

Self-recorded audio feedback as a means to allow young, vulnerable children to participate in design

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Abstract

Cooperative inquiry is a widely adopted method for involving children as full partners in technology design. There is a notable absence of reports on the use of cooperative inquiry (CI) in the developing world. One explanation could be that aspects of the developing context (e.g., cultural issues, socio-economic circumstances) make it more difficult to conduct CI. We argue that nothing should prevent designers from involving children from disadvantaged communities, but that it may be necessary to devise mechanisms for participation that overcome the more pronounced vulnerability of these children. The research reported here was conducted in the context of a design project whose aim is to develop a social media based, cross-age tutoring system whereby teenagers can provide online homework support to younger children from less advantaged communities. Our approach was to design the system in collaboration with children from both intended user groups. The team included nine teenagers from privileged communities and six younger children from a children's home in Pretoria.

Our design team lacked design experience and they did not have sufficient content and pedagogical knowledge. Neither the teenagers nor the young children had previously been involved in cross-age tutoring. Our strategy was to let them engage in face-to-face tutoring sessions over four weeks so that when we subsequently conducted the CI sessions both groups would know what such tutoring support entails. To obtain feedback on the face-to-face sessions, we invited the children to record audio feedback after each session. This would be used as supplementary input into the design. By sharing the surprising results and the problems we encountered along the way, we provide the ICT for development community with pointers on how to maximise children's contribution to design solutions.

Keywords

Children's voice, cooperative inquiry, participatory design, audio recordings

Introduction

Participatory design with children, also referred to as cooperative inquiry (Druin, 2002), is a widely adopted method for involving children as full partners in technology design. Despite this, there is a notable absence of research studies on the use of cooperative inquiry in the developing world. One possibility is that issues relating to the context of the developing world (e.g. cultural aspects and socio-economic circumstances) have made it difficult to initiate and implement cooperative inquiry efforts. Also, the institutionalised ethical clearance processes aimed at protecting vulnerable children during the research process could potentially hinder children's participation in the creation of knowledge that directly relates to them (Coppock, 2011). We argue that nothing should prevent designers from involving children from disadvantaged communities, but that it may be necessary to devise mechanisms for participation that overcome the more pronounced vulnerability children in developing countries.

The research reported here was conducted in the context of a design project with the aim of developing a social media based, cross-age tutoring system whereby teenagers from more privileged communities in South Africa can provide online homework support to young children from disadvantaged communities. From the outset, our approach was to design the system in collaboration with children from both of the intended user groups – teenagers who act as tutors and young children who receive homework support. A complete discussion of the rationale behind the inclusive design of this system appears in Chimbo and Gelderblom (2012; 2014). We had to identify children from both these groups who would be willing and able to form part of the design team for a period of four months in the second half of 2013. Through word of mouth, we recruited a team of nine teenage volunteers (ages 14 to 17) from high schools in affluent urban areas. However, our main challenge was to identify a team of young children from disadvantaged communities. To address practical problems – such as those related to scheduling, adult consent and transportation of young children – we recruited a team of children from a single children's home (i.e. an orphanage) as the younger members of our design team. Government controlled children's homes in South Africa do not allow teenagers of 18 years or younger to work with the children in the homes, so this proved more difficult than expected. We were fortunate to find a partner in a privately owned children's home in Pretoria that is run by a Christian church. In collaboration with the home staff we identified six grade 3 and 4 residents (ages 9 to 10) as design partners.

With reference to Yip et al.'s (2013) work with children with different levels of design and subject expertise, we realised that our design team not only had little design experience, they also did not have sufficient content and pedagogical knowledge of tutoring systems. First, the teenagers had not provided homework support to younger children in any form before. Second, the younger child partners had never been tutored by teenagers. To alleviate these constraints, our strategy was to let them engage in face-to-face tutoring sessions at the children's home for a period of four weeks, so that when we subsequently conducted the cooperative inquiry sessions to design the online tutoring system, both groups would understand what such tutoring support entails.

Before these sessions commenced, three of the authors attended a workshop on "Enhancing children's voices through media and technology" (Rubio, Inkpen, Ly &

Kaminsky, 2013). This sparked the idea to use audio recorded, individual stories as a way for the children to provide personal feedback on the face-to-face tutoring sessions. These recordings would then be used as additional input into the design of the online tutoring system (that is, to supplement the data gathered through cooperative inquiry). In this paper we specifically report on the use of individually recorded, audio-only feedback as part of children's contribution in the process of cooperative inquiry. We found that this approach holds potential as a mechanism for giving vulnerable, young children a voice in design; however, to use it successfully, several challenges need to be addressed.

The research problem

The research issue that we address in the paper is to establish the outcomes when young children (aged 9 to 10) are given a voice in design by providing them with opportunities to individually record their own reflections on situations and activities that relate to a real world design problem that is relevant to their own lives; then, based on these outcomes, to evaluate the viability of the method in the context of designing technology for development. A unique aspect of the context within which we investigate this problem is that our six young design partners live in a children's home where they had been placed by the court of law due to lack of proper care by their parents or families. The children attend normal public schools in an urban environment. Although they receive excellent care and the home staff members do everything within their power and means to fulfil their needs, it is difficult to provide sufficient homework support to every individual child in the home. In our research, these children represent a population of children in South Africa who are disadvantaged by their social or socio-economic circumstances to the extent that they do not have access to sufficient after school learning support.

The research problem (to determine whether audio recordings can be used successfully in cooperative inquiry) should not be confused with the real world design problem under discussion (i.e. creating the online tutoring system). The design problem provides the context in which we investigate the stated research problem.

Lack of learning support out of school has been identified as one of the factors that contribute to the low literacy and numeracy levels of many South African children (CDI, 2013). To develop a sustainable, technology-based solution to this problem of after school learning support, we believe that the children who will be the users of the system should be involved throughout the conceptualisation, design and implementation. Therefore, through a process of participatory design (PD), we worked closely with the team of teenagers and younger partners right from the start. For this collaborative effort to be successful, we needed suitable communication channels for all the different parties involved so that maximum participation was supported. Central to PD is to provide participants with tools that will enhance dialogue within the design team (DiSalvo & DiSalvo, 2014).

With regard to their competency to contribute during a process of cooperative inquiry, our younger design partners face constraints in the following ways:

- They have had limited exposure to technology. For instance, they are not allowed to own mobile phones and the computers that are available for them in the home are out-dated. The home has a slow internet connection accessible from one specific computer and the children are not allowed to use it by themselves.

- Their home language is not understood by all the adults and teenagers in the design team, so that whatever input they provide in their home language must first be translated into English. Consequently, during the design sessions, communication problems may occur between team members.
- Adults often disregard young children's opinions (Christensen, 2004). Besides being subject to the effect of this universal power imbalance, the young design partners in this study are further disempowered by the fact that they had been placed in the children's home (Daly, 2009) due to abuse or lack of proper parental care. Their status as "children from a home" makes them more vulnerable than children who live with their families.

How do we overcome these problems to give our young partners a chance to actively contribute in the search for technology-based solutions that will impact their own education? DiSalvo and DiSalvo (2014) suggest the use of "provocative activities" during PD to encourage participation from participants who may for some reason feel disempowered. The idea that we explore here was to give the children audio recorders that they could use in private to tell us how they experienced the face-to-face tutoring that they received from the teenagers, what they liked about it, what they did not like, and so on. We first position our study within the existing body of knowledge by briefly discussing a subset of related literature. Next we describe our research approach in detail and then discuss the results and our findings.

Related work: design, children's voice and audio recordings

Participatory design with vulnerable children

Participatory design (PD) originated in Scandinavia in the 1970s to provide a mechanism for workers to voice their opinions with regard to design of new workplace technologies (Ehn, 1993). Bonsignore, Ahn, et al (2013) write: "The primary motivation for PD is the democratic ideal that the people who are affected by a decision or event should be given the opportunity to influence it." The cooperative inquiry methodology as described by Druin (2002) is a form of PD that specifically includes children in the design process. It originally included a collection of techniques that have been adapted or developed for use with children, namely: contextual inquiry (observing users using a system), participatory design (collaborative building of prototypes), and technology immersion (observing children in an environment that is richer with technology than what they currently have access to). In cooperative inquiry children are regarded as equal stakeholders throughout the design process. To do this successfully, the distinction between adults and children must be minimised. Over the years, cooperative inquiry has been adapted to suit various contexts and problem domains (Guha et al., 2013), but the fundamental characteristic of equal partnering across generations has remained constant.

Writing about democracy in education, DiSalvo and DiSalvo (2014) describe PD (and implicitly then also cooperative inquiry) as a means to "break down knowledge, language and power barriers" that may restrict input from learners (p. 796). Various studies have demonstrated the success of cooperative inquiry in this regard (e.g., Bonsignore, Quinn et al., 2013; Yip et al., 2013). Whereas cooperative inquiry usually involves typically developing children, the method has also proved successful when used with children with special needs such as those with autism spectrum disorder, dyslexia (Foss et al., 2013), and attention

relations present in schooling contexts. Researchers should distinguish between the social identity and communication patterns shaped outside of school and those developed within the hierarchical system of schools. In listening to the pedagogic voice we can overlook the real message. The implication for cooperative inquiry is that when conducted in a school environment, adult designers need to be sensitive to the possibility that child partners are using their “pedagogic voice”.

Marginalised children may be silenced by the fact that they have never learnt what constitutes a “legitimate text” in an unfamiliar context (Arnot & Reay, 2007, p. 320). The scripts that they associate with a specific aspect of their context (such as social class) may be the ones they fall back on. Christensen (2004) emphasises the importance of children’s silences, because the fact that they do not want to give an opinion may be significant in the research context.

When conducting research with children, adults should rise above their adult perspectives, language, and assumptions. From the planning stages and throughout the research process there should be self-awareness of assumptions and use of power (Daly, 2009).

Audio recording and storytelling for data collection from children

A search of the literature yielded very little with regard to the use of individual audio recordings to glean children’s input during PD (or in other kinds of participatory research). In experience sampling – a method whereby research participants document their thoughts and actions in the context of their everyday lives (Christensen et al., 2003) – electronic devices such as PDAs and mobile phones are typically used by the respondents to record their input. Christensen et al. discuss how using technology can optimise the success of this method. Experience sampling has been used successfully with children (Langhout, 2010).

Crivello et al. (2009) provide a comprehensive survey of methods for gathering data from children. These include diaries, photographs and role play. Crivello et al.’s also discuss talk-based methods, but all of these follow an interview approach to allow children to voice their opinions. A problem with interviews is that when the interviewers have higher social status or social power than the interviewees, the latter may be particularly susceptible to response bias (Podsakoff et al., 2003). Dell et al. (2012) investigated this problem in the context of human-computer interaction (HCI) design and evaluation and found clear evidence of demand characteristics response bias (i.e. the participants adjusted their responses to fit the expectations of the researchers). Their findings suggest that this kind of bias can be addressed by minimising the power differences between the researcher and the participants.

In a study to design an electronic schoolbag with children’s help, Dindler et al. (2005) used a radio broadcast scenario to record children’s narratives that would contribute to the design. In the scenario, a group of children communicates with a Martian to explain to him the content of their electronic school bag. The children used only audio, but the researchers recorded the sessions on video as well. Letting the children communicate with Martians rather than adult researchers proved to be very successful in overcoming the power differences (Dindler et al., 2005).

StoryKit is a mobile application designed at the University of Maryland's Human-Computer Interaction Lab (HCIL) that can be used to create and share multimedia stories (Bonsignore, Quinn et al. 2013). Bonsignore et al. conducted a three year study to increase their understanding of the ways in which mobile storytelling applications can be designed to enhance children's personal expression and literacy practices. They found that a simple, integrated interface worked well to enable children to capture their stories. The audio in StoryKit was an especially effective tool for early grade school children, because it allowed children with emerging written literacy skills to tell audio-based stories naturally first, then transcribe them using text input. In this case, audio was more comfortable for children who were not yet adept at expressing their stories in writing. StoryKit could have been an ideal tool for our young design partners to record their reflections, but restrictions on private use of mobile phones and tablets in the children's home made this impossible. In South Africa less than 10% of all mobile phones sold are iPhones (Vermeulen, 2014). The fact that Storykit is only available for iOS practically excludes South Africa from its user population.

Carnegie Mellon University's Create lab runs a project called "Hear Me" (Hear me, n.d.) whereby children are encouraged to record stories about any topic and upload it to the web based Tell-Port where anybody can listen to what they have to say. Hear Me can be used as a platform for teachers to get children to think and record stories about specific topics, or for campaigns aimed at the improvement of children's lives (e.g. the Pittsburg Youth-Police relations campaign). The broad aim is to provide children with an opportunity to participate in important dialogues – individually or in groups. Although this project is not directly related to the design of technology, issues concerning technology has been on its agenda, for example a video project aimed at addressing the relationship between technology, depression, and adversity (Spice, 2014).

The literature reviewed here supports our research. Cooperative inquiry is a suitable approach for vulnerable children, but its success depends on removing the communication barriers created by adult-child power relations. The context within which we conduct research with children is an important factor to consider when asking children to voice their opinions. Researchers have used different approaches and systems to tap into the minds of children and give them voice. The use of technology in this regard has proved successful in a number of the studies that we discussed.

Research methodology

The plan

Only two of the fifteen children in our design team had previously participated in the design of a technology solution to a real world problem. This meant that starting right away with cooperative inquiry sessions would not likely be the best approach. Constraints, such as their limited access to technology and limited content and design knowledge relating to the educational problem under investigation, would make it difficult for them to participate optimally. Instead, we opted to start with face-to-face tutoring sessions at the children's home at least twice a week for four weeks.

With the help of a psychologist we prepared the teenage partners for their interaction with the children in the home so that they would be equipped to handle potentially difficult or

emotional situations in the correct way. The psychologist was on standby throughout the project to deal with any issues, but was never called upon.

We transported the teenagers to the children’s home where, depending on the number of teenagers available on a particular day, they provided the children with homework support in groups or individually.

We asked the children in the home to tell us, after each tutoring session, about their experience during the session by recording their impressions using a simple digital audio recorder. Two teenagers explained to the young participants how to use the recorders and what we wanted them to do with it (that is, to tell us what they did during the session, what they liked about it, what they did not like, and anything else they wanted to tell us). They gave the children a chance to play with the recorders and practice recording themselves. We planned to leave the recorders with a care giver at the home. The children could then ask for a recorder whenever they felt ready to record their stories and return it for safekeeping. At the end of the series of face-to-face sessions we would collect the recorders with all their stories.

Table 1 explains how this approach would address the specific constraints listed in the problem statement.

Table 1: How the young partners’ challenges were addressed

Constraint:	How addressed:
They have had little exposure to technology.	In anticipation that they might not be able to conceptualise and communicate usable design ideas due to limited design experience, content knowledge and lack of exposure to technology, we collected their personal reflections on the face-to-face sessions, hoping that this might yield input into the design.
Some of the adult design partners did not understand their home language.	The recordings were translated into English so that all adult partners have access to the children’s stories.
Disempowered by their status as abused or neglected children.	These children might find it more difficult to overcome the inhibiting effects of adult-child power relations in the design context. We hoped that allowing them to record their reflections on their own, without the presence of an adult, would make it easier for them to communicate their ideas. Having the teenaged tutors brief them on the use of the recorders (rather than adults) might support this.

In addition, we asked the teenagers to record their reflections after each session using their mobile phones. Although our focus in this paper is on the recordings made by the younger partners, the teenagers’ recordings are used for comparison purposes.

The implementation

In this section we provide details of the actual implementation, pointing out the methodological difficulties.

Participants

Our design team consisted of two adults, nine teenagers (all girls) and six grade 3 and 4 children (three boys, three girls). One boy and one girl were nine years old at the time of the research and the rest were ten. All the young partners are Afrikaans speaking and two can also communicate well in English. We had no information on their backgrounds, e.g. the reasons for being in the home, who or where their parents are or where they were before they came to the home. We deliberately did not investigate the tutees’ backgrounds

so as not to be influenced by feelings of sympathy unrelated to the research during the project. None of the children displayed learning or intellectual challenges.

The teenagers ranged in age from 14 to 17 (except for one who was 12 at the time but did not participate in the tutoring - only in the subsequent design sessions). Two teenagers attend English schools and regard English as their first language, although their parents speak Shona and Zulu respectively. The rest attend Afrikaans schools, although two of those speak English at home. All the teenagers are fluent in English. This reflects the multilingual, multicultural character of the community.

The face-to-face tutoring sessions

The face-to-face tutoring sessions started in the last week of August 2013 for four weeks. The adult researchers collected the tutors from their various schools and drove them to the children's home twice a week on average (sometimes three times a week and sometimes once). Beyond that, the adults did not interfere with the tutoring activities. Each session lasted 90 minutes. How the time was used depended on the number of tutors and the tutors' preferences with regard to grouping the tutees. There were always at least five tutees present, but most of the time all six children were there. The tutor numbers varied a lot with only one tutor available on two occasions and a maximum of five tutors on two occasions. The tutors all participate in a number of extracurricular activities and the tutoring had to be scheduled around these activities. When only one tutor was available, she split the session in two, working with groups of three at a time. We left it up to the tutors and the tutees to decide how they paired up, who they wanted to work with, where they wanted to work and what work they wanted to cover. On a few occasions there was some competition for a specific tutor, but never to the extent that it became a real problem. The tutors always found a way to keep all the tutees satisfied with the arrangements.

The recordings

Three Philips Voice Tracker digital audio recorders were used for the recordings made by the tutees. We chose this recorder because it is easy to operate and inexpensive (so we could leave them with the young partners without burdening them with unfair responsibility). However, leaving the recorders at the home so that the children could make their recordings when they felt like it, did not work out. The care giver who kept the recorders forgot about this and the children never asked for the recorders. We did not press them for reasons, so it is not clear if they too just forgot or whether they did not feel comfortable to ask. We changed our strategy and let them record privately in a small play room directly after the sessions.

The tutees provided a total of fifteen usable individual recordings and one recording made by a pair of tutees. In total the transcriptions contain 1886 words. The longest single recording was 346 words and the shortest eighteen words.

The teenagers made recordings on various mobile phones and an iPad. They provided nine individual recordings and one with a group of four. These were transcribed in a total of 1680 words – the longest contained 192 words and the shortest 83.

The first author transcribed all the recordings, translating from Afrikaans into English while transcribing.

Data analysis

Initially our analysis of the transcripts was driven by the search for suggestions, comments, or any feedback that could be used as design input. It took one reading of the text to realise that none of these were overtly present in the tutee recordings. Our initial reaction was to focus only on the tutor recordings for design input, but after some reflection and discussion among the researchers we realised that there may be hidden value in the tutee recordings. We then decided to follow an analysis approach that is based on grounded theory research to see if anything useful emerged.

Martin and Turner (1986, p.141) define grounded theory as “an inductive, theory discovery methodology that allows the researcher to develop a theoretical account of the general features of a topic while simultaneously grounding the account in empirical observations or data”. Although grounded theory is primarily a research methodology, aspects of it can be used for qualitative analysis of data (Martin & Turner, 1986; Myers, 1997). Here we used the coding mechanisms associated with grounded theory (open, axial, and selective coding) to analyse the transcripts with the aim of understanding the nature of the narrative contributions made by the participants (Baskerville & Pries-Heje, 1999; Corbin & Strauss, 1990). In open coding, concepts emerging from the data were identified then grouped at a more abstract level into categories. Through axial coding we then searched for relationships between the various categories, and finally (through selective coding) developed a core category (or story) that represents the central phenomenon in the data.

The nine categories identified during open coding are:

1. **Identity** (references to self and identification of self): Most of the tutees introduced themselves because this is what they were instructed to do. Only two of the teenagers did this. It was very important for one tutee that we knew it was him speaking, often repeating his name and grade (e.g. “I am X in grade 4. Please just remember my name.”).
2. **Expression of emotion** (gratitude, love, care, sadness and enjoyment): Tutee contribution counts are as follows: Enjoyment/Gladness=17; Love=5; Gratitude=18; Care=5; Sadness/Unhappiness=3. The children came across as extremely thankful, caring and concerned for our safety, making statements such as “my heart is very sore that you are going away because you do all the things you can for us”; “can you please look after your body well”; “You must go very carefully home. And don’t make accidents”. In the tutor data we found two expressions of enjoyment, one of sadness and one referral to emotional attachment to the tutees.
3. **Learning content** (school subject related references, e.g. to mathematics or reading): The tutees mentioned doing mathematics sixteen times and reading only once. The tutors mentioned the following topics covered during the sessions: mathematics (8); reading (4); language and spelling (5). In the group recording, the tutors discussed things outside the school curriculum that they could do with the children, showing that they see potential for tutoring to provide more than just homework support.
4. **Description of individuals** (includes descriptions of tutors and researchers by the tutees and of the tutees by the tutors): Tutees used the following words to describe the tutors: nice, pretty, cool, great, sweet, kind (they do it out of their hearts), good people. Tutors described tutees as cute, resistant to work, an angel, good reader, adorable, nice, clever, focused on work.
5. **Description of tutee behaviour** (tutees’ references to their own behaviour in the tutoring sessions as well as tutors’ description of the tutees’ behaviour): There was very little

contribution from tutees – three references to themselves or others being naughty or not focussing on the tutoring. Tutors provided rich information on tutee behaviour that interfered with the tutoring, e.g. differences between personalities that caused problems, how the group sizes influenced behaviour. There was a balance between positive and negative opinions about tutee behaviour from the tutors.

6. **Classroom management** (how the tutoring sessions should be set up or managed): There were too few tutors to generalise in this regard, but the younger tutors struggled to keep the tutees focused and to use initiative when they came without homework (or when there were more than one at a time). They solved this problem themselves by coming prepared with extra work in later sessions. There were no contributions from tutees in this category.
7. **Religious expression** (references to God, speaking as if in prayer, thanking God): Eight of the tutee recordings (made between two tutees) ended up as prayers or just expressions of thanks and hope that God will look after the tutors and others involved (e.g. “I just please want you Lord to be with us tonight and with the people that taught us today”). There were five uses of “Jesus” and “Lord”; eleven if we add implicit mentions where “you” clearly referred to God. When their talk turned into prayer it was clear that they spoke more fluently, following an internal script that they are comfortable with. For example, “I want to say thank you for You who made the world ... that there are people with good hearts ... and who can prepare themselves. And I just want to say thank you that we could have another wonderful day Lord. And I want to ask You if You can please help that the people who are not as fortunate as us, that they The people who do bad things, that they will be forgiven. I ask please. Lord, can I just ask that we have another nice day today.”
8. **Opinions about tutoring** (expressions of opinions about what worked and what did not during the face-to-face sessions): There were eight contributions from the tutees and 27 from the tutors. Whereas the tutors’ expressions are informative, providing clear indication of problems and solutions (e.g. “It is different from what I expected. It is very emotional. I didn’t expect to become emotionally attached to the kids, but yes”) the tutees just provided positive feedback and requests for more tutoring (e.g. “And I just want that they will come and help us forever, but if they can’t it is OK”).
9. **References to home staff** (references to specific staff members and to the home in general). In these references the tutees again expressed gratitude, for example “And I also want to say thank you very very very much that we have a roof over our heads and that we have people that can teach us ...”.

The tutees’ contributions were concentrated in categories 2, 3, 4 and 7 with no contribution to category 6 (Classroom management) and substantial contribution to category 2 (Expression of emotion). The most surprising data were found in category 7 (Religious expression). The emergence of religious expression as a prominent category and clear signs of the important role religion played in the narratives recorded by the tutees, led to a deeper investigation of the role of religion as an important contextual factor in this research (we discuss this further in the next section).

The concern for our safety picked up in category 2 may relate to their situation in the home. They have all experienced loss of, or separation from, their parents. When they develop relationships, the possibility that something may happen to these people are clearly significant to them.

Axial coding revealed strong links between categories 2, 7 and 9. For example, in *Religious expression* there are indications of care and gratitude that we did not include in the *Emotional expression* category. The data in *References to home staff* were also

expressions of gratitude and they are conveyed as if in prayer, which could also classify them as religious expression. We identified *gratitude* as the central theme in the tutee data – that is, gratitude towards the tutees for teaching them, towards the researchers for making this possible, towards the home staff for their love and support and, finally, towards God. This theme emerged in all the categories where the tutees made a contribution (particularly categories 2, 4, 7 and 9).

Results and discussion

The content of the tutees' audio recordings did not seem useful at first glance. Their contributions were not narratives about their experience of the tutoring sessions, but rather short, repetitive expressions of gratitude guided by scripts that relate to thanking those who provide for them or who make an effort to help them. This is an example of DiSalvo and DiSalvo's (2014) assertion that unexpected outcomes can inspire a different line of inquiry. If this can lead us to improving the communication between designers and participants we have achieved our primary goal as PD practitioners. Instead of discarding the input received from the tutees, we tried to find meaning in their apparent inability to express useful comments, asking whether the silences or omissions tell us anything about the design or the design process. We recognised the outcome as an example of Arnot and Reay's (2007) reference to marginalised children's inability to express themselves when in an unfamiliar context. To these children, being asked for opinions that would potentially assist adults in finding a solution to a problem, was an unusual situation and they did not have a script that could support them in formulating feedback.

With reference to the literature discussed earlier, we consider the results from two viewpoints. Firstly, the power relations were as prevailing when the children made their private recordings as they would have been in direct communication with the adults. Secondly, when the children recorded in private they reverted to a familiar text because they did not know how to use their own voices in this new context. These perspectives are connected. We expand below.

The presence of power relations in the data

The way we approached the use of audio recordings was not successful in overcoming the power differences. Although the children were excited about using the recorders and very willing to provide us with recorded feedback when we requested it, their recordings demonstrate an inability or unwillingness to include anything that could be conceived as criticism. Although we specifically asked them to also say what they did not like or what they would change, they mostly expressed thanks and love, complimented the tutors, and asked for more visits. Our hope that removing the adult presence during feedback did not solve the problem of demand characteristics response bias that typically occurs during interviews when there is a notable inequality between interviewer and interviewee (Dell et al., 2012). We can interpret this inability to express negative, or even neutral, opinions as the result of the children's reaction to the power relations between them and whoever they believe would be listening to the recordings. This confirms Christensen's (2004) statement about the significance of the unspoken message.

The effect of power relations was also explicit in the data. Whenever the tutees referred to the researchers or the home staff, they called them "Tannie" – a respectful Afrikaans form

of address. They even addressed the tutors as “Tannie”.

The fact that some of the children’s narratives started off as feedback that gradually transformed into prayer, further demonstrates the level of respect with which the children approached the recordings. This relates to Hussain et al.’s (2012) finding that religious beliefs influence design contributions – their participants were also very reluctant to voice anything that could be interpreted as ingratitude or criticism due to their Buddhist religion. It is important to note here that we cannot assume that the children’s prayers indicate fundamental religious belief. This could just as well be the result of socialisation into religious normative behaviour, because the home is run by a church.

Using context-based voices

The research was conducted in children’s home. One can transfer Arnot and Reay’s (2007) notion of “pedagogic voice” to that of “care facility voice”. The children’s talk may be affected by the rules and power structures within the children’s home. With the home being run by a church, we also consider the presence of “religious voice” in these children’s talk. In our results, religion emerged as a significant contextual influence. The church plays an important role in these children’s lives and prayer is a familiar text for them. When we asked them to record their feedback in private and they struggled to find a voice, they reverted to prayer which is a text they know how to use in private.

According to Moore et al. (2012) the words and thoughts that children use in prayer can help them to articulate their feelings. Besides being a source of support and comfort it helps children with self-expression. Mountain (2005) found that children see prayer as a way to express strong feelings and hopes. Children understand prayer through their experience of prayer in their own faith communities. It is a “comfortable aspect of family life or membership of a religious community” (Mountain 2005: 297). Mountain also found that praise and thanksgiving in prayer can merely be the result of personal happiness or it can follow from the religious community’s prayer rituals. Both of these views can explain the prayers in our data: the experiences during tutoring made the children so happy that they wanted to express this joy and the gratitude that goes along with it, very clearly. Like the children in Mountain’s study, they used prayer here as a way to express these strong feelings. On the other hand, they do live in a highly religious environment where thanksgiving and praise in prayer is an important ritual. Their prayers can thus be a ritualized form of expression based on conventions and rituals of religious talk from the adults whose care they are in. This could be interpreted as another power dynamic at play.

Not all the children used prayer in their recordings, but all the recordings displayed a pattern of expressing gratitude and care towards the tutors and adults involved. Children develop storytelling practices through their interaction with parents, teachers and caregivers and these can become patterns in their communication which depend on the context (Miller et al. 2003). The children in the home have been removed from their parents indicating that there must have been lack of proper parenting. We can assume that these children have not been exposed to the kind of parent-child communication patterns that Miller et al refer to. For them this has been replaced by child-caregiver communication in the home and communication in the religious community. The lack of proper narratives in our data can be an indication that these children did not acquire the

narrative patterns that are developed through everyday conversations with adults.

This discussion culminates in a refrain of reports by Komulainen (2007) and Mannion (2007): Children's voice is a multidimensional social construction that changes depending on the context in which it occurs. If we do not acknowledge the contextual influences, we will miss or misinterpret what they are saying.

Conclusions

Our research problem was to determine whether young, vulnerable children can be given voice in design by letting them individually record their own reflections on experiences that relate to a real world design problem that is relevant to their own lives.

If you place children in a new situation where they have to interact with people who they see as higher on the social ladder, they revert back to narratives that they feel comfortable with (in our case it was often prayer or "religious voice"). The fact that they gave their feedback in private changed the situation so they did not know what voice to use and naturally reverted to prayer which is one "voice" they know how to use in private. What this means for cooperative inquiry is that if we use private audio recordings as a mechanism to remove power relations when getting children's input, we need to be very aware of the possible "voices" that are created and triggered by contextual factors.

Letting them record their feedback in private did not alleviate the effect of power relations between adult and child partners. The unfamiliarity of this activity triggered familiar communication patterns that ironically also reflect clear power structures implicit in the rules of a care facility or the rituals of the religious community that they are part of.

With regard to the challenges listed in table 1, the way we used of audio recordings only solved one of them. It provided us with tangible data that could be transcribed and translated so that it was accessible to all the researchers involved. In terms of providing the children with a mechanism to give input into the technology design and addressing the power imbalances, the method was less successful. Using the teenagers as facilitators was not sufficient as they were seen by the younger children as adults rather than children. The children lacked suitable scripts on which to base their feedback and reverted back to familiar communication patterns of expressing gratitude towards adults and God.

The problems experienced could also be attributed to methodological issues. We had no examples of similar studies to inform our procedures with regard to the use of individual audio recordings. Through this experience we learnt valuable lessons that can inform future studies that use individual audio recordings to collect data from vulnerable children. Contextual factors must be studied carefully and researchers must be clear beforehand on how these might influence the children's input. The children must be given more opportunity to practice and by, for example, letting them listen to other recordings of this kind, one could provide them with the kind of script that they could use in their feedback. One could also experiment with recording private conversations between two or more children, rather than individually.

Despite the difficulties, we are convinced that this method holds potential to solve the mentioned problems. Although they may not have given us what we expected, there was no reluctance from any of the children to record their feedback. They were curious to learn how to use the recorders, mastered them within seconds and clearly enjoyed recording themselves.

With regard to the design of technology for development, we can recommend the use of audio recordings as supplement to the accepted cooperative inquiry methods, especially when vulnerable children are involved as co-designers. If the problems identified in this research are addressed as suggested above, the power imbalances will be reduced and the children will be able to make useful contributions into the design.

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