

# Recommendations for participatory design in low-resource settings: a case study of Simprints

CORSINI Lucia<sup>a\*</sup>; ARANDA-JAN Clara B.<sup>b</sup>; HENDERSON Cassi<sup>a</sup> and MOULTRIE James<sup>a</sup>

<sup>a</sup> University of Cambridge, UK

<sup>b</sup> University College London, UK

\*corresponding author e-mail: lc500@cam.ac.uk

Participatory design is a widely recognised approach in Design for Development projects. It supports collaborative, community-based practices and it empowers users to take ownership. Despite the importance of participatory design in solving global challenges, the majority of research has focused its application in the Global North. Recently, some studies have explored participatory design methods in more low-resource settings. Still there is a gap between the existence of these methods, and designers being able to use them successfully because of the complex realities they face in low-resource settings. Existing knowledge is fragmented and there is a lack of best practice guidance for practitioners using participatory design in low-resource settings. We address this problem by reporting the experiences of Simprints, a technology company based in the UK, providing biometric identification solutions in the Global South. Our study reveals key recommendations for participatory design in low-resource settings, providing useful insights for practitioners and design researchers.

Keywords: participatory design; development; low resource; Global South; developing countries

## Introduction

Design for Development (DfD) is a rapidly growing field in design research and practice (Margolin, 2007; Whitehead et al., 2014). DfD is defined as the process of designing products or services aiming to satisfy the needs and improve the wellbeing of disadvantaged or marginalised populations living in low-resource settings (LRSs) (Donaldson, 2009). Schumacher's 1973 publication *Small is beautiful* and Papanek's 1985 publication *Designing for the real world* marked an ontological turn in design, focusing on user needs and their surroundings. Since then, design practice has seen an increasing interest in participatory design (PD) (Björgvinsson et al., 2010). PD is particularly relevant to DfD as it leverages users' socio-cultural insights (Fuge, 2015), whilst empowering users (Puri et al., 2009) and supporting local ownership (Braa, 1996).

Despite the importance of PD in DfD, most research has focused on its practice in the Global North (Kraff, 2018). This limits the relevance of existing knowledge, as DfD contexts are vastly different (Aranda-Jan et al., 2016). Recently, a handful of studies have explored PD methods specifically aimed at use in the Global South. *Lean Design for the Developing World* (Pease, 2014) and the *Design for the Developing World Canvas* (Wood and Mattson, 2016) adapt existing tools to the needs of DfD. Drain et al. (2018) also propose a method for evaluating PD in technology for humanitarian and development projects. Still, there is a gap between the existence of these design methods and designers being able to successfully use them. This is particularly the case of technology-orientated DfD (Zewge, 2015)

In this respect, Simprints, a technology company based in Cambridge (UK), found little practical guidance on how to overcome challenges when using PD in DfD. Whilst Simprints' members had trained themselves in



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participatory design using tools such as IDEO's *Human-Centred Design Toolkit*, the team experienced challenges in translating the methods into their technical projects. Moreover, they found it difficult to access shared experiences from other organisations working in DfD.

Whereas existing studies have focused on the development PD methods, and some challenges of their implementation in LRSs have been well-reported, there is little precedent that advises designers on how to overcome these challenges. In this paper we investigate and report Simprints' experiences using these methods, highlighting the complex realities that designers face. We do so by uncovering practical recommendations for using PD in LRSs, therefore shortening the gap between existing design methods and their use in reality. We provide this report to help designers to move from knowing what to do to knowing how to do. These findings are particularly relevant for designers with a technical and science background, who are from the Global North and have little experience working in LRSs.

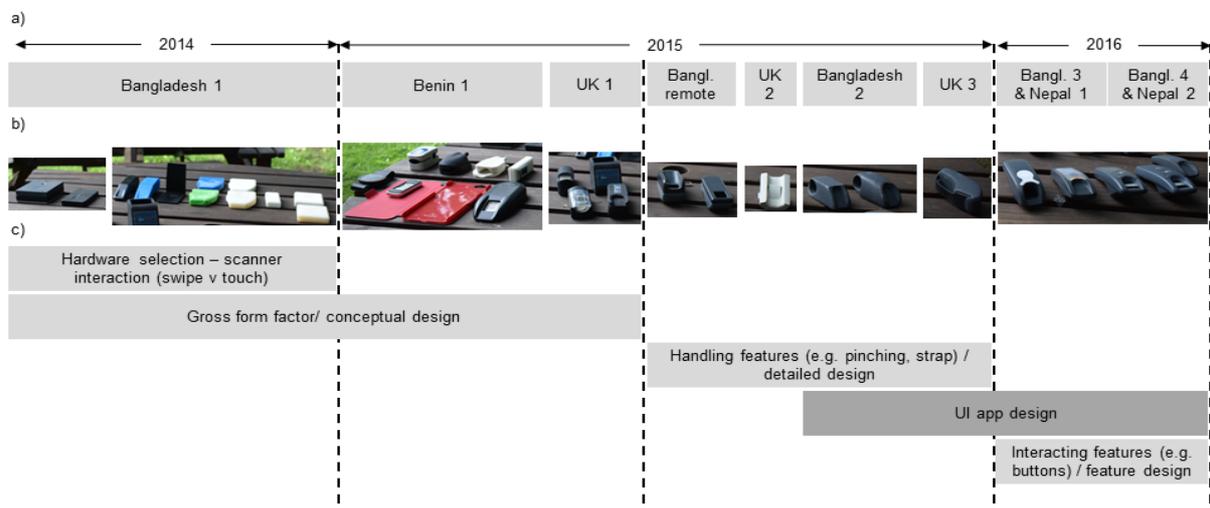
We focus on reporting Simprints' experience, which we consider to be highly valuable, as we are aware of similar projects taking place in the technology clusters around the University of Cambridge, MIT and Stanford University. We have documented anecdotal evidence of Simprints' experiences learning, planning and implementing PD for the design of their technology. We synthesise fragmented knowledge from existing literature and enrich it by providing an in-depth case study. Overall, this study makes an important contribution to the field, by providing practical insights for practitioners and drawing attention to aspects of PD that are particularly challenging, for which there are limited solutions.

The paper is structured as follows. First we describe the Simprints case study. Second we identify key themes in the literature and describe our methods. Finally, we discuss recommendations for PD in LRSs.

## Simprints case study

Simprints is a non-profit technology company founded in 2014 and based in Cambridge (UK). They provide a system for integrating in-house designed fingerprint scanners with third-party mobile apps to facilitate identity verification (Storisteanu et al., 2016). Simprints provides accurate identification to organisations using mobile tools in healthcare, education and microfinance in order to tackle poverty. Standard biometric technology is expensive and has been developed for the high-resource settings, whereas Simprints has focused on a solution specifically designed to meet the needs of LRSs (Storisteanu et al., 2015). In August 2017, they were awarded a \$2 million innovation grant, enabling them to scale their maternal healthcare project with BRAC in Bangladesh to reach two million mothers by 2020. Currently Simprints operate projects in Bangladesh, Nigeria, Uganda, Zambia, Kenya, Malawi, Somalia, Ethiopia, Zimbabwe and Afghanistan.

Simprints formed after winning a Hackathon in 2012 which introduced the challenge of patient identification in LRSs. The four founders were graduate students, who were inexperienced in product design and had limited experiences working in LRSs. The importance of using PD was clear to them from the outset, and they took steps to search for open-access tools and methods, and completed training using IDEO HCD Toolkit. However during initial field work they quickly found it challenging to use these PD methods because of the constraints of working in LRSs. Simprints found it difficult to access shared experiences from other organisations working



in DfD. Moreover, they found that there was a lack of in-depth guidance on how to apply PD methods specifically for LRSs.

Figure 1: Product development timeline and associated field tests. a) field tests b) prototypes, c) product development

## Methods

### Systematic literature review

To gather PD experiences in technology-related DfD projects, we searched Scopus to conduct a systematic literature review (Kitchenham, 2004). Workshops, book chapters and any non-peer-reviewed papers were excluded. The key search terms were: (“participatory design”) AND (“low resource” OR “limited resource” OR “developing country” OR “third world” OR “Global South”). This resulted in sixty-seven articles. An abstract review was undertaken based on the following two criteria:

1. The paper describes the design of a product for Development, in a LRS
2. The paper describes and evaluates PD methods

Of the remaining thirty-nine papers, twelve papers could not be retrieved and seven papers were added by snowballing. After full paper review, twenty-five papers met the criteria. The literature was analysed using open and axial coding to group thematically similar concepts (Daengbuppha et al., 2006). Particular attention was paid to the challenges for using PD methods in LRSs. These challenges (Table 1) guided our case study analysis.

Table 1: Challenges of using participatory design approaches in low-resource settings

<i>Challenge related area</i>	<i>Challenge</i>	<i>Reference</i>
Participants	1. Encouraging participant engagement	Ambole et al. (2016); Del Gaudio et al. (2016); Haque et al. (2015); Kam et al. (2006); Kiura (2006); Manen et al. (2015); Sandman et al. (2018); Wakil and Dalsgaard (2013); Wang et al. (2016);
	2. Creating awareness of design methods	Ambole et al. (2016); Brubaker et al. (2016); Cabrero et al. (2016); Del Gaudio et al. (2016); DeRenzi et al. (2017); Gangadharan et al. (2011); Haque et al. (2015); Hussain et al. (2012); Kam et al. (2006); Manen et al. (2015); Maunder et al. (2007); Puri et al. (2004); Racadio et al. (2014); Roland et al. (2017); Wang et al. (2016); Wakil and Dalsgaard (2013)
	3. Managing multiple and varying stakeholder needs	Mohedas et al. (2014); Roland et al. (2017)
Designers	4. Setting realistic objectives	Ambole et al. (2016); Del Gaudio et al. (2016)
	5. Compensating for designers’ lack of experience	Mohedas et al. (2014)
Relationships	6. Building relationships with stakeholders	Del Gaudio et al. (2016); De Los Reyes (2012); Gangadharan et al. (2011); Hussain (2010)Hussain et al. (2012); Racadio et al. (2014); Zegwe et al. (2015)
	7. Flattening the hierarchy	Antle et al. (2012); Brubaker et al. (2016); Del Gaudio et al. (2016); DeRenzi et al. (2017); Haque et al. (2015); Hussain et al. (2012); Kam et al. (2006); Kiura (2006); Korpela et al. (1998); Manen et al. (2015); Puri et al. (2004); Racadio et al. (2014); Sandman et al. (2018)

Context	8. Bridging language and cultural barriers	Ambole et al. (2016); Del Gaudio et al. (2016); Hussain et al. (2012); Korpela et al. (1998); Maunder et al. (2007); Mohedas et al. (2014); Puri et al. (2009); Wang et al. (2016)
	9. Using time-effective approaches	Ambole et al. (2016); Del Gaudio et al. (2016); Kam et al. (2006); Hussain (2010); Hussain et al. (2012); Sandman et al. (2018);
	10. Staying safe and comfortable	Ambole et al. (2016); Hussain et al. (2012); Manen et al. (2015)
	11. Getting access to users	Haque et al. (2015); Roland et al. (2017)

### Case study

In order to expand on findings from the literature, a case study approach was taken (Yin, 2018). Efforts to ensure data triangulation and investigator triangulation were made as far as possible (Yin, 2018). Field work data from 2014-2016 was reviewed, including field guides, storyboards, card sorting decks, prototypes, original interview transcripts and communication logs. Semi-structured interviews were conducted with three members of Simprints, who were involved in the product development from the outset: Alexandra Grigore (Chief Product Officer); Daniel Storisteanu (Director of Research); and Toby Norman (CEO). Interview questions were structured around the eleven challenges found in the literature (Table 1). Each interview lasted approximately 60 minutes, and was recorded with the participants' verbal consent. The interviews were transcribed verbatim and imported into MAXQDA.

A code hierarchy was created based on the challenges reported in from the literature (Table 1). Multiple coder analysis was undertaken to identify the challenges and recommendations of using PD in LRSs, based on Simprints' experience. Following this, a validation workshop was set up with the Director of Innovation and Director of Research to verify these findings.

## Results and discussion

### *Recommendations for participatory design for Development in low-resource settings*

#### *1. Encouraging participant engagement*

Difficulty encouraging participants to engage with the design process was identified as a key challenge across all stages of the design process. In particular, this presents notable challenges for conducting interviews and focus groups, as well as implementing more PD methods, such as storyboarding and card sorting. For instance, as found in the literature, some participants may fail to contribute meaningfully in design sessions, and instead look to the designers for answers (Ambole et al., 2016; Del Gaudio et al., 2016; Kiura, 2006;, 2013; Wang et al., 2016). Similarly, Simprints noted this challenge as one of the most significant barriers to their work. The most important recommendation for designers in this case, is to make the purpose of the product specific and relatable for users. If participants recognise the potential value of the design exercise, then this might encourage them to engage more meaningfully with the project. Including participants' ideas and feedback can also make them feel valued and encourage more confidence and participation later in the process.

*“Some people are very excited to be part of the process and even proud to be part of the process. Especially when we’ve worked with them and then we come back four months later and they see that some of their ideas have been incorporated. They’re very proud and they feel ownership over the product” (Daniel)*

In the short term, translators can also try to encourage participants to respond and emphasise the value of their participation. Moreover, establishing a rapport with participants can help to improve engagement. Empowering participants to feel confident is key to maintaining engagement, particularly in focus groups, in which less confident participants may be reluctant to voice their opinions. In this case, the designer should be flexible and rearrange groups to establish new dynamics to encourage more participation from quiet participants. Additionally, designers should consider whether one-to-one interviews may be more effective.

Alternatively, designers might choose to use more participatory techniques like card sorting or stack ranking to elicit engagement. Observing how participants engage with physical products also removes the need for direct engagement with the designer.

*“Things like stack ranking are usually more engaging for people... because people have opinions now and you’re forcing them to make judgement calls. For direct observation, you don’t need their [the participants] engagement with you [the designer] but they definitely need to be engaged with the product or the technology you’re testing. For interviews, socially it’s hard to totally disengage, especially if it’s a one-on-one interaction.” (Toby)*

Finally, designers need to be realistic about how much engagement can be expected from participants. Ambole et al. (2016) find that participants do not engage with design exercises independently outside of structured sessions. Awareness of participants’ capacities and capabilities is important to avoid burdening participants with unrealistic tasks. At the same time, designers should be aware of the dangers of tokenistic participation of users, which may undermine the value of PD approaches (Yee et al., 2015).

## 2. *Creating awareness of design methods or reasoning*

Participants may not be familiar with the design process and as a result find it difficult to generate solutions or to contribute (Del Gaudio et al., 2016; Hussain et al., 2012; Kam et al., 2006; Manen et al., 2015; Racadio et al., 2014; Roland et al., 2017; Wakil and Dalsgaard, 2013; Wang et al., 2016). Designers should be aware that methods used are typically based on Western orthodoxies of knowledge and reasoning that may be substantially different to approaches in other contexts (Cherlet, 2014). In this case, explaining the design process to participants, as well as the purpose of the product, is essential to improving their awareness of the methods and approaches.

*“We started every session with an introduction... The translator had a text explaining who we are, why we are there for, what’s the context. So giving them actual concrete examples of how the system will benefit them.” (Alexandra)*

A major barrier to Simprints in their efforts to get feedback from participants was the lack of understanding about work in progress, also noted in Maunder et al. (2007). Participants struggled to give feedback on unfinished prototypes, as it was difficult to imagine something that had not yet been created. Whilst it is recommended to start field testing as early as possible to avoid incorrect assumptions, designers should be aware of the limitations of testing work in progress and pay attention to avoid including confounding variables in a set of prototypes. Explaining to participants the concept of work in progress is important to encourage more meaningful feedback.

In some cases, being sensitive to different participants’ ability is important, and different tasks might be prepared for people with different skills and backgrounds. Generally, designers are recommended to avoid leading questions, however, Simprints found that participants were confused and unsure how to respond to open-ended questions. In particular, ‘holding the silence’, a commonly used technique to elicit responses in developed nations, was found at times to be particularly uncomfortable for participants. As a recommendation, designers should prepare open-ended questions, but be ready to use prompts or move towards more closed questions if necessary. In general, designers should avoid unnecessary shortcuts to quick answers by asking leading questions.

The study also found that participants’ illiteracy or technology naivety may be a challenge confirming findings in the literature (Ambole et al., 2016; DeRenzi et al., 2017; Gangadharan et al., 2011; Haque et al., 2015; Kam et al., 2006; Manen et al., 2015; Maunder et al., 2007; Puri et al., 2004). In this case, one option is to use narrative and culturally-appropriate styles of communication, such as storyboarding. There was some disagreement however, with regards to the effectiveness of visuals among the Simprints team. Daniel and Toby strongly supported the use of visuals, citing greater engagement among participants. Alexandra, on the other hand, considered that for the most part, visuals were not effective and resulted in greater confusion for participants. More research is needed to clarify the effectiveness of visual aids in PD.

## 3. *Managing multiple and varying stakeholder needs*

Conflicting needs and requirements from the different stakeholders were reported by Del Gaudio et al. (2016), Mohedas et al. (2014), and Roland et al. (2017). These resulted in inconsistencies and incompatibilities between some of the user requirements for the designs. For Simprints, the differences between the

requirements of the end users and the donors resulted in conflicting needs. To minimise these conflicts, Simprints made sure that the value of the project was clear and agreed upon by all types of participant (users, program managers and local partners). In this way, stakeholders recognise that the technology is solving a problem which they face, either directly or indirectly. Simprints emphasise the need to choose a user champion and project champion, who take ownership of the project. For Simprints, these champions were effectively 'active citizens' (Yee et al., 2015), operating at various organisational levels to support product testing and adoption.

*"In every project, we use a user champion and a HQ champion... We want to make sure that there is someone fighting for the users' interests when it comes to Simprints and then someone who is genuinely fighting for HQ interests." (Toby)*

It is important to recognise that impact can only be achieved with the buy-in of participants. Simprints have discussed ways to acknowledge champions more formally by providing certificates and including their bios on the Simprints website. Officially recognising the time investment of champions is an effective way of keeping them motivated and engaged.

#### 4. *Setting realistic objectives*

Unmet expectations from participants can disrupt trust and undermine projects (Del Gaudio et al., 2016; Wang et al., 2016). Moreover, misalignment of stakeholder goals can also create confusion, disrupt progress, and divert resources. In particular, Ambole et al. (2016) criticises the 'unquestioned optimism' of design projects that may suffer from unrealistic expectations. This was not a challenge that Simprints readily identified with, however in general they pointed out that informing participants about the project goals and keeping them updated with project process was important.

More specifically, projects should have a clear, public output. In addition, a collaborative relationship should be established with the project partner in order to negotiate objectives and manage collaboration (Del Gaudio et al., 2016). Measuring long term project impact can be challenging, however, one approach suggested by Simprints is to measure impact against the pain points identified by users. Moreover, it is important to set up systems and establish relationships to provide feedback between and after field tests.

*"We follow up with questions and every week for the first two months we have a project call where we follow up with the users and the managers to ask how the project is going. We also have some questionnaires for the users, where users will just fill in any errors or bugs that they encounter in the system." (Alexandra)*

There is another opportunity here to leverage the capacity of user champions who can be responsible for providing feedback from the field. Simprints recommend that relationships with user champions must be nurtured and they describe varying levels of engagement from different user champions. Designers can be proactive in training champions and keeping them updated with the project, however champions must fundamentally be people who engage with the project's purpose, and who are socially and emotionally connected to the project's value. Considering the most enthusiastic participants during field testing is a recommended way to select user champions.

#### 5. *Compensating for designer's lack of experience*

Some designers in DfD projects may be working in LRSs for the first time and they may not have extensive training in design. For instance, designers may come from engineering or other technical backgrounds and have difficulties processing and analysing the information gathered through PD. Mohedas et al. (2014) reports some of the challenges faced by engineering students when using design ethnography. In the case of Simprints, the team also lacked formal design experience, although they did search for commercially available toolkits (i.e. IDEO and +Acumen Massive Open Online Courses). To compensate for their lack of experience, Simprints identified their own weak points and identified mentors and experts who could help them. After initial interactions, they built these relationships further to keep mentors engaged in the project, in order to receive further support from them. Simprints recommend that requests from mentors and experts should be small and tangible.

Another way in which Simprints tackled these challenges was through testing the methods in the field and going through iterative cycles of testing. It is only through learning-by-doing that designers will be able to learn and gain experience designing and connecting with the users.

*“There is no replacement for field effort. When you do that process multiple times, then maybe you start to get build up a little bit wisdom in this space.” (Toby)*

## 6. Building relationships with stakeholders

Access to users is a recognised challenge in PD and, hence, stakeholders with user access are fundamental for design projects. A frequently reported challenge is the selection of the local partners and the development of the relationships with them. Simprints found that local organisations often have existing strong relationships with users. They also identified project champions within organisations that could help them to build their network further. Some of the ways in which Simprints built their relationships with project champions included meetings, workshops and tours. For example, Simprints invited champions to visit their headquarters. During their visit, champions were invited to co-design sessions and some of the champions’ recommendations were included in the subsequent iterations of the product design.

*“One recommendation is first establishing a collaborative relationship with a partner in the field. Get them brought in into what you are doing. Make sure that you are going towards a solution that they need so that you are not in a position where you are just using them as a field testing site, but they are invested in you developing a product because it solves one of their real needs.” (Alexandra)*

To establish these strong relationships with the local partners, designers need to prepare concise study and field test protocols, indicating benefits to the partners but also explicitly expressing the project goals and the purpose of the project. For Wang et al. (2016), local partners were fundamental for the long-term diffusion, and successful adoption, of PD in rural China. Specifically, identifying qualified stakeholders and sustaining their motivation were key factors for long-term PD processes.

Building rapport with the participants is also fundamental to PD projects. Simprints worked with organisations that had good relationships with the end users but also tried to establish positive direct relationships, by learning basic vocabulary in the users’ first language and ensuring that their inputs were included in the iterations of the design.

*“Show that you’ve incorporated their advice and then they will become champions for you and help you out.” (Daniel)*

## 7. Flattening the hierarchy

Power imbalances are one of the key reasons for unreliable responses or lack of participation when involving several stakeholders. During field testing, Simprints noted that differences in gender, age and socially-defined caste groups were notable barriers to participation. Where such power imbalances are identified, it is recommended to separate participants by gender or roles for focus groups. In some other case, one-to-one interviews and interactions can be used to improved users’ engagement and participation.

Power imbalances can also occur when individuals or organisations are perceived as having a higher authority. Simprints, for instance, observed power imbalances between the local partnering organisation or translators and the end users. To avoid this, Simprints conducted workshops in which managers and supervisors were not involved.

*“I was running a focus group with community health workers who would be our end user. Certainly, the quality of their answers changed significantly depending on whether the boss was in earshot or not.” (Alexandra)*

Power imbalances can also result from designers’ intervention in the local context. These could be between the designer and the local partner, or between the designer and the participants. Some participants assume that certain answers are expected or that the designer knows the situation better. This power imbalance results in the participant’s inability or unwillingness to express difficulties understanding the design-activities, the purpose of the activities. Simprints, used local partners to encourage participation without pushing participants out of their comfort boundaries and allocated time for participants that were more engaged.

*“They were very concerned of telling us that our product is bad, that something is not working properly. I felt that we did overcome that by training the translators to tell them that ‘it’s okay, you can tell’ and some of them would be much more willing to just say ‘this doesn’t work.’” (Alexandra)*

Regardless of the source of the power imbalance, overcoming the lack of participation and getting honest feedback from the participants is important when conducting user research or testing. Hussain et al. (2012), as well as Simprints, report using anonymous written feedback, prioritising individual interviews rather than group discussions, and encouraging honest feedback by remarking that the product is only a prototype that needs to be improved with the participant's input as approaches to overcoming power imbalances between designers and participants.

*“People gave better critical feedback when it was clear that this was really a process because [otherwise] nobody wants to say anything negative about it.” (Daniel)*

Simprints also trained the translators to indicate that it was fine for participants to be critical about the product. They also effectively used methods such as stack ranking, which forced people to express preferences and made critical discussion more comfortable for participants.

## 8. Bridging language and cultural barriers

This challenge is reported as one of the most significant, as designers lack contextual understanding. Hussain et al. (2012) point out that projects should be based on an in-depth understanding of the history, culture and society of the product's use-context. Technology is not a sustainable solution in itself, but needs to be embedded in a social-cultural framework (Corsini et al., 2019). The recommendation for designers to spend as much time as possible in the local context is noted in Wang et al. (2016), however, as pointed out by Simprints, this might not always be feasible because of resource constraints. Furthermore, there is concern that these experiences may be enriching for designers but will not necessarily lead to tangible design outcomes. Emphasis is placed not just on visiting the design context as much as possible, but on iterating designs and testing them frequently.

Language barriers and translation issues are also frequently reported. If possible, it is recommended to organise workshops in the first language of participants. As noted in Ambole et al. (2016), when workshops were organised in English, participants did not feel confident speaking English and therefore only gave brief responses. It is recommended to hire and train an external translator before designers go to the field to avoid any potential biases. In particular, it is important to train translators on how phrasing questions in different ways can introduce bias, and to ensure that the translator understands the purpose of the design exercise so that they are motivated and engaged. Providing written questions in advance can assist translators and help to avoid leading questions in the moment. Finally, designers should also consider using other methods such as direct observation to complement and verify data from interviews and other exercises that require translation.

It is also recommended to carefully research any symbols and graphic styles being used to ensure that they are culturally appropriate and to test visuals before going to the field with someone familiar with the context. Simprints describe how cartoon style illustrations were recommended to them for producing visual support material for the Nepali context.

*“a typical power button symbol wasn't always intuitive... Then there was a frowny face that was put into a positive pile.” (Daniel)*

## 9. Using time-effective approaches

Time constraints affect the design process with respects to both the participants' time and the designers' time. Firstly, finding an appropriate time to meet with participants can be challenging and designers should be aware of the opportunity cost of participants' time. Designers should be flexible and should recognise when particular exercises may have a negative impact on people's responsibilities. On one occasion, Simprints describe cutting short an interview with a doctor, as they were aware of a long line of patients waiting for appointments.

In general, designers should prioritise questions, and have clear and streamlined protocols. Keeping tests concise, simple and focused is highly recommended. Hussain et al. (2012) recommends that it is possible to visit participants in their homes to reduce the participation burden, however, this does not completely eliminate the burden, as described in the extract below.

*“There were definitely cases when it was apparent to us that we were taking up time from people that was valuable to them and we would cut something short... I remember doing some shadowing and there was a woman in a slum. We were trying to look at her interaction with the community health*

*workers and it was clear that she didn't want to give the time of day. She was cooking, she was running around, talking to other people" (Daniel)*

Ambole et al. (2016) suggest that designers can consider using different groups of participants to minimise the burden on any individuals. Perhaps most importantly, it is recommended that the direct value of the project is fully explained to participants in order that they value the time spent on the project. Designers should also consider appropriate ways of rewarding participants for their time. In cases where participants receive paid salaries, thanks and appreciation may be sufficient. In some cases, Simprints provided gifts in kind, such as providing lunch for participants. More generally it is recommended to discuss incentives with project partners in order to make sure that they are culturally appropriate.

Finally, time constraints are also noted from the perspective of the designers, as they may have limited time in the field. As well as keeping tests concise and simple, designers should bear in mind some of the additional time requirements for particular exercises e.g. the time taken to travel between different locations for shadowing visits.

### *10. Staying safe and comfortable*

As well as potentially working in an unfamiliar context, designers should be aware that the context may be unpredictable and volatile. Most importantly, designers should create a risk assessment strategy with input from the local partner. It is also recommended that the consent and involvement of all participants should be included (Ambole et al. 2016).

It should be noted that some communities may be concerned about the participation of vulnerable groups, particularly women and children. In this case, it is important to ensure that all engagement with vulnerable groups takes place in an environment where they are visible to communities. It is possible to arrange this such that participants are safe, but also that supervision does not influence power dynamics.

Designers should also be mindful of how poor working environments may affect participant engagement, including heat, light and other comfort factors. Simprints described trying to create comfortable environments for participants e.g. ensure they were not exposed to direct sunlight.

### *11. Getting access to users*

Remote design is naturally difficult. The distance between users and designers poses challenges that are not only geographical, but also economic and technical. Such challenges were faced by Simprints, who have their head offices in UK and their users in Africa and Asia. Simprints, however, learned to cope with these challenges through the different field visits they conducted and other strategies. Planning and allocating enough resources for field testing is key for getting access to the user, ideally multiple trips. When they are not in the field, Simprints receive support from user champions. At the same time, they recognise that this may have certain limitations. For example, inexperienced user champions may inadvertently bias responses.

*"Flying out is very expensive and timely and we've tried to counter that by having local champions to do testing for us... It's up to us to train them on how to get clear unbiased answers. Some people will intuitively be very good at getting the information from end users and communicating back to us and some people will clearly incorporate their own biases into that." (Daniel)*

Finally, Simprints has realised that many of their design activities required time in the field. As their product has developed, the need for an in-country office became apparent. In 2018, the organisation decided to set up a local office in Bangladesh and are considering opening representative offices in other locations.

## **Conclusions and further research**

This study explores the application of PD methods in LRSs. The research was prompted by the experiences of Simprints, who found that there was a general lack of information for designers using PD in technology-related Development projects. Our work responds to these concerns, by synthesising fragmented knowledge to identify eleven key challenges for PD in LRSs. We build on this knowledge to provide a detailed case study of Simprints, revealing recommendations that can be taken in order to overcome commonly-faced challenges when using PD in LRSs. We believe this is particularly valuable for designers who are planning to use a PD approach and who are not familiar with working in LRSs. Specifically, it offers insights for designers who may come from a science or engineering background. The authors also believe that this paper provides a valuable

resource for academia. It highlights particularly challenging areas, such as power imbalances, cultural barriers and unequal understanding of design methods, for which future PD methods need to be specifically developed.

As interest in DfD projects increases, there is a more urgent need to disseminate this research to designers. As a next step, the authors plan to develop the findings into an actionable tool for designers, to assist with the planning stage of PD for DfD projects. Future plans include the organisation of DfD workshops in Cambridge (UK), using the planning tool for novice designers with a technical or science background.

## Acknowledgements

The authors are grateful to Alexandra Grigore, Daniel Storisteanu and Toby Norman for participating in this research. Their experiences provided the inspiration for conducting this research.

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