it with another iteration (see: [4].

5.1 MXShare

When the UK-based researchers visited, we met the Headman to clarify potential issues, reinforce that the community controlled use and review plans to deploy the Charging Stations. Then we set up the Stations and MXShare. The Headman had assigned Station operation in Ncgobo to his voluntary secretary, G, who speaks English; and, in Ridge, to a Subheadman who cannot speak English or write. LRs suggested recruiting a 24-year old woman in Ridge, who owned a cameraphone and used Bluetooth to share multimedia. G was eager to manage the system effectively, but was unfamiliar with cameraphones, touch-screens or MXit. Thus, we taught two male LRs in Ncgobo and the female LR in Ridge, as well as G, to use and maintain the Stations [8]. The LRs' first interaction with the system provided valuable feedback and suggestions for the media browser to be more familiar and intuitive to inhabitants. For instance, initially users needed to browse their media within 5-mins of synchronizing but as LRs interactions revealed that this was not long enough, we increased it to 10-mins. We also revised registration to enable users to browse and synchronize media without requiring the MXit aspect.

We launched the system at events in each village, which included speeches by the TA and A1, and introductions to UK-researchers, followed by lunch. Around 40 people attended each event, most of whom were older people from nearby villages. In Ncgobo, a DJ used Transcape's sound system to play music and in Ridge we responded to discussion about inhabitants' concerns about the system. LRs invited people to see the Stations, explained how the system works and recorded short interviews about perceptions.

After the UK researchers left, A1 and LRs ran seven workshops lasting 2-hrs to 4-hrs, to introduce MXShare to 24 TA and Community Association members (22 men, two women; aged 35 to 65 years). As many phones locally were incompatible with MXShare, we gave each workshop attendee one of the cheapest internet-able phones, Nokia 2330. LRs taught TA members who had low text-literacy to use MXit as an alert since the name of a contact changes colour when they send text. We also explored with soccer players how tablets might support the popular local league and encouraged use of tablets by uploading locally created videos, photos and voice commentaries of soccer games. We logged use of MXShare automatically and LRs recorded who charged phones each day in notebooks. We observed each site for over 80 hours on different days of the week, at different times of day and times in the year, and interviewed 40 people who left or collected phones [8].

5.1.1 Interactions & Use

The LRs, already familiar with MXit, seemed to understand the entire system quickly but other inhabitants' reactions were mixed. Attendees at the launch in Ncgobo were keen to charge their phones at the Station, but seemed uninterested in using the browser and archiving or sharing media. Several attendees at the launch in Ridge registered with the system and their reactions suggested that they understood the browser's graphical interface, even though it was unlike anything they had seen before. Elders said they could use the platform to store photos of deceased people so that orphaned children could know their ancestors and that their grandchildren could facilitate their use of the browser by taking and uploading photos for them. Workshop participants said that leaving messages on MXit might evade the frequent problem that a contact's phone is switched off or out of range and that uploading audio and video to the browser might enable people with low literacy to exchange information. However, most registrations with the media browser occurred during launch events or workshops. In six months only 33 people registered in Ncgobo and two in Ridge and no-one registered after October 2011.

Totals of 1183 and 139 media items were archived in Ncgobo and Ridge, respectively (Table 1) and only 13% were MXit conversa-

tions. Very few items were shared and most were private in Ncgobo or uploaded by unregistered users in Ridge. Media comprised of 40% images, 18% video, and 42% audio. Images and video tended to have been recorded locally, however non-locally captured items included "adult content" uploaded anonymously to the public mode, which worried LRs. Usage of MXShare contrasted with the Stations that, together, charged 700 people's phones, many regularly [7]. Charging phones was prioritized over tablets, which require more power and were sometimes not charged. Further, despite minimising operations the initial registration process for the client was still too complex and beset with problems for people with no technological experience and low text literacy. We experienced technical problems in Bluetooth pairing, time-outs due to intermittent network connectivity, which required repeating the login process, and erratic changes in the contact information MXit provided. Further, 15% of workshop participants' SIM cards would not allow MXit data access.

Media	Ncgobo	Ridge
Text	15	11
Images	63 *(L: 13)*	18 *(L: 13)*
Video	14 *(L: 10)*	22 *(L: 10)*
Audio	23 *(L: 6)*	60 *(L: 15)*
Public	24	70
Private	74	29
Shared	2	1

Table 1. Percentage of items uploaded to MXShare that were texts (MXit conversations), images, video or audio of which *L* were locally recorded. Percentage of items uploaded by unregistered users (public), shared with other users or kept private in the user's account

Adoption of MXShare was also affected by the stations' locations and older people's literacies. During deployment most MXit conversations were between two young male LRs who alternated Station operation at Ncgobo. Text-based elements of MXShare suited younger people's literacies and phones better but they do not feel at ease at the Headman's homestead. In contrast, men over 45 years are more at ease at the Headman's homestead, but are less likely to own a Bluetooth-enabled phone or to read and write. The MXit client permits sending media without using text, but this feature was seldom used. Elders' perceptions that MXit use is playful and irrelevant to local co-ordination may have been amplified because Java ME's non-editable default installs applications in "Games." Further, the female LR in Ridge did not leave the tablet at the Station when she went home each day due to safety concerns [8]. Further, low-end phones did not support key features of the multi-platform MXit client. Most of the approximately 20% of phones in Mankosi that were Internet-able could use text elements of the MXit client but the features for recording audio in the application itself were not always available due to Java ME incompatibilities and fragmentation. Thus, unlike images and video, only 25% of audio content was recorded locally. This was unfortunate as elders showed preferences for recording speaking and singing, in workshops on MXShare, and younger people enjoyed listening to commentaries of soccer matches that we uploaded to the tablets.

5.2 Audio Repository

Older people said that audio recordings of meetings could inform those unable to attend and assist accountability by deterring people from "lying". Meanwhile, some younger people noted the importance of orature to Xhosa identity [2, 7]. We thought AR might support elders' oral practices and act as bridge to youth who own more Bluetooth phones but are not at ease in the same places. Elders are less likely to own phones but, if they own a phone, make more calls than youth. Thus, we hoped elders would record speech on the tablet or their phones, which youth could download from AR onto their own phones to listen to elsewhere.

We introduced AR in 7 workshops, lasting 2-hrs to 4-hrs. We taught 14 men, aged 35 to 65 years, most of whom were TA or Community Association members; and, 36 women, aged 18 to 65 years, only two of whom were TA or Community Association members. LRs taught in groups of 2 to 8 people and suggested participants use Callback to alert others that they had shared a recording [2, 7]. Then we interviewed 23 people, in three groups, about their opinions on AR and sharing media. We observed usage after deployment and analysed recordings and interviewed inhabitants about AR after 9 months.

5.2.1 Interactions & Use

Illiterate and literate, older and younger, women and men readily learnt and taught each other to use AR, including the Headman who had refused to try MXShare [2, 7]. Inhabitants were enthusiastic and twice 30 women arrived for workshops in Ridge when we expected six [2, 7]. They said they would use AR to post messages for family members and updates about events (e.g. funerals, church). Yet, despite wide interest, access to AR was restricted over the next 10 months. Inhabitants had taken responsibility for the Charging Stations after the first year's trial, so LRs no longer operated them [8]. Thus, the Headman began charging the tablet with another system and people who came to charge phones at Ncgobo did not easily access AR. Meanwhile the Station in Ridge was damaged and was not re-deployed until after trialling AR.

AR was used to record and store files in the Headman's account, which included 35 of meetings, 12 of background chatter or no audible sound, a chat about the tablet and a song on the radio. Recordings of meetings included 22% that were shorter than 10-mins; 70% of 10 to 60-mins; and, 7% exceeding 1-hr. People found a part of a recording easily using the time bar that displays when the audio plays. Finding a specific file was harder, even with few to search. There were usually less than 5 recordings a month, but in one month there were 17. Users could not identify a file based on whom it was shared because they did not use AR's sharing feature. Instead, the Headman looked at the date of a recording, but this was incorrect for 50% of files because the clock automatically reset when the battery drained [7].

Only two files recorded a whole meeting and most files recorded only one main topic. The Headman decided an issue warranted recording based on who spoke and "what they start to say". Files from meetings included 24% recording debates about communal resources and their management; 28% recorded Tribal law cases; 31% recorded notices and problem-solving, ranging from health issues to wage delays to ancestors; and, 17% recorded speakers at events in Mankosi or elsewhere hosted by the Chief or municipality [2, 5, 7]. Speakers used different oral styles for testimony, and apologies in cases, accounts of customs and experiences and, notices and debate. Some 88% of voices were male in files recording meetings. Most files contained only male voices, only two had only female voices, and older men spoke most. Over half of files were recorded outdoors, where many meetings occur and 14% of files contained long pauses without speech, because a young man carried the tablet between each person as s/he stood to speak. The

movement of the man carrying the tablet and the tablet's size afforded visibility and twice in meetings people resisted recording, as their permission had not been sought. The vertical display of alphabetically-ordered, profile photos affected meanings inhabitants made that related to communication protocol; for instance, the Headman said the photo directly above his own, of a young man using a rap-style gesture "over" his head, connoted disrespect [7].

The Headman said the tablet was his "witness", that he had not deleted any files and used AR to remind himself of topics after a meeting and "to deliver information" to the TA. He listened along with others, rather than sharing to their accounts or via Groups created on the AR, and logged-in to his account on AR so his secretary could listen alone to enhance his minutes of meetings.

6 DISCUSSION

Deploying social media platforms over years illuminates factors affecting information sharing that are not revealed in shorter trials of comparable systems (e.g. [35, 38]). Sharing media asynchronously, using either MXShare or AR, was much less useful in Mankosi than charging phones [8]. Thus, we now consider how use of the social media prototypes related to generational and intergenerational communication practices and how this was affected by meanings about communication produced in design. This leads us to propose that processes in designing platforms for information sharing should include reflecting on the ways meanings, about target users' communication skills and needs, are produced.

6.1 Generational Differences

The ways the tablet was situated worked together with MXShare's complexity and AR's simplicity to bias use to younger and older people, respectively. Both prototypes were situated in sites and decision-making that emphasised community communication and cohesion, but they did not similarly support communications that inhabitants envisaged. During MXShare's trial we funded LRs to operate the Stations so they could assist people to use MXShare. However, older people rarely used MXShare, though they often came to charge phones [8], and younger people did not feel at ease at the Headman's homestead. Initially, older people had said they would use MXShare to store media to share with children, such as photos of deceased ancestors. Yet, MXShare was not used to store content that clearly related to either inter-generational communication or community decision-making, and content associated with younger people's practices, such as sharing music files. On the other hand, elders used AR in community decision-making and governance and asked youths to carry the tablet during meetings, but the Headman's ease of using AR meant recording was selective and sharing restricted to the TA. Thus, both prototypes reinforced differentiations in communication practices related to social hierarchies, generations and genders [see: 4].

Unlike the bias of MXShare towards use by younger people, which as we discuss in 6.3 resulted from design processes, AR's usage bias was due to restricted access to the tablet. Inhabitants did not, however, overtly object to the TA's use of the tablet, provided permission to record them had been sought. Indeed, younger and older people, such as LRs and Community Association members, insisted we work with the TA, and discussions at community meetings openly expressed that older people's communications were most vital to local co-ordination. Inhabitants widely consider that tribal governance is integral to community interests, identity and stability, despite frustrations with information sharing. Meanwhile, co-present communication practices, differentiated by social roles and relations, contribute to sense of self. In one video LRs recorded an older woman explained oral customs related to age; in daily life we observed that youth avert their eyes and are humble in co-present speaking to elders; and, in meetings, young people speak more discretely than older men who orate boldly and gesture broadly to engage listeners and animate words [2, 4].

Generational differences in using social media are as common in South Africa as elsewhere [18], yet the interaction of these differences with the skip generation phenomenon may profoundly impact community cohesion, stability and the co-operation that Mankosi's inhabitants say enables them to survive. To accommodate use by different social groups, we designed AR to enable recording and listening to audio via phones or the tablet, but we did not account for differential access to the tablet according to community hierarchies. Rey-Moreno's random sample of 250 people in 2012 [37] shows that phone ownership has increased in Mankosi by at least 15%, and some 80% of older people now own phones. This suggests we need platforms that are accessible to all but with features that can be customised to the specific communication practices of different generations and social roles. Consider the use of the Callback service in Mankosi. Older people use Callback for alerts and younger people for free texts that they do not expect older family members, or their intermediaries, to read. Oduor *et al* [30] suggest tailoring phone functionality to different responsibilities in Kenyan families based on insights from culturally-sensitive interviews that showed that eldest children and the siblings of widows are socially obliged to stay aware of family members' activities and coordinate information exchange [31]. In Mankosi roles related to gender, age and birth-order also include representing families in community decision-making.

6.2 Nuances of Oral Practices

The bias of MXShare's use by younger people resulted from design decisions that focused on text and visual media and remote synchronous communication. In designing AR we sought to better match media to local communication practices by focusing on the need for audio recording that inhabitants expressed. However, inhabitants' use of AR in co-present interactions shows that we had insufficiently accounted for the implications of oral practices for situated displays. Essentially, inhabitants used AR as a publicly visible voice recorder that shows visually which person was responsible for recording by virtue of the account that stored the file. The TA shared media on the tablets in co-present interactions, not digitally, using AR and did not send media to/from their own phones and the display, even though this was far more simple and accessible with AR than with MXShare.

Inhabitants' communication needs and co-present use of AR demonstrates interactions with a communal display that we did not prioritise in either AR or MXShare [see: 4]. People often emphasise "*friendships made by talking*" in rural African communities [1] and acquire information mainly by "*word of mouth*" in many low-income settings [e.g. 25]. Yet design efforts tend to focus on distributing and accessing information remotely, and not on the bodies that speak and hear words [2, 4]. Interviews and observations in Mankosi described local expectations of co-operation, mutual support and younger people's duty to elders [2, 8]. They also revealed different ways that trusted intermediaries assist those who do not own a phone or have low technological or written literacy. However, beyond workshops older people seldom asked younger people, such as LRs, to help them to use MXShare. In contrast, elders instructed youth to hold and carry the tablet in recording meetings using AR. This suggests that in designing features that can be customised by different social groups we must

respond to the nuances of generational and intergenerational co-present information sharing and the complex interactions between social structures and genres of communication.

6.3 Implications for Design Processes

MXit recently expanded into India and released MXit 7, which enables users to add audio clips to group chat, and switch easily between multiple profiles. Meantime Facebook acquired WhatsApp. These ventures are likely to inspire more light-weight J2ME solutions to assist information sharing amongst people in low-income communities. Our insights from MXShare and AR suggest success in meeting users' needs lies in intended and emergent design processes and the meanings about communication these processes produce. Heeks [21] promotes focusing on processes that ensure ICT4D efforts enable people to harness technology for their own goals in their own communities. We argue that such focus must include reflecting on the ways meanings about users' communication practices, literacies and needs, are produced.

Engaging with LRs and participating in meetings and daily life in Mankosi sensitized A1 to qualities and roles of orality and the value of voice recording. These factors were difficult to reconcile with the agenda and communication practices and literacies that oriented MXShare. The agenda orienting MXShare assumed that one toolkit of designs and practices would be useful to rural communities globally. This justified monetary investment in designing and developing MXShare - some 50 times the cost of AR. We opted for a tight development schedule so we could test MXShare for as long as possible. Yet, this meant UK-researchers did not have enough time to engage with A1's lengthy descriptions of practices in Mankosi. Devoting time is integral to local orality in Mankosi [5], so MXShare manifested UK-researchers' existing understandings about communication based on their familiarity with the visual cultures and media sharing practices in UK, North America and India. For instance, they focused analysis of the range of video, that inhabitants recorded, on the content of what local people said, not the spoken genres used; and tended to interpret local use of Callback as implying wider text literacy and greater remote communication. Thus, inadvertent elements of a 'blueprint' approach [21] constrained both flexibly developing MXShare to suit preferred communication modes and genres in Mankosi and engaging with local meanings about differentiation.

The aim to design a platform for use in many regions led to a curious situation for researchers living locally. Inhabitants assumed that experimenting with systems for the benefit of other communities like theirs implied responding to their own needs and constraints. We explained the difficulty of developing applications that are compatible with diversely-capable phones but it was hard to justify the emphasis of MXShare on images and text, not audio, as people knew that A1 and LRs were familiar with local practices. On the other hand, MXShare manifested the UK-researchers' understandings about communication and inhabitants' experiences with it enabled them to further confirm needs, which informed the design of AR. AR was also advantaged because design directly involved an LR along with a developer who had designed and evaluated in Africa, a mobile digital storytelling application [5]. Thus, our unfolding research illustrates that integrating local capacities can respond to practices [21, 40], provided we appreciate that it is a process of *mutual* learning.

Designing platforms to support information sharing usually draws on analysis of barriers to accessing technology. Such analyses identify assets that social groups lack, such as skills gained at school, egalitarian social orders, money etc. (e.g. [9, 14, 23]). Yet focusing design on perceived lacks can distract from noticing a community's assets, such as rich co-present oral practices. Compensating for perceived lacks to improve access to media, thus, devalues and decentralises the skills of target groups and their own ways of communicating. This is unlikely to help people's sense of 'self-efficacy' [43]. For instance, as elsewhere in Africa [27], there are more phones in Mankosi than adults who can read and write but elders often said they were not educated to use phones properly [3]. Just as importantly, design usually applies meanings that are generated in the communication practices of design teams, not target users [40]. Tensions between meanings about communication embedded in technology and communities' own communication practices can have long-term negative impacts [28] and cultural and social expectations differentiate information in complex ways [31]. Thus, more effort is needed to reflect on the ways that design processes impose meanings, such about "lack", "inequality", or "information poverty" and to locate understandings of social relations in target communities (see: [2]). In other words, we need to adopt more reflexive, as well as participative, approaches in designing technologies.

7 CONCLUSION

We have reported MXShare for the first time and juxtaposed its design and use with AR in studies that were far longer than trials of other social media systems designed to assist information sharing in low-income, rural communities. Interactions with MXShare and AR showed that co-present, oral practices effect media recording and sharing, and that the modes and genres of communication supported by platforms reinforce information differentiation. Local appropriation of prototypes was also affected by interactions between the sites for information exchange and protocols that differentiate information flow. The way that MXShare reinforced differences in communication practices between generations, at the expense of wide dissemination, did not result from consciously focusing on youth. Instead it resulted from gulfs between the communication practices and literacies of the design team and elders in Mankosi. Our brave, frank reflection reiterates the inefficacy of "blue-prints" for diverse user groups globally but, more importantly, shows the value of reflecting on the ways meanings about users' communication skills and needs are made in designing social media systems for them.

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