Making the Link – Providing Mobile Media for Novice Communities in the Developing World

Andrew Maunder, Gary Marsden

University of Cape Town, South Africa

Richard Harper

Microsoft Research, Cambridge, UK

Abstract

In this paper we investigate the media needs of low-income mobile users in a South African township. We develop and deploy a system that allows users to download media at no costs to themselves, in order to probe future media requirements for similar user groups. We discover that, not only are the community interested in developmental information, but are just as interested in sharing local music or videos. Furthermore, the community consume the media in ways that we did not expect which had direct impacts on their lives. Finally, we conclude with some reflections on the value of media and the most appropriate ways to deliver it in developing world communities.

Keywords: ICT4D, M4D, Situated Media

1. Introduction

Much has been written about the proliferation of mobile handsets throughout the developing world. Within South Africa, the penetration rate is close to 100%, implying that the mobile is an ideal platform to deliver locative media in the developing world [1]. But this is only half the story. Whilst many people in Africa do have handsets, many cannot afford air-time in order to download, upload or share media [2]. Governments, Non-Governmental Organisations (NGOs) and commercial bodies are frustrated as they create valuable online content, yet the people they are trying to reach cannot afford to download it.

Based on our research into the problems of media sharing in Southern Africa it became apparent that we needed to create a system that would allow users to download relevant media at *no cost* to themselves. Nor should costs be incurred by forcing users to purchase special hardware or state of at smart phones. Standard phones need to be the platform on which cost free interaction is supported. Furthermore, as the target users are not familiar with the internet (and cannot afford large download fees) the distribution system would have to work in ways that the users are familiar with.

To satisfy these requirements led us to develop a system called Snap and Grab. This is a new public media sharing system It consists of a PC-based image processing and media database system which users can interact with via their camera-phones and Bluetooth. Users select content from a public display by photographing the content with their phone and Bluetoothing that photograph to the computer running the display. The computer processes the image to determine the selected content, then sends the relevant media (images, audio, video etc.) to the user's handset over Bluetooth. (The process is described in Figure 1).

Furthermore, users can upload their own media to the display via Bluetooth by first sending their vCard, followed by any media

they wished to upload. This process can be seen in Figure 2. (The design of the system is discussed more fully in [2].)

Having solved the technological problem of distributing media to standard camera phone handsets (at no cost to the user) we were eager to see what applications it might be used for. The rest of this paper reports on how we went about unearthing relevant media and evaluating how successful the community was in appropriating the technology to access, share and reuse that media. The paper ends with a reflection on these findings and their implications for future public media sharing systems in the developing world. Our findings suggest that the value of these systems is likely to be great, but that the content exchanged via them may not be what many HCI for development researchers and NGOs would expect.

2. Environment

Our goal was to explore the media sharing patterns and needs of those who (before the advent of the cellular handset) had no access to digital communication networks. We were interested in what media they might value and whether the Snap and Grab system could be used to facilitate the distribution of that media.

Specifically we choose to study people living in a township just outside Cape Town in South Africa. This group was chosen as many people living there have camera-phones and a basic level of literacy (we had considered more rural communities, but our initial data showed that few people in rural South Africa own handsets with a camera or Bluetooth). Having identified a target group, the question remained of how to engage that group in a way that would encourage them to create their own media, as well as download media provided by others.

After running several projects in developing communities, we have found that collaborating with an NGO provides many benefits for researchers working in an unfamiliar community. Researchers can build on the trust the NGO has created within a community; the NGO can act as a bridge, facilitating communication between researchers and local communities and the NGO can provide a physical location within the community, from which the research can be conducted. Of course, this is not a one way relationship and as researchers, we have a responsibility to

work within the NGO's remit and ensure our work matches theirs [3].

In this case we shied away from partnering with NGOs dedicated to media provision as we did not want to bias users into believing the system was for a single purpose (e.g Partnering with an organisation like the HIV/AIDS awareness NGO Cell-Life since doing so might make the community believe that the display is only for HIV information). Instead we worked with an NGO called Learn To Earn (www.leartoearn.co.za) based in the Khayleitsha township. Our choice of Learn to Earn was based on the fact that it provides skills training in the form of six week courses. As the courses run in the same centre as we would place the Snap and Grab system, learners would have the opportunity to explore the system in an un-pressured way.

3. Managing the Deployment

Before installing the system at the NGO's building, we wanted to choose an appropriate method that would allow us to observe 'natural' media usage – by this we mean that we do not want our expectations to bias the system's usage, but would like to deploy in a way that allows usage to grow naturally. In the literature we found two similar deployments of media sharing systems. In both cases, fieldwork methodologies had been developed to capture data about the 'natural use' of media sharing by the community as a whole.

The first of these was a prominent long-term intervention by Taylor and Cheverst [4] of a media sharing application in the small village of Wray in the UK. In this work, the researchers were interested in how a community, with no previous exposure to situated displays, would appropriate such a system. Although not used to distribute information to a wider group, it was used to engage the Wray residents to create and share information within their community. In creating the system, they took a user centered approach, employing technology probes and participatory design. They reported that the technology probe approach was highly successful as "it provides a concrete example for residents to relate to when discussing issues surrounding the display." Many other researchers have discovered a similar effect when working with communities that have low exposure to technology (e.g. [5]). Less successful was the use of participatory design. Of concern was the residents' fear that their

suggestions would be seen as foolish in the eyes of the researchers. Related to this was a reluctance to provide negative feedback for fear of offending the researchers. Of course, much can be done in the facilitation of these sessions, but Taylor and Cheverst's findings echo our previous research in working with communities with little exposure to technology [6]. We too found that participants in these sessions were reticent to contribute (their exposure to technology was so limited they did not feel they could make any comment on design) and they would never give negative feedback, for fear of offending the researchers.

One successful modification to the participatory sessions reported in the Wray work was the usage of 'indirect' feedback methods which allowed participants to provide negative feedback through a comments mechanism. For our intervention, we aim to follow a similar route, where negative feedback can be given in indirect ways.

A second system comes from research within the developing world. Here, Frohlich et al [7] created a system called StoryBank to distribute digital stories within an Indian village. This system also seeks to exploit digital technology and form a platform for "Community Generated Media" creation and sharing. Whilst we too wish to create a platform for media distribution and sharing, this project differed in that the goal of StoryBank is to share only digital stories within a community – there is no provision for populating the system with external media nor is it possible to store other media types. (In their reflections, the StoryBank team felt that more general media sharing would be useful – "an integral part of future systems.") However, the intervention was similar in nature to our own, and much can be learnt from the StoryBank project. Certainly, the technological basis of these systems (combining situated displays and cellular handsets) was found to be successful – "The internetworking of mobile devices with public displays was found to be particularly effective."

The methodology used was also one of a technology probe, whereby the technology could be understood and commented on by the local community. It should be noted, however, that the StoryBank system did not provide a sufficiently robust display-handset transfer mechanism and, as a consequence, Bluetooth transfers were less common than had been anticipated – transfers typically too more than 30 seconds and did not always complete successfully. Furthermore, the project team partnered with a local technology NGO which not only provided insights into the needs of the local community, but also provided a vehicle to introduce the researchers to, and build trust with, the community. This approach of partnering with an NGO mirrors our own.

Following on from the work of Frohlich et al and Taylor & Cheverst [7,4] our deployment took the form of a technology probe [9]. Mindful, however, of the issues around negative feedback and participants' perceptions of inadequacy, we wanted to deploy the system in an 'abstract' way; so that the community itself could drive how the system was used and what it was used for without referring directly to members of the research team.

Of course, an ideal solution would allow the users to build and adapt the entire system to fit their needs. But as Heeks [9] points out, communities in the developing world often suffer from knowledge and skills deficiencies, effectively ruling out such a solution. Rather, abstract technologies present the users with fundamental components that can be locally appropriated and creatively applied to a variety of problem domains that the designers may not be aware of. Most importantly, the users are empowered to derive their own solution strategies that comprise a variety of fundamental components and services. In some of our other work [10] we have referred to this notion as 'communitization' – a technology that can be changed beyond mere personalization, but falls short of an open-source solution, which would require locally unavailable knowledge of programming tools.

In the case of our system, the tools required to modify the Big Board are cellular handsets, with which most users are already familiar. Using the upload mechanism, our hope was that the community could create and upload content that is locally relevant. As this content is in the form of images and audio, we expected that the potentially low literacy levels of our community would not be a barrier to participation. But we also wanted to seek measures of success beyond mere participation.

Given that the system is designed as a technology probe, it is not possible to compare outcomes with a set of success criteria laid out before the deployment. Furthermore, measures of efficiency and productivity are also redundant. What we are interested in is if the system is in any way of value to the participants in the trial. We therefore framed the evaluation in terms of the three value-

centered criteria of Cockton [11,12], namely: quality in use, contextual fit and delivery of value. These measures give us dimensions along which to explore the nature of the system's impact. Again, as this is an exploratory study, we heeded the advice of Greenberg and Buxton [13] and did not conduct any explicit form of usability evaluation.

Finally, we did not wish to fall foul of the Hawthorne effects reported by Taylor & Cheverst, whereby participants were unwilling to criticize the system for fear of upsetting the researchers. The potential for this is even greater in our situation where the researchers not only come from outside the community, but also outside the same cultural and socio-economic group. Inspired by Gaver et al.'s work on systems such as Flight Tracker [14], we adopted his method of polyphonic assessment. With Flight Tracker, the researchers were also keen to see how their system was appropriated, but needed to gather feedback in a way that did not influence the subjects' opinions. The approach they took was to gather feedback through journalists, reasoning that journalists are trained to be unbiased and are skilled in eliciting informative feedback. These journalists were termed 'polyphonic assessors.'

In light of the above, for our project, we therefore recruited two Xhosa-speaking film and media students from a local university in Cape Town, South Africa. Being Xhosa speakers, the commentators were part of the same language group as the deployment community, thereby negating several socio-cultural barriers that would have existed if the authors had conducted the assessment. Furthermore, they would have had no prior knowledge or personal attachment to the system being evaluated and hence provide an un-biased opinion.

4. DEPLOYMENT

4.1. Background

The community we chose was learners at Learn To Earn, which provides local community members with access to affordable skills development courses and seminars that focus on practical training and mentoring. Community members are thereby given a chance to play an active role in improving their livelihood and generating an income. There are many ways in which the relationship between NGO and researchers might be managed. In our interventions, we prefer to work with a single point of contact within the NGO who would act as a proxy for the wider community. For the want of a better term, we call such people 'human access points' (HAP) as they provide our access to the wider community. Although similar to Millen's idea of a 'key informant' [15], Millen advocates using key informants in the initial stages of design to help with requirements gathering. However, when using an iterative approach to design, there needs to be continual testing and refinement with the community, so we need to engage informants over the entire period of the project.

As a triangulation with the polyphonic feedback, we required our HAP to keep a journal in an attempt to capture an insider's perspective of the system and its impact on the community. (In a sense, the HAP's voice could be regarded as an additional voice in the polyphonic assessment.) Noteworthy differences between Gaver's [16] notion of a cultural commentator and a HAP commentary is that:

- the HAP data is gathered over a longer period of time
- HAP data is captured is highly personal
- HAP data is captured from a community member's point of view.

We acknowledge the danger of placing too much emphasis on the HAP's view of the system but believe that the insights they provide could not be gathered in any other way. Of course, it is essential to provide some of mitigation against HAP bias, which is why we employ the polyphonic evaluation.

Finally, the system was able to keep logs of uploads and downloads as a final form of triangulation. We decided to deploy the display system inside the semi-public, Learn To Earn sewing centre, which allowed members of the sewing co-operative (and anyone else inside the building) access to rich multimedia. The deployment is shown in Figure 3.

Figure 3 – The board displayed in the common area of Learn To Earn

4.2. Experimental assistants and subjects

4.2.1. The Human Access Point (HAP)

For a HAP we chose a twenty-three year old Xhosa woman who had recently completed her basic computer training, desktop publishing and office administration courses at Learn To Earn. Our vision for the HAP was to perform the role of local assistant and trainer who would be able to help the Learn To Earn community interact with the system. We also needed her to spearhead the generation of local multimedia content and media packages via the user generated content interface.

4.2.2. The Zakhele Team

A group of women at Learn To Earn, called the Zakhele team, were earmarked as the target user group. The Zakhele women worked at Learn To Earn as part of a sewing co-operative that produced fashionable products under the label of KhanyaKreations. The team consisted of approximately thirty-two Xhosa women with their ages ranging from the early twenties to late sixties.

5. Experiment Plan

The study consisted of three distinct phases. The first phase included a brief accessibility analysis of Learn To Earn in order to determine if Bluetooth-enabled camera phones were ubiquitous devices within the community. The second phase focused on local resource development. The goal of this phase was to establish a new technological baseline within the Learn To Earn community. The development program ensured that the community possessed the necessary Bluetooth and camera skills for interacting with the display technology, thereby negating the potential accessibility barriers identified in the laboratory study.

The third phase consisted of the HAP training sessions and an incubation period. The HAP-led training sessions ensured that the necessary interaction skills were available within the community and the incubation period provided the users with time and space to experience an interaction first hand. Most importantly, we purposefully refrained from defining or describing how and when the technology should be used. The community's understanding of the system would then be based purely on their personal experiences with the technology.

5.1. Phase one – Analysis of the Context

A brief analysis was conducted at Learn To Earn to determine whether compatible handsets were ubiquitous technological components within the community. The findings showed that the handsets found at Learn To Earn ranged from models released in the late nineties to those that are currently available from local retailers. The system design requires handsets with an integrated camera and Bluetooth. Although many such handsets existed within the community, they were not ubiquitous; the handsets that were compatible represented a diverse set of models and manufacturers. So whilst users could have used their own handsets, we were concerned that individual handset variations would introduce a confounding variable into usage of the system (e.g. some handsets bury the functionality to share photographs via Bluetooth, whilst other show it as an option immediately a new photograph is taken). Therefore fifteen volunteers were given identical Bluetooth-enabled camera phones. The volunteers were allowed to keep these handsets beyond the duration of the trial.

5.2. Phase two – Local resource development

The subjects grasped the basic telephony features quite quickly, but seemed to struggle with the camera and Bluetooth features. A series of group activities were then planned to teach the subjects the necessary skills and give them an opportunity to practice. This was an important step towards establishing a new technology baseline within the community. The first of these was an introduction wherein the HAP introduced the researcher to the Zakhele team and explained to them that we wanted to learn about cellular phone usage in Khayelitsha.

The second was a familiarization exercise in which the fifteen volunteers were given the opportunity to learn the core features of their handsets. These classes aimed to develop their cellular phone skills to ultimately prepare them for future interaction with our system. The activities also aimed to limit the effects of diverse handsets when evaluating the overall usability of the system. We wanted to simulate an environment where the users were familiar and comfortable with their cellular phones, thus ensuring that the handset did not represent a barrier to using the display system.

The participants were given a week to practice using their new phones and were encouraged to ask the HAP for assistance should they struggle. The use of a common cellular phone model meant that skills could be transferred in a 'peer learning' fashion, thus building and developing the community's collective knowledge base.

This was followed by a group activity that taught the participants how to capture photos using the integrated camera feature of their phone. The HAP led the teaching activity by demonstrating and explaining how to take photos using the handsets. The participants were then encouraged to practice taking photos and to bring one of their favorites to the next group meeting. During the next meeting the HAP would send the participants' favorite photos via Bluetooth to a laptop for display. Each participant would be given a chance to share the story behind their photo as a means of encouraging participation and discussion within the group.

In the second group session, the HAP taught the volunteers how to switch on the Bluetooth feature, personalize their Bluetooth name and send a photo to a laptop PC for display as part of an evolving 'Polaroid-style' mosaic presentation. An important feature of the session was that the each participant was required to perform the activity individually so that the utility and end result of the interaction could be experienced. The HAP made an important comment at the end of the workshop, "The participants now understood how a cellular phone can work with a computer".

In the final session, we taught the HAP how to download content from display system onto her handset, which she mastered very quickly (two attempts and less than five minutes in total). We purposefully avoided any detailed explanations regarding 'the purpose of the technology' as we did not want to advocate any specific use for the technology. Her role

was to teach the rest of the participants in a peer-learning fashion and thereby to ensure that the necessary system interaction knowledge and skills existed within the Learn To Earn community.

5.3. Phase three – System Deployment

Phase three consisted of the deployment of the system within the Learn To Earn sewing centre for a period of four weeks. Mindful of Frohlich et al.'s [7] issues with failing Bluetooth technology, we tested the system in the Computer Science Department of our home university (computer science students were chosen due to their familiarity with technology and their pre-disposition to attempt to crash systems). The system was left open to public access for several weeks in a corridor and students were invited to download/upload content. By the end of the trial period the system had been refined to the point where it worked robustly and transfers were much shorter than the 30 seconds experienced by the StoryBank team.

When the system was deployed at Learn To Earn, the participants were very interested in finding out more about the technology (or 'the screen' as they described it). What was its purpose? What could it do? It seemed that curiosity was an initial motivational factor for some of the participants, which was encouraging.

The system deployment was seeded with some generic content of 'Cape Town' as a theme. The returned media held little value in the participants' eyes, but it was sufficient for use during the training sessions run by the HAP.

5.4. HAP facilitated group discussions and diary

The HAP facilitated group discussion about the screen and captured these sessions in her diary. The group discussion and diary entries were designed to capture the community's collective perspective of the technology at that point in time. The HAP described the Zakhele participants as being very curious about the purpose of the screen and very interested in finding out more about it. The same was said for visitors and tourists who entered the sewing centre. Whilst initial curiosity was apparent, the participants found that the system lost some of its appeal over time. The general feeling was that it should do some more

interesting things, like play music or possibly show some videos.

The HAP was then asked to probe the community's vision for the technology now that they had been exposed to it. As a result of the discussions, the HAP highlighted four possible media package concepts:

•   Music – Music is an important part of daily life at Learn To Earn and is reflected by the fact that there is always a radio or CD playing in the sewing centre. Several of the participants were able to load music onto their handsets, either through actively engaging in a Bluetooth transaction themselves or by asking another person to do it for them. The result was that the participants were able to listen to their own music selection whilst working. Interestingly enough the managers felt that the participants were more productive when they were listening to their own music or radio via their personal headphones.

•   Pictures with sound – As previously mentioned, the participants felt that the board was too static and not vibrant enough for Learn To Earn. They felt that it could do more for them in terms of entertainment. The participants suggested that the board play music that could be heard in the sewing centre.

•   Social information – The Khayelitsha community is plagued by social instabilities such as violent crime, gangsterism, theft and child abductions. One suggestion that emerged was to use the system to display pictures of criminals and missing children that have been reported in the area.

•   Advertising – The woodworking students felt that the system would be useful if it could provide them with information about sourcing the wood and equipment they may need for a particular project.

These findings helped the researchers and the HAP tailor the seeding of editorial content to the screen, according to the interests and desires of the Zakhele participants. We were keen to see if new content would hold additional value in their eyes and thereby motivate future interactions.

The contextualized content was significantly richer than the original content, leveraging the full multimedia potential of the handsets. For example, an item on Nelson Mandela utilized slideshow presentations accompanied by music. A daily Bible reading was recorded in the local language (Xhosa) and uploaded by the HAP in an attempt to encourage local content generation. Additional editorial content was then added on a weekly basis, whilst the HAP encouraged the

participants to post content of their own. Later, the HAP encouraged the participants to create their own media packages and content that they wished to share. Examples of these are shown in the Table 1 below.

Title	Contents
Dlomo	Contact Card, 2 x MP3, Photograph
Nonesi	MP3
Mama	MP3
Nonkhona	2 x Photograph, MP3

Table 1 – Summary of user generated media packs.

6. Evaluation

A detailed evaluation session was planned after the four-week incubation period. The evaluation session consisted of a two-day polyphonic assessment, HAP diary and a log file analysis.

6.1. Logs

Although the logs recorded an average of 5.7 interactions per day, we were also able to look at the content that had been uploaded to the system. This proved fascinating and gave further evidence of appropriation.

One type of media found were images for tee-shirt designs. The board happened to be situated by a member of the Learn To Earn team who was doing silk-screen printing of tee-shirts. People wishing to have tee-shirts printed would upload images for later retrieval and printing. One member of the Learn2Earn community uploaded a picture of a family member that had recently passed away as a way of paying homage to her life. Another member saw the picture and asked the researcher if he could get the picture from the display for printing purposes. Other members began to upload media files with the assistance of the HAP. It was interesting to note that music files were being shared – music was an important part of daily life. Most days a radio would be playing or the ladies would use their headphones to listen to MP3's on the phone.

6.2. Polyphonic Assessors

The polyphonic assessors were equivalent to the journalists employed by Gaver in his evaluations [16]. Consequently, they were

provided no information about the goals of the system and had no experience of technology development or design. They would learn from the Zakhele participants and not the HAP, which meant that the assessors would capture a (hopefully) unbiased view of the system's impact. Finally, the assessors were asked to draw some conclusions of their own relating to the overall usability, usefulness and value of the technology.

Overall, they found that the participants were excited by the technology. The technology represented a welcome change for how they normally used their handsets, although many participants needed more practice before they could claim to use the system naturally. The assessors felt that the usage of the system would continue to increase in line with their familiarity of the system.

However, usage of the system varied greatly between individual users. Here we report some of key findings recorded by our assessors of these individual differences. In the interests of brevity, we select just three of the participants to show a representative range of responses.

6.2.1. Participant S

Participant S gave us an interesting insight into the difference between the perception of and the interaction with the system. From her comments below, it was clear she understood the purpose of the technology and the benefits it could bring; yet she struggled with the mechanics of interacting with the Big Board.

During the first part of her interviews with the assessors, she expressed a sense of elation and excitement, "I have three children, one in Grade 9, one in Grade 6 and one in Grade R. This technology has helped me interact with my children more as I show them some of the things I take from it. There are very educational videos in the technology and I'm happy." (Videos explaining the life of Nelson Mandela and the history of Robben Island were included on the system).

The extract reveals an interesting value scenario involving S and her children. S moved to Cape Town from the rural Eastern Cape and feels that she does not understand all the technologies found in the city. Her children, however, may have been exposed to popular technologies, such as cellular phones, through their friends. It seems that a 'digital divide' exists between the two generations. Our system allowed S to bridge the divide by trafficking multimedia back to her home and sharing rich multimedia experience with her children. Before, she might have had few topics of conversation with her children, but now they are able to engage with the downloaded material as a family. S now has knowledge and skills that her children look up to – giving her respect and empowerment. However, despite her enthusiasm, the assessors' comments from the interview show that S lack confidence in using the technology, "…when we asked her to show us how to use it she struggled with the phone even before she got to the screen." This may be as a consequence of being interviewed directly by unfamiliar people, or it could be that she simply is not able to use her handset. Yet, with the help of the community around her, S reported that she was able to use the system effectively.

6.2.2. Participant N

For some participants, the interaction presented no hurdles. Participant N was one of the younger and most experienced technology users and was described by the assessors as "one woman who frequently uses the screen." Examining the amount of media stored on her handset verified this claim. Her view of the technology was reported by the assessors as follows, "Her enthusiasm for the screen was matched by the number of items she downloaded. She has almost downloaded everything and cannot wait for the new items to be loaded onto the screen."

6.2.3. Participant L

By using unbiased polyphonic assessment, we also received some negative and occasionally puzzling feedback. One particular incident concerned participant L who had an experience which could, potentially, have prevented her continued use of the system. She claimed that she lost R75 (~$8) worth of air time after making a single call. She believed that our system was to blame for this, even though this is technically impossible. (To put the value into perspective, R75 is a significant amount of money, in fact it is more than a day's wage for a Zakhele participant.) However, she continued to interact with the screen and download content. Clearly the system held a significant amount of value in her eyes. Extracts from her discussion with the assessors revealed that she was thankful for the system as it has helped to strengthen her relationship with her husband. She would typically download content from the screen during the day and then consume the content in the evening with him.

6.3. HAP Diary

The HAP's diary entries captured a more personal, internal perspective of the experience. These pieces of data were important because the HAP was free to express herself: there were no guidelines as to what should be documented, how she should document or when she should write an entry. The result was a mixture of entries that captured significant feelings and emotion.

One entry after the board was deployed, but not operational, captured the level of curiosity, excitement and anticipation that had built up: "They all wanted to know what was going on with the screen. Some would say I must switch on the T.V. but then I told them it was a computer. They were so happy that they were going to use a computer with their phones."

It was clear that the intervention was able to generate a high level of curiosity within the Learn To Earn community by sparking the interest of the Zakhele participants and the HAP. The high levels of excitement continued once the system went live. The HAP documented the following entries around that period. "I worked so well with it! I never found any complications with it! I was so happy that I could even help a lot of people by showing them how to use it."

It is clear that the system was able to 'create a buzz' within the community as Ramachandran et al. [17] puts it. We designed our system to be accessible to the widest number of potential users, therefore, it was essential that it sparked initial interest to encourage the community to experience at least one interaction and thereby set them on the path towards appropriation. The HAP documented examples of users from outside the Zakhele team trying out the system. On one particular day she invited some of the younger students from the office administration course to experience an interaction with the board. They believed that it could provide: "Information about bursaries and courses at schools or Learn To Earn" or "Important things to help young people".

Finally, the HAP diary entry also captured commentary regarding the participants' perspective of the media packages.
- "This boy [researcher] should bring us more music!"
- "He brought us Rebecca Malope's video. Yho, yho, yho it was like he brought a car for them!"
- "Everyone was willing to go to the screen and we were happy!"

The HAP diary data showed that if the participants found the content to be interesting or valuable, it would spark further interest and potentially future interactions. The problem was that we initially had no idea what type of content the participants would be interested in. We therefore started with seeding content and aimed to adapt the content over time to fit the participants' interests. To do this, we asked the HAP for assistance in capturing participatory feedback and encouraged the participants to upload their own content.

6.4. Reflection on Evaluation

Clearly the reports produced by the HAP and the assessors are open to bias: both were paid to participate in the experiment and they may have felt that positive reporting may have extended the project and consequently the period for which they would receive payment. So whilst we cannot lend too much weight to the enthusiastic response of the HAP and the assessors, it does not invalidate the data that they collected around media use and consumption. This usage was also confirmed by the log files, providing a reassuring triangulation. Furthermore, as we saw with participant L, the assessors felt free to report negative findings. So, although we note the potential biasing, we believe that the approach we took to the evaluation provided data that was as reliable as the circumstances allowed.

7. Discussion

Our design goal was to create a system which could be used to determine the media requirements of a community which cannot afford access to mainstream digital media channels. In this regard, we consider the intervention to have been a success. Firstly, from that data, it is clear that the system could be used (our logs recorded several interactions on any given day). Analysing the feedback from participants, we see that they are keen to access music, music videos, social information, advertising, educational material, religious information and information on training courses. If one reviews the research on mobiles for development (M4D) or ICT4D in general, there is a huge focus on providing social development, education and health information (there is not room to list every project here, but a good overview can be found at web sites such as www.ngopulse.org and

mobileactive.org). Yet in our intervention we see that other forms of media (music, religious and even commercial) are considered just as important by these communities. Clearly then, there is a large discrepancy between the perceived media needs and the media that is being created for them. Perhaps international development donors and researchers do not consider music, for example, to be essential to the lives of the people in the developing world, yet our research would suggest that the community itself considers it to be just as important – witness the effort that community members went to in order to record, upload and share choir music.

So the system can be used and people could upload and articulate desired media that they would like to download from the system. Yet in a resource constrained environment such as a South African township, it is important to understand the value that the system brings to the environment – would the money spent on the system not be better spent on improving the local clinic, for example?

It is in this regard that we used Cockton's measures of 'worth' [11,12] to give us some insight into how media could affect the community. Cockton's framework aims to measure quality from the user's perspective after experiencing the technology, rather than the properties of the technology itself [5].

The evaluative framework started with an assessment of technology access within the interaction space. Cockton believes that quality in use and contextual fit are the most important measures of quality in this context. Using this framework on our data revealed some salient and suggestive findings relating to both interaction quality and context.

In terms of quality in use, some of the participants felt that they did not have time during the day to use our system. This finding seems to point towards a quality in use/usability problem – perhaps the participants could not achieve a sufficient level of productivity when using the system? Whilst this may be true, the rich assessment data provided some additional evidence to consider.

Firstly, not all the participants felt the same way; in fact, many believed that more training, practice and assistance from the HAP would remedy the situation. Perhaps the participants did not have time for training and practice and therefore described the system as 'difficult to use'?

The assessment data revealed that the participants earned their wage according to the number of garments completed each day. As a result, many participants worked from when they arrived, through their lunch break, right up until the centre closed at 4:30pm. For these participants the value of the interaction did not outweigh the value of the money earned during that time.

For the participants who did attempt an interaction, a different picture emerged. Productivity issues were not raised or expressed. Instead the participants expressed real-life usage scenarios that extended beyond the interaction space and clearly held value in their eyes. The assessment revealed value scenarios where downloaded media helped enhance family and social relationships (as with participant S reported above) which were more important to some participants than direct financial gain. Several of the older participants expressed a sense of empowerment when learning the technology skills.

The assessors (journalists) also raised an issue around contextual fit as they were sceptical as to whether the system could fulfil the role of a public information system owing to its lack of support for active media browsing. The assessors expressed frustration when engaging with it as they had no way of actively browsing the screen content.

The participants, on the other hand, did not share their sentiment. The peripheral nature of the display meant that the participants waited passively for content to be shown whilst they were working at their desks or walking around the sewing centre. If they noticed content that looked interesting or that they did not have yet, they could grab their phone and download the content. Over the course of a day and week, each piece of content would be shown many times over, thereby providing ample opportunity for the content to be noticed and downloaded by the Zakhele participants. From this observation we learnt that any public media intervention (in the developing world or otherwise) should be mindful of the chronological patterns of those who are exposed to it.

Cockton believes that quality in use and contextual fit afforded by a technology has to be good enough to support the delivery of intended value. For an abstract technology, evidence of value delivery implies that the technology affords sufficient quality in use and contextual fit for a particular user. It was clear that not all of the participants saw value through interaction with the screen, but the data revealed that for other participants the interaction was positive and generating value

of various kinds. Because of the exploratory nature of the intervention, we could not have predicted which participants would react that way ahead of time. It was for this reason that the design strategy focused on capturing multiple user perspectives of the abstract technology.

8. Conclusions

Our intervention has not only shown that it is possible to provide free, useful media distribution to a marginalized community, but the uses for such a system are much wider than we might previously have imagined. Music, and tee-shirt design might seem a long way from the agenda of NGOs, but are critical to the community with which the NGO might be trying to engage. In particular, we would encourage researchers working on a development agenda to take a bottom up, user-centred approach and find out from the community directly what its needs are. Of course, initiatives such as the United Nations Millennium Development Goals are critical at a governmental level, but they often abstract away from the needs of individuals within a community – life is more than being kept alive. For our participants it was also about creativity, for example, allowing our participants to aid in the manufacture of clothing; and about enriching the sensual experience of living – through playing music in the public space where our snap and grab board was placed.

Our choice of participants, elderly black females, was deliberate in that we wanted to empower the most disenfranchised members of South African society. One consequence of this choice was that the users were not previously familiar with the ideas of Bluetooth trafficking, even though some possessed handsets capable of supporting it. So we did not see examples of side-loading as researchers in more technically advanced communities have found [18]. Furthermore, the mobile handset is the only digital device available to many people in the developing world, they have to be careful about which images they store on their handsets as they cannot offload images onto a personal computer or application such as Flickr (they cannot afford the bandwidth) [19]. Nor did the participants need to use the system to create a sense of community as seems to be the case in the developed world [20]; our participants were already part of a strong community and the

media sharing behavior we saw served to strengthen the ties within the community, rather than to form new communities.

In terms of assessing how much value the system was providing to the community, we found Cockton's notions of worth useful in understanding the data we collected. Without it, we may have been tempted to think that the system was a failure as not all participants engaged fully with the system. However, by understanding motivational values, such as building relationships with a partner against earning more money, we were able to better contextualize and understand the data. The notion of contextual fit also helped us understand the discrepancy between the assessors' view that the system needed active media browsing and the participants' more passive usage of the system.

However, the cost of the system does remain prohibitively high both in terms of the equipment and supporting the equipment. At present, the system requires a small personal computer and a large LCD screen – both of which are considered luxury items in the developing world. In order to keep the system running, the building in which they are deployed must have a reliable electricity source (a rarity in the developing world) and must be sufficiently secure to stop the equipment from being stolen. So whilst we accept that the system does provide worth, it is not clear that it is sustainable in its current form.

8.1. Re-thinking media sharing

In order to address the problems of cost, we set about reducing the cost and visibility of the system. Given that the Snap and Grab system requires a PC, it would seem logical to port the code to a mobile handset, which could act as a media server. This would reduce the cost of the PC, its visibility and its reliance on a constant power supply. Fortunately the original code for the system was written in C# which we were able to port to a Windows Mobile handset. The code now runs stably although the performance is more sluggish than the PC system.

Of course, their remains the problem of the screen that also requires a constant electricity supply. However, it would be possible to replace the screen with a poster; all one needs is a photograph of the image depicting the desired media which can be a photograph of a poster as easily as a photograph of a screen. By using a poster, uploading media becomes a

more complex process, but posters can be reprinted easily. Also, we are experimenting with providing stickers and sticker printers so that users can contribute their own media.

We are now at the point where the system is running stably and we are planning to repeat the media sharing experiments in other communities to analyse their media needs. However, just as the initial Snap and Grab technology probe challenged us about what media people would wish to consume, our new system is challenging us about *where* people would want to consume media. For example, as we conduct research in more rural regions with no electricity supply, we have found the a handset-based media sharing device would be ideal for the minibus taxis that service these areas; the handsets can be powered from the cigarette lighter in the taxi cab. So whilst we as researchers would not think of a minibus as an ideal place to access media, it does at least provide access to previously marginalized groups. It is unclear what media residents of rural villages might want to download from or upload to a taxi, but giving the community that opportunity can only help to improve our efforts to democratise digital media.

Acknowledgements

References

[1] International Telecommunications Union, Information Society Statistical Profiles 2009: Africa, ITU Press, Geneva, Switzerland, 2010.

[2] Gitau, S., Jonathan D. & Marsden, G. 2009 i-Internet? Intle. In Proceedings 3rd International IDIA Development Informatics ConferenceKruger Park, South Africa, 196-210,

[3] Gitau, S. & Marsden, G. (2009) "Working with NGOs through Fair Partnerships" Procdings Interact 2009, Sweden, pp. 704-707.

[4] Taylor, N. and Cheverst, K. "This Might Be Stupid But...": Participatory Design with Community Displays and Postcards. Proceedings OZCHI 2008, ACM, 41–48.

[5] Kam, M., Agarwal, A., Kumar, A., Lal, S., Mathur, A., Tewari, A., and Canny, J. 2008. Designing e-learning games for rural children in India: a format for balancing learning with fun. In Proceedings of the 7th

ACM Conference on Designing interactive Systems (Cape Town, South Africa, February 25 - 27, 2008). DIS '08. ACM, New York, NY, 58-67.

[6] Maunder, A., Marsden, G., Gruijters, D. & Blake, E. (2007) "Designing Interactive Systems for the Developing World – Reflections on User-Centred Design" Proceedings ICT4D, Bangalore, India. pp. 321-328.

[7] Frohlich, D. M., Rachovides, D., Riga, K., Bhat, R., Frank, M., Edirisinghe, E., Wickramanayaka, D., Jones, M., and Harwood, W. 2009. StoryBank: mobile digital storytelling in a development context. In Proceedings of the 27th international Conference on Human Factors in Computing Systems (Boston, MA, USA, April 04 - 09, 2009). CHI '09. ACM, New York, NY, 1761-1770.

[8] Hutchinson, H., Mackay, W., Westerlund, B., Bederson, B. B., Druin, A., Plaisant, C., Beaudouin-Lafon, M., Conversy, S., Evans, H., Hansen, H., Roussel, N., and Eiderbäck, B. 2003. Technology probes: inspiring design for and with families. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (Ft. Lauderdale, Florida, USA, April 05 - 10, 2003). CHI '03. ACM, New York, NY, 17-24.

[9] Heeks R. i-Development not e-Development: Special issue on ICTs and Development. The Journal of International Development. Wiley & Sons, 14(1). 2002. 1-11.

[10] Marsden, G., Maunder, A. and Parker, M. People are People, but Technology is not Technology. Philosophical Transacations of the Royal Society A, 28 October 2008 vol. 366 no. 1881 3795-3804.

[11] Cockton G. Value-Centred HCI. Proceedings of NordiCHI conference on Computer Human Interaction (NordiCHI'04). ACM Press, 2004, 149-160.

[12] Cockton G. Design worth is worth designing. Proceedings of NordiCHI conference on Computer Human Interaction (NordiCHI'06). ACM Press, 2006, 165-174.

[13] Greenberg, S. and Buxton, B. 2008. Usability evaluation considered harmful (some of the time). In Proceeding of the Twenty-Sixth Annual SIGCHI Conference on Human Factors in Computing Systems (Florence, Italy, April 05 - 10, 2008). CHI '08. ACM, New York, NY, 111-120.

[14] Gaver, W., Boucher, A., Law, A., Pennington, S., Bowers, J., Beaver, J., Humble, J., Kerridge, T., Villar, N., and Wilkie, A. 2008. Threshold devices: looking out from the home. In Proceeding of the Twenty-Sixth Annual SIGCHI Conference on Human Factors in Computing Systems (Florence, Italy, April 05 - 10, 2008). CHI '08. ACM, New York, NY, 1429-1438.

[15] Millen. D., R. Rapid Ethnography: Time deepening strategies for HCI field research. Proceedings of the DIS Conference on Designing Interactive Systems (DIS '00). ACM Press, 2000, 280-286.

[16] Gaver W. Cultural commentators: Non-native interpretations as resources for polyphonic assessment. International Journal of Human-Computer Studies. Elsevier, 65. 2007. 292-305.

[17] Ramachandran, D., Kam, M., Chiu, J., Canny, J. and Frankel. J.L. Social Dynamics of Early Stage Co-Design in Developing Regions. Proceedings of SIGCHI conference on Computer Human Interaction (CHI'07). ACM Press, 2007, 1087-1096

[18] Jacucci, G., Oulasvirta, A., and Salovaara, A. 2007. Active construction of experience through mobile media: a field study with implications for recording and sharing. *Personal Ubiquitous Comput.* 11, 4 (Apr. 2007), 215-234.

[19] Marsden, G. 2008. Toward Empowered Design. Computer 41, 6 (Jun. 2008), 42-46.

[20] Peltonen, P., Salovaara, A., Jacucci, G., Ilmonen, T., Ardito, C., Saarikko, P., and Batra, V. 2007. Extending large-scale event participation with user-created mobile media on a public display. In Proceedings of the 6th international Conference on Mobile and Ubiquitous Multimedia (Oulu, Finland, December 12 - 14, 2007). MUM '07, vol. 284. ACM, New York, NY, 131-138.
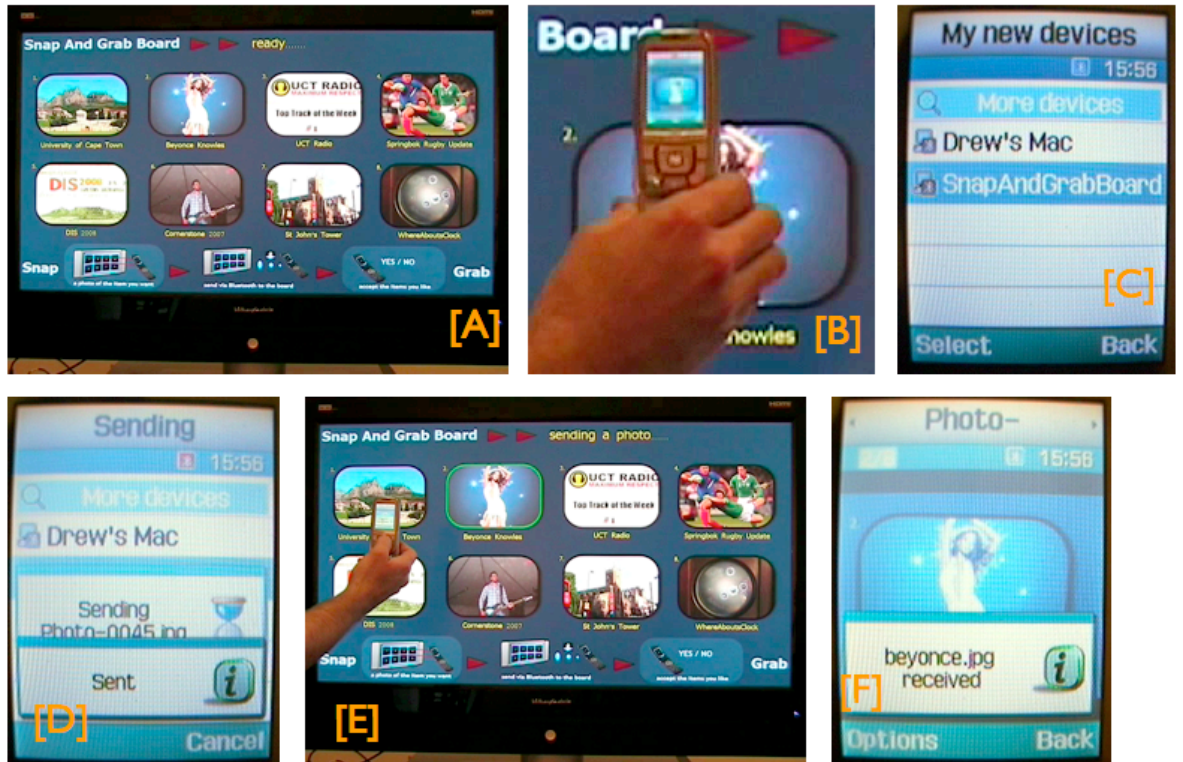
Figure1 – [A] shows the 40" screen; [B] the user takes a picture of the item they are interested in; [C] the 'SnapAndGrabBoard' is selected as a target to send the photograph to; [D] the photograph is sent; [E] the system performs image recognition on the photograph (feedback is given by highlighting the image in green); [F] an image (and MP3 in this case) are sent to the transmitting handset

Figure2 – [A] shows the vCard of the user; [B] shows that vCard being selected for sending; [C] shows the vCard being transmitted to the SnapAndGrabBoard; [D] shows the new, blank, slot being created on the display screen; [E] shows a photo being selected by the user; [F] shows the photo being transmitted to the screen; [G] shows the photo populating the newly created user-slot.