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Probes and prototypes: a participatory action research approach to codesign

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Participatory Action Research (PAR) has a long history of use with disadvantaged groups in order to assist them to improve their living conditions, however its use with Information and Communications Technology (ICT) projects is less well known. This paper examines a case study where PAR was tied with the use of a technology probe by an Aboriginal group, with the goal of determining if culturally appropriate design of ICTs could help support individual well-being. The results of this project show that although PAR and probes can be used together, this combination has the potential to alter how probes are traditionally used in the design space. To support this premise, we review the history of the probes method in the literature and discuss changes in how cultural and technology probes have been implemented in recent years. We argue that as modifications are made to these frameworks due to the needs of the research, two sorts of project results should be fully elucidated: (1) the changes made to the original methodology and (2) how these changes have had an effect on the real-life environment to which they were applied.

Keywords: Information and Communications Technology; Participatory Action Research; Aboriginal women; collaboration; technology probe; well-being

1. Introduction

Participative frameworks have been shown to be useful in design environments both within and external to Information and Communications Technology (ICT). These methodologies are particularly beneficial in scenarios where significant power differences exist between the design team and the participants. One such framework, Participatory Action Research (PAR), has a long history of use with disadvantaged groups in order to assist them to improve their living conditions (Kemmis and McTaggart 1988; Liamputtong 2009). As ICTs are increasingly being used as the basis of emancipatory change (e.g. ICT4Dev), Participatory Design (PD) is often paired with different types of probes (simple, flexible tools that allow designers to learn about potential users in their home environment) in order to elicit innovative design concepts from both designers and participants (Gaver, Dunne, and Pacenti 1999; Hutchinson et al. 2003). This paper examines a case study where PAR was tied with the use of a technology probe in an Aboriginal group, with the goal of determining if culturally appropriate design of ICTs could help support individual well-being. Additionally, we discuss how the constraints of time, resources and delivery schedules affected the codesign decisions

made by our participants. The results of this project show that although PAR and probes can be used together, this has the potential to alter how probes are traditionally used in the design space. To support this premise, we review the history of the probes method in the literature. We argue that as modifications are made to these frameworks due to the needs of the research, two sorts of projects results should be fully elucidated: (1) the changes made to the original methodology and (2) how these changes have had an effect on the real-life environment to which they were applied (Boehner et al. 2007).

2. Background

PAR developed out of Critical Action Research, which combines Critical Theory with Action Research in order to break down the power structures between the researcher and the research subjects by having them work collaboratively to develop solutions for community issues (Kemmis and McTaggart 1988; Davis 2008). The emancipatory nature of PAR makes it useful in settings where disadvantage between groups exists, and where the goal is to empower group members to improve their situation (Reason and Bradbury 2006). The techniques involved in PAR move the control of the outcome of the project into the hands of the participants rather than in the hands of an outside team of researchers. Much of the extant research regarding development with Indigenous people suggests that collaborative methods that prioritise empowerment and self-determination for participants foster a sense of ownership in the research group, leading to better outcomes (Conrad and Campbell 2008). The participants themselves define the problem and the actions to be taken. This is in direct contrast to much research conducted 'on' indigenous people that views them as the problem rather than the economic environments and social realities which they inhabit. In Australia, many of the recent PAR studies with Aboriginal people have focused on empowerment through education and improved health (Liamputtong 2009). For the purpose of this project, we frame our study as a partnership of experts: (1) the authors as knowledgeable about research methods and (2) the Aboriginal women as experts about their lived experiences.

2.1. From cultural probes to technology probes

Over the last decade, various types of probes have been used to explore design ideas with people. Gaver and a group of designers initially developed the idea of a cultural probe to explore the design space for the elderly (Gaver, Dunne, and Pacenti 1999). Since their creation, probes have been used for four main purposes: to inspire design, to gather data, to increase participation and to facilitate dialogue. Mattelmäki (2008) offers five stages to the design probes process: (1) tuning in for co-exploring, i.e. the act of creating the probe pack; (2) the probing phase where the probe is distributed to the participants and they interact with it; (3) first interpretation of the probe returns; (4) a deepening phase where the probe returns inspire more detailed questioning of the participants; and finally, (5) the interpretation and ideation phase where the process inspires the creation of a new design.

After the development of cultural probes by Gaver, Dunne, and Pacenti (1999), the idea of using probes expanded into several variations including domestic probes (Gaver et al. 2004), empathy probes (Mattelmäki and Battarbee 2002) and value probes (Voids and Mynatt 2005; Boehner et al. 2007). Technology probes fall under this umbrella of approaches (Mattelmäki 2005) and are low-fi technology applications that are designed to collect information regarding ICT use and the environment of the participants in order to inspire design. As proposed by Hutchinson et al. (2003), the use of technology probes in domestic and workplace settings have three interdisciplinary goals: (1) understanding the needs and desires of users in a real-world setting, (2) field-testing new technology and (3) inspiring users and researchers to think about new technologies. Designers have applied probing methods in varied ways over the last decade, and this is reflected in the variations in research

design of projects. Next, we briefly introduce three such studies, beginning with Hutchinson et al. (2003).

As part of the European Union-funded interLiving project, Hutchinson et al. (2003) developed two technology probes that were used with distributed, multi-generational families in France, Sweden and the USA to explore alternative ways to maintain family communication. The method described by the team involved deploying a new technology into a real-world situation, observing how it was used over a period of time and then reflecting with the users about what types of technologies would be interesting to develop in the future (2003, 18). Following on from Hutchinson et al.'s (2003) work, Taylor and Cheverst (2009) describe a prolonged iterative study using a mixed methods approach of ethnographic observation, using a cultural probe, focus groups and a technology probe (consisting of an interactive media display placed in the local post office) while maintaining close participation with members of a small community (about 500 people) in Wray, England. A project by Vetere et al. (2009) echoes the mixed methods approach of the previous projects by combining observational studies, a cultural probe and a technology probe with the goal of exploring the properties of intergenerational play between grandparents and grandchildren and how technologies can mediate playful activities when family members are separated.

Thus far we have traced the evolution of probe use from the original cultural probes defined by Gaver, Dunne, and Pacenti (1999) to technology probes as described by Hutchinson et al. (2003), to implementations of these probes in the literature. Boehner et al. (2007) note that many of the studies that posit the use of technology probes apply this term broadly, from studies to open up new design spaces, to those that seek to find a single design application. A mixed methods approach appears to be the most common, with some aspects of the original method omitted and others added.

3. Introducing the Gugu Badhun Women on the Move study

Many Aboriginal Australians report a diminished sense of well-being in their everyday activities. This effect can be seen in the well-publicised gap between Aboriginal and non-Aboriginal health (Australian Health Ministers Advisory Council 2008). The reasons for this gap are varied, but are primarily caused by the after effects of colonisation. Indigenous people from other countries report similar outcomes (Nakata 2007). Our research sought to discover whether access and the use of culturally appropriate ICTs could improve this situation by enhancing participants' sense of support and engagement with their culture.

Indigenous people often find themselves on the wrong side of the digital divide. Data from the Australian Bureau of Statistics (2009) support this, showing that Australian Aboriginal people lag behind in their uptake of ICTs compared with other Australians. While multiple studies have shown that access and use of ICTs can provide real benefits in regards to empowerment for women, few of these studies have focused specifically on the well-being aspects.

We next provide a description of a PAR study in which we participated with Aboriginal women of the Gugu Badhun, an Australian Aboriginal language group. The project was conducted as part of a doctoral research study by Madden at James Cook University. The other authors of this paper were Madden's thesis supervisors. In addition, Cadet-James is a Gugu Badhun woman, and acted as a cultural mentor for the research as well as an active participant in the design activities. The Gugu Badhun trace their ancestry back to five main family groups whose traditional country is in rural north-west Queensland, Australia, including the present-day town of Greenvale (population 250) and environs. Due to lack of employment prospects in the area, most of the Gugu Badhun have moved to Townsville, Cairns or Mt Isa. The main focus of the research was to discover how well-being in the group could be supported by the design and use of a culturally appropriate online system. The research was conducted over three phases or 'cycles' to use the PAR terminology.

The research plan for the study was divided into three phases which corresponded to the three Action Research cycles: (1) focus groups, (2) use of the technology probe website and (3) feedback. Seven Gugu Badhun women participated in the focus-group interviews, and five additional women from the community were added in the technology probe phase of the project. The composition of the larger group was based on a ‘snowball’ approach to participant selection where the members of the first group of Gugu Badhun women suggested additional people to recruit (Gray 2004). In this case, all of the women added were either sisters or daughters of the women who participated in the previous group interviews. All of the new participants lived at a distance from Townsville, which made it too difficult for them to engage in the group activities conducted in the first part of the project. The participants were members of three of the five families that make up the Gugu Badhun. We chose to use only female participants in order to avoid any culturally based gender issues concerning secret/sacred knowledge (Mead 1986; Bernard 2005) and the lack of documented Aboriginal women's voices regarding the use of ICT. The time frames for the group meetings are listed in Table 1 below.

For the first cycle of the project, we held focus group meetings in Townsville (with five to seven women attending each one, the numbers varied each time), and then repeated the meetings in Greenvale where one of the women lived. The methods used were a combination of questioning and hands-on activities to elicit information regarding the participant's needs and goals for the project. The second cycle of the project consisted of use of a technology probe, constructed by Madden based on input from the group. The probe was deployed in the community for a year. One of the participants' first moves towards claiming ownership of the ICT was to provide the name for the site: ‘Gugu Badhun Women on the Move’. This name was used by the research team for the remainder of the project. At the end of a year, we held a focus group with as many of the members of the project as we could (by teleconference), and interviewed them regarding their feelings about the probe. An in-person interview was also held with the Greenvale participant.

In discussing this project, we were often asked ‘so, why not just use *Facebook*?’. Although there are similarities between the functionality provided by the probe site described in this study, and that available on social networking sites like *Facebook*, there are significant reasons why such pre-existing software was not adequate for the information-sharing needs of the group. Status updates as implemented on social networking sites are designed to be short bursts of information regarding activities of the poster. The brevity of this metaphor makes it problematic for sharing complex historical or cultural information where a wealth of detail is to be preferred. As a person gives permission for greater numbers of people to view their updates via accepting them as a ‘friend’, the hazard increases for sharing data that may be inappropriate for everyone to see. A further concern was the potential for private, personal details about their family and children to be available over the Internet. Finally, a significant request of the participants was to have their own space apart from others to store and share aspects of their valued cultural data and history. Taken in combination, these issues made *Facebook* or other public social networking sites too open and insecure for this project.

Table 1. Locations and dates of study activities

Cycle	Activity	Location	Date
1. Focus groups	Interview 1	Greenvale	16 Dec 2007
	Interview 2	Townsville	18 Dec 2007
	Workshop 1	Townsville	26 Mar 2008
	Workshop 1	Greenvale	9 Apr 2008
	Workshop 2	Townsville	24 Oct 2008
	Workshop 3	Townsville	2 Dec 2008
2. Technology Probe	Probe demo 1	Townsville	15 May 2009
	Probe demo	Greenvale	21 Jun 2009

	Probe demo 2 Began use of site	Townsville Teleconference	18 Jul 2009 19 Jul 2009
3. Feedback	Conference call Interview	Townsville Greenvale	15 May 2010 21 Jun 2010

4. Implementation of the study

In the following section, we detail the steps that we (the authors) and the women of the Gugu Badhun took jointly to codesign a website for the sharing of cultural heritage and family history. Although we make a distinction between the activities that we led and the activities that the women participated in, we do so not to elevate ourselves above others as the ‘research experts’, but to acknowledge our individual roles in the project. As researchers, we attempted to decolonise our methodology (Smith 1999), as far as we were able to, and facilitate the ownership of the project by the Gugu Badhun women.

4.1. Cycle 1: focus groups

During the first cycle of the research project, we attempted to understand how the women felt about the role of technology in their lives and how it could be used to support their family interactions and sharing of cultural heritage. In the first meeting they shared information about what place ICTs had in their work and home life and their comfort with it. In the following focus group, we categorised the items mentioned previously into themes and discussed how important each was to them. During another focus group, we alternated direct questioning with cultural probe-like activities that asked the group to draw on poster paper in small groups and detail their favourite place to meet friends and family, their favourite animal, their favourite foods, ways to communicate and to note down what things are important to them. The groups then reported back on their responses, giving reasons from their personal lives as to why they gave the answers that they did (see Figure 1). In the third focus group, we discussed ideas that the group felt would be useful for a site. We also evaluated some sketches of a possible design and discussed how the site should operate, including who should have access to it.

We engaged in six sessions with the women and audio-recorded each one, and took handwritten field notes as well. After each meeting, Madden transcribed the recordings and performed open coding on the documents, looking for patterns in order to develop categories based on this information. The analysis focused on aspects of well-being, needs regarding ICT usage, family connections and the goals to be achieved in this project. These categories



Figure 1. Activity from a focus group; diagramming activities that are important to Aboriginal women (Greenvale, North Queensland)

were then used to develop activities for the next meeting to further refine our understandings as a group. In each meeting, Madden, as the only non-Aboriginal member of the research team, reality-checked her assumptions regarding these analyses by prefacing her questions with words such as ‘it seems like’ or ‘please tell me again about x’. A summary of this analysis from Cycle 1 is presented in Table 2.

Table 2. Important concepts from Cycle #1

Category	Important features
Aspects of wellbeing	Difficulties associated with distance – not being located in same town Safety concerns about usage of ICTs – online interactions, social networking Access to traditional country and the importance of this activity to spirituality
Needs regarding ICTs	Understanding context for use of ICTs in this group Record stories and knowledge held by older people to pass on Transfer of information regarding important group events
Family connections	Keeping in contact with one another Supervision of younger members by Elders to provide guidance Sustainability of the group as a whole (cultural background)
Project goals	Use technology to stay in contact with each other Recording of cultural heritage Convey their history to their descendants

4.2. Cycle 2

Using the feedback from the group regarding the sketches and the types of functionality that they were interested in, the first author designed a technology probe that would allow the

participants to share stories and send messages to each other. The technology probe took the form of a simple website, accessed via a web browser.

During one of the earlier focus groups, we discussed the idea of having a picture of each person next to her content. However, on the whole the women were not enthused with this idea, and as a group we decided to have each person pick an animal that they felt symbolised their character or had some meaning to them. Many of the women chose an animal avatar that was their particular totem.

The first version of the application was demonstrated to a few of the women on three different occasions, looking for any usability issues. The goal was to make a probe that would be so easy to use that the participants would require little to no instruction in using it. Each of the interactions with the probe was logged and later analysed. The probe provided four types of interaction possibilities for the participants: (1) create or respond to a MESSAGE, (2) create or comment on a STORY, (3) upload or comment on an IMAGE and (4) create or comment on a MY MOB posting. Mob is a word used by Aboriginal people to mean a group of people, in this case a person's family. Each of these content types is depicted in Figures 2-6 using images from the probe.

4.3. Cycle 3

At the end of a year, we invited the women who had participated in this project to a concluding focus group via telephone, and asked them about their feelings regarding using the probe. An in-person interview was also held with Yvonne and Ailsa in Greenvale. At this point, the probe had been used by the research group for a year. The major areas of feedback received in Cycle 3 are listed in Table 3.

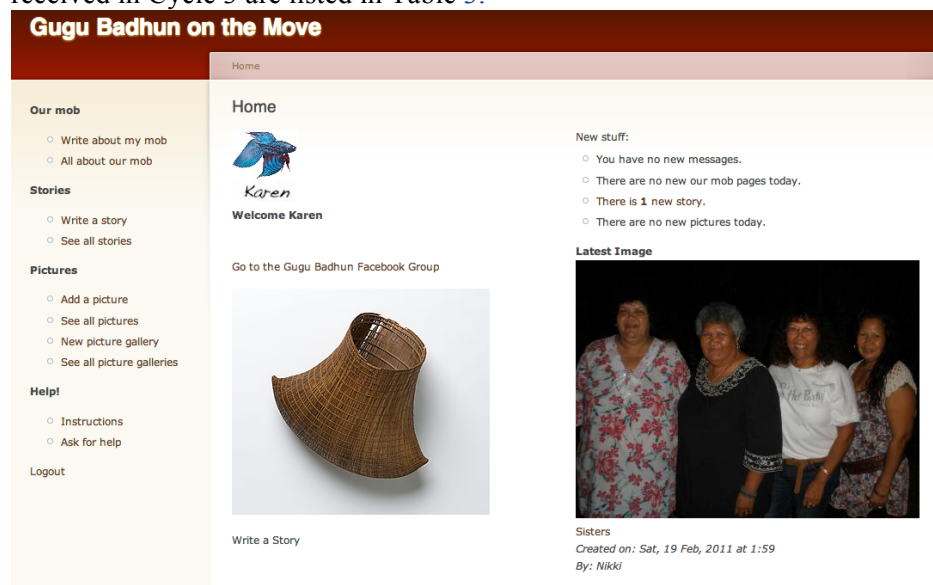


Figure 2 Home page of the probe site.

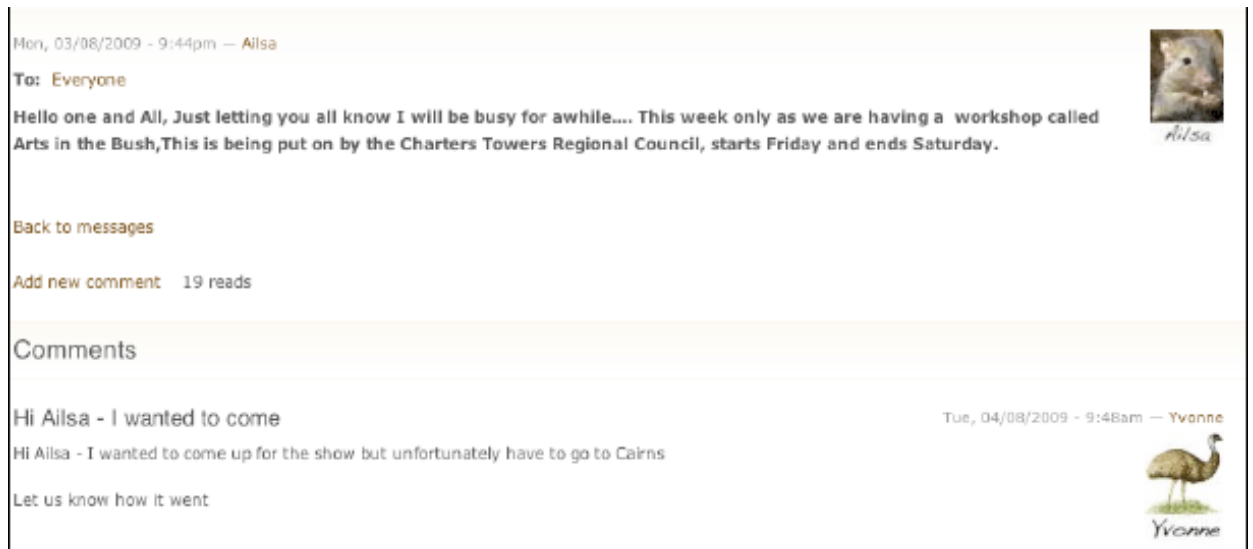


Figure 3 Message on the probe site.

Table 3. Important concepts from Cycle #3

Category	Important features
Using the probe site	Very easy to use Useful for keeping in contact Building up and correcting stories Site as teaching and learning tool A new opportunity they have not had before
Effects on well-being	Healing through storytelling Closure, revisiting and reframing happenings Developing ICT knowledge, ability and confidence
Next steps	Bring in more people (the wider group of Gugu Badhun) Use site for everyday connections Collecting and archiving records Would like to categorize by topic not just content type

5. Analysis of the probe entries

After completing the analysis of focus groups, Madden analysed the data from the technology probe by reviewing the usage statistics and the content of the postings. Two of the original research members moved away from Townsville and became unavailable for further participation. When the probe was made available, five additional women were added to the team. Table 4 below represents the amount of content posted to the probe. Content items are shown to be either original postings, i.e. the participant initiated a discussion, or a reply to a content item. Although there were more individual images posted than stories, responses to stories produced over 40% of the 715 pieces of content added to the probe.

Next, the content of the data was analysed using thematic coding. This technique helped in ascertaining an overall idea of what items were important to the participants. The analysis showed that early use of the MESSAGE functionality was related to testing the probe, while the women were getting used to the interface. However, the women quickly shifted to using the facility to communicate news. Although three people used the message feature to write stories, this soon shifted to the use of the STORY area, so that all stories would be kept together. Use of the MESSAGE feature dwindled after a month and the STORY and IMAGE sections were prioritised by the participants. User feedback suggested

that the MESSAGE functionality did not offer any significant benefits over that of traditional email.

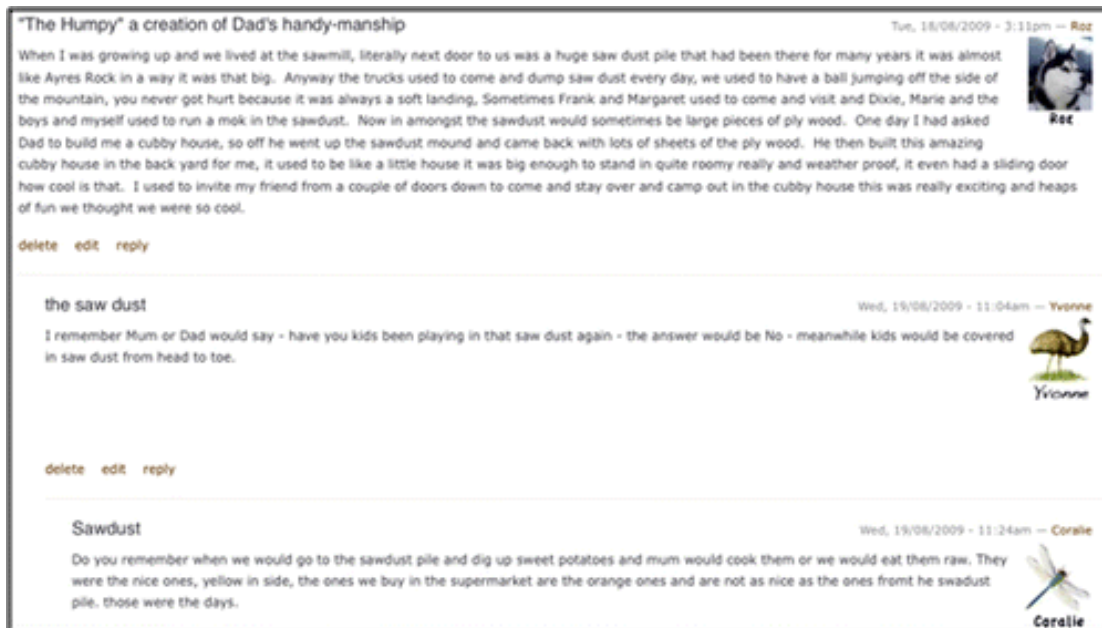


Figure 4 Story on the probe site with comments by the group members.

The STORY and IMAGE areas were often used in relation to each other. In one story, a woman described a pedal car that had made the rounds through the family, being handed down from child to child and then to various cousins. An image of this car was then uploaded by another group member (see Figure 7). By comparison with the other content types, the MY MOB area was used relatively infrequently (three original postings and seven replies). However, an anthropologist working with the Gugu Badhun on their Native Title claim produced a very detailed genealogy of their family while the probe was still in use, perhaps making this feature seem unnecessary to the group.

Cycles 1 and 2 each took a year to complete. While it is not unheard of for ethnographic activities to require a significant amount of time, this is less usual with technology probes that are usually deployed at the start of a codesign project. In this study, there were significant data gathering and design activities that occurred *before* the probe was used by the group in order to ensure that all of the women had an active voice in the design. During the first cycle of the project, it was oftentimes difficult for the participants to arrange a two-hour block of time due to the pressures of work, childcare and family responsibilities. In Cycle 2, the technology probe came to be used as a keeping place for family stories and images. Due to the longevity of commitment to the study and the value of the data being recorded, in Cycle 3 the Gugu Badhun women requested that the probe site be kept available as long as possible, until arrangements could be made to move this information to a secure location. While this is a departure from the traditional probe method, we feel that it was in keeping with the tenets of PAR.

At the station




Image Gallery: [Old photos](#)
 To see more pictures: [Back to images](#)

[Add new comment](#) [Original](#) [Thumbnail](#) [Medium](#)

Comments

Just a query. Fri, 07/08/2009 - 10:23am — Val

Who are the two people in the picture??



Figure 5 Image and comments on the probe site.

While many of the stories related on the probe regarded family togetherness and solidarity, others focused on overcoming racism and injustice in the past. One particular story embodies this case in point. A younger member of the group posted a description of a story she had heard from her grandmother, and requested some additional details. She starts off the story with ‘Beware this is a sad story! ... can anyone fill in the gaps/names please and I’m curious if Nan ever told anyone else this story’. She then proceeds to tell a story of abuse where her grandmother and great-grandmother had worked as live-in household domestic servants. The daughter of the house was cruel and forced the participant's great-grandmother to beat her young daughter with a stick over a misperception. When the lady of the house returned home and sorted the situation out, the only penalty incurred by the abusive girl was a quickly mouthed, insincere apology.

The participant originally had requested additional details about the story, but this led to a discussion of power differences and racism experienced by her family over the years. The participants discussed the changes in economic situations between then and now, how the older people had to strive hard for basic necessities, a situation that is very different from

what the members of this group now experience. This led to a discussion about how their parents experienced hardship, but always had aspirations to improve their lives:

But you know what, Mum never showed any poor bugger me ('woe is me'), she just got on with life, Mum and Dad taught us kids that we were just as good as anybody else and to be proud of ourselves. (Participant C)

But what I am thankful for is that for me she facilitated an environment where I had the confidence, capacity and knowledge to take advantage of opportunities in my life allowing me to achieve what I have in life. I hope that I have been able to pass this onto the next generations in my family. (Participant Y)

The extended discussion reveals key aspects of what the participants hoped to achieve via the design. First, the possibility of reviewing older family stories to fill in the details for the younger members. Second, conveying the changes in economic situations and power that their group has experienced. Third, emphasising individual and family responsibilities; and fourth, sharing emotions regarding their culture and history.

Table 4. Postings and comments on the probe site

Posting type	Original posts	Replies to posts
Image	132	84
Story	90	299
Message	48	52
My Mob	7	4

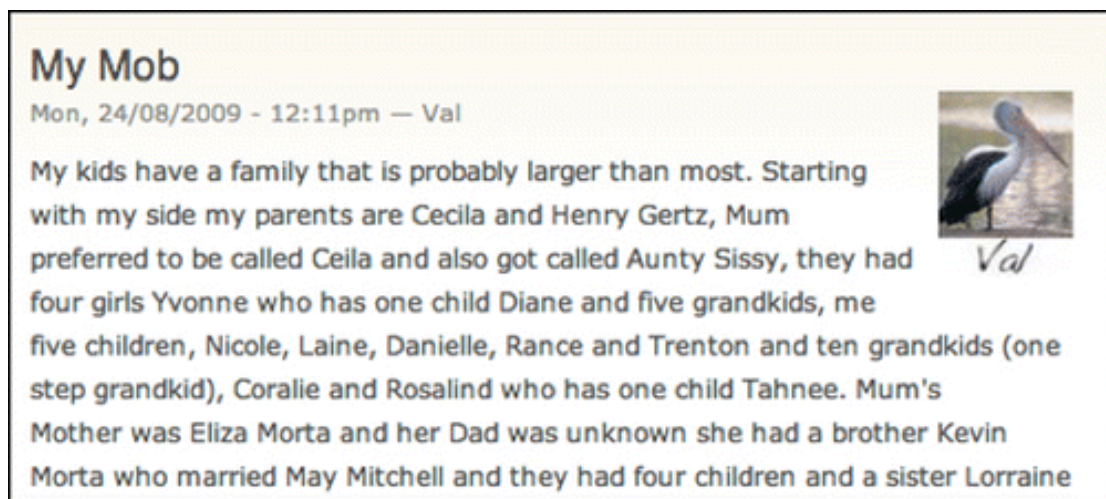


Figure 6 My Mob posting with family details

The Little Red Car
 Thu, 06/08/2009 - 11:19am — Yvonne

I remember when we were little we had a little red pedal car which was passed down through the kids in the family. After we were too big it went to Margaret and Frank and got passed down through the kids. It under went a few modifications, maintenance and paint jobs over the years. It was good to know that it gave a lot of Gertz kids a great deal of enjoyment over the years.

 Yvonne

[Back to stories](#)

[Add new comment](#)

Comments

I remember seeing that little Fri, 07/08/2009 - 5:26pm — Ailsa

I remember seeing that little carI think I had my first driving lessons in it.  Ailsa

Figure 7 The Red Car story on the probe

6. Reflections

Over the past decade, we have seen probe methods applied in a great variety of styles, and because of that, it is necessary that authors describe what they did rather than use a by now vague and generic term such as ‘probe’. In general, probes are used as a way to gain an understanding of the participant's world and to subvert the traditional relationship between researcher and subject in order to inspire design (Boehner et al. 2007). The step where this inspiration occurs and how that applies to the final product is often not made explicit. Indeed, Gaver et al. acknowledge that ‘the responses they elicit [probe results] are not necessarily accurate or comprehensive, and that they seldom give clear guidance to the design process’ (2004, 56).

For our research, we developed a probe to be used as a mechanism to learn more about the Gugu Badhun and their experiences, as well as a way to collaboratively design a technology tool that they could use. The original purpose of the probe was not to act as a prototype, a precursor of a service to be implemented, but to help inspire further design ideas with the group and to provide a mechanism for observing the women's use of an ICT. The design of the probe reflected a subset of the functionality requested during the earlier focus groups and was engineered to be as simple to use as possible so that little training would be required. This is not entirely in keeping with the original ethos of the probe as a tool for inspiring *later* design, as the participants themselves mandated which items to keep, eliminate or improve.

The choice to use PAR as a conceptual framework for our study had a profound impact on the results of the project. PAR's primary goal is an emancipatory one, to improve the lives of each person in the research group. As stated earlier, the use of PAR moves the control of the project into the hands of the participants rather than in the hands of designers. Research with Indigenous participants has a chequered history, with many of the studies being of dubious value to individuals (Smith 1999). The need to provide concrete, observable benefit to the Aboriginal women made the uncertainty of the classic probe method problematic for this group. Although the women were patient with the extended time period of the study, they wanted something to claim for their own that would be of immediate use. This understanding required us to create something that had more in common with a prototype than a standard cultural or technology probe.

Brainstorming ideas for the system (in the first cycle) allowed people to jump in with early ideas that they had regarding the project. Also, the talk around things that they described

as important to them allowed us all to understand how the women envision themselves in the world. These steps were necessary in order to be able to begin to develop an image of what functionality would be needed in a potential system. From these activities, we obtained a wealth of data regarding the day-to-day activities of the group and accessed more information regarding important issues in the group. Another important output of these activities was to give the women an opportunity to air their feelings and wishes in a comfortable fashion.

In reflecting back on this project as researchers, we have discovered that although the probe website was intended as a probe, it was used more in keeping with a prototype, that it became an end-product rather than an inspiration for design. Along with our participant group, we developed a space for the Gugu Badhun to share stories, to reminisce and to maintain connections to one another in a society where these actions are increasingly more difficult, whether the person is of Indigenous background or not. Many of the postings on the website describe situations that still stir the group members to an emotional response. Frequently, the participants replied to stories or images on the site saying that they were 'sitting there in tears' in regards to content on the probe. Other times the content was funny enough to make them 'burst out laughing', which was embarrassing to them when reading the postings in public or at work.

Privacy, via a secure login to the probe system provided a sense of safety for the female participants. Although many places on the Internet require the women to watch what information they reveal, the Gugu Badhun women reported that they were able to relax and enjoy the freedom of a site that belonged to them. The concept of cultural safety is pertinent here. Cultural safety goes beyond the concept of cultural sensitivity where people are trained to accept differences, to the idea that professionals should act in ways that enhance rather than diminish individual and communal cultural identities and empower and promote individual and community well-being, addressing issues such as power imbalances and institutional discrimination.

7. Conclusion

Increasingly, we see technology probes used not in an inspirational sense, but as a way of generating functionality requirements to determine the one best way forward. Indeed, we see this as one of the ways that technology probes veer away from the standard cultural probe design. Rather than focusing on probe returns as a solitary method of understanding the user's environment, we think that projects that use multiple types of data-gathering techniques such as Vetere et al.'s (2009) approach that combined participant observation, cultural probes, technology probes and feedback interviews allow us as researchers to develop a more nuanced understanding of what designs would be desired. Qualitative research methods such as these allow the designer to access knowledge and beliefs held by the participants, but do not provide a direct solution to the issue about how to spark innovation.

Our recent experience in using a technology probe in a PAR qualitative research study as well as readings of other projects using similar methods have led us to four core understandings regarding the possible reasons for the evolution of the technology probe method as it is often employed. First, the rise in the use of participative methods in codesign over the last few decades means that our participants have a sense of agency in the creation and ownership of design apparatus such as technology probes. In methods such as PAR, the participants themselves are part of the design process and decide what paths future design will take. Second, following on from this, the artefacts created for technology probes often provide enough functionality to be immediately usable, especially if previous design cycles have included sufficient ethnographic or qualitative research to make this possible. Third, the process of implementing a technology probe with a group of users is sufficiently similar to iterative design that developers treat the probe as a prototype, often embedding in the initial system many of the functionality items that would eventuate in the final product. We feel that this occurred in our project and we also see evidence of this in the Taylor and Cheverst's

(2009) study, for example. Finally, the brief funding cycles for academic research as well as short development time frames in the commercial environment mean that the iterations of the process involved with technology probes, i.e. the design of an inspirational product based on the probe, can be limited. In the case of our study with the Gugu Badhun, although they definitely wanted to retain the data and interface created during the study, they also suggested improvements that they would like to see in a future version of the software. As of yet, these iterative changes have not been carried out due to a lack of funding.

In this paper, we have described a study that used a combination of PD methods with PAR. The combination of these methods led to an interesting juxtaposition of activities in the traditional flow of co-creating from pre-design to generative, to evaluative, and finally, to post-design phases. We base the following discussion of outcomes from the project on Sanders and Stappers' diagram in the lead paper (see Figure 8 below). In the initial stage of the PAR study, we used ethnographic and cultural probes-inspired activities to gather information regarding our participants' experiences, culture and environment. Through many conversations and interactions, we co-designed a web interface for the women to use. We label this as Cycle #1 on the diagram, placing it in the temporal location of before-design, designing with participants. As can be seen in the diagram, most probe activities lean towards the designing for mindset, but the use of PAR places us in the designing with paradigm. In the second stage of the study, the technology probe was made available to the women and their use of it was logged. We place this activity in the generative section of the diagram, as Cycle #2. The third phase involved further interaction between the participants and researchers to evaluate the understandings we developed as a group via the previous activities and we designate this as Cycle #3 on the diagram. In this final phase, we were able to not only combine our evaluation of the study, but also provide the women an 'opportunity to tell a story about what they have made' (Sleeswijk Visser et al. 2005), and also to hear what effect it had on their lives. We had assumed that it was of value to the women because of their insistence on retaining the data and interface after the project. However, we were very gratified to hear that the women had obtained a positive benefit from the action of storytelling on the probe (more details available in Madden et al. 2012). This is much in line with the ethos of PAR, which prioritises improvement of the lives of participants over research for research sake.

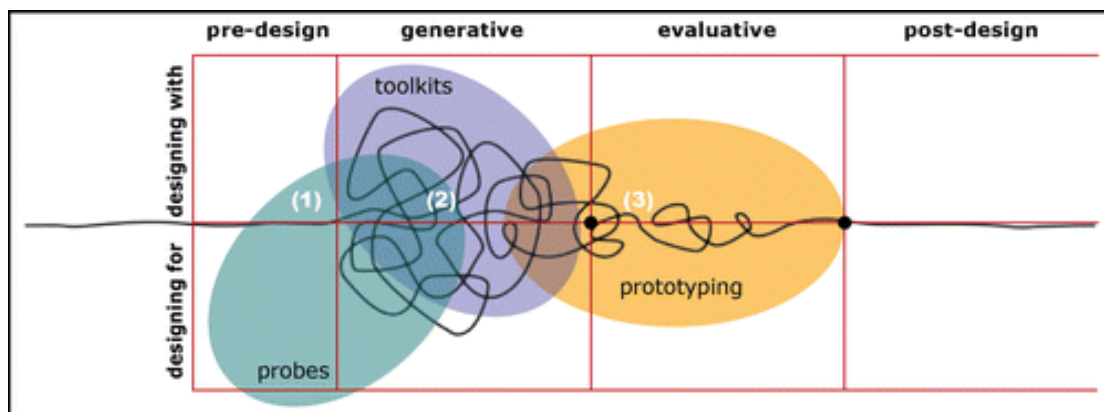


Figure 8 Placement of our research cycles in the design research framework

We find three main learnings regarding combining aspects of PD with PAR and technology probes in this study. First, mixed methods approaches to design offer the opportunity for in-depth, contextualised understandings of participants' motivations, desires and environment that can inform further ideation. However, these methods should not be applied in a piecemeal fashion, without an evaluation of what each activity brings to the study. Each time a new variation to a method is added, this has the potential of veering the outcome in a new direction. This variation is not negative in itself, but makes generalisation across supposedly

similar methods more difficult. Second, the use of a PAR methodology with designer-led activities such as probes requires a continuing evaluation of the direction of the project. This evaluation has the potential to add to the time needed to complete the study, which may be problematic when funding is limited. Finally, due to the overlap between many of the codesign methods, the actual differences between these methods are not obvious to a novice researcher, potentially leading to cherry-picking between methods or to confusion in how they should be applied. A thorough grounding in the literature describing these methods is necessary before implementing such a project. However, while qualitative research methods such as these allow the designer to access knowledge and beliefs held by the participants, they do not provide a direct articulation of how inspiration that leads to final products is sparked from these activities. Perhaps this is an area where future reporting can focus.

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