



The Design Journal

An International Journal for All Aspects of Design

ISSN: 1460-6925 (Print) 1756-3062 (Online) Journal homepage: www.tandfonline.com/journals/rfdj20

Design probes and toolkits for healthcare: Identifying information needs in African communities through service design

Ralitsa D. Debrah, Retha de la Harpe & Mugendi K. M'Rithaa

To cite this article: Ralitsa D. Debrah, Retha de la Harpe & Mugendi K. M'Rithaa (2017) Design probes and toolkits for healthcare: Identifying information needs in African communities through service design, *The Design Journal*, 20:sup1, S2120-S2134, DOI: [10.1080/14606925.2017.1352730](https://doi.org/10.1080/14606925.2017.1352730)

To link to this article: <https://doi.org/10.1080/14606925.2017.1352730>



© 2017 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group



Published online: 06 Sep 2017.



[Submit your article to this journal](#)



Article views: 1602



[View related articles](#)



[View Crossmark data](#)



Citing articles: 3 [View citing articles](#)

Design probes and toolkits for healthcare: Identifying information needs in African communities through service design

Ralitsa D. Debrah^{a*}, Retha de la Harpe^a, Mugendi K. M'Rithaa^a

^aCape Peninsula University of Technology (CPUT), Cape Town, South Africa

*Corresponding author e-mail: ralitsadebrah@gmail.com

Abstract: Design practice as a problem solving strategy explores ways of addressing challenges in organisations, communities, healthcare and many more. The process is usually human-centered, but in certain contexts, it is devoid of user inputs. The process starts with exploring a context and identifying the problem. We propose a service design approach that uses visual strategies of probing to empathise, among others, with users to find ideas that could be used to solve problems. In this study, the authors explore a co-design process developed to gain insights into healthcare, and access information needs of mothers in South Africa and Ghana. During these design processes, probes and toolkits were used to emphatically respond to the contexts and needs of participants. Through this process, health information needs and sources of participants were identified. The authors infer that probes are viable research tools to gain better understanding, when designing *with* users in African communities.

Keywords: Co-design, Design Probes, Empathy, Maternal Healthcare Information, Service Design

1. Introduction

Design Probes (DP) are a way of facilitating communication and gaining insights into what users might perceive to be relevant in their lives, to inform designers on what steps to take at the front-end of the design process. Through probes, users' belief systems and attitudes are usually shared with designers or researchers, which makes it easier to know what users may otherwise not be able to share easily in a design environment. This study describes how the probes were developed as a tool for enquiry to identify Health Information Needs (HIN) of women living in two African communities. The essential aim was to identify what their HIN are, to serve as a foundation for designers, such as software developers, information designers and the like, to provide innovative ideas to make health information easily accessible to women in African communities.

In this design intervention, the authors developed visual thinking tools as the starting point for probing. These toolkits were pre-tested in two different geographical locations, South Africa and Ghana. Although the designing of the probes formed the basis of the research, the critical aim was to encourage design empathy and a collaborative research approach, and not to use the women as test subjects. "Design empathy means that people are seen and understood from where they stand, not as test subjects but as persons with feelings" (Mattelmäki & Battarbee, 2002, p.266). Therefore this study explores the context of probes and toolkits, the developmental process of producing the probes and the approach to using them *in situ*. Additionally, the results obtained from the co-design engagements with participants are described.

2. Background and purpose

Information is relevant in every given communication process. In a typical communication process there are always a *sender* and a *receiver* of the information. When sending messages to persons, the information which is delivered can make an impact on the receiver positively, or negatively, depending on the context of the message. However, information in itself is described as the outcome of human interaction that carries a specific meaning to targeted persons within a particular community (Andrade & Urquhart, 2010, p.4). Hence, information seeking is said to be a social construct. Context and content influence how receivers will *make sense* of the information that is being shared (Andrade & Urquhart, 2010, p.5).

Further to this, information seeking is defined as the process of obtaining information through human and also technological contexts. The human and technological context entails purposive acquisition of information by persons to satisfy a need. During the process of seeking information, persons might interact with physical information sources such as the library, or technological sources such as the internet to achieve their goals (Wilson, 2000, p.49). More often, the information is provided by one end of the communication channel without putting the perspectives of the end-users on the other side of the channel in focus. Hence, the context of the information seekers usually affects how the information is accessed and applied (Andrade & Urquhart, 2010, p.5-6).

Traditionally, information was mainly obtained from physical books and libraries (Wilson, 2000, p.49). Nowadays information is not only looked for in those sources but also from electronic sources such as the internet. These are searched for using Information and Communications Tools (ICTs) such as mobile phones, TVs, computers and the like to seek information, which is quite common among young people these days (Kukka et al., 2013, p.17). Therefore placing information in either Electronic media (E-media) or Print media (P-media) requires the understanding of information seekers and how they access information within their geographical locations.

Additionally, individual HIN may vary from one location to the other. For instance, when providing health information as part of a health education activity, particularly in rural settings, the HIN must be contextualised. Yet this is usually not the case. More often than not the information is based on the provider's point of view, which may not always be contextualised in the worldview and perspectives of the target audience (Andrade & Urquhart, 2010, p.3-5). With this background, the authors explored the identification of HIN of mothers in two African communities, using design methods. Design strategies enabled researchers to immerse themselves into the worldview and gain insights into the context of the participants within their localities. Thus, the questions underlining this paper are:

- How can design-led strategies be used to identify information needs of mothers in the African context?
- What are the information needs of mothers in the African communities?

- How is this information presently provided?

As indicated by Wilson (2009, p.49), designers of information are usually concerned about how actors are utilising information or a system, instead of determining what might be the IN of the users. Thus, in this case study, some of the research questions used by Wilson (2009, p.49) were selected and modified to enquire about HIN of women in Africa through design methods. Design probes and toolkits were created and used as an alternative way of determining the HIN of mothers using design strategies such as Human-Centred Design (HCD).

2.1 Designerly strategies and future experiences

Design as a discipline has evolved over the past six decades to meet the needs of the 21st century populace. The discourse on design since the 1970s to the present has been focused on the need to include the user in the design process and during the implementation of solutions to problems that may be inherent in their societies. Therefore, design education and processes have equally evolved focusing on designerly ways of making products and services encouraging more interaction with users during the design process. Designerly methods create the possibility for groups to work together productively to achieve usable outcomes which serve the needs of the people (Kimbell & Julier, 2012, p.5). This can be seen across many design disciplines such as communication, product, fashion, and industrial design, among others. Designers do not only design products; they also design future experiences of users who are informed and connected in ways that were not conceivable in the last decade (Sanders & Stappers, 2008, p.5-10).

Furthermore, one of the strategies that designers adopt to design these future experiences is the Human Centered-Design (HCD) strategy. The beginning of the HCD process focuses on empathising and understanding the needs and aspirations that surround the everyday life of people. The HCD process oscillates between intangible or abstract thinking and tangible ideas (+ACUMEN, n.d., p.5-7) to find solutions to problems. However, through design methods such as HCD, the capabilities of persons involved in design engagements can be harnessed, to find solutions to problems. Cipolla (2009, p.4) explains that interpersonal relationships in design activities cannot be controlled; they can just be “enabled”. This could be achieved by using probes and toolkits to empathise with users in co-operative design environments.

Additionally, design strategies such as service design also focus on designing *with* users to better understand their desires to inform the designing of solutions. In service design methods, designers act as facilitators in design settings to gain insights and have a shared understanding of human desires and experiences that may be needed to improve a product or a service. This usually occurs in a participatory and co-operative design process where designers empathise with users, to provide services that are *useful, usable and desirable* from the perspective of the client. From the service provider’s point of view, the service must be *effective, efficient and distinctive* (Mager, 2006, p.6; Mager & Sung, 2011, p.1). In designerly ways of thinking, designers mainly use cultural probes and visual thinking toolkits (see Figure 1), which aid participants to communicate their ideas with the designer- researcher during design engagements (Mattelmäki, 2006, p.156). These cultural probes might be cameras, diaries, post cards, toys and relevant images that could trigger ideas in the design setting. They can also be made electronically, exploring the use of the digital environment to gain insights into the desires of users.

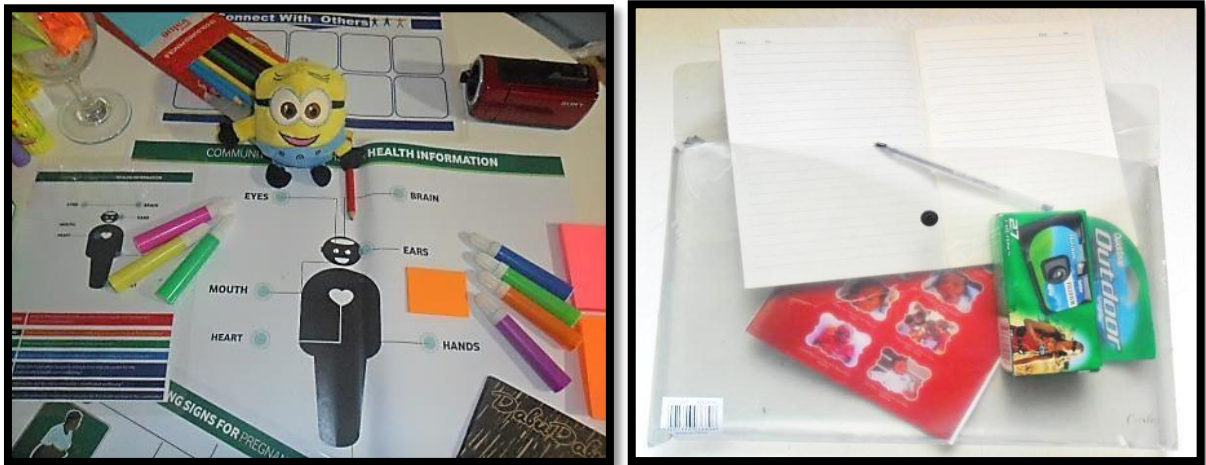


Figure 1: Sample of probes

2.2 Design probes and empathy

Probes, simply defined, are visual ways of thinking which allow designers to create empathy with users. Thus, “design probes are an approach of user-centred design for understanding human phenomena and exploring design opportunities” (Mattelmäki, 2006, p.156). As a viable research method, users can capture and record their experiences in their everyday life either through verbal or visual means, making it possible to create a dialogue between users and designers. This way, users’ attitudes and beliefs towards a product or a service are recognised.

Probes have enormous benefits in HCD activities in the sense that they minimise the presence of the “designer” and “researcher” when exploring ways to address solutions to emerging problems (Mattelmäki, 2006, p.153). However, using probes does not necessarily provide all the solutions to problems being investigated. Instead, probes, when used as tools for enquiry, could bring results which are useful as well as surprising, or even fail to achieve the objectives for which they are made (Hutchinson, et al., 2003, p.81). These are some of the pertinent risks that are associated with using probes.

However, the use of these tools in design engagements is perceived as an exploratory exercise to gain insights during the pre-design phase in the design process. Probes are usually explored during the pre-design phase (Figure 2) which is described as the *fuzzy front-end* where probes and toolkits are tested (Sanders & Stappers, 2014, p.9-11). The knowledge gained during this phase serves as the foundation for prototyping ideas obtained in a more concrete manner, through the design phases as shown in Figure 2.

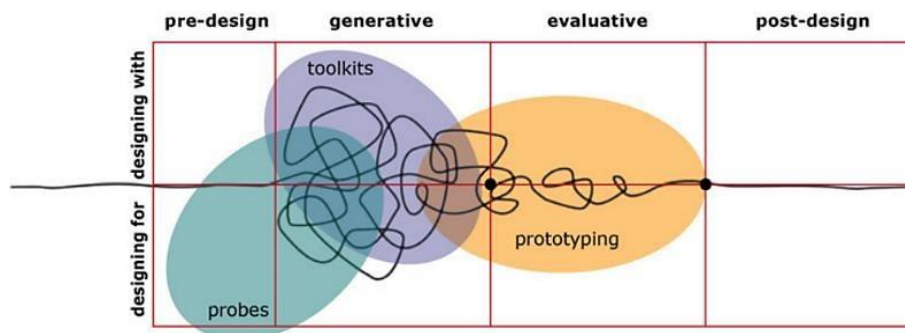


Figure 2: The revised framework: three approaches to making are positioned relative to three mind-sets and phases in the design process (Sanders & Stappers, 2014, p.11).

The framework above (Figure 2) specifies two creative mind-sets, which are designing for – “user as subject”, and designing with – “user as partner”, often applied during the design process. The pre-design phase focuses on a larger context of experience whereas post- design examines how users actually experience designed solutions. The generative phase gives an indication to the design opportunity which is indicated by the first black dot. The evaluative phase occurs in succeeding design development processes, where the second black dot is situated representing the point where outcomes are put to use. The design process is iterative, thus the process can be repeated starting from post- to pre- design research processes until the desired results are obtained (Sanders & Stappers, 2014, p.10-11).

3. Materials and Methods

Designing probes and toolkits requires gaining an understanding of the study case and participants. This serves as the foundation to empathise with participants (Mattelmäki & Battarbee, 2002, p.627). Thus, design methods such as HCD were adopted to become familiarised with the communities in this study context. Through immersing and observing happenings in the communities, initial insights were gained about participants. Information was obtained about women through informal conversations with home-based carers (caregivers) resident within the community. This served as the starting point for exploring the designing of the probes that could be used to determine the HIN of mothers in the two selected African communities. As health information contains sensitive topics, these initial engagements made researchers cognisant about the feelings and language of participants, which informed the design of the probes (Mattelmäki & Battarbee, 2002, p.627) for the contextual enquiry. The creation of these probes and toolkits for the design sessions were modelled after Brandt, Binder and Sanders’ (2012, as cited by Sanders & Stappers, 2014, p.7) model as shown in Figure 3. They explained that novice researchers can make their own tools and enact the situation in which these tools can be applied and then tell the story of it through an iterative process in co-designing. These concepts shaped the designing and the processes involved in this research.

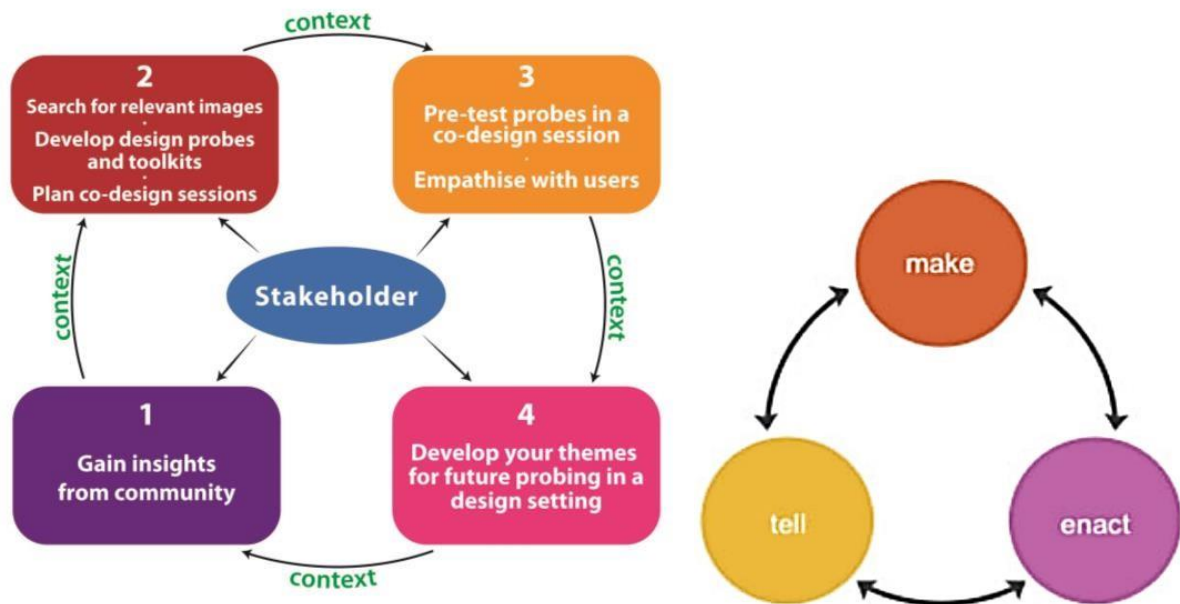


Figure 3 (right): Making, telling and enacting as complementary, connected activities in co-designing (Brandt, Binder & Sanders, 2012, as cited by Sanders & Stappers, 2014, p.7).

Figure 4 (left): Process diagram of making probes and toolkits

3.1 Making probes and toolkits

Three major probes and toolkits were created for the co-design activities. These were based on the prior information obtained from the initial engagements with the South African community. These were the *community character*, *visual enquiry* and *answering toolkits*, designed to identify the HIN of women in the two African communities. The Ghana case was a cross-case study to discover if there was going to be a resonance in the responses obtained from the South African case. Thus, results from this study are not generalisable but context specific owing to the fact that the participants were purposively selected for this case and their geographical locations are different. However, the approaches used in developing the toolkits could be applied to the development of similar probes for enquiry in different disciplines. The processes involved in making these probes and toolkits for the contextual enquiry have been represented in the diagram in Figure 4 above.

3.2 Community character tools

In developing the probes to gain insights into context, inspiration was drawn from the IDEO toolkit. The community character exercise toolkit, which is used to understand the different roles of members within a community, was adapted and modified for the contextual enquiry. This exercise allows participants to warm up prior to the actual co-design sessions (IDEO, 2012, p.166). Using the community character exercise, as shown in Figure 5, the women in Ghana and South Africa identified key persons in their communities and the various roles they play in their health and wellness.



Figure 5: Community character exercise and images of women to aid in probing

3.3 Visual probing tools

Additional probes were developed based on themes identified from earlier studies conducted by other researchers on purposes defined by individual actors when seeking information. Some of these themes adapted include, “Be happy”, “Get ideas” and “Get support” (Dervin, 1989, as cited by Andrade & Urquhart, 2010:6). The themes were then made into a visual questioning tool that can be used to generate discussions and share ideas vividly (see Figure 6). Some of these themes served as a starting point to consider the HIN topics to reflect upon during the enquiry process in a shared design space with the women.



Figure 6: Samples of visual probing toolkits

3.4 Visual answering tools

More themes that could be used by participants to generate ideas were created. These themes were based on the information obtained from caregivers during initial interactions with the Grabouw community in South Africa. Some of the relevant images that were closely related to the themes were obtained through the internet using Google search engines. For instance, the selection of images using keywords such as phones, government, house, cars, community, nurse, teacher, etc., provided interesting results which were downloaded and modified. After this exercise, the images were sorted to ensure that relevant images suitable for the possible answers were used. Although the images that were chosen were not always closely associated with their community context, it was a starting point for participants to share their thoughts. These ideas were then made into small cards that were used as part of the probing process (Figures 6 & 7).



Figure 7: Sample of images to aid in answering questions

3.5 Affordances of the toolkits

The toolkit had basic characteristics giving it an affordance for the participants to use for the enquiry. We discuss the contextual affordances of the toolkits using some basic principles of design on two levels, namely **shape** and **appearance** of the toolkits. Observing the level of shape, we describe the physical sizes of the toolkits and usefulness thereof. In the case of the appearance, we observed some basic elements of design such as balance, emphasis, repetition, proportion, rhythm, variety, which added aesthetic value to the toolkits (Figures 5, 6 & 7).

Shape: the toolkits were designed in two formats; the large ones were made up of the major themes or questions, whereas the smaller ones were conceived for answering purposes. The larger ones were produced mainly in rectangular formats and the smaller ones were designed to fit into the spaces provided on the sheets. These were large enough for participants to input their responses (Figures 5). The smaller formats were equivalent to the size of a passport photo and they were mainly used for feedback purposes (Figures 6). In the larger templates, there were reasonable spaces where participants could input their feedback using the smaller cards. The shape and format of these toolkits made them flexible and easy for the participants to use (see Figures 9 & 10).

Appearance: design elements present in the tools, such as line, color, size, the silhouette nature of images and the use of native languages made it flexible for the participants to use the toolkits. The selected colours (such as pink, yellow, green and other warm colours) made the tools very attractive to the participants; this enhanced their overall co-design experience (see Figures 4, 5&6). Participants expressed their thoughts in relation to the affordances of the tools as follows:-

“I like the drawings and I can see a pregnant woman on the card that relates to some of my experiences during pregnancy. The colours are very beautiful and they look very good to me” (Mother A).

“I like both the drawings and the pictures. Yes, I can see these images represent a doctor, church, hospital and the other images represent a family and community. The images are well designed and they make sense to me” (Mother B).

3.6 Description of research contexts and participants

The study was conducted first in South Africa, and then in Ghana. These two African countries were selected for this study based on an existing Memorandum of Understanding (MoU) for research collaboration between Cape Peninsula University of Technology (CPUT), South Africa and Kwame

Nkrumah University of Science and Technology (KNUST), Ghana. The researcher is affiliated to both universities and therefore familiar with research contexts in the two countries.

The participants were purposively selected and organised into focus groups to generate discussions and inform researchers of their HIN through co-design engagements. The participants were mainly women, and the inclusion criteria for participants were for them to be potential mothers. There were two women participating from South Africa and six from Ghana, making a total of eight participants. They all have two to three children, with two of them expecting new ones. Most of the participants are employed as informal traders. The majority fall within an average age of 35-49 years (Figure 8). Their educational levels were mainly high school or less. All participants speak some degree of English, which is part of the official languages in both countries, and at least one local language. However, participants from South Africa were mainly Afrikaans speaking, while the Ghanaians spoke Twi (Akan) language (Figure 8). As a way of facilitating communication, during design engagements the information for the probing was translated into the most predominant local languages of these participants with assistance from a translator where needed.

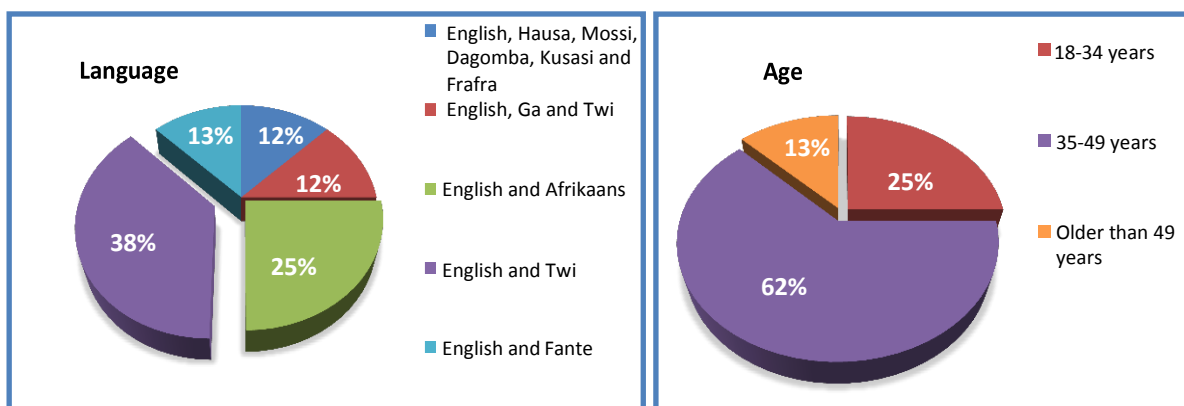


Figure 8: Language and age distribution of participants

3.7 Designing *with* participants

Design sessions were organised in the respective countries with the identified women in focus groups. The participants in South Africa living in the Western Cape province of Grabouw were contacted through Elgin Learning Foundation (ELF), and caregivers who are resident in the community (Van Zyl & Pennanen, 2013, p.4). While in the Ghana case, participants in Kumasi were approached individually by the designer-researcher and invited to attend co-design sessions. The purpose of co-design engagements was to achieve the following:

- Pre-test the probes and toolkits in the two African countries
- Identify the information needs and sources of the participants

3.7.1 Co-design sessions in Grabouw

The South African case was selected because Grabouw is close to CPUT near where the researchers work and study in Cape Town. There is also an existing partnership between CPUT and ELF to conduct research in Grabouw. These factors influenced the selection of this location for the study. Planning of the co-design sessions was done with the assistance of the ELF team (Debrah, et al., 2014, p.96; Van Zyl & Pennanen, 2013, p.4). The setting was organised making sure that the women would be comfortable during co-design sessions. There were tables and chairs available for them to sit comfortably since some of them were pregnant. Ethical considerations were adhered to, ensuring that they knew what the activity was about and that they participated out of their own free will by completing a written consent form prior to the design engagement.

The day's activities began with facilitators introducing themselves to participants present. The objectives of the session were also explained to participants. Since the researcher in this case is not Afrikaans speaking, the communications were explained with the assistance of an Afrikaans speaking research fellow who acted as co-facilitator during the design sessions. Theme by theme, they shared their thoughts using the probes and toolkits (Figure 9) to express their ideas. Extra ideas were provided using sticky notes to express themselves.

Additionally, using the community character toolkit for probing, a shared understanding of the context of the participants was obtained. It was ensured that during the design sessions, clarity was provided with regard to the use of the tools to suit the context of the participants when required. The visual probing process was applied to the other topics in the same cycle, until the answers were exhausted by the women. The sessions then closed with a shared lunch, exchanging of pleasantries and picture taking.

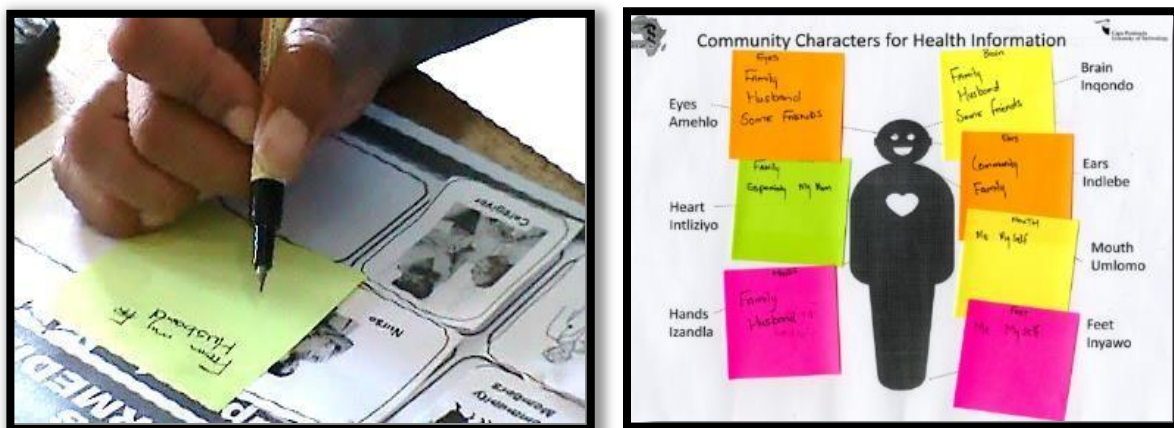


Figure 9: Participants at work: Grabouw

3.7.2 Co-design sessions in Kumasi

The researcher is familiar with Ghana and this influenced the selection of the study context in Kumasi City near KNUST campus. The participants in this case live around the KNUST campus and this made it possible to include them in this research. In this context, the same process that was used in the South African case was also applied in Kumasi, Ghana. Although the outcomes may not be generalizable, the idea was simply to pre-test the probes in another context to find out if the process can be applied in similar settings. The only difference here was that parts of the consent forms were partially made visual to enable participants to understand the conditions in the consent forms easily. Next, similar processes and topics were answered within similar timeframes with these participants. However, slight modifications were made where required. For example, the literacy level was equally catered for by translating the information into the local language of participants to facilitate the enquiry. The process continued as undertaken in the South African case, until the closing of co-design sessions (Figure 10). The day ended with the exchange of pleasantries, a snack break and picture taking.



Figure 10: Participants at work: Kumasi

4. Discussion

During observations in both cases, it was noted that participants found it easy using the images to share their ideas (see Figures 5, 6 & 7). They appreciated using the probes to express their thoughts in both settings. In Ghana, the women were further asked what informed their choices during the selection of the images to answer the questions. They stated that they could relate to most of the images and the presentation formats were suitable. Thus, “the probes were part of a strategy of pursuing experimental design in a responsive way” (Gaver, et al., 1999, para 2). However, this calls for further research on how images for probing should be rendered. In such studies, the socio-cultural context of participants should be considered in designing the probes. This way, the toolkits can be better understood by participants in the design setting.

Also, contextualised probes could potentially minimise the presence of designers and users during design engagements, making it easier for participants to relate with the design tools from their perspective and enable positive outcomes during design engagements. As the use of probes aims at giving users a tool to think with, document and reflect on their thoughts and actions on their environment (Hulkko, Mattelmäki, Virtanen, & Keinonen, 2004, p.44), it is worth considering them in any given designerly activity. Empathy is a very useful resource in design that helps in gaining an understanding of user needs (O’Kane et al., 2014, p.987-988). Hence, the use of relevant probes will create empathy between designers and participants towards improving the communication link between them (Blomkvist & Segelström, 2013, p.6-7) during co-design sessions in an African context.

A summary of the outcomes of the studies in South Africa and Ghana based on the use of the probes and toolkits is provided in Table 1.

Table 1: Summarised results from co-design sessions in South Africa and Ghana

Get Ideas	Support	Be Happy
Persons: parents, friends, husband, community, nurse, doctors, grandmothers, mother and learning from colleagues Materials and places: school, health campaigns, health training-center, church, NGO, antenatal unit, donors, government and posters at hospital, adequate materials and teaching materials provided. Tools: television, radio, magazines, poster, computers, books to read & enquiries at clinics, phone and other communication devices.	Persons: friends, husband, family, boyfriend, mum, caregiver, community members, nurse and teacher. Places: church, health training center, school, government, donors and NGOs.	Personal desires: entertainment, provision of house, food, better neighborhood and comfortable working environment for pregnant women, and provision of cars, increment of salary and a place of “my own for me and my family”. Services: better services at clinics, better law services, better services at municipality. Education: Training kids in the Lord, night school for teenagers (from age 12-14 years), provision of flexible school system for adults and the youth. Health: provision of mosquito nets, healthy food, provision of Vitamin A for children.

The outcomes from the study, as compiled in Table 1, are the answers to questions such as “How do you obtain ideas about health?”, for instance, from whom, where, what, and so on. These were answered by the women using the probes and the coloured sticky notes during the enquiry process in the co-design sessions. The inference that can be made from the results in Table 1 is that women living in these local communities can access some amount of health information. They ‘*get ideas*’ and ‘*support*’ about their health from reliable persons living within their context. Also, the results show that, to “*be happy*”, they would like their personal desires (such as education, healthcare services and other services within their context) to be improved for a happy healthier living. However, the themes in Table 1 can be developed further and converted into more advanced probes and toolkits. The toolkits could be applied in future co-design activities *for the next health*, to determine HIN of women in similar settings.

Furthermore, the focus of this paper was not on solving problems at the stage of designing *with* users, but simply on exploring possibilities that could emerge. Therefore, the processes described in this paper and the outcomes obtained serve as starting point in the early stages of designing as part of an ongoing research (Figure 2). The processes elicited in this paper could be modified further by researchers or designers when they have to gain insights into HI seekers in African communities (such as mothers) and health intermediaries (midwives and caregivers, etc.). Researchers may integrate probes and toolkits as part of the pre-design process when designing *for* or designing *with* users of future health services within an African context.

5. Conclusion

Design probes and toolkits are usually applied at the forefront of the design process that helps in achieving empathy with users and these concepts were explored in this case. The study is aimed not at 'theory building' but 'theory testing', building on existing research on design probes, to be applied and tested into a socially critical context, such as that of women in African communities. Following this direction, this case is only one study of an on-going larger research project and the impact will be evaluated at a later stage. At this point of the study, we observed that providing equitable access to health information presents complexities due to the disparities in the literacy levels of women within the research context. These complexities required exploring ways of empathising with the women towards designing sustainable health information system for equitable access to healthcare in future.

We envision that design interventions could lead to emancipation making these women protagonist in their contexts to promote happy healthier living for themselves and their children in the *next health*. In these contexts, we explored the use of probes to create a situation in which users could share their ideas with designers without difficulties in two African communities. Through this design intervention, we were able to empathise with participants gaining insights into some aspects of their HIN. Despite the difference in their geographical locations, the women in both settings provided similar responses to the probes and toolkits during the co-design sessions.

In conclusion, the probes facilitated the communication process creating empathy with the participants. Therefore, the authors infer that there is a resonance with the results obtained in South Africa and Ghana. Hence, for improved outcomes and better affordances, the socio-cultural dynamics of the subjects should be factored into the design of probes and toolkits in future studies. This way, participants can make sense of the probes and toolkits to facilitate communication in an environment of *designing for the next health*. Further research is suggested to explore other design tools such as cultural probes (eg. diaries, cameras, legos), podcasts and vodcasts in designing *for the next health* information services. Mixing relevant design methods and tools could enable researchers to gain a deeper understanding and holistic perception of women when seeking health information within similar African settings.

References

- +ACUMEN. n.d. An introduction to human-centered design. pp.1-19. Retrieved January 2, 2016, from http://plusacumen.org/wp-content/uploads/2013/07/Week1_readings.pdf.
- Andrade, A.D. & Urquhart, C. (2010). The Role of social connectors in seeking computer- mediated information in rural societies. *Human IT*, 11(1), 1-28.
- Blomkvist, J. & Segelström, F., 2013. External representations in service design: a distributed cognition perspective. In *10th European Academy of Design Conference - Crafting the Future*. Gothenburg, pp. 1-15.
- Cipolla, C. (2009). Relational services: service design fostering sustainability and new welfare models. In *proceedings of the 2nd international symposium on sustainable design (IISD)* (pp.1-6). Sao Paulo, Brazil. doi:ISSN 2176-2384
- Debrah, R.D., Bhebe, S.V., Ruhode, E., M'Rithaa, D.K., Vainikinen, V., (2014). Technology assimilation in community healthcare, in the Western Cape, South Africa. In TBA (Ed.), *Proceedings of the 9th Health Informatics in Africa Conference (HELINA) '14 PART 2 [Preview]* (pp. 95-106). Hamburg: Koegni eHealth, Innovation for Development. doi:978-39816261-2-4
- Gaver, B., Dunne, T. & Pacenti, E., (1999). Design: Cultural probes. ACM Digital library. Retrieved March 05, 2016, from [/bill.gaver.acm.org/DigitalLibrary/interactions.html](http://bill.gaver.acm.org/DigitalLibrary/interactions.html).
- Hulkko, S., Mattelmäki, T., Virtanen, K., Keinonen, T. (2004). Mobile Probes. In *NordiCHI '04*, (pp. 43-51). Tampere, Finland.

- Hutchinson, H., Mackay, W., Westerlund, B., Bederson B.B., Druin, A., Plaisant, C., Beaudouin-lafon, M., Conversy, S., Evans, H., Hansen, H., Roussel, N., Eiderbäck, B., Lindquist, S., Sundblad Y. (2003). Technology probes: inspiring design for and with families. In *Domesticated Design*, (pp.17-24). Ft. Lauderdale, Florida, USA.
- IDEO, (2012). *Human Centered Design Toolkit: Field Guide* (2nd ed.). Retrieved November 20, 2016, from http://www.ideo.com/images/uploads/hcd_toolkit/IDEO_HCD_ToolKit.pdf.
- Kimbell, L. & Julier, J. (2012). *The social design menu: in perpetual beta*. London: Fieldstudio Ltd. Retrieved October 5, 2016, from http://www.lucykimbell.com/stuff/Fieldstudio_SocialDesignMethodsMenu.pdf.
- Kukka, H., Kostakos, V., Ojala, T., Ylipulli, J., Suopajarvi, T., Jurmu, M., Hosio, S. (2013). This is not classified: everyday information seeking and encountering in smart urban spaces. *Personal and Ubiquitous Computing*, 17(1), 15-27. doi:10.1007/s00779-011-0474-1
- Mager, B. (2006). Service Design as an emerging field, (pp.1-11). Köln. Retrieved October 10, 2015, from www.service-design-network.org.
- Mager, B. & Sung, T. J. (2011). Special issue editorial: Designing for services. *International Journal of Design*, 5(2), 1-3. Retrieved August 14, 2015, from www.ijdesign.org.
- Maoulidi, M., (2013). Kumasi Maps-Google Search. Kumasi Map. Retrieved May 5, 2016, from http://mci.ei.columbia.edu/files/2012/12/City-Maps_Page_06.jpg.
- Mattelmäki, T. (2006). *Design probes*. Vaajakoski: University of Art and Design Helsinki. Retrieved January 14, 2016, from www.uiah.fi/publications.
- Mattelmäki, T. & Battarbee, K., (2002). Empathy probes. In B.T.J. Gregory & I. Wagner, (Eds.), *Proceedings of the Participatory Design Conference (PDC 02)* (pp. 266-271). Malmö: Palo Alto. Retrieved February 2, 2016, from <http://rossy.ruc.dk/ojs/index.php/pdc/article/view/265>.
- O’Kane, A.A., Rogers, Y. & Blandford, A., 2014. Gaining Empathy for Non-Routine Mobile Device Use Through Autoethnography. In *Personal Values and Preferences CHI, One of a CHIInd.*. Toronto: ACM Digital Library, pp. 987–990. Retrieved September 12, 2016, from <http://dx.doi.org/10.1145/2556288.2557179>.
- Sanders, E.B. & Stappers, P.J. (2008). Co-creation and the new landscapes of design. *CoDesign: International Journal of CoCreation in Design and the Arts*, 4(1), 5-18. doi:10.1080/15710880701875068
- Sanders, E.B. & Stappers, P.J. (2014). Probes, toolkits and prototypes: three approaches to making in codesigning. *CoDesign: International Journal of CoCreation in Design and the Arts*, 10(March 2015), 5-14. doi:10.1080/15710882.2014.888183
- Van Zyl, I. & Pennanen, T. (2013). Service design as an approach for envisioning e-health solutions: Mapping the context of development in Grabouw, Western Cape. In *Health Information Systems in Africa (HISA)* (pp.1-8).
- Wilson, T.D. (2000). Human information behavior. *Informing Science*, 3(2), 49-55. doi:10.1186/1472-6963-7-190

About the Authors:

Ralitsa D. Debrah is a design educator at Kwame Nkrumah University of Science and Technology and PhD researcher at Cape Peninsula University of Technology, Faculty of Informatics and Design. Her research interests include design, health informatics, sustainability and social innovation.

Retha de la Harpe is Professor of Information Technology and Head, Department of Research, Innovation and Partnerships at the Faculty of Informatics and Design, Cape Peninsula University of Technology. She has co-ordinated numerous international projects in informatics and design.

Mugendi K. M'Rithaa is a Professor of Design, at the Cape Peninsula University of Technology. He is currently the President of World Design Organization (WDO) at Montreal, Canada and he is on several editorial boards for international design journals.

Acknowledgements: We appreciate Elgin Learning Foundation (ELF) for permitting us to partner with their organization to undertake this research. We thank INDEHELA ISD4D and the University Research Fund (URF) for the provision of knowledge and financial support. Our gratitude goes to all the women who participated, from South Africa and Ghana. To all CPUT and KNUST staff and students, we say thank you!