Complementing backyard-bedroom recording studios with a mobile app

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Abstract: Research on township hip-hop musicians in South Africa suggests that media producers in developing countries may increasingly be combining use of mobile phones with other digital technology. This demonstrates the need for M4D designers to conceptualise apps which fit such cross-device digital media ecologies. We describe the co-design methods used to support such hybrid township hip-hop digital media ecologies. These designs emerged from an interdisciplinary collaboration, where the ethnographic work of a media studies student and her access to participants were used as a basis for a computer science student in setting up a participatory design project. Such collaboration has been fostered for some time at the ICT4D lab at our university and may provide a model for postgraduate mobile app design collaboration. The mobile application developed supports hip-hop production. We argue for the importance of such creative digital tools in M4D, as they may facilitate voice and capability in marginalised communities.

Introduction

Several scholars have argued that popular media consumption should be given more attention in the ICT4D and M4D literature, as these build a range of digital and mobile technical skills (Arora and Rangaswamy, 2013; Sey and Ortoleva, 2014). We argue that popular mobile media production needs to be recognised as a key focus for M4D designers. Digital and mobile media production provide marginalised communities in the global South with voice, (Couldry, 2010) and inclusion in global dialogues resisting corporate media power (Jenkins, 2006). This is why the ICT4D centre at the University of Cape Town has for some time now worked in this field of popular media production (Bidwell et al., 2010; Noakes et al., 2014; Walton, 2009; Walton et al., 2012). Recent ethnographic research with township hip-hop artists by the second author, show how hip-hop production is integral in resisting a hegemonic violent consumerist masculinity in the marginalised space of the township (Schoon, 2014). We may therefore consider hip-hop through Sen's (1999, 1992)

capability approach, as allowing young people some control of their own lives, and making it an important focus for M4D.

What distinguishes several hip-hop artists, from other poor, black and predominantly unemployed young people who also owned mobile phones, was their ownership of second-hand personal computers. Hip-hop artists who mastered the digital media software on their computers and had access to a microphone became known as producers. Their simple corrugated iron, cement and mud backyard bedrooms behind the family house were then acknowledged as recording studios (Figures 1 & 2). In this space a communal ownership of the 'yard' computer developed between the rappers and the producer.

The ethnographic research, on which the study is based, approached the hip-hop artists' music production holistically in terms of 'digital media ecologies' (Horst et al., 2010). The term 'media ecologies' originates in McLuhan's (1964) medium-determined approach to technology in society. Various scholars have extended his medium-determined notion of 'ecology' to describe more dynamic relationships between people, social environments and technologies, such as 'information ecologies' (Nardi and O'Day, 1999) or 'communicative ecologies' (Foth and Hearn, 2007). Horst et al's (2010) practice-focused 'digital media ecologies' was used to study the township hip-hop world, since its emphasis on broader meaningful practices within which digital practices should be understood, was considered particularly useful to explain how digital media production fitted into a broader practice of redefining the self. Among hip-hop artists in this study, with the acquisition of computers, new practices emerged where digital media was frequently transferred between the computer, mobile feature phones and the mobile internet. The yard computer became a repository of hip-hop media which was transferred back and forth to mobile phones via USB cable, and then further distributed in the streets via Bluetooth. There has been some research considering how, with increased access to computers, mobile
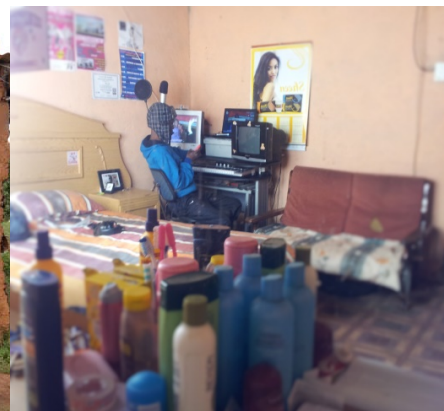

Figure 1: Backyard-bedroom studios,
exterior view

Figure 2: Backyard-bedroom studios,
interior view

phone users in the global South are making choices between using different digital devices (Donner, 2015; Pearce, 2011; Walton and Donner, 2012). Up to now, however, there has been very little research that examines how marginalised people in the global South transfer media between mobile phones and other digital devices such as computers.

Actor Network Theory (ANT) emphasises, like digital media ecology, the interactions between technology objects and people, but ANT differs in that it argues that interactions of objects and people in the network transform their characteristics and produce new 'assemblages' (Latour, 2005, p. 43). The backyard computer coupled with the mobile feature phone here may be conceptualised to produce such a new assemblage for the creation and distribution of digital media. We argue that digital media ecologies should include a focus on how various devices are used in tandem, and that focusing on such assemblages may provide additional insights beyond only considering each device in relation to the user. This focus will be particularly useful for the M4D designer, who may through this realisation, be able to design for such a new assemblage: a second-hand computer with digital media production software, connected to a frugal feature-phone mobile internet.

Studies have shown that appropriately adapted methods are required in developing world contexts (Marsden et al., 2008). Community based co-design aids in navigating complex design spaces where requirements are determined by the many designers who have varied design skills and technological abilities (Blake et al., 2011). Solutions found in this way address users' communicated wants and support their learning, alleviating a researcher's short-sightedness and bias. Our co-designed mobile application ("app") set out to support the digital practices of the hip-hop community and their collaborative work practices without trying to replace all their music production processes.

This paper describes the design of mobile services in situations where they cannot replace computer based systems but are valuable additions that amplify the resources and allow enhanced participation in hip-hop music creation.

Limitations of mobile phones in developing contexts

This ubiquity of mobile phones in the developing world has seen them proposed as solutions in many Information and Communications Technology for Development applications (Rashid and Elder, 2009). However there remain limits to what is possible on mobiles compared to computer based systems. Most hip-hop artists had feature phones such as BlackBerry's, or Nokia's;

budget phones with smartphone capabilities, a smaller screen and limited processing power.

At the outset an understanding of the capabilities of a smartphone was realised by all co-designers. It meant that limited recording and producing processes could be managed on a low cost smartphone as music production is computationally intensive task. This affected the features of the app could have.

In music production there are many aspects to visualise, including waveforms, channels, compression ratios, equalizers and much more. PC software interfaces are designed to allow users to navigate through multiple functionalities in music editing. This works well on interfaces with split screens or multiple monitors but a smartphone has severe constraints in this regard.

Interdisciplinary Co-design Method

Our method is flexible and sensitive to a context that depends on the participant, intermediary and designer perspectives and agendas (Marsden et al., 2008). Design is a creative and proactive activity. The designer's role includes mediating different interests, and facilitating the ideas and initiatives of participants while maintaining a reflexive stance (Wyche, 2015). Importantly, it includes the designer's judgement with respect to creativity and design knowledge, to conceive and realise design interactions and their corresponding design devices (Ehn, 2008).

The design of mobile apps for creative expression, have increasingly been the result of collaboration by interdisciplinary teams of post-graduate students at UCT. Such collaboration is based in the notion of an intermediary, who bridges a gap between the community and technologists, and acts as a user champion, allowing different stakeholders participation to become protectors and enablers (Simonsen and Robertson, 2012). In our case the intermediary, second author, was a doctoral media studies student with a long term relationship with the community. This allowed the first author trusted admission into this hip-hop community in Grahamstown, South Africa, and access to observations and insights into their digital and media practices.

We built on such insights to expose the technology gaps in the community without having to do extensive interviews and invasive methods. Through joint co-design sessions and visits to home studios, both technologist and intermediary could gain further insight into the digital and media practices of the community. In the design sessions and in previous interaction with the intermediary, hip-hop artists were made aware of their contribution to potential commercial research for mobile app development. Contrary to expectations,

there was universal enthusiasm for this endeavour, and excitement to associate their individual hip-hop brands with a major mobile phone producer.

The knowledge gained from using prototypes, ethnographic information from the intermediary and user design sessions provided the foundation of the app design (Jones and Marsden, 2006). Co-design meetings occurred at every design intervention step: contextual inquiry, identifying requirements, paper prototyping then finally creating a smartphone prototype.

Contextual Inquiry

For the discussion below, the reader should note that many of the terms are explained in the glossary appended after the list of references.

Altogether, fifteen hip-hop artists participated as co-designers at various times during the research project. Ten were recruited through a workshop that took place at the July 2015 Fingo Festival, a township festival that runs along-side Grahamstown's National Arts Festival ("Fingo Festival," n.d.) ; and other artists who gave permission to visit their home studio in the townships, were recruited through the intermediary's network .

Backyard studio visits
Observing the artists' recording, mixing and electronic beat production activities revealed that they could not create music without backyard-bedroom studios. Rappers are dependent on producers to create beats, the underlying music upon which their vocal recording it placed. While rappers had access to yard computers, as these were seen as communal assets, digital beat production involved many hours of learning musical and digital skills, which meant that such skills were concentrated in only a few of the producers who had constant access to computers in their bedrooms. Thirteen of the fifteen participants had a feature phone, but only six had a functional home studio and the other nine did not have any recording facility. This called for the design of an app where such beatmaking skills could be developed on the mobile phone and then transferred to the computer.

Mind maps and musical process
The first co-design session focused on each artist's music creation process; from the initial steps of ideation, to writing lyrics, beat creation, recording and mastering, to distribution and finally promotion. Ten participants were recruited; they were attendees and performing artists of Fingo Festival 2015 and first set of co-designers for our research project. This session provided insights into the community's media and technology practices, and commonalities and gaps in such practices.

Figure 3: Mind maps produced from first co-design session, mind map from producer (left), artists (right)

Artists were asked to map their music creation process and were given materials to help plot this on paper. They were asked to include what media and software they would use at each phase. They were free to illustrate this process (Figure 3). Participants produced music creation mind maps that were similar, mainly differing in ordering of steps. Many used the same recording software and shared their music via Bluetooth on their phones or with flash sticks.

Dependency of Artists on Producers Artists

Four of the ten participants were both producers and rappers, while the rest were strictly rappers and relied on their producer for the bulk of the music editing and beat creation. The following quotes were from the first session.

"I'll write my verses on paper then I'll message my producer. Once he makes a beat, I'll go visit him. Then I recite my verses on top of his beat. Sometimes he will have to change the beat and I'll have to come back another day." - Rapper1

Rapping involves a technique called 'flow' in which the inherent rhythms of the beat are accentuated in the rap vocals through emphasis and punctuation. This meant that if the rapper had not written his rap lyrics to the specific beat, it might be particularly difficult to adjust the flow to match it.

"Guys come in to record and we end up recording lots of takes, it takes time to get his flow and doesn't know his lyrics and verses" – Producer1

As one of the most respected beatmakers in the hip-hop community, Producer1 was able to charge an hourly fee for his services, encouraging rappers to prepare as much as possible. However, if they were not able to practice rapping to the beat beforehand, this was difficult, leading to wasted time.

Differing interests of Artists and Producer Artists

In this session it was apparent that producers and rappers have different interests in the overall music creation process. Producers prioritised mastering and production of beats, while rappers were interested in being able to record their verses and capture ideas for beats. This was so that they might more easily send these to each other via mobile phone instead of timeous travel to visit each other.

> *"MC's don't practice their verses with the beat, they only get to rehearse when they come to record"- Producer2*

> *"I get my beats from my producer via Bluetooth or on a flash. Sometimes on WhatsApp but then the sound quality is lost" – Rapper2*

Sending uncompressed works in progress, from rappers to producers, and finished compositions, from producers to rappers, was thought to be of value to both parties, and better than sending beats via instant messaging where sound quality was lost and it could not be used in desktop recording software since it was the wrong format.

Mobile device complements PC recording

From the first it was clear that any app would not act as a substitute to existing recording and production practices, since this would mean a significant step down in sound quality, which was of utmost importance to the artists. There was a need to shorten the lengthy recording process through a technical solution that could eliminate the back and forth travels to get the right beat and quality; and facilitate rehearsal on the correct beat. A mobile phone could handle subtasks of the recording process like beat creation and vocal recording. These could aid the creative process without diminishing overall sound quality for beats, since they could be saved as high quality audio and edited on PC software without sound loss, but vocal recordings would be for rehearsal only. Using a smartphone for rappers and producers to send each other beats or recordings would promote collaboration, and give rappers more control over the beat-making process.

Paper prototyping

Paper prototyping involved seven participants, two producers and five rappers forming a co-design group. Five participants were from the previous design session. While an app which helps both producers and rappers was agreed upon, its features were still up for debate. In this session it was agreed that a
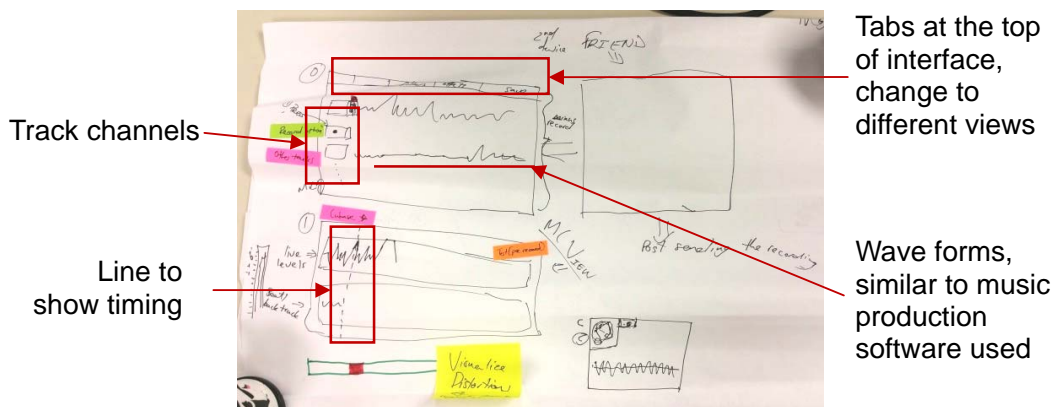
Figure 4: First co-designed interface, brainstorming interactions

mobile phone could bridge gaps, since everyone had one. In reflecting on the problems discussed in the previous workshop, of rehearsal and time wasted on finding appropriate beats during recording, it was agreed that collaboration and *ad hoc* beat creation was a priority for an app.

Participants were shown some existing mobile music applications which facilitated a discussion on which production features are possible on a mobile platform. This improved their design understanding and mind-set in the co-design session. Participants were then prompted to describe the look and behaviour of a possible app. The paper prototype was co-designed by firstly agreeing upon functionality and then a meaningful music visualisation.

Figure 4 documents how typical PC music software influenced the visualisation the hip-hop artists suggested for the app. It used a line cursor to indicate the playback point on the music timeline. They also suggested a landscape view interface to emulate familiar PC music software. Figure 4 also shows a tabbed interface to navigate to different features. A list of limited features was agreed upon by participants. Given the limitations of mobile processing they prioritised effects, that is, tempo, instruments, samples; and sharing of beats created with peers via Bluetooth (format compatible with existing PC music production software); and the ability to save beats in progress.

Implementation

The app developed was designed to be a tool that complements artists' music creation process. It is not a substitute for a home recording studio but a resource that accompanies backyard-bedroom recording process. It therefore fits the hip-hop artists' digital media ecology where mobile phones are ubiquitous, but interchanges of digital files with backyard computers are common. Here we have chosen to highlight the beat maker and sequencer app

Figure 5: Prototype sequencer and beat maker on Nokia Lumia 520

of the project (Figure 5). These reflect the design concepts in Figure 4. The prototype beat maker and sequencer was built on a Windows Phone 8.1 platform and deployed on Nokia Lumia 520s as many participants owned or have had interaction with Nokia budget smartphones (Molapo and Densmore, 2015).

The sequencer builds on previous sessions and the interface adopts what artists were familiar with (Figure 5). Artists may change tempo, add more instruments, change the looping of the beats, save to the device, play back their beats, and send them to peers via Bluetooth or through Wi-Fi connection.

Figure 6 shows how the app allows for more samples and instruments to be added to different channels to make more complex beats. This was a priority requested by participants in the paper prototype session, to allow artists to create varied beats on a portable device.

Figure 6: Edit channels, the highlighted channel Guitar 4 can be edited to any of the listed samples or to the synthesiser mode (as shown) where a more advanced user can make synthesiser modifications

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Evaluation

The beat maker and sequencer app was evaluated by six artists. This evaluation had two components: the first several task completion exercises, the second a qualitative user experience questionnaire. The tasks were composing a beat, editing tempo, editing channels, saving a beat and sending a beat via Bluetooth. After completing these tasks, artists were left to explore the app and create beats as they desired. Afterwards they were asked to complete a questionnaire to rate components of the app, usefulness and ease of use.

All artists were able to create and send beats to one another with minimal assistance. This reflected in task completion tests, with every participant completing the tasks in less than three minutes. The task completion tests soon evolved into a beat jam session, since users were instructed to explore the app and create as many beats as desired. A jam session is where artists play ("jam") by improvising without extensive preparation or predetermined arrangements. Artists preferred if they could save to more audio formats such as MP3 (MPEG-1 Audio Layer 3) but this was in conflict with the producers' preferred default of AAC (Advanced Audio Coding) which could be ported to their PC's with no loss in sound quality. Hence the decision to implement AAC was adhered to.

The app was used by all hip-hop artists who attended the evaluation session and met with universal approval. We also visited an artist at home, in his backyard-bedroom recording studio. This artist evaluated both the interface and usability favourably: *"It looks beautiful, I love it. You can learn how to use it in one day, look I'm able to learn it in a few minutes" – Producer2*

Emergent properties of mobile app

The analysis resulted in that three types of emergent properties were identified:

Ad hoc usage – The ubiquity of mobile phones allows for such tools to be used in many different contexts. This potential of *ad hoc* usage was seen as something useful and empowering: being able to create music whilst still in bed or on a bus ride. Artists appreciated its independence of PCs, which meant that more members of the community were able to participate in composing music. By leveraging available technology it extended the ability of artists to create content for later high-quality recording on PCs. The app thus complemented both their music creation process and their particular digital media ecologies.

Simplicity of App – The simpler functionality of the app meant that it was also simpler to learn and easy to quickly convey creative ideas and beats to fellow artists. Hip-hop artists were appreciative of this, and compared it to the

complex learning curve for PC production software. This is a positive consequence of simplification required for developing for mobile phones.

Practice and collaboration – Producers and rappers used the app collaboratively while evaluations were taking place: working on beats together both in workshop evaluations and at home interviews. Rappers valued accessibility of the app, being able to capture song ideas at their convenience and practice music making skills. Such practice may help in building both personal confidence and a more constructive recording relationship.

Conclusion

This paper has shown how co-designing such an app can result in a tool which supports an artist's technology practices and responds to the particular township hip-hop digital media ecologies where mobile phones were used in conjunction with backyard computers. We showed that even mobile phones with limited capabilities can play a positive role, not replacing PC functionality, but complementing and amplifying resources already in place.

Central to our approach was the interdisciplinary teamwork between a media studies scholar and technologically skilled designer. This frees the technologist from attempting to master ethnographic skills and focus on co-design of appropriate and productive tools in a resource limited context.

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Glossary

Beat: a hip-hop instrumental is casually referred to as a beat

Channel: path for passing data or digital audio. In sequencing, each channel is assigned to a single instrument in any particular instant of time.

Mastering: form of audio post production, is the process of preparing and transferring recorded audio from a source containing the final mix to a data storage device (the master)

MC: (also referred to as a rapper) is a music artist and/or performer who usually creates and performs vocals for his/her own original material

Mixer: an electronic device that channels incoming audio signals while maintaining control over such effects as volume level, tonality, placement, and other dynamics for music production.

Producer: a composer is casually referred to as a producer. In the studio a hip-hop producer also functions as a traditional record producer who is ultimately responsible for the final sound of a recording.

Samples: portion, or sample, of one sound recording and reusing it as an instrument or a sound recording in a different song or piece.

Sequencer: programmable electronic device for storing sequences of musical notes, chords, or rhythms and transmitting them to an electronic musical instrument.

Synthesizer: an electronic musical instrument that generates electric signals that are converted to sound through instrument amplifiers and loudspeakers or headphones.

Township: suburb or city of predominantly black occupation, formerly officially designated for black occupation by apartheid legislation.