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Production of Use: Reconceptualizing “the User” in Low-income Communities in Urban India

DISSERTATION

submitted in partial satisfaction of the requirements  
for the degree of

DOCTOR OF PHILOSOPHY

in Information and Computer Sciences

by

Nithya Sambasivan

Dissertation Committee:  
Professor Bonnie Nardi, Chair  
Professor Alladi Venkatesh  
Dr. Edward Cutrell

2012

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## **DEDICATION**

To

appa, amma, and Vidya

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# CURRICULUM VITAE

## Nithya Sambasivan

- 2005            B.E. in Electronics and Communication Engineering, Anna University
- 2007            Master of Science, Human Computer Interaction, Georgia Institute of Technology
- 2009            Master of Science, Information and Computer Sciences
- 2012            Ph.D. in Information and Computer Sciences,  
University of California, Irvine

## FIELD OF STUDY

Information and Communication Technologies in low income India

## PUBLICATIONS

### Book chapters

1. Susan M. Dray, Ann E. Light, Vanessa Evers, Andy Dearden, Melissa Densmore, Matthew Kam, Gary Marsden, Divya Ramachandran, Nithya Sambasivan, Thomas Smyth, Darelle van Gruenen, and Niall Winters. Human Computer Interaction for Development: Changing HCI to Change the World. To appear in the 3rd Edition of the Human-Computer Interaction Handbook, edited by Julie Jacko, published by Taylor & Francis in 2011

### Journal articles

1. Rangaswamy, N. and Sambasivan. N. Cutting Chai, Jugaad, and Here Pheri: towards UbiComp for a global community. In Personal and Ubiquitous Computing. Special issue on the Digital Divide edited by Matt Jones and Gary Marsden. 15(6). pp. 553-564, June 2011.

### Conference papers (peer-reviewed)

1. Sambasivan, N. and Cutrell, E. (2012). Understanding Negotiation in Airtime Sharing in Low-income Microenterprises. To appear in Proc. of ACM conference on Human Factors in Computing Systems (SIGCHI), Austin, TX, USA.
2. Sambasivan, N., Weber, J. and Cutrell, E. Designing a Phone Broadcasting System for Urban Sex Workers in India. (2011). In Proc. of ACM conference on Human Factors in Computing Systems (SIGCHI), Vancouver, Canada, pp. 267-276 [Best paper honourable mention]

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11. Sambasivan, N., Jackson M.M., "Design of Pervasive Brain-computer Interfaces", 3rd Symposium on Usability and HCI in Medicine, Lecture Notes in Computer Science (LNCS), Graz, Austria, pp. 267-272.

### **Workshop papers**

1. Sambasivan, N., Ventä, L., Mäntyjärvi, J., Isomursu, M., Häkkinä, J., "Rhythms of Non-use of Device Ensembles", (2009). Extended Abstracts on Human Factors in Computing Systems (CHI), Boston, U.S.A., pp. 4531-4536.
2. Hui-chun, L., Liu, K., Sambasivan, N., "GreenSweeper: A Persuasive Mobile Game for Environmental Awareness", Workshop on Ubiquitous Sustainability: Citizen Science & Activism, Ubicomp 2008, Seoul, South Korea
3. Sambasivan, N., Häkkinä, J., Mäntyjärvi, J., "Liminal, Spiritual, and Ritual: Fabrication and Evasion in Urban Journeys through Portable Devices", workshop on Automated Journeys, Ubicomp 2008, Seoul, South Korea

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5. Sambasivan, N., "Value-sensitive Design in Pervasive Brain-computer Interfaces", position paper for the workshop on Brain Computer Interfaces for HCI and Games, CHI '08, Florence, Italy
6. Jimison D., Sambasivan N., Pahwa S., "Wigglestick: An Urban Pedestrian Social Navigation Mobile Application", position paper for PERMID, 5th International Conference on Pervasive Computing (Pervasive), Toronto, Canada, 2007

### **Workshops and Panels organized**

1. Thomas, J., Dearden, A., Dray, S., Light, A., Best, M., Arkin, N., Maunder, A., Kam, M., Chetty, M., Sambasivan, N., Buckhalter, C., and Krishnan, G. 2008. HCI for Community and International Development. In CHI '08 Extended Abstracts on Human Factors in Computing Systems, Florence, Italy
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5. Ladeira, I., Ramachandran, D., Sambasivan, N., Weber, J., Panel on "Women on Women--Gateways to Socio-economic Development", at the Grace Hopper Conference, Tuscon, Arizona, 2009 Posters and extended abstracts
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1. Sambasivan, N., Rangaswamy, N., Toyama, K., and Nardi, B. Encountering Development Ethnographically. ACM Interactions. XVI.6. 2009, pp. 20-23

## **ABSTRACT OF THE DISSERTATION**

Production of Use: Re-conceptualizing “the User” in Low-income Communities in Urban India

By

Nithya Sambasivan

Doctor of Philosophy in Information and Computer Sciences

University of California, Irvine, 2012

Professor Bonnie Nardi, Chair

The concept of “the user” is central to the academic discourse as well as practice of Human Computer Interaction. The concept is largely shaped by economic conditions, cultural norms, academic theories, abstractions, and formalizations shaped by western values. However, as technology finds new users, uses, and contexts across the world, this image of “the user” is proving to be severely limiting. This dissertation is concerned with understanding and conceptualizing use in emergent digital technology user groups in low-income communities in Bangalore and Chennai, India.

The methodology followed in this dissertation is comparative fieldwork. By employing the comparative method (Nardi, Vatrapu, & Clemensen, 2011), I systematically examined the similarities and differences across three technology user groups—domestic workers in slum communities in Bangalore, urban sex workers in Bangalore, and urban microenterprises in Bangalore and India—in contexts including low incomes, genders, technologies, professions, formalities, languages, geographies, and social units. I weave together these three strands of ethnography to create a nuanced analysis of digital technology as it comes to terms with these

contexts and actors. I examined individuals interacting with the interface along with the broader collectives, infrastructures, cultural logics, and economics that constitute and configure technology use.

Through this study, my attempt is to produce an analytical apparatus of Production of Use to study digital technology usage within these emerging contexts. I argue that Production of Use is a more constructive and generative unit of analysis than that of “the user” in the enterprise of design. It opens us up to the possibility of multiple users engaging with a single artifact by considering the richness of human activity. I engage with debates in the fields of Human Computer Interaction, Information and Communication Technologies for Development, Ubiquitous Computing, while staying attentive to larger discourses of public policy and development.

## CHAPTER 1: Introduction

Consider these facts: mobile phones are increasing at the rate of 7 million per month in India, making it the fastest growing mobile market in the world (TRAI, 2011). M-PESA, a mobile money transfer service, is used by 9 million people, or 40% of the national population of Kenya (Mas & Radcliffe, 2010). MXit, a mobile social networking application, has over 10 million active users, exceeding Facebook's 3.9m users in South Africa (Jidenma, 2011). As technologies rapidly penetrate new contexts and find new users around the world, an emerging question in Human Computer Interaction (HCI) is whether design concepts from the west, such as user, use, need, context, value, and access, can translate to other countries. My research attempts to answer this question by examining technology practices in low-income communities in India. With a burgeoning population of over 1.2 billion people (India Census, 2011) and rapid technology uptake (TRAI, 2011), understanding technology use in India is critical in building a global HCI discipline.

Design concepts, practices, and methods in HCI hinge upon the foundational construct of “the user”. Employed as a metric and a description, “the user” flavors much of HCI; consider, for example, user-: interface, experience, -centered design, and modeling. The imaginary—the social and embodied constructions consisting of a set of cultural notions, predicaments, and anxieties (Nardi & Kow, 2010) (Murphy, 2004)—of the *user* in HCI is typically an individual who sits in front of a computing device. This prototypical user owns his or her device and is mostly entirely capable of operating the computing device, by formulating goals and achieving activities and



tasks towards reaching the goal (Grudin, 1993; Ito, Hutchins, Hollan, & Norman, 1985; Okabe, & Matsuda, 2005).

With technologies spreading far and wide across the world, local conditions such as cultural logics, values, financial frameworks, technical capabilities and infrastructures, and social structures affect usage practices, in ways unanticipated by the designers. Conditions in a slum in Bangalore or in an economically poor household in Atlanta (Yardi & Bruckman, 2012) are drastically different from the imagined context of the user in Silicon Valley. The user in a slum in Bangalore is embedded in conditions of resource constraint, uneven textual and technological literacy, and a culture of sharing (Sambasivan, Cutrell, Toyama, & Nardi, 2010). Moreover, the user can be more than one person. The question, then, is whether the underlying principles of “the user” imaginary, influenced by personal and private assumptions, can apply to these new contexts.

My dissertation points to an emphatic “no”. The personal and private nature of the user (Ito *et al.*, 2005) is transformed to shared and collective in the low-income communities of the developing world (Sambasivan *et al.*, 2010). In order to examine how the specificities of the context affect usage of technology, I employed an ethnographic approach to study users in low-income communities in India (Spradley, 1979). I wrote ethnographic accounts of the socio-technical processes of use in three field sites. I examined the local interface of the person(s) using technology, in conjunction with the broader cultural practices, social capital and economic and political factors. I analyzed my findings to characterize use across these sites. My approach here is not to extend and extrapolate current notions of “the user” into the developing world

context, but to provide a detailed, grounded account of use, user, and interactions as they emerge in these contexts. In this dissertation, I critically re-examine the concept of “the user” in various contexts and suggest new ways of thinking about people interacting with computers in low-income communities of southern India. I propose *Production of Use* as an alternative analytic for analyzing use in both emerging and existing low-income contexts of technology access.

Even within the scope of developing countries, current research tends to commonly characterize developing countries as a singular geographical, economic, and cultural unit. While terms like “Global South” were defined in the United Nations Development Program (UNDP, 2005) to represent countries in the southern hemisphere, including medium and low human development (as measured by the Human Development Index (HDI), described later in this chapter), their usage in ICT4D and HCI signify homogenous aggregates of low-income, resource-constrained, or non-literate populations (Chetty & Grinter, 2007; Dias & Brewer, 2009). However, much heterogeneity and difference appear not just between these countries, but within countries and communities. My dissertation examines this difference productively by documenting the creativity and resourcefulness exhibited in various low-income contexts in accessing technology. Based on these empirical findings, I offer an analytic for design for the developing world that expands the scope from one-person, one-computer to the broader socio-cultural context and possibility of multiple users. By looking at the assemblages of people, values, relationships, materiality, institutions, histories, and contexts, my hope is to re-conceive the vocabulary of HCI to better understand and design for emerging user groups and to accommodate the diversity present everywhere in our world.

The narrative movement of the dissertation starts with stating the limitations of extending “the user” to new resource-constrained contexts. I propose Production of Use as an alternative analytic of understanding use of technology. It focuses on use as an activity and a production, shifting the unit of analysis from “the user” to people (both in the sense of having agency as well as plural in some contexts). I then describe my field experience and narratives of my interlocutors. The middle chapters are divided as follows: firstly, I describe the intermediated uses in low-income India, or how direct users are “split” into intermediary and beneficiary users in the predominant intermediated usage (Sambasivan *et al.*, 2010). Technological sharing is a predominant phenomenon in resource-constrained communities, along with other goods (Burrell, 2010; Steenson & Donner, 2009). Secondly, I present a cautionary counterpoint to the notion of sharing in low-income communities, by describing the murky separation of technologies as public and private, of how shared use breaks into individual use based on context and purpose (Sambasivan, Weber, & Cutrell, 2011). Thirdly, I describe how shared usage is always negotiated, or how shared goods are repurposed towards personal interests (Sambasivan & Cutrell, 2012). In the concluding chapter, I present the fourth issue of Production of Use as a design analytic, reflecting on four guiding questions that emerge from my empirical work; methodological concerns such as defining the collectivity and relations; development metrics like access and ownership; and design concerns for the intermediated and shared technological usage.

## **1.1 Overview of the dissertation and significance**

The title of this dissertation is “Production of Use: re-conceptualizing the user in low-income communities in urban India”. I deconstruct “the user” imaginary as it applies to HCI in its

emergent and shifting manifestations and conundrums in the developing world. I borrow the term “imaginary” from anthropology, in which it exhibits multiple, unstable meanings (Murphy, 2004; Nardi & Kow, 2010). As design expands its boundaries globally, I am interested in the features and consequences of this move, as well as in asking what it means for HCI to design for new locales, agendas, and practices. My dissertation applies to the emerging fields of Information and Communication Technologies for Development (ICT4D), HCI and its subset Human Computer Interaction for Development (HCI4D), and Ubiquitous Computing (UbiComp). It addresses the rhetoric of “emerging markets” (The Economist, 2005) and “the next billion” (Next Billion IBM, 2012)—sobriquets for how “within the next three years, another billion people will begin to make regular use of cell phones” (Next Billion Networks MIT, 2012).

My research focused on answering the following descriptive and analytic research questions: What are the patterns and practices of interaction and exchange around ICTs in low-income communities in India? What is the ecosystem of roles, responsibilities, and agency in these interactions? What are the local responses to building and creating new social and technical infrastructures or making existing work, in times of social and material contingencies? What are the tools, regulations, social actors, and institutional settings that operate in concert in this infrastructure creation?

To answer these questions, I undertook comparative fieldwork in India to understand technology use across social groups and cultural affiliations that are marginalized by the global economy. I uncovered how digital technologies are implicated in the everyday life of three low-income communities: 1) female domestic workers in two urban slums in Bangalore, India, and their use

of mundane technologies, 2) work spaces of urban sex workers in Bangalore, India, and their coordination technologies, and 3) micro-entrepreneurs and their trade activities involving communication technologies. I sought out to bridge local complexities and cultural specificities with various HCI notions such as user, interaction, and infrastructure, providing alternate, nuanced conceptions for design in the developing world.

I employed a comparative method (Nardi, Vatrapu, & Clemmensen, 2011), wherein I examined the difference in user populations for better design. My comparative fieldwork took place between February 2009 – May 2009 in the slum communities, June 2010 – September 2010 with the sex workers, and March 2011 – September 2011 with the microenterprises. I focused on the interaction with the interface and infrastructure of technologies, and the broader offline ecology of sharing, social norms, and cultural logics. Comparative fieldwork is not a thick description (Geertz, 1973) of behavior and context; rather, it is an exercise in revealing difference through comparison. The technique is not truly multi-sited (Marcus, 1995): the purpose is not to link objects of study but to link concepts and create patterns. Across my three sites, I followed the concepts of Production of Use, shared technology usage, and the broader ecology. My end goal in using comparative ethnography was to arrive at a nuanced portrayal of users in low-income communities, larger than the discrete set of differences between user groups, but including the ways in which technology is produced in three low-income groups that are geographically collocated. While I do not generate a tightly focused conversation stabilized around highly stylized categories of discourse (Nardi, Vatrapu, & Clemmensen, 2011), my field sites have many commonalities, such as microenterprise (informal, low-capital) professions and the low-income context of Bangalore. While the research output is tied to the specific context of urban

south India, I argue that it can provide us with alternative suggestions for design and use in general.

It is hoped that the dissertation will have an impact in a number of areas. It aims to contribute to the HCI discourse in India; to extend methodological frameworks of comparative fieldwork across multiple sites; to feed into broader debates of ICT4D, HCI4D, and public policy on penetration metrics; and to add to the emerging literature on groups in developing countries in CSCW. My primary contribution is an HCI framework for design in the developing world. The framework takes into account the various categories of users, usages, and contexts, and suggests design methods and practices. While the framework is informed by the three studies that I conducted, it is hoped that the framework will extend beyond current models of oversimplified concepts of developing world users. This dissertation offers a reflexive critique with a view to constructively inform technology design for developing countries.

## **1.2 Related work**

### ***1.2.1 A history of the user***

*Changing meanings of “the user”:*

According to the Association of Computing Machinery Special Interest Group for HCI, a working definition of HCI is “a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them” (ACM SIGCHI, 2009). HCI studies the communication between humans and computers. This human performing the interaction with the computer, or “the user”, is a unit of analysis for HCI (others may include computational systems, interactions, or

interfaces). Simply put, a user is “someone who uses a particular computer system or application”, as defined by Bannon (1991). He distinguishes the term from an “operator”, which involve greater involvement with the machine or system, presumably one where the person is more uniquely assigned to the device. “The user” abstraction is crucial in designing user interfaces and refers to a set of shared characteristics among a group of people using computers. User-centered design is the hallmark of HCI design methodologies (Norman, 2000).

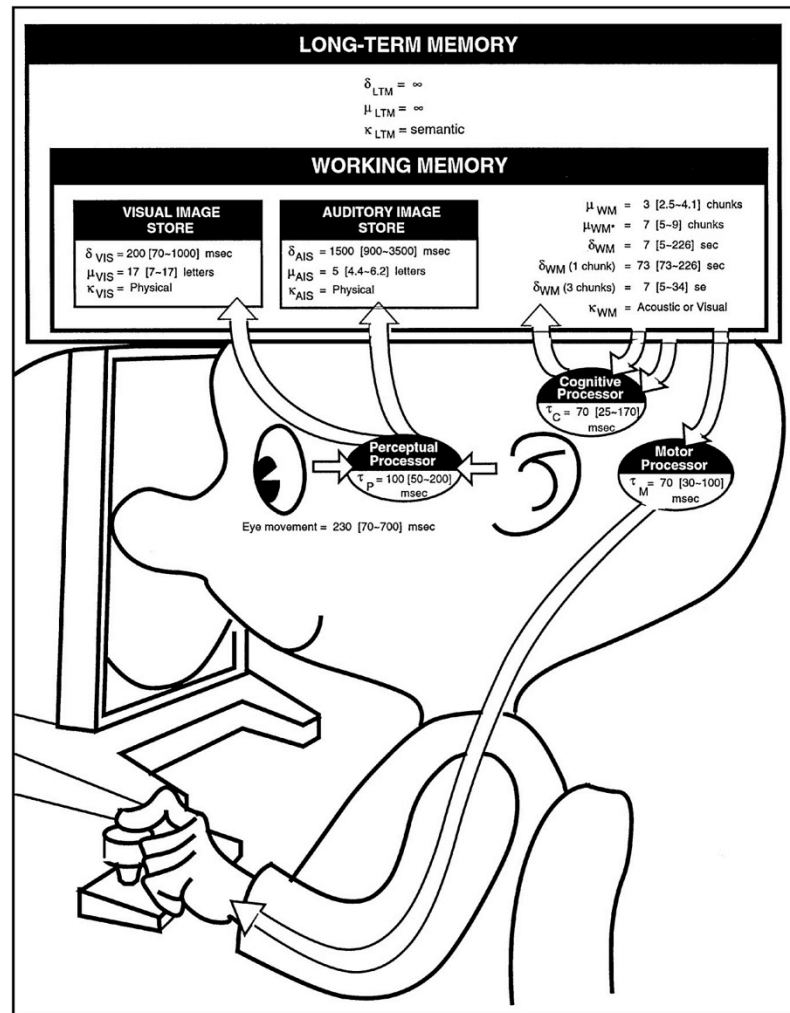
A history of “the user” is a history of HCI. Changing conceptualizations of “the user” are implicated within changing HCI frameworks. The earliest manifestation of HCI was human factors engineering in the early twentieth century. Motivated by efficiency of machine operation, and tasks that reduced both mental and physical strain on the operator, this paradigm was concerned with improving performance of the human-machine system by a combination of human factors and engineering (Bannon, 1991). People were specially trained to perform operations of the machine, to become the operators. However, with more discretionary users, or untrained people whose jobs were not primarily geared towards the computer itself, and with the rise of the personal computer, the field proceeded towards cognitive coupling between the human and the computer in the eighties.

The Model Human Information Processor (MHIP) as proposed by Card, Moran, and Newell is one of the cognitive frameworks of “the user” (Card, Moran, & Newell, 1983). The MHP model was oriented around the idea that human information processing is analogous to computational signal processing, and that the primary computer human interaction task is in enabling communication between the machine and the person (see figure 1) [Harrison, Tatar, & Sengers,

2007]. This human information-processor model enabled engineering calculations to approximate human performance by looking at structure, content and dynamics of individual user cognition at the interface (Bannon, 1991; Card *et al.*, 1983). The model compared the processing and storage areas of a computer to the perceptual, motor, cognitive and memory areas of the computer user; thus, reducing the human user to a low-level calculation model. The Goals Operators Models and Selection rules (GOMS) is a modeling technique proposed by Card, Moran, and Newell, that reduces user interactions with a computer to elementary actions (Card *et al.*, 1983). Harrison, Tatar, & Sengers (2007) argue that this cognitive paradigm has deeply influenced how HCI conceives design and evaluation.

The information-processing paradigm suffers from severe limitations in its reductionism of human beings studied in isolation in a laboratory (Bannon, 1991; Kapetlinin & Nardi, 2003; Suchman, 1987; Winograd & Flores, 1986). In response to the limitations of this paradigm, post-cognitivist HCI is concerned with how the use of technology emerges in social, cultural, and organizational contexts, such as activity theory (Nardi, 1996), distributed cognition (Rogers, 1997), ethnomethodology (Suchman, 1987), and phenomenology (Winograd & Flores, 1987).





**Figure 1:** Model Human Information Processor (Card, Moran, & Newell, 1983)

*My approach in the dissertation:*

Any critique is forged by personal, political and ideological positions. My approach in this dissertation is shaped by three concerns: Firstly, design has geographical homes and that human culture and identity change emergently across space, dissociating the typified experiences and de-contextualization from the point of origin of a technology (Nardi & Kapetlinin, 2012). This often results in a mismatch in presumptions of usage and actual usage shaped by new cultures,

practices, and identities. I acknowledge, examine, and theorize these realities where technologies are beginning to be embedded.

Secondly, western world HCI concerns of efficiency and usability (Nielsen & Molich, 1990), originating from tightly controlled, ergonomic experiments among information technology users with high socio-economic status, literacy and familiarity with devices, are narrow in scope. My work is inspired by post-cognitivist HCI thinking of considering users as social actors embedded in social and cultural contexts (Bodker, 1991; Card *et al.*, 1983; Millen, 2000; Nardi, 1996). Specifically, I employ the ethnographic technique (Spradley, 1979) to gather an understanding of the lived experience in various low-income contexts.

Thirdly, design for developing countries have historically been encapsulated in notions of spatialized cultural difference (Gupta & Ferguson, 1992). Examples include Geert Hofstede's categorization of national cultures into labels such as "collectivism" (Hofstede, 2001) and the discourse of digital divide (Fuchs & Horak, 2008) motivated by the universalistic promise of technology. These notions inevitably implicate developing countries in political and portable ideologies of development, historically envisioned as simple transfer of western technologies to developing countries without regard to local context (e.g., the Washington Consensus, a one-size-fits-all economic package proposed by the World Bank for developing countries, which turned out to be a failure (Stiglitz, 2003; Rodrik 2006). While I employ the rhetoric of technologies travelling from the designer context of Silicon Valley to new locations worldwide (I am aware that "a slum in Bangalore" may invoke images of exotica, but that is not my goal here), I am mindful of the important reminder that anthropologist Alex Taylor offers us in

examining technology practices “there, right there” (Taylor, 2011). Instead of drawing contrast with conventional usage practices in HCI, I examine the agency, resourcefulness, and creativity exhibited by actors in their local practices in making technologies work for them. I am heedful of simplistic binaries (us versus them, developed versus developing, or single user versus collective user) and add nuance and texture to local conditions and concomitant technology practices. I should note that in connecting observations back to design practice and theory, some amount of tying it to “back here” (Taylor, 2012) is inevitable.

Going back to the fundamental principles of HCI, I argue that while the abstraction of the technology user is crucial to design theory and practice, the imaginary of “the user” is severely limiting. Indeed, in as early as 1993, Jonathan Grudin (1993) points to the limitations of the term “user”, helpful from earlier engineering contexts, but problematic in the broader context of HCI. He further notes that the term “user” invokes associations with “drug-users” and pointed to the shift towards groups or organizations as a collective and multifaceted “user”. This point resonates with the crux of my dissertation—that the scope of the term is narrow since there could be more than one “user” in several contexts. There is already a discontent in the area of library studies discourse on the “death of the user”, or the theoretical end of the understanding of humans and their activities as either determinative causes of, or effects from, ‘generating’ or ‘using’ information (Day, 2011). Norman (2000) calls for designers to consider “people”, not “users”. Clemmensen (2010) argues that designers should be sensitive to regional and national differences in understanding work styles and interaction design. A notable example he provides is the lack of support for Danish characters in MS-Word and domain names until recently and the unwieldy adaptations that people come up with in printing Danish characters on “un-Danish”

computers by using Hex codes (Å : 0197, Ø : 0216, or æ : 0230). Abdelnour-Nocera (2010) argues that we must take the broader context into account in order to understand the usefulness of any interaction design.

### *Production of Use*

As emerging technological contexts and on-the-ground realities challenge canonical constructs such as “the user” and their underlying personal-private assumptions, traditional analytics in HCI need to be pushed, pulled, and prodded in new directions. The user abstraction would adequately serve the changing contexts of use, only when we re-ground and re-conceptualize “the user” within conditions of use, and not merely extend it into new contexts of use. For instance, we cannot simply multiply the number of users by five in a collective use setting, without paying attention to the *interactions* between users.

In this dissertation, I re-imagine and re-configure existing HCI analytics and assumptions through three field studies. Based on my findings from the field, I propose Production of Use as an alternative design analytic for studying emerging technology contexts, especially in low-income settings.

*Production of use is a multi-user design analytic that examines the relational aspects of user groupings, technologies, and resources, and how they together produce use.*

The Production of Use analytic considers the various groupings of users, resources available, access and ownership configurations, and various interface arrangements for different users. As we steer away from the personal-private model, we begin to see that multiple users may constitute an interaction, changing the interface, its inputs and outputs, access mechanisms, and

ownership with each user / group. Therefore, the unchanging, one-to-one analytic of “the user” begins to break down because it does not capture the dynamism that is inherent in shared use. By analyzing the Production of Use, we can critically examine the changing users and conditions of use.

A Production of Use analysis starts off by asking “how is use produced?”, instead of “who is the user?” It is a relational exercise that considers the activity and relations between and among users and technology. While the design process reduces knowledge into concrete entities that can be incorporated into requirements for product design, the analytics in the process can help the designer to critically examine the people, activities, resources, and modes of action. Production of Use is motivated by the changing unit of analysis in technology use; in many cases, it is not an individual user sitting in front of a computer with a personal and private relationship, but use may be split among multiple users (noted further in chapter three). Shared access, as we shall subsequently see, arises out of a combination of economic necessity and cultural norms. We need a better handle on critically understanding these changing conditions to productively shape HCI to evolve with the continuously shifting contingencies of technology use.

Production of Use addresses several key challenges in current HCI analyses. It considers various *groupings* of users, with their ownership and access relationships. It considers *time*, a critical component of multi-user interactions, *i.e.*, how does usage change with time and with changing sets of users. Production of Use considers *heterogeneity* of users, that the various groupings of users are composed of different entities. It considers the *scale* of use, looking into how the properties, relevance, ownership, and maintenance of the technology scale up or down in user

groupings. It considers the *agency* and powers of the users and the *resources*, both material and non-material, involved in interactions.

“Use” as a starting point allows us to generate an expansive set of directions to understand technology usage, which is often shared. Shared usage is not unique to developing countries; rather, several personal interactions involve multiple users on occasion (Kiesler, Zdaniuk, & Lundmark, 2000; Yardi & Bruckman, 2012). Production of Use analyzes use as a continuous phenomenon through time and space, tracking changes through multiple actors and resources. It helps us understand various direct users, intermediaries, beneficiaries (described in detail in chapter three), tertiary users, and non-users. It helps us go beyond the “technologically literate” assumption to examine more deeply the technological skills, textual and symbolic literacies at hand, and the various physical resources employed in accessing the interface. It helps us understand ownership and access (property is the right to benefit from things, whereas access is the ability to benefit (Ribot & Peluso, 2003)), not as a given, but to understand where access is provided and where it is taken or subversive. If social norms are subverted to access technology, then what are the tools, regulations, and people involved in these interactions and infrastructures (Cervantes, Warschauer, Nardi, & Sambasivan, 2011)? Finally, Production of Use helps us understand how interfaces are re-arranged and re-configured with each user.

Finally, following Norman, I argue that for a healthy design discipline, we should consider technology users as *people*, not “the *user(s)*”. People have subjectivity and agency in everyday activities, and this extends to using technology, not merely in “using” the device (Grudin, 1993). Particularly in resource-constrained settings, where technology is very much an aspirational

desire (Pal, 2010), people are creative and resourceful in creating workarounds to access the technology. I should note that using the term “people” leads to inaccuracy, by suggesting that there is always a collectivity using a technology, especially in low-income communities (while it is a possibility, it is one among several). Instead I simply argue for imbuing the spirit of the term people in any design activity, understanding, or analysis i.e., considering the richness of human activity, not just the plurality. This dissertation deals with the relational aspects of use, by studying people in complexity in context and activity around the technology, thence the user; versus the user interfacing with the technology, thence the technology. It deals with questions of defining the collectivity and scope of the group considered.

### ***1.2.2 Sharing and coproduction***

In this section, I discuss shared access and multiple users in both developed and developing country contexts.

#### *Sharing in developing countries*

In developing countries, technology is characterized by high ownership costs amidst cultural norms of sharing (Burrell, 2010; Steenson & Donner, 2009). As a response, shared access or multiple users for a single technological resource is a prominent mode of technology use in these contexts. Technological sharing is a complex production of both culture and economics. Previous studies have been inconclusive about attributing causality of sharing to either resource/financial constraint or cultural logics (Benkler, 2004; Burrell, 2010; Steenson & Donner, 2009). This dissertation follows the norm, rather than the exception, in showing that sharing is borne out of a combination of economics and culture.

### *Cultural norms*

Previous studies have predominantly focused on the low-income household and village communities (Pal, Lakshmanan, & Toyama, 2009; Steenson & Donner, 2009). Genevieve Bell, in her examination of Asian homes, argues that the individual is not the smallest unit of social organization; rather it is a range of social units, from extended family to clans (Bell, 2003). While I agree that there is a need to examine social units larger than the individual and there is evidence of the communal nature of interactions, I do not find it productive to start examinations at the group unit, because such a lens summarily misses the individual, where the interactions may occur in addition to the groups.

Jenna Burrell (2010) closely examines the social relations in mobile phone use, providing a nuanced look at the various roles that people play with respect to technology. In her examination of shared access of mobiles among Ghanaian households, Burrell describes multiple roles in mobile phone usage—the user, purchaser, owner, possessor, or operator. She notes that some of these roles were plural (*i.e.*, multiple owners, operators, or users). Burrell's work provides a great perspective on the various configurations of ownership and access in a socio-cultural context.

Another nuanced perspective comes from Steenson & Donner (2009), in their ethnographic research on various modes of mobile phone sharing in urban middle-class Indian families. They classify domestic sharing into four types: conspicuous sharing, or hands-on sharing where people borrow devices; stealthy sharing, or sharing without the owner's knowledge; person-seeking, or calling to speak to a nearby person; and place-seeking, or treating the mobile as a landline in



particular contexts. They further note that mobile sharing is born not merely out of economics, but may also be influenced by cultural factors. Their work points to the phone as an informal sharing device and the structuring of the sharing by economic constraints, family mores, and literacy.

The ethnography of middle- and lower-middle class families in Mumbai and Dharmashala by Rangaswamy & Singh (2009) deconstructs the notion of sharing as borne out of economics. They point out that in the Indian context, there is significant sharing among members of a family, community or neighborhood. However, the desire for privacy among members leads to a personalization of the shared space and a tension between owning individual devices and sharing them at the same time with family members. Rangaswamy and Singh articulate that sharing is not a neat phenomenon even among cultures where it is a common practice; rather, personal interests conflict with shared interests. Venkatesh, Gonsalves, Monk, & Buckner (2007) created a compilation of domestic technologies, including the design and usability of community-based technologies.

The Grameen “Village Phone” is viewed as a success of commercial technological sharing in developing countries. The Village Phone extends technology sharing to village communities through paid phones (Donner, 2005). The model works through a micro-entrepreneur, who borrows money for a special mobile phone configured for multiple-user accounts and rural access via powerful antennas. The entrepreneur purchases minutes in bulk, which she resells to customers in her village. She gets a livelihood, and her village gets connectivity. Grameen

reports over one hundred thousand villages already served, and is now rolling its model out beyond Bangladesh, into Uganda, Rwanda, and elsewhere (Grameen phone, 2012).

Another example of a system of shared phones is that of the “umbrella ladies” in Ghana, who own a mobile, a chair, and an umbrella (Sey, 2007). A study by Sey (2007) shows that the relatively affluent are the owners of these shops, but these efforts themselves indicate utility by connecting rural and urban households. In Rwanda, Donner (2005) notes that:

*“handsets often pull double-duty, used by multiple family members, shared among friends (perhaps by swapping SIM cards in and out), or perhaps by a whole set of users in a village or neighborhood. Across the region, many people make their living by selling individual calls on handsets”.*

The Grameen model and umbrella ladies pose an interesting question for us: can we consider commercial sharing as sharing in the traditional sense (non-remunerative, not an exchange, not paid)? I believe the answer is that commercial sharing is a different kind of sharing. It calls on other kinds of shared norms that are somewhat established within the category of general commercial activity. Thus, there is substantial negotiation and interaction between people, but it is along a trajectory wholly defined and understood as monetary—and hence, easily identifiable as separate from other forms of social intercourse. The three research studies in this dissertation are limited to non-remunerative sharing in communities.

Human mediators constitute an important part of ICT4D projects, either in a development institutional context or commercial setting. Human mediators transfer technological benefits to grassroots levels, ensure that projects run smoothly, and contribute to their sustainability. Digital Green (Gandhi, Veeraraghavan, Toyama, & Ramprasad, 2007), DakNet (Pentland, 2004) and

Babajob (Babajob, 2012) are some projects where field staff contributed to data collection and information dissemination. Medhi, Menon, and Toyama (2008) note the importance of intermediaries in job-search systems for the developing world.

In a study of multiuser interactions in India, Parikh (2006) defined primary users as direct users of a technology and secondary users as “those having only partial or no physical access to computing devices, who must interact with information resources via a proxy primary user who has the required access rights and skills”, particularly in the context of ICT4D interventions and commercial services. For example, commercial kiosk operators (primary users) helped secondary users (local villagers) access and print information from the Internet. Sukumaran (2009) examined changes in trust in source based on positioning of the intermediary versus the user, noting that beneficiaries tended to prefer balanced conditions between intermediary and technology. Here, the intermediary is the direct users with technology skills or literacy and beneficiary is the secondary user accessing the information. However, prior research in ICT4D has examined intermediation only in institutional, commercial, or laboratory settings. Inquiry in naturalistic and organic settings of use, especially domestic households, will shed different light on multiple users and intermediation.

*Sharing in western contexts:*

Technology sharing studies are not limited to the international development literature. Previous studies in HCI have examined technology and content sharing among multiple users. Karlson, Brush, & Schechter (2009) describe how users are selective about the kind of smart phone function or content they want to share. Brush and Inkpen (2007) observed technology sharing in

domestic environments, noting that families wish to have a shared device with personal profiles. Voida, Grinter, Ducheneaut, Edwards, & Newman (2005) discuss music sharing in iTunes in a corporate environment, highlighting how impression management was an important part of sharing. However, studies of technology sharing in resource-poor settings in the West are missing in the HCI literature.

Previous studies in HCI have investigated the role of technical experts in enabling usage of devices. Answer Garden 2 combined technical and human resources to create a collaborative help program for answering questions (Ackerman, 1998). HomeNet examined the role of “family gurus” (typically teens) in providing assistance in Internet usage (Kiesler, 2000). The gurus acted as bridges between computer users and external help desks, solving technical issues. Jackson, Von Eye, Biocca, Barbatsis, & Fitzgerald (2005) examined the influence of family support in HomeNetToo in low-income communities in Midwest United States. They reported a negative relationship between family support and Internet use, leading users to independently use the Internet once they were experienced. Another thread of investigation is in-home networks, where technically knowledgeable users assist family members in setting up networks. Poole, Chetty, Morgan, Grinter, & Edwards (2009) examined the factors involved in giving and taking informal help in tech support. The cost and know-how in seeking formal resources motivated help-seekers to look for informal help within social networks, whereas reputation, technical expertise and obligation motivated help-givers to provide help.

Shared access, then, involves complex and messy social and technological practices that complicate design notions and representations around multiple users. We know little about

sharing in low-income households and how people of limited skills or literacy access technology. If sharing is a common method of access, we do not know when sharing occurs and when not. Further, we do not know about sharing in the low-income enterprise, where sharing is neither borne out of tight family structures nor is it remunerative. This dissertation examines these questions by locating itself in low-income settings in India.

### ***1.2.3 Anthropological texts on India***

#### *Family and society*

Several aspects of the Indian life experience, ranging from caste systems to nation building, have received academic attention. Of relevance to this dissertation is the ideology and practice of the Indian joint family system. Ethnographic texts point to the shared nature of the social unit. Susan Wadley (2002) points to the idea of power in numbers in India's village communities and the training that children receive that marks their interdependence, and a sense of belonging to a group that is more than individual goals and aspirations. David G. Mandelbaum (1948) writes that a very important part of the social unit of the family is that all property is held in common. There is a common purse into which all members of the family contribute their gains and earnings, from which all expenses of members, earners, and non-earners are paid alike. In the economic sphere, the joint family is not just a single consumer unit, but also a single producer unit, involving multiple members in the production of an economic exercise.

Margaret Trawick (1992) writes about *anpu*, or "love" in the Tamil language, in an open-ended fashion, rather than a bounded, authoritative reading. *Anpu* is not understood literally by one definition, but by a range of relationships to many metaphors and lexemes in Tamil culture, such

as *adakkam* (containment), *kodumai* (cruelty), and *azhukku* (dirtiness). It is used as a free-floating signifier by Trawick, referring to what Tamils feel when their children are teased, when they are frightened, when they are forcefully fed during an illness, and the like (Lynch, 1990) (Trawick, 1992).

Indian anthropologist Andre Beteille (2006) adds another slant on the shared nature of information. He notes that Indians put very little value on privacy, whereas they delight in secrecy. He further adds that dispositions towards privacy is encouraged in some societies and discouraged in others.

#### *Entertainment and communication*

Technologies are always understood in cultural contexts (Leonardi, 2003). Entertainment and communication technologies have profoundly influenced the Indian society, both, through their social construction and shaping of society. William Mazarella, in his book “Shovelling smoke”, describes how the global and local interact in the advertising industry in India, shedding light on the delicate relationship between culture and consumerism (Mazarella, 2003). Purnima Mankekar’s “Screening culture, viewing politics” is an ethnography of television viewing in two low-income neighborhoods in India (Mankekar, 1999). By using the lens of national television, it circumscribes the reconstitution of family, engendering of communities, narratives of violence, and reconfiguration of Indian nationhood. Mankekar extracts interpretive responses to her respondents’ television-watching practices and “highlight the materiality of interpretative practices: women’s responses to Doordarshan discourses had concrete implications for how they made sense of their lives” (p. 23). Kavoori and Chaddha (2006) add a cautionary note to the

mobile phone as a *cultural technology*, by discursively examining mobile phone advertising. They argue that when the cultural value of the phone becomes a part of the arrangement of daily life, what results is not prosperity, but cultural dislocation and alienation. They point to further work to be done before we completely embrace mobiles as indicative of a new popular consciousness or as a restructuration of traditional communication patterns.

#### ***1.2.4 Development and Livelihoods***

##### *On “development”*

“Development’ is a long contested term. Created for the reconstruction of countries after the devastation from World War II, international development has historically involved economic and political institutions, governments, and aid agencies. In 1944, the United States of America created the International Bank for Reconstruction and Development (now part of the World Bank Group) and the International Monetary Fund (IMF), and in 1945, the United Nations was created. The idea of development as a policy goal can be traced back to the inaugural speech of American President Truman in 1949 (Esteva, 1993). The vision he declared was of,

*“...making the benefits of our scientific advances and industrial progress available for the improvement and growth of underdeveloped areas.”*

Development was widely interpreted in terms of increasing nations’ economic output. Under one of the first conceptual apparatuses in development, modernization theory, the Marshall plan provided American aid to European countries affected by the World War II (Hogan, 1998). In 1960, WW Rostow proposed his Rostovian take-off model, providing a linear path between “traditional society” to “age of high mass consumption” (Rostow, 1960).

In the 1970's, Andre Gunder Frank (1996) made popular a neo-Marxian theoretical development, called Dependency theory. The theory contended that “developed” countries constituted a “core”, which transported resources to the “developing” “periphery”, which created uneven, lopsided growth for the developed countries at the expense of developing countries. The World Bank and International Monetary Fund created Structural Adjustment programs to allow developing countries to borrow money from these institutions or to borrow existing loans for lower interest rates. Critics of the program have claimed that it affects the sovereignty of the nation by creating a dependency of the national economic policy on external financial institutions (Kapur, 1998; Zaleski, 2006).

The economic view is now widely recognized as inadequate for a range of reasons. Firstly, it assumes that increasing average incomes will benefit all of the population, whereas huge inequalities may not be addressed. Secondly, it assumes that increasing economic production and consumption is a fundamental good in itself, whereas it often has damaging environmental impacts and might be achieved in the context of extremely repressive regimes. Thirdly, it frames development as a process of making “underdeveloped” areas more like the “developed world”, implying that the way of life in these “developed” countries represents the best of all possible worlds.

In the 1980's, moving away from traditional approach of welfare economics, development economist Amartya Sen (1979) introduced the “capability approach”. Sen argues that development should result in people having greater freedom to make and act on choices about the kind of life that they want to live. He discusses the importance of other liberating factors such



as: political freedoms (such as freedom of speech and democratic governance), social opportunities (such as education and social mobility), guarantees of transparency (from agents of government and other wielders of power), protective security (health care and other social safety nets), as well as the economic freedom in the form of opportunities and abilities to earn or create a livelihood. This work was foundational in the creation of the Human Development Index (HDI) by Mahbub Ul Haq & Amartya Sen (1995) in the 1990's, shifting metrics from national income to people-centered measurement (UN HDR, 2012). The HDI is a measure of life expectancy at birth, adult literacy, combined gross enrollment in education, and gross domestic product per capita.

In the 1990's, a new wave in the development discourse was created when critics of colonialism and post-colonialism, such as Arturo Escobar (1995) and Gustavo Esteva (1993) challenged the very meaning of development, calling the intellectual movement post-development (Allen & Thomas, 2000). According to them, the way we understand development is rooted in the earlier colonial discourse that depicts the North as "advanced" and "progressive", and the South as "backward", "degenerate" and "primitive". They contend that development had never worked, as conceived by the large-scale IMF and World Bank recipe models. Development is seen as a set of knowledges, interventions and worldviews (in short, discourses) that are also powers—to intervene, transform and to rule. Post-development critiques challenge the notion of a single path to development and demand acknowledgment of diversity of cultural perspectives and priorities. Post-development argues for two approaches: 1) development must be from bottom-up, and 2) poverty must be tackled systemically, i.e., the forces of poverty must be handled in addition to poverty itself.

In a similar vein, the participatory development movement argues for “putting the last (target communities) first.” According to Chambers (1983), three main questions need to be addressed in implementing policies for the poor: Who is poor? Why are they poor? What needs to be done to reduce the number of the poor? As an alternative to the top-down reductionist definitions and objectives, and poor people’s realities present development professionals with challenges that are institutional and professional. Central to the participatory development approach is the basic human right of poor people to conduct their own analysis. Inspired by Chambers and the post-development literature, I shaped my approach in research as largely participatory in nature and considered the economically poor communities as central to my data collection and analysis.

In contrast, the concept of ‘sustainable development’ upon which much HCI4D work is more or less implicitly based, draws attention to the need to consider the whole technical, financial, social, and environmental ‘ecosystem’ in which a development initiative is sited. Sustainable development is in part a response to the failure of projects where technical equipment was given by government donors (or often purchased on the basis of a long term loan). When the equipment requires maintenance, or parts need replacing, the recipients do not have the skills, the infrastructure or the currency to solve the problem. The Sustainable Livelihoods framework (DFID, 1999) is a widely used framework that reflects this perspective. One dimension of sustainable development is a concern with ‘capacity building’, which concentrates on developing the skills and capabilities to sustain external initiatives after initial funding is withdrawn. Another approach is ‘capacity centric’ which focuses on sustaining initiatives with funding that

builds on those capacities that are present in the community or on finding solutions that capitalizes on the communities' existing capabilities.

*My approach to development in the dissertation*

Anthropologist James Ferguson (2007), in his excellent book “The Anti-politics Machine”, notes that any question on the development problematic of the form “what is to be done” implies both an aim and an actor who strategizes towards the goal. The question immediately identifies the undoubtedly worthy goal of alleviating poverty and its suffering. A first step is in clarifying the goal. He puts forward two other questions: “what should they do” and “what should we do” and calls for defining the “they” and “we”. Ferguson argues that that there is no single collectivity with a united political interest in advancing the interests of the people, or the “they”; depending on the specific, localized, tactical question, it is the government or, ideally, people. For the question of “we”, he suggests that a more helpful question is “what should we, the scholars and intellectuals working in or concerned about the Third World do”. As a development researcher and HCI4D designer, I comprise the “we”, the group that shares the intellectual commitment in bringing equality, democracy, and empowerment to less privileged groups. Being in this space, I view development efforts by the nation-state or non-profits not with skepticism, but the critical eye of the researcher.

Much of the social sciences literature on development describes the lump sum of these countries as the “third world” (Elyachar, 2005; Escobar, 1995; Ferguson, 2007). In my opinion, the term is derogatory and outdated: neither are the countries non-aligned with the Soviet Bloc any more nor do they comprise a separate geographical or ideological entity that “third world” seems to

suggest. Another term used in HCI, more specific to HCI4D, is the “Global South” (Chetty, 2007). The term suggests a homogenizing of sorts, a clubbing together of attributes geographically, that seems rather inaccurate. After all, Singapore, South Korea, and Australia technically comprise the Global South.

For lack of a better term, I use “developing countries” throughout this text to signify economically poor countries that are bottom 100 countries of the Human Development Index. I use the term “emerging contexts” to signify contexts where technology is just beginning to penetrate and where new users are being created. I use the term “developing contexts” to signify low income, resource constrained areas in both developing and developed countries. While “developing” as a measure and description is still inaccurate, the term offers a fairly decent label for economically poor countries. After all, one has to question how a statistic can signify “development”? Is the 101th country to be considered as “developed” by virtue of being one rank ahead? Using poverty as a measure is thorny: how do we calculate for Purchasing Power Parity? And the debate of relative (Townsend, 1979) versus absolute poverty (The Economist, 2008) leaves us with no definite answer. The term is certainly more positive than “underdeveloped” countries, although the opposite is “developed countries”. The term “developed countries” is further contested. For example, the USA, has a Gini coefficient—an economic measure of distribution of wealth or equality, typically on a scale of 0 to 1, where 1 denotes perfect equality and 0 denotes perfect inequality—of 0.801 compared to Bangladesh’s 0.660 (Davies, Sandström, Shorrocks, & Wolff, 2008; Gini, 1936).

*ICT4D*

ICT4D (ICTs for Development) refers to the area concerning with the application of information technology for poverty reduction. The premier conference in this area—the IEEE/ACM international conference on Information Communication Technologies and Development (ICTD, 2012)—defines the term "ICT" as that which “will comprise computing devices (e.g. PCs, PDAs, sensor networks), and technologies for voice and data connectivity such as mobile telephony, the Internet, and related technologies”. The application domains are listed as education, agriculture, enterprise, healthcare, poverty alleviation, general communication, and governance. The papers published in the venue consider novel design, new technology, project assessment, policy, impact, content, social issues around ICT for development, and so forth. Offering a similar definition, Kentaro Toyama and Bernadine Dias (2008) defined ICT4D as a field involving multiple sectors—governments, academia, small start-ups, large corporations, intergovernmental organizations, nonprofits, and nongovernmental organizations (NGOs)—and drawing interest from multiple disciplines: anthropology, sociology, economics, political science, design, engineering, and computer science to name a few. Jenna Burrell and Kentaro Toyama (2009) define ICT4D elsewhere as broadly involving a consideration of human and societal relations with the technological world and specifically considers the potential for positive socioeconomic change through this engagement.

Richard Heeks (2009) provides a historical overview of the field of ICTD tracing the recent explosion of ICTD to the 1998 World Development report from the World Bank for highlighting the role of information, knowledge and ICTs in development; G8 Digital Opportunities TaskForce in 2000 for setting an agenda for action on ICT4D; and the World Summits on the Information Society held in Geneva in 2003 and Tunis in 2005. He describes a shift in ICTD

from late 1990's-early 2000's to the late 2000's model of ICTD 2.0, marked by a shift in goals from effecting Millennium Development Goals to social development and growth. There is a significant departure from the tele-center/Personal Computer model to mobile phone-based solutions. He also notes a shift in key development actors, from philanthropic organizations and donors funding non-governmental organizations to “south-based” funding from governments and private players. I agree with the above definitions; although ICT4D is an evolving discipline with expanding scope, it is primarily the application of information technology in social and economic development. The objective of development can go beyond Millennium Development Goals to include climate change, justice, money transfer, or creativity, i.e., the goal may not necessarily be development, but the context may be a developing country. Although the majority of ICT4D work focuses on the developing world, it can apply equally well in the developed world, where poverty and its consequences can also be seen—ICT4D is the application of technology in alleviating poverty, not specific to geography but to socio-economic strata affected by poverty and developmental issues impacting them.

Innovations in ICT4D address healthcare (Sherwani *et al.*, 2007), agriculture (Gandhi *et al.*, 2007), and education (Kam *et al.*, 2008), to name a few. ICTs such as television, in combination with human info-mediation, are optimized for use in projects such as Digital Green (2007). Networking technologies, such as wireless protocols, have undergone major overhaul, in projects like DakNet (Pentland *et al.*, 2004). Finally, there has been interesting work in user-centred design for development, e.g., user interfaces for non-literate users (Medhi *et al.*, 2008). Mobile phones are often touted as the most promising platforms for ICT4D, owing to their tremendous uptake in low-income communities in the “global South.” Explorations such as MILLEE (Kam

*et al.*, 2008), Nomadic\*AID (Patterson, Sim & Aiyelokun, 2009), and Healthline (Sherwani *et al.*, 2007) have targeted development problems by innovating applications for the mobile phones. Economist Robert Jensen (2003) has tracked economic benefits to the poor through the mobile phone, notably in a study on fishermen of Kerala. Sociological studies addressing the fit of mobile phones to development point to a range of techno-social innovations—“missed calls” or “flashing” (2007) and circulation and sharing of mobile phones (Sey, 2007). Previous research has also studied the changes to social and business networks through mobile phones, including in India (Donner & Escobari, 2010) and Jamaica (Horst & Miller, 2006).

Christine Avgerou (2010) profoundly notes that we are the first to witness in our research the falsity of widely held technology-deterministic expectations that ICT, by virtue of its technical properties, will have this or that development effect on people.

#### *Livelihoods theories and frameworks*

A common feature of all the populations under study in this dissertation is that they are microenterprises. Microenterprises are major employers in both developed and developing countries, spanning both formal and informal economies (ILO, 2012). They are significant in number in developing countries where the informal economy is significant in employment and GDP. In India, they account for over 90% of the total enterprises and 45% of the manufacturing output (MSIM, 2012). Microenterprises typically have low capital, no legal status, produce goods and services for sale in the marketplace, and do not completely account their activities (ILO, 2012). The International Labor Union (2012) defines microenterprises as enterprises with 25 workers or less whereas the European Union (2005) caps the number at less than 10. In my

dissertation, I define a microenterprise as an non-farm enterprise; with 10 or less employees; without a formal payroll; and sometimes tax-paying. In this dissertation, I focus on urban microenterprises. Domestic workers and sex workers are both one-person microenterprises, whereas the urban microenterprises in the third study were made up of anywhere between one to ten persons.

I limit my focus to urban India because these communities are undergoing dynamic changes due to the exponential population growth resulting from the numerous immigrants moving from India's villages, the rapid uptake of new infrastructures and technologies, and a fast pace of growth (and its problems). I am interested in how the low-income microenterprise sector, typically comprised of migrants from neighboring villages and states, finds value in technologies and integrate them into their personal and professional lives, amidst the prevailing social and cultural values present in these communities.

Another lens to look at microenterprises is that of livelihoods, or, simply, making a living. Following the mainstream livelihood approach literature, I adopt the Chambers and Conway (1992) definition (Scoones, 2009):

*A livelihood comprises the capabilities, assets and activities required a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base.*

According to Ashley and Carney (1999), the Sustainable Livelihoods Framework (SLF) is a way of thinking about the objectives, scope and priorities for development, in order to eliminate poverty. This approach been central to rural development thinking, which has been influenced by

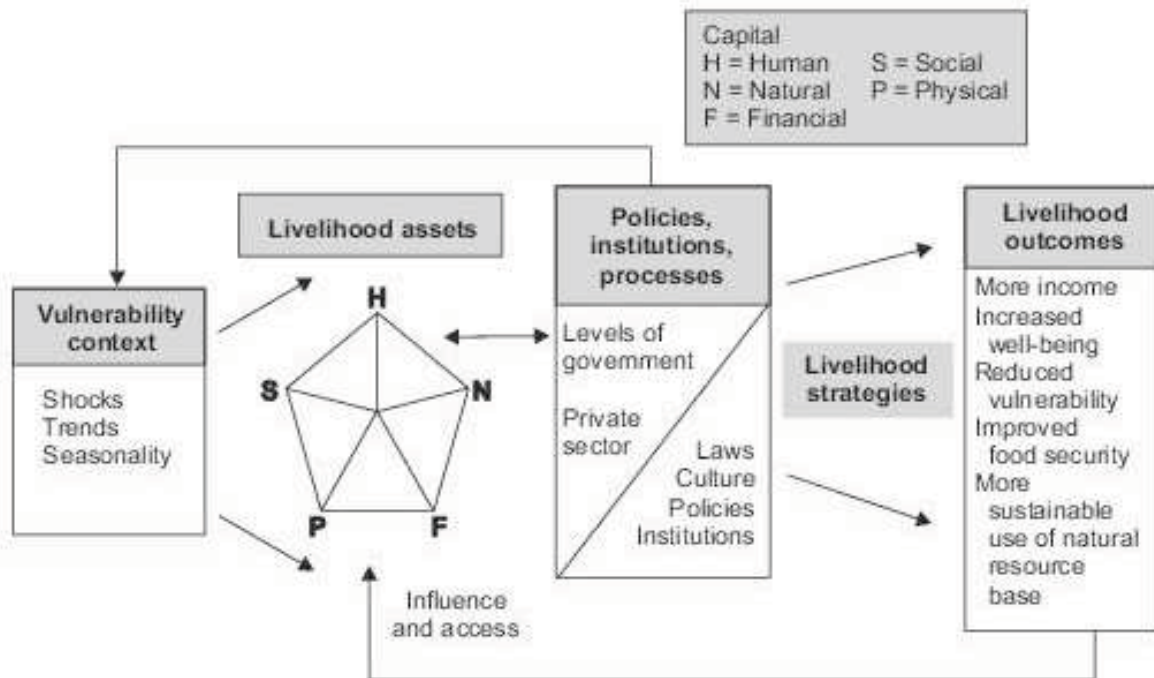


British overseas development work in sub-Saharan Africa. The idea is that effective development initiatives may be achieved through a manageable analysis of the causes and nature of poverty, taking a more informed view of the opportunities for development and how they compare with livelihood priorities and “placing people and the priorities they define firmly at the center of analysis and object-setting” (Scoones, 2009).

The SLF views livelihoods as systems and provides a way to understand:

1. The *assets* people draw upon, both tangible and intangible. They are broadly classified into five groups: human capital, social capital, natural capital, physical capital, and financial capital.
2. The *context* (social, economic, and political) within which a livelihood is developed
3. The *strategies* they develop to make a living, within their social, economic, political, and environmental contexts, and
4. Those *factors* that make a livelihood more or less vulnerable to shocks and stresses, such as livelihood vulnerability and interdependence.

There are five capital assets according to the livelihoods approach including natural, social, physical, human, and financial capital. The five assets are represented in the HPSFN pentagon as below.



**Figure 2:** The Sustainable Livelihood framework (CRDI, 2004)

Although the SLF is not directly applied to the study, it offers a broad, ecological perspective within which to consider the various microenterprises.

### 1.3 Outline of the dissertation

In chapter one, “theory and critique”, I have discussed the problematic of extending “the user” imaginary as it applies to western contexts into emerging, developing contexts. Current notions of “the user” are distinct and rather limited in focus in describing people interfacing with technology in contexts that significantly vary from the west in cultural, geopolitical, infrastructural, and technological factors. As the boundaries of HCI expand, “the user” needs to be re-grounded rather than extended, by considering socio-cultural factors in these new contexts.

In chapter two, “Comparative ethnography and praxis”, I describe the social context of my research. I present an anthropological account of the comparative fieldwork that I undertook across the three field sites, viz., slum communities, sex workers, and microenterprises. I provide a comparative view of use across the three sites, each with its own cultural, political, and institutional contexts. I will elaborate upon how difference can help us locate a concept, rather than an object, and present my reflections as an Indian national writing of/from India.

As already noted, I will examine four key issues through the rest of my dissertation: the fractured use in low-income India; the murky duality of technologies as public and private; the negotiated aspect of sharing; and the separation of use, authority, and ownership. The subsequent chapters address these issues in detail.

In chapter three, “intermediated use”, I deal with the first question of documenting an emerging phenomenon: what is really new? I present an account of the fundamentally “intermediated” use, which is making use of technologies with the help of technology experts. Against the backdrop of resource constraint and uneven technological skills, I argue that intermediation is a fundamental enabler of technology use for a vast number of people in the developing world. I describe how intermediation takes place in these communities, amidst a broader ecology of sharing. I then present how intermediated use presents design mismatches to traditional heuristics for user interfaces for direct interactions.

In chapter four, “dual lives, dual SIMs”, I answer the second question of the boundaries of shared technology use. I examine the specific case of urban sex workers in India, who maintain

clear boundaries between work and home by crafting different identities. I explain how such boundaries in identity map to technology usage: by maintaining different mobile phones or SIM cards across work and home, different routines, contacts, logics and stories, and values are attached to the two technologies.

In chapter five, “sharing infrastructures”, I describe how airtime in mobile phones is shared among members of a microenterprise. I introduce social “negotiation”, or the repurposing of airtime usage towards personal interests, as the foundation of airtime and bandwidth sharing. Negotiation occurs when there are conflicting technological goals, user interests, or activities. I highlight negotiation mechanisms in the microenterprise, showing how shared resources are used towards personal interests amidst tensions and value conflicts, by adapting, modifying, subverting, and repurposing airtime.

In chapter six, “re-conceptualizing the user”, the final chapter of my dissertation, I describe a framework of Production of Use in low-income communities in India. I highlight how use, authority, and ownership are separated in the low-income locale, as opposed to the unified “user” in the traditional western scenario. Based on my findings, I explore the design space of multiple users and technological sharing. I then discuss the methodological considerations for other researchers in studying use in low-income communities, especially in considering a group as the unit of analysis, defining the scope of the group of users, and examining the use activity in context. I present some implications for ICT4D and public policy, by relating studies of use to development metrics such as access and ownership. Finally, I present a set of conclusions and limitations of my work and ideas for future work.

## **CHAPTER 2: Comparative fieldwork and praxis**

This chapter is largely concerned with my ethnographic adventures in the field. I introduce the concept of comparative ethnography, a technique for studying multiple field sites. I then present the field methods and demographics of the sites and people I studied. I present vignettes and excerpts to elucidate the social lives of the people in these settings. Finally, I examine issues of identity and authority as a researcher, specifically my own feelings, background, and socio-economic position as an Indian native studying and writing about Indian people.

### **2.1 Comparative ethnography**

In the past few decades, the traditional conception of ethnography as confined to a bounded site containing a whole culture has come into question (Appadurai, 1990; Gupta & Ferguson, 1992). A number of scholars have noted the shifting notion of culture from a stationary to one configured by intersection and flow (Appadurai, 1996; Burrell, 2009; Castells, 1996; Hannerz, 1992; Ong, 1999). In a similar vein, the field sites that I studied were already implicated in movements of economies, media, objects, ideas, and people.

I employed a comparative ethnographic method, wherein I examined the difference in user populations for better design (Nardi, Vatrapu, & Clemmensen, 2011). Comparative ethnography is an exercise in accountability of the researcher and people. It is not a thick description of the behavior and context; rather, it is an exercise in revealing difference through comparison. Studying contrast helps us understand points of transition where phenomena break, continue, or

transform. Some examples include where unique characteristics define various user groups, such as subjects having dual identities not as forgery but as a necessary occupational safety measure and reciprocity of technological sharing through other means, despite having similar characteristics like low incomes, informal economies, and lack of textual literacy.

Another technique to study a field site configuration that is not spatially bounded is the multi-sited ethnographic method (Marcus, 1995). The comparative technique is not truly multi-sited: the purpose is not to follow persons, artifacts, or metaphors, but to link concepts under study. Comparative ethnography is not merely about carrying out fieldwork in different locations, but about finding linkages and tracing concepts across different sites to achieve contrasts. More specifically, in my analytical endeavor of following the concepts of making use of technology—multiple users and shared utility across three populations and the trajectories within each—comparative ethnography is an organic methodological response. Similar to multi-sited ethnography, the dissertation is not concerned with representing “the whole” (Sunder Rajan, 2006), or in this case, formalizing a design principle. The study is about navigating different sites to resist overt generalizations in design and to produce a nuanced narrative of users and technology in low-income communities.

As such, this study is not tied to a single-site. While the move achieves contrast, the inherent feature of studying multiple sites, as noted in (Sunder Rajan, 2006), is the polyphonic nature, which may lack the depth of immersion found in a traditional single-site project. The study hopes to address of these drugs. Such a study is *about* the systems *through* a set of interacting locales as a conceptual topology.

## **2.2 Methodology**

Ethnography is a highly favored field technique in HCI4D research. It owes this privilege to the lens it provides in gauging the social worlds of the people and acceptability of technologies in a given context, often unfamiliar to the researcher. As anthropologist Franz Boas noted over a century ago during the origins of ethnography, the ethnographic approach “considers every phenomenon as worthy of being studied for its own sake... without regard to the laws which it corroborates or which may be deduced from it” (Boas, 1887). I employed a palette of ethnographic methods to observe as well as elicit the worldview from people. My fieldwork examined technologies by “seeing” like the informants (Scott, 1998). I investigated the place of technology through 1) socio-economic profiles, 2) resource constraints or enablement, 3) changes in information, communication and cultural processes through technology, 4) social networks, and 5) life courses and histories of the interviewees.

Ethnography is highly interpretive in nature, as summarized in Geertz’s (1973) dictum that ethnography is “not an experimental science in search of law but an interpretive one in search of meaning”. My primary method was participant and non-participant observation, pivotal methods of the ethnographic enterprise. I observed social dynamics and cultural conventions in various sites. Ethnographic observation provides the detail and nuance of technology in the lives of informants: the passion, the dreams, the frustrations, or cultural production around technology. I followed informants in their everyday, to understand how, when, where and why technology interplayed with their lives. As summarized in this extract from Biocapital (2006), ethnography illustrates objects of study:

*“I think anthropology is most powerful [...] when it is used as an illustration rather than evidence, especially since believing in the latter involves reifying ethnography as an enterprise of factual knowledge production that is precisely what anthropologists of science and technology try to deconstruct in their objects of study”. In other words, the “I was there” is not necessarily “that is how it is””.*

My second method was the ethnographic interview. Interviews provide opportunities to learn about people’s elicited narratives and representations of their social worlds, including beliefs, ideologies, justifications, motivations, and aspirations (Boellstorff, Nardi, Pearce, & Taylor, 2012). Informants can sometimes be eloquent commentators about their cultures, as ethnographers have long noted [e.g., (Mead, 1928; Tsing 1993)]. Interviews allow researchers to labor to grasp informants’ own “visions” of their worlds. My interview questions were based on people’s life stories, technology usage, and day-to-day activities, and, more specifically, on sharing, identity, infrastructure work and invisibility.

In addition to traditional fieldwork, I made use of technology to elicit additional data. I provided analog cameras to informants to record the visual minutiae of life that cannot be verbalized in interviews, such as people, places, and activities. I provided paper-based mobile phone diaries to log callers/users, time, location, and purpose (Horst & Miller, 2006; Grinter, Edwards, Newman, & Ducheneaut, 2005). My final technique was to take design prototypes to the field to gather inspiration to foray into the design space (Gaver, 1999). These methods allowed me to record the stories about subjects’ own early engagements with technology, services, and/or mobile phones, and how those experiences have spilled over into their current work.



I focused on understanding technology use among three low-income communities. The methods employed in each study are discussed below.

### ***2.2.1 Study I: Intermediation***

For the first study, I studied technology use in urban slums in India. Two urban slums in Bangalore—Ragigudda and Nakalbandi—were chosen as the sites of investigation. I partnered with a local non-governmental organization for domestic worker rights, Stree Jagruti Samiti, which has built excellent rapport with the slum inhabitants for the past 17 years. I sought to understand technology usage in the informal and non-institutionalized settings of slums.

#### *Methods*

Since this study focused on uncovering technology usage practices, it was imperative to employ methods that were ethnographic in method. A thick description (Geertz, 1973) was obtained through a variety of qualitative methods and probes. I employed participant observation in gathering background data. I spent time in NGO meetings, activist demonstrations, homes, temples, offices, and near water pumps, where the informants tended to relax and chitchat. I employed open-ended interviews, which was followed by semi-structured interviews and surveys, to uncover technology usage and development issues. I gathered socio-economic data to understand family structures, sources of income, education levels, assets, and other demographic backgrounds of our informants.

Finally, I asked five persons to maintain “a day in the life of” photo diaries using analogue cameras (Brown, Sellen, & O’Hara, 2000). They were asked to capture photos of people, places,

activities, and technologies (cooking, transportation, technologies at work, and domestic appliances) that they engaged with during the course of a day. This helped us understand technological, personal, and social aspects of the informants' lives that could not be clearly verbalized in interviews.

### *Demographics*

Twenty-two women served as primary informants in our ethnographic study. I interacted with them for 110 hours through interviews and spending time in the communities. They ranged in age from 26-68 years. Twenty women were employed as domestic help or cooks, working daily between 2-3 households, and in hostels and offices, comprising the low-income informal sector (non-tax paying, low capital economic sector) (Hart, 1973). Job diversification was employed as a strategy to earn additional income (Banerjee & Duflo, 2007)—one was a part-time masseuse and the other a part-time seamstress. Eighteen of the women wove garlands of flowers and sold handkerchiefs and snacks for extra income. None of them were educated beyond high school. In addition, I interviewed 9 children and 5 men when visiting the women's homes. The children ranged in age from 5-22 years. The men ranged in age from 26-60 years. Four children had graduated from college. Two of them worked as call centre employees. Many children were enrolled in school, while some others had dropped out to contribute to the household income. The men were not educated beyond high school, and were employed in the informal sector (plumbers, electricians, construction workers, and in one case, security guard). Average family income was from 5000-8000 Indian Rupees (100-170 US Dollars) per month. Majority of the income was expended on food, rent and infrastructure expenses, as also noted in the study of the poor around the world by Banerjee and Duflo (2007).

All interviews were audio-recorded, transcribed, and anonymized. Informants were recruited through snowball sampling. Gifts, such as utensils and bedspreads, were provided.

### ***2.2.2 Study II: Urban Sex Workers***

For the second study, I focused on understanding technology use among urban sex workers in Bangalore, in collaboration with a non-profit for sex workers—Pragati.

#### *Field methods*

My preliminary field study was targeted at gaining an understanding of the function of the organization and the lives of the urban sex workers. In particular, my inquiry probed into entry into the sex trade; identity management of USWs; sites, pay scales, and entities in sex trade; physical, financial, and emotional security; and knowledge of sexually transmitted infections (STIs).

In my ethnography; I employed participant and non-participant observation, combined with semi-structured interviews. In order to understand the organization planning, implementation, and logistics, I conducted interviews with various stakeholders at the Pragati office (head office staff, zone-level staff, and field workers). I employed non-participant observation at the zone 3 Swati Manne, or the drop-in shelter, which houses some beds, a microfinance payment collection center, health checkup center, and counseling center. I spent 3



**Figure 3:** Interviews at the drop-in shelter

months at the zone three Swati Manne, attending meetings, helping at events, observing transactions and checkups, and ‘hanging-out’ in general. Interviews were conducted in Tamil, Hindi, and Kannada by the first author. I conducted non-participant observation at client solicitation locations, on streets and at homes and bus-stops. I administered semi-structured interviews with 21 urban sex workers at these locations.

### ***2.2.3 Study III: Microenterprises***

For the third study, I focused on understanding microenterprises and their use of technology. Microenterprises are small, low-capital businesses, such as flower sellers and milkmen. They constitute over 90% of the total enterprises in India. In order to understand the landscape of microenterprises, I decided to study a continuum of businesses in Bangalore and Chennai. Using

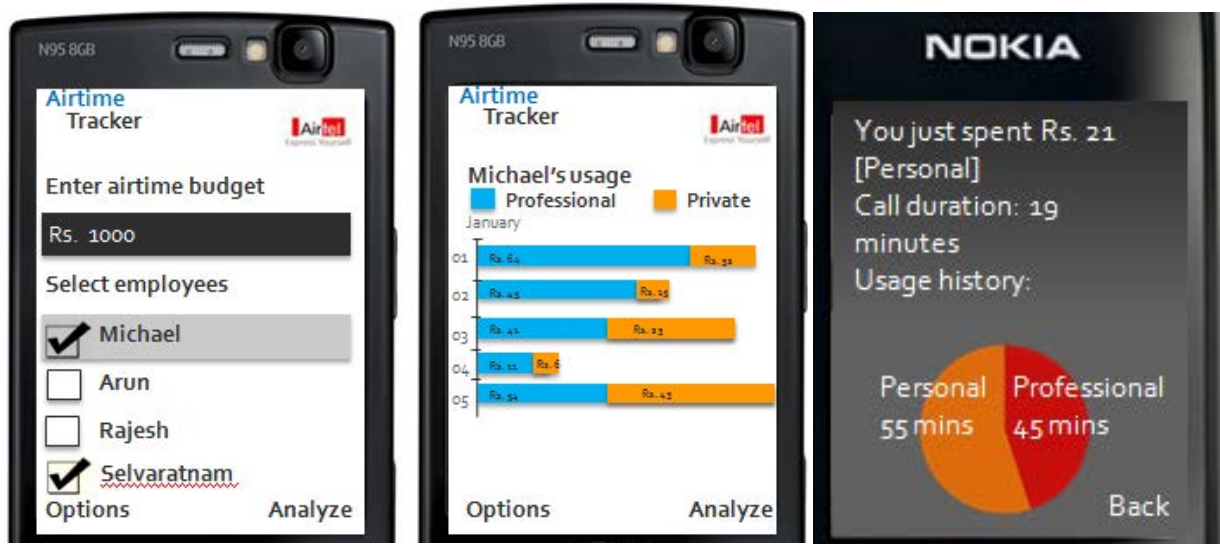
revenue as a defining axis, I approached five income brackets of microenterprises, which I call *tiers*. As I go from tiers one to five, monthly revenues increase in a scalar fashion (2,500 INR, 5,000 INR, 10,000 INR, 18,000 INR, and 40,000 INR, or 50 USD, 100 USD, 200 USD, 360 USD, or 800 USD). Tier one businesses were highly informal with family members as employees (e.g., street-side vegetable-sellers) whereas tier five businesses were nearing formality with formal employees (e.g., computer businesses). This scheme offers a range of social structures, formality, technology ecologies and usage, employee strength, and organization. I conducted all interviews in Tamil, Kannada, and Hindi.

### *Survey*

In the first stage, I conducted a preliminary survey to understand the socio-economic profiles and technology practices of the microenterprise spectrum. My goal was to study diverse microenterprises and not limit to a particular type, commodity, or service. I was interested in eliciting data on socio-economic profiles, household consumption, ICT ownership (appliances, phones, Internet, & PCs), sharing behavior, and communication ecology in the enterprise. To explore this, I surveyed 58 microenterprises. The survey exercise took me two months to complete.

### *Fieldwork*

In the second stage, I conducted a qualitative field study to further understand the social protocol, workflow, technological practices, and airtime sharing. I conducted intensive field observations and open-ended interviews with 10 microenterprises (two in each tier) for three months.



**Figure 4:** Design concepts taken to the field

### *Design provocations*

Based on results from the fieldwork, I was interested in using airtime as a lens to study sharing of technology, social relations, and economics. To this end, I employed two methods. One, I took design concepts to provoke participants and elicit their reactions and broader feelings on airtime sharing (Figure 4. More in appendices). I designed concepts for the employer, to track their employees' usage; and for the employee, to balance their personal-professional usage. Two, I designed mobile phone diaries to understand a “day-in-the-life-of” mobiles among multiple users (Figure 5). Participants recorded mobile phone logs into diaries, which helped me understand social networks, expenditure, and allocation of resources, such as talktime, similar to Horst and Miller (2006). Diaries probed into who the user was, features used, whether it was a business or family call, location of usage, duration of usage, and airtime balance at the end of the day. Diaries were partitioned into three-hour slots from morning to night, and lasted a weekend and two weekdays. Seven participants out of the initial pool were recruited. I offered airtime recharges as incentives at this stage.


























Aug 22 <sup>nd</sup> Monday		Who used? யூஸ் பண்ணது யாரு ?	Purpose எதுக்கு	Business/ Family call? தொழில்/ குடும்பம்	Location எடம்	Duration எவளோ நேரம்
	1		   	Business / Family		
6:00 - 9:00	2		   	Business / Family		
	3		   	Business / Family		
	4		   	Business / Family		
	5		   	Business / Family		
	6		   	Business / Family		

Figure 5: Mobile diaries

## 2.3 Sites and context

### 2.3.1 Study I: Intermediation

The multi-dimensional aspects of technology use cannot be discussed in isolation, without an understanding of the slum locality and context, so I provide a brief description of slum habitats and their technological penetration.

#### *Slums*

United Nations agency UN-Habitat, defines a slum household as one that lacks any of the following five elements: access to improved water, access to improved sanitation, security of tenure, durability of housing, and sufficient living area (UN Habitat, 2010). As of 2001, slums make up for 31.6% population of the world and 10% of the total urban population in India. Urban migration is one of the root causes of accelerated poverty. Burgeoning cities attract thousands of immigrants by the day, owing to the promise of socio-economic mobility. These exploding cities are weaving extraordinary new urban networks, corridors, and hierarchies (Davies, 2007). Urban slum sprawls have received little research attention despite their hyper-dynamic information and communication contexts. They were considered marginal to the

evolution of techno-scapes (Appadurai, 1990) until the mobile phone revolution kindled interests in adoptions among the next billion. In cities like Bangalore, urban planning and land pricing have led to acute stress in low-income populations to acquire habitats—informal and sometimes formal slum dwellings—in specific geographical locations. These slum settlements, also known as shantytowns, favellas, townships, or skid row, are estimated to provide housing to roughly 1 billion people in the world (UN Habitat, 2001).

Underneath Bangalore's veneer of economic prosperity and India's most-wanted IT city, lies a "non-legal city," invisible at first glance (Liang, 2006). Roughly 10% of Bangalore lived in slums in 2001, which is relatively low as compared to other Indian metropolises. However, many contest this figure. The Bangalore Development Authority provides for approximately 15-20% of housing requirements, while another 12-15% is catered by private developers, increasing the proportion of slum housing to roughly 60% of Bangalore (Liang, 2006). Lack of lease documents or ownership certificates make this number especially difficult to verify.

### *Slum Ecologies*



Both slums were located in metro-core areas. Public transportation and proximity to major commercial venues aided in connectedness. Although domestic work provided the primary income, secondary incomes were accrued by weaving garlands, providing massage services, and selling *chaat* (snack) items and handkerchiefs. The slum quarter was an evolving assortment of small habitats, spatial layouts, and commercial enterprises. Roughly 2000 households constituted each slum. Houses varied in size from 100-200 square feet. Resource constraints resulted in maximum utilization of real estate by cramming in objects within each household, open doors for ventilation, and activity on the by-lanes and doorsteps. As a result, an openly social environment was fostered.



**Figure 6:** A gathering outside the Ragigudda slum community

### *Organization of Domestic and Other Spaces*

A typical home in all three slums varied in size from one to three rooms of 100-200 square feet in total. Narrow concrete gullies (alleys) ran between houses, which were typically 3-4 feet wide (Figure 6). Constraints of space and resources forced compartmentalization of homes based on activities and functionality—kitchen area, television area, mattress area, storage area, and a washing/water storage area. Doors were usually kept open and every home typically had a constant influx of visitors—relatives, neighbouring children and adults stopping by. Children played in the gullies while mothers sat on the doorsteps. Informal spaces were popular local landmarks like fast-food joints or video parlours. Green spaces such as playgrounds were used for cricket and street soccer, though male members exclusively inhabit these. Informal collective spaces for women were religious sites like temples and water pumps during hours of water supply when they were out to clean dishes, wash clothes, bathe kids, and perform other cleaning activities. These spaces served as information hot-spots of information sharing and exchange of neighbourhood gossip.

### *Technological Landscapes*

Electricity was the most pervasive technology in the slums I studied. It was, however, prone to frequent failures. Other pervasive technologies were entertainment and communication technologies (e.g., television sets, DVD players, and mobile phones, as shown in figure 3) And kitchen appliances, like gas stoves. Laboursaving technologies, such as washing machines, clothes irons, and water heaters were rare. Objects were crammed above and below devices (refer to figure 7), due to space constraints. Despite strong face-to-face and word-of-mouth channels, subjects depended on telephones (mostly paid telephones) and mobile phones to

maintain, expand, and regenerate socio-business ties and networks. The sizable migrant population moving to Indian metropolises in search of employment accounted for robust telecom usages to stay in constant touch, and send money and resources to families in native villages.

### *Always-on Technologies*

Entertainment technologies, such as television and radio, were always-on. Every household in the study population subscribed to cable television. Local-language soap operas, local news, cookery shows, and film songs were habitually consumed. In all three slums, the most popular mobile phone was the Nokia 2600—a phone with FM radio doubling up as an always-on and a stationary entertainment source in the home. Privatization of the radio spectrum led to high uptake of modern, entertainment-based private channels.



**Figure 7:** Inside a slum household.

### *Information Ecologies*

Unaffordable Internet connectivity, limited digital literacy, and difficult-to-use mobile phone user interfaces created dependencies on alternate, human, oral sources for information. Strong information sources with vested, altruistic, or activist interests (e.g., NGO workers) acted as primary sources in Bangalore. They provided ad-hoc information on a range of topics such as personal hygiene and education loans. Members of the community active with NGOs and external social networks formed a secondary level of information diffusion. Television soaps and films portraying female, middle-class and virtuous male protagonists were considered strong sources for current affairs, lifestyle choices, and aspirations.

#### **2.3.2 Study II: Urban Sex Workers**

##### *Project Pragati and urban sex workers*

Project Pragati (meaning “progress”) is a healthcare project for USWs, primarily targeted at HIV prevention and treatment. It also provides auxiliary services, such as microfinance banking and counseling. Pragati was created in the year 2005, when Bangalore was surveyed and an HIV prevalence of 12.1% among USWs was noted.

The Pragati organizational structure was constituted by employees both from within and outside the sex worker community. The head office administration comprised non-community members and community members. As the structure moved closer to grassroots, community members essentially ran it. In particular, outreach workers (*Jananis*) and field workers (*Jeevikas*) were chosen from the sex worker community.

Jeevikas, or fulltime field workers, were senior USWs who sometimes continued to practice their trade in their free time. They were chosen from the community, based on criteria like friendliness with other USWs and local expertise. They visited the field regularly during times when USWs were available in the field, i.e., soliciting clients. This posed a logistical challenge, since USWs were usually busy and not always available. Jeevikas monitored health checkups, distributed condoms to USWs directly and placed condoms in strategic public areas (like paid restrooms and parks), offered counseling, and monitored monetary payments. Jananis, or outreach workers, monitored and trained Jeevikas as well as visited the field themselves. During the time of this study, dissemination was largely driven by the Jananis and Jeevikas, who delivered information back and forth to the grassroots and Pragati officers.

#### *USW overview*

As of 2010, India was home to an estimated 2.8 million USWs (Times of India, 2007). USWs in Bangalore may work full-time or part-time, owing to the informal, flexible nature of work. Broadly, the Bangalore-based sex trade is divided into four categories (breakdown and percentages come from Pragati officers):

*Street-based sex trade:* Roughly 50% of the Bangalore USWs were street-based. They solicited in the streets and went with clients to motels and public-private spaces, like restrooms. Most of them were homeless, seeking rest in bus stops and railway stations. They were the most vulnerable type of USWs, perpetually dealing with the police and rowdies. Street-based sex workers generally carried out the trade at night.

*Home-based sex trade:* About 40% of the USWs were home-based. While solicitation was carried out on the streets, they rented out rooms in apartments or houses. Several home-based USWs were married with children. They worked during the day and returned to their families at night. Such a lifestyle was built upon a dual identity—the USWs told their families that they work innocuous jobs, such as domestic work or tailoring in the garments industry.

*Lodge-based sex trade:* About 5% of the USWs were based in motels (commonly known as lodges in India), renting out rooms on a permanent basis.

*Brothel-based sex trade:* The remaining 5% of the USWs were based in brothel buildings in residential areas. Brothels constantly change locations, for fear of suspicion among neighbors or the police.

USWs are vulnerable to several social, economic, and health issues. Many USWs were affected by poverty (especially those earning in the range of 50-200 INR or 1-4 USD per client). Poverty manifests as other issues: condoms were not enforced on male clients since they agreed to pay more for “going natural”. Condoms are also telltale signs if discovered by the police, resulting in harassment. This results in HIV and other STIs. Violence is pronounced in these communities: police, pimps, intimate partners, or *goondas* (thugs) may abuse the USWs and extricate a major share of their earnings. Not surprisingly, many USWs turn to alcohol during work, resulting in further tensions.

### *Legality*

The Immoral Traffic (Prevention) Act or PITA is a 1986 amendment of legislation passed in 1956 to prevent illegal trafficking (Human Rights Reports, 2008). While it is illegal to operate brothels and surrounding activities in India, it is not illegal to exchange sex for money. A sex worker can be punished for soliciting or seducing in public, while clients can be punished for sexual activity in proximity to a public place. In reality, sex work in India lies in a grey zone, under police enforcement and pimp discretion.

### *USW vignettes*

I present two vignettes to illustrate the everyday life of urban sex workers. I pick two types from the general typology—home- and street-based—since they represent majority of the USWs at 90%.

Sudha, a 45-year old, was a practicing home-based USW. She was a mother of 3 adult children, who were all married. Originally from the Mandya district of the Karnataka state, she was a native Kannada speaker who lived in Bangalore since her marriage. Lakshmi had not attended school. Her husband's alcohol addiction drove her into the trade at 35 years of age. She was introduced by her female friend (also a sex worker) to a client. Among friends and family, she maintained an image of a garment-factory worker, working a day-shift between 9 am to 6 pm. Lakshmi rented out a room in the neighborhood where she solicits, usually on one of the busy streets. Her earnings varied between zero to INR 1,000 (~USD 21) per day, after servicing multiple clients. Her professional mobile phone is strictly switched off and hidden in her purse when she is home. She distributed her mobile number to her clients, encouraging them to pass it

around. She shared her other phone freely with her family. This phone was used as a mobile landline at home, and also functioned as radio.

Jaya, a 25-year old at the time of the interview, was a street-based USW. She was introduced to this line of work at age 19, when she left her family in rural Hosur. She dropped out of school in 5<sup>th</sup> grade. Her first contact in the city of Bangalore was a female USW, who then initiated her into the trade. Jaya was unmarried during the study. She practiced sex work at night, between 10 pm and 7 am. Her usual solicitation spots are in and around the Bangalore city bus terminal. She rented out a room throughout the night at a motel near the terminal. She slept during the day, usually at the local Pragati drop-in shelter or at her friend's place. Jaya earned anywhere between zero to INR 500 (~USD 11) per night; a huge portion of the earnings are distributed among the local police and her intimate partner. She sent another portion of her earnings to her family in Hosur, who believed she worked as domestic help. Jaya owned a dual-SIM mobile phone, switching numbers when she visits her family. Her mobile phone was her nodal point in everyday communications and in soliciting customers: she used the same phone to make calls to her tailor and milkman, as well as intimate partner and clients. Despite being non-literate, she got her friends to store address book contacts, and rote-memorized names through symbolic literacy (Sambasivan *et al.*, 2010). The phone was strictly “cleansed” when she took it to her village, as she sometimes reverted to her old SIM for everyday tele-communication, but rejected calls from any clients.

### ***2.3.3 Study III: Microenterprises***

#### *Microenterprise characterization*



I studied a continuum of microenterprises to understand the transition points across each tier and to sketch out the trajectory of microenterprises to small-and-medium enterprises. Based on the survey and interview findings, I characterize each tier as follows (see Table 1 and Figure 8).

### *Tier one*

Tier one (T1) businesses were informal street-side businesses such as flower-sellers and vegetable-sellers. Family members, who helped out with the various aspects of running a store, ran them. T1 businesses did not pay a monthly rent. However, locations were fixed due to social negotiations and understandings. T1 businesses did not maintain financial records. As we see in Figure 8, most of the infrastructure equipment was portable, like baskets and plastic sheets. T1 microenterprises were usually run by middle-aged women who have studied up to the 5<sup>th</sup> grade.

Mobile phones were the only information technology used by T1. Almost every mobile was a low-end, basic phone, used mainly for phone calls, low-resolution photos, and radio. Although every family member owned their mobile phone, usage was frequently shared among multiple users. T1 businesses formed sharing communes of technology and other resources with neighboring enterprises, with a technology expert in every commune (Sambasivan *et al.*, 2010).



**Figure 8:** Examples of the five tiers (starting with tier one of the leftmost)

### *Tier two*

Tier two businesses were street-side businesses, but no longer family-run. They were more formalized than T1 enterprises, with at least one formal employee. Examples included purse and jewelry stores. T2 businesses paid a monthly rent for their spot on the street and the store equipment was portable (wooden supports). Record-keeping was done on pieces of paper. The employer visited the store once in a day or few days, and this necessitated phone calls from employees every night to check-in the day's sales. The employee was responsible for all the activities of running the store, from sales to procurement of goods. Employees were typically young males who have studied up to 8<sup>th</sup> grade.

In T2, mobile phones were the only information technology used. Mobile Internet (GPRS) connectivity was used for entertainment (multimedia and games downloads). A typical mobile in T2 was a dual-SIM feature (multimedia) phone. One SIM card was used for personal calls and the other for professional calls. Similar to T1, sharing communes with neighboring microenterprises were formed. In addition, these communes were derived from religion (I observed two Muslim communes).

### *Tier three*

For T3, I was interested in coordination businesses with a major mobility component. I studied milkmen, *iron-wallahs* (steam-iron pushcarts), newspaper stands, and mobile tea shops. In contrast to T2, 2-3 delivery boys were employed at specific times of the day to deliver the goods to the customers, e.g., the milk and newspaper delivery boys usually delivered in the early mornings. The store remained open throughout the day, usually run solely by the employer. Stores were housed in either pushcarts or permanent kiosks, in which case, a monthly rent was

paid. Record-keeping was more formal than in T2, and was maintained in ledgers. Employees were typically young males educated up to 10<sup>th</sup> grade.

Similar to T2, the average mobile was a feature (multimedia) phone with mobile Internet (3G), used primarily for phone calls and entertainment. Unlike tiers 1 and 2, sharing of technology was restricted to coworkers.

#### *Tier four*

Tier four microenterprises were regular grocery and wholesale stores such as grocery stores, tailoring stores, and pharmacies. Unlike the previous tiers, T4 stores had concrete storefronts with shutters. A monthly rent was paid. Similar to T3, financial records were maintained in ledgers. Two-three young males were employed in running the store, and the employer is co-present. There was a small delivery component at certain times of the day. Employees were typically young males educated up to the 12<sup>th</sup> grade.

T4 included more technologies than the other tiers, such as individual mobile phones, landlines, and personal computers. A typical mobile phone of an employee was a low-end smart phone with mobile Internet (3G), used primarily for Orkut, Facebook, and personal e-mail. Technology sharing with coworkers was frequent.

#### *Tier five*

In contrast to the above tiers, tier five microenterprises were at the cusp of formality, e.g, mobile phone and computer hardware retail and services. Similar to T4, a monthly rent was paid for a

	Monthly revenue	# Employees	Education	Modal mobile	Year when first mobile was purchased	Mobile Internet penetration and predominant type	Internet penetration and predominant type	Pay for employee airtime	Shared airtime at work
Tier one (n=19)	Rs. 2500 (55 USD)	1	5 <sup>th</sup> grade (regional)	Nokia 2600	2008	5.26% (n=1), GPRS	Work = 0, Home = 0	100% (n=19)	100% (n=19)
Tier two (n=17)	Rs. 5000 (110 USD)	1	8 <sup>th</sup> grade (regional)	Nokia 5235	2006	41.18% (n=7), GPRS	Work = 0, Home = 23.53% (n=4) Broadband wired	88.23% (n=15)	100% (n=17)
Tier three (n=7)	Rs. 10000 (222 USD)	2	10 <sup>th</sup> grade (regional)	Nokia 5530 Express Music	2006	42.86% (n=3), 3G	Work = 0, Home = 28.57% (n=2), Broadband wired	85.71% (n=6)	85.71% (n=6)
Tier four (n=5)	Rs. 18000 (400 USD)	2	12 <sup>th</sup> grade (regional)	Samsung Corby	2004	80% (n=4), 3G	Work = 60% (n=3), Home = 80% (n=4) Broadband wired & datacard	80% (n=4)	100% (n=5)
Tier five (n=10)	Rs. 40000 (889 USD)	10	College (English-medium)	Nokia C6-01	2003	100% (n=10), 3G and Wi-fi	Work = 100% (n=10), Home = 81.82% (n=9) Broadband Wi-fi	100% (n=10)	100% (n=10)

**Table 1:** Characteristics of the microenterprises we studied

permanent concrete store. The workforce was larger than the other tiers, typically constituted by ten employees, including 1-2 family members that held key positions. Employees were men and women who had graduated from college.

In T5 for the first time, we see heavy use of high-end technologies for work, such as multiple landlines, mobile phones with mobile Internet (3G and Wi-fi), and PCs with broadband. Unlike the previous tiers, a typical mobile was a high-end smart phone. Employees used two mobile phones each—one for personal use and one for professional use. For the first time, an official e-mail address was used; e-mail was supported by mail clients like Outlook and IM clients like GoogleTalk. T5 record-keeping was done on MS-Excel and Tally. Sharing with coworkers was seen.

## 2.4 Data analysis

A systematic analysis of data as well as field experiences was carried out. Like participant observation itself, data analysis is highly emergent and contextual (Bernard, 1998). While traditionally ethnographers have emphasized about “experiences in the field”, particularly since the publication of *Writing Culture* (Clifford & Marcus, 1986), they have also explored the process of writing itself.

I engaged in a rigorous process of working deeply and intimately with ideas that emerged from the data, and then translating those ideas into writing. In addition to carrying out my own data analysis, I tried to add rigor to the ethnography in two ways: one, developing concepts in consultation with informants in the field; two, by conducting a meta-analysis with those not directly constituting the field. For the first kind, I conducted preliminary analyses and verified concepts with informants. While culture is not completely conscious to its members (which is why participant observation, not predicated on elicitation, is a pivotal ethnographic method), people are aware of many aspects of their own cultures (Boellstorff *et al.*, 2012). This step was crucial in adding articulation to the story and eliminating false claims to whatever extent possible. Where participants could not be consulted, relevant literature, conversations with colleagues, and presentations and discussions at conferences guided the analysis. Colleagues at Microsoft Research India and the academic environment at Irvine provided natural homes for defamiliarizing from the field after field engagements throughout the day.

The analysis was not strictly sequential as in the sense of data collection through field notes followed by data analysis through ethnography, but was rather a highly iterative process. In the words of Clifford Geertz, “distinguishing these three phases (observing, recording, and

analyzing) of knowledge-seeking may not, as a matter of fact, normally be possible; and, indeed, as autonomous ‘operations’ they may not in fact exist” (Geertz 1973:20; Gupta & Ferguson, 1997). Data analysis was a highly emergent and continuous process, taking place throughout the course of the studies. As LeCompte and Schensul noted, “ethnographers begin data analysis well before data collection is complete” (LeCompte & Schensul 1999:149).

Specifics of the data analysis include coding interviews, surveys, photos, and field notes in digital software like Microsoft Word or Excel. Ideation and syndissertation was performed using affinity diagrams (Nayak, Mrazek, & Smith, 1995) to group similar concepts and data visualizations and graphs to represent transition across and within different user groups. Ideas, concepts, and story arcs were grounded within the data collected.

The project treated the concepts and domains that become important in design for development discussions and frameworks around ICT4D not as givens, but as arenas of debate and contest. Terms like “development”, “non-literate”, or “sharing”, were brought into scrutiny, by discovering through the interviews and ethnography. The data was analyzed to determine what discursive strategies “worked,” what concepts or domains had an impact or travelled. For example, what was the role of technologies beyond information and communication? What could I learn from the constructions of privacy and identity, especially when populations chose to explicitly hide their identities? How were objects, concepts, and memories linked in intermediation, and in what ways does this form of access overcome constraints in resources?

Life history, occupational mobility, interview data, together with ethnographic data, was first organized chronologically and diagrammed. Key concepts or domains were mapped onto this chronology, and their movements through space and time were charted. Informants' use of specific metaphors was noted, as well as informants' language for discussing the technology was documented.

## **2.5 Reflections**

### ***2.5.1 Native ethnography***

As a native of India, speaking Tamil, Hindi, and Kannada, writing and representation were highly reflexive processes (e.g., Geertz 1983; Clifford and Marcus 1986; Visweswaran 1994; Behar and Gordon 1995). At several points, I had to reconcile my identity as a researcher, my relationship with informants, and the kinds of data I was gathering in the field. As sociologist M.N. Srinivas (1966) pointed out, even for a purported insider, it is clearly impossible to be omniscient; one knows about a society from particular locations within it. He questions the notion of identity, wherein he argues that total identity is the ability to become, in every respect, the same person as the whom they identify, which will draw anthropologists to write in their native language or settle down to never write at all.

Arguably, I was positioned as a “native anthropologist” (Haniff 1985; Abu-Lughod 1991), a “native” or “insider”, as opposed to other anthropologists who must come to know “other alien worlds” as noted by anthropologist Kirin Narayan (1993). Narayan further elaborates that writing ethnographic texts involves enacting hybridity of personal and ethnographic selves, inspiring reflection in “self” and “other” in our ethnographic research as well as design. However, in many

situations I was clearly not the “insider”, having been entrenched in my middle-class Indian values, attire, and ideology while growing up in India and, later, some American influences during the course of my education in Atlanta and Irvine. I identified and documented biases, wherever perceivable, to overcome problems of subjectivity (Sambasivan, Rangaswamy, Toyama, & Nardi, 2009).

### ***2.5.2 The embodied researcher***

#### *Gender and cultural access*

There are inherent power differences between the interviewer and study participants (income, social class, language, skin color, appearance, and so on). Efforts to reduce this gap and navigating cultural specificities sensitively were imperative (Sambasivan *et al.*, 2009). A researcher’s gender may interact with social and cultural factors such as economic differences, ethnicity, social class and religious beliefs in the field is a first step in understanding the ways in which research goals, processes, and outputs are impacted by the researcher’s self (Light *et al.*, 2010). As a young, unmarried, Tamil-speaking woman, I shared several socio-cultural elements with my participant population, such as language, religion, gender, and ethnicity. However, my foreign-education, employment for a giant IT research lab and “upper-caste” (Brahmin), set me apart from the community. As standard ethnographic practise, I tried to resolve some of the differences by sitting on the floor, co-dining, dressing in traditional attire, speaking the local tongue, and revealing genuine concern for the informant, which somewhat helped in generating engaged and deep responses. I felt the differences were necessary in shaping my relations with the informants. M.N. Srinivas (1966) questions whether the fieldworker must identify him/herself by shutting off other castes or observe graduated distances from the others. It would



greatly lower their mobility, and might even deny them access to some groups. Adding identification to this already thorny exercise is a troublesome, he argues.

Certain deeper differences continued to shape social interactions. For example, women participants were acutely concerned that I remained unmarried despite “being old enough to bear children” and one generously offered to set her up with a young man from the community.

Access to the slum communities was channelled through the NGO, championing women’s rights (especially domestic workers). Upon my introduction to the community, I was immediately cast as a student activist affiliated to the NGO. As I later discovered, some community members assumed that I was the NGO founder’s daughter! The NGO umbrella provided cultural access to the women in the community. However, attempts to converse with husbands and male teenage children were often anxious, uncommunicative exchanges. On-going interviews with the women would taper off as men returned home from work. Possibly some of this response was due to the social anxiety experienced by men and (young and unmarried) women; however, a closer investigation revealed a misconception about my being a proxy NGO member. The men wanted no part in a research agenda to empower women. Thus, I re-arranged field schedules with women while the men were away at work, for free-flowing conversations.

It should be noted that the data was gendered due to both, the female segment under study and my presence as a female researcher. While I tried to achieve a rather holistic representation by trying to talk to both genders (this is more deliberate in the third study on microenterprises), it was not possible in several cases.

### *Developing trust*

The starting point for fieldwork is in developing trust. The first two projects were carried out in collaboration with NGOs: Stree Jagruti Seva for the domestic workers and Pragati for the sex workers. I was introduced by the NGOs, as noted in the previous section, which helped establish my credibility, but also cast me as an NGO member. Groups meetings were conducted to introduce me to an initial set of informants, which later snowballed into a larger group. These meetings were helpful in mitigating any mismatch of expectations. For example, some people expected me to provide them with financial incentive or infrastructure for the community, to which I responded that I was only there to learn more about their lives, which could possibly be used to build technology, but could not provide any sufficient incentive.

Daily visits to the field helped in slowly gaining trust over time. Occasionally, I brought sweetmeats to the field to distribute.

### *Compensation*

As noted by Boellstorff *et al.*, (2012) ethnographers should have at a minimum, neutral impact on the community to not bias data. However, positive impact helps in not only creating a favorable impression of the researcher, but also in paving the way for future researchers. Wherever possible, I involved myself informally in NGO meetings and activist demonstrations. Generally, I tried to not recompense participants directly for their involvement in fieldwork. But a host of informal opportunities helped me reach out back to them and gift them for their time and involvement in the projects. Some gifts include printed photographs and utilitarian goods such as

utensils and blankets for domestic workers for a contest, as noted in (Sambasivam Cutrell, & Toyama, 2010), computer training and free lunches for the sex workers.

### *Research ethics*

All interviews and field data were anonymized. No names or revealing identities, such as addresses, were collected. Phone numbers were collected as part of two projects—ViralVCD and a phone broadcasting system, but the number files were deleted after the projects ended. Conducting research with USWs entailed paying special care to research ethics and informant privacy. Interviewees were asked for verbal consent before conducting interviews. No identifying information was collected, including names and addresses. Photographs were only shot in Swati Manne premises, which were post-processed for pixilation. Audio recordings were avoided for interviews—I took down notes wherever possible. In order to respect our informants' privacy and identities, I restricted interviews to Swati Manne premises and streets. Our field access was mediated by Pragati, which helped me gain entry into the women's lives as well as avoid any possible confrontations with the police.

### *Researcher values*

In general, I tried not to approach the field with a development/interventionist approach, but with a curiosity to learn more about the people's lives. I approached my informants as individuals with agency and capacity to act within their circumstances. In retrospect, I feel this constructive (yet not romantic) outlook helped me understand acts of subterfuge, of course, operating within the social norms of the particular societies. For example, as we shall see in more detail in chapters three, four, and five: the intermediation process happens without the husbands'

knowledge; sex workers maintain two phones secretly; and microenterprise employees take advantage of the free airtime provided by their employers to make phone calls to their families and friends.

With regard to sex work, my own views and values with respect have inherently biased my research. While sex work can be exploitative and risky, I decided to view informants as independent professionals, family members, colleagues and friends in their own right, instead of viewing them as victims of their circumstances. Such a position helped me understand the agency, relationships, and identities constructed in their everyday realities.

### *Methodological reflections*

At the core of ethnographic research is field immersion of the researcher as participant-observer. It follows that ethnographic studies are not only vulnerable to biases held by the researcher, but also are products of relationships established between the researcher and informants. Ethnography has historically involved power imbalances between researcher and informants. In the context of HCI4D, projects may fall into the trap of mistranslating findings into a design irrelevant to the needs of target users in specific socio-economic contexts, even with the best of intentions. Consequences arising from misreading cultures can disrupt the developmental underpinnings of HCI4D, which is concerned with technologies design for fulfilling human developmental goals.

I present some ideas from field engagements between 2008-2009 in the urban slums of Bangalore, where I observed domestic worker women. While the following reflections are not

new to the field of anthropology, I present ways to manage these age-old problems in the context of HCI4D. Below, I note salient lessons from my fieldwork. The full text with Nimmi Rangaswamy, Kentaro Toyama, and Bonnie Nardi appears in the ACM Interactions article (Sambasivan *et al.*, 2009).

*1) Question the notion of development:* Understanding the meaning of development is critical to any developmental project. Broadly, development as a goal addresses the necessities of human life, such as food, sanitation, healthcare, education, and employment. However, a critical component in strengthening the socio-economic and moral foundations of the project is to elicit the idea of development held by the target community—what do they consider as empowering, progressive, upwardly mobile, or beneficial?

*2) Understand scope:* Most development projects are limited by funding and scale. The effects of interventions, however, live longer than their funding sources. Any HCI4D project needs to allot significant care to understanding local social arrangements, including those that may seem exploitative. It is one thing to be appalled by the degree of injustice in the field, and another to attempt to intervene without understanding cultural mechanisms of injustice. Development interventions may sometimes exacerbate existing social divides and inequalities. In one of our field sites, I was dismayed by high rates of alcoholism and domestic violence, and the community acceptance of these practices. I was tempted to include video episodes to counter domestic violence in our participatory video exchange program. On deeper introspection, I turned our focus from domestic violence to raising nutritional and educational awareness. This worked on two counts—it generated a positive response from our audience, and avoided a

serious and controversial community issue that our short-term design intervention was ill equipped to address. A humble approach towards development research goals, and sensitivity to local context aided in creating impact within the scope of the project.

3) *Understand internal politics:* Access to informants is critical to conducting research in any community. In our case, I snowballed our pool of informants initially recommended by our key informant—an active member of the local NGO. While the snowball sample ensured a trusted path for obtaining informants, it precluded us from interviewing those unknown to, or holding a relationship of animosity with the key informant. This generated heated reactions from members of the community whom I did not approach. I redesigned field schedules to interview a wider range of members and make peace in the community. Spending time over casual conversations with the local NGO helped in understanding internal politics, local dynamics, and historical changes in the community. I learned that it is important to stay alert to tensions within the community.

4) *Understand the moral economy:* Gifts are characteristic research incentives, but can cause unintended consequences. Choosing the appropriate gift is important in avoiding creation and escalation of tensions between study participant and non-participants. A seemingly innocuous gift of a school bag for an informant's child proved disproportionately valuable in relation to the family and community's income standards. While everything was fine when I was in the field, the local NGO reported ill feeling among those who did not get a bag. Fortunately, I spotted gift-giving tensions early in the research, and assuaged community sentiments. Ultimately, I gifted our informants with bed sheets and stainless steel utensils.

5) *Re-mix the method*: Certain field techniques elicit rich data while others lead to *culs-de-sac*. Ethnography is concerned with responding to the immediacies of the situation. I modified our method to reflect the contemporary idiom, similar to the Bollywood technique (Chavan, 2004). Popular TV soaps function as yardsticks to assess reaction and response to existing and changing social environments (Mankekar, 1999). Our informants did not provide us with detailed responses on health and educational issues when confronted with direct questions. A persona modeled on a character in a popular Tamil TV soap—*Kolangal*—however, elicited revealing data. The character, *Abhinaya*, a brave, young, middle-class woman who faces a slew of difficulties, mirrored the aspirations and day-to-day struggles of the informants. Participants were asked to guess the persona’s reaction to specific health issues. By speaking for a third person, they were able to simultaneously situate and distance themselves, providing concrete details on these issues, making the exercise extremely enjoyable.

Socio-economic analysis of subjects is a vital methodological aspect of most projects. However, directly asking about an informant’s income, assets, or business practices can result in make-believe responses to ‘save face’. Looking for physical manifestations of income such as domestic appliances or a scooter, may furnish vital data. It also provides opportunities for conversations of exchange, rather than difference.

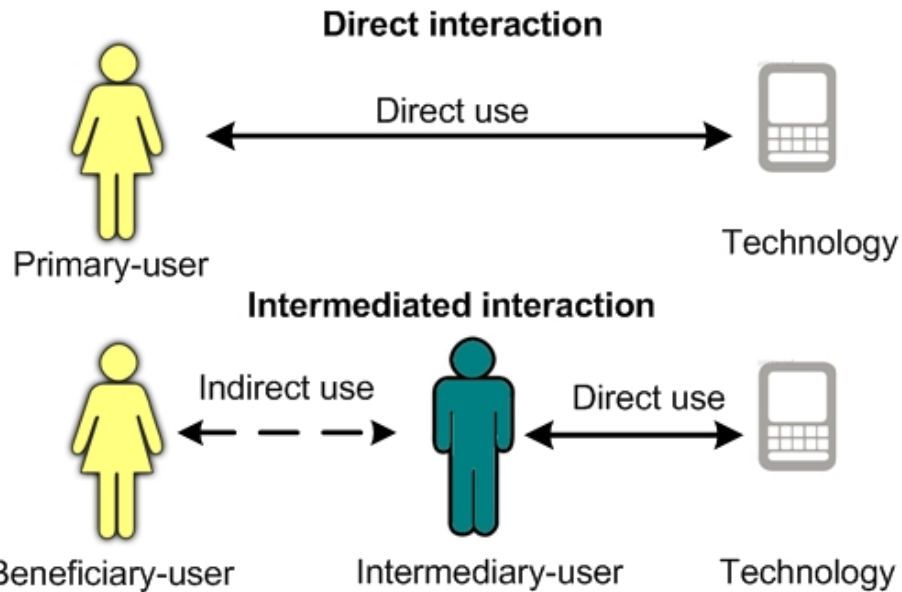
### Chapter 3: Intermediated technology usage

In this chapter, I describe my first research study of the dissertation, an ethnographic examination of technological practices among domestic workers. I start with my primary question of interest—how can we re-conceptualize “the user” in low-income communities? A related question I ask is what are the various kinds of shared use (if use is, indeed, shared) in these contexts.

Human-computer interaction, as the name suggests, is concerned with direct interactions between user and computer (see Figure 9, top). Many applications are designed for personal use and private ownership (Ito *et al.*, 2005). They assume textual and digital literacy. However, in many contexts, use is not direct; intermediation by another person occurs when the primary user is not capable of using a device entirely on their own. For example, many people rely on experts in the family to help them set up home networks (Chetty, Sung, & Grinter, 2007) or to figure out how to use the Internet (Kiesler, Zdaniuk, Lundmark, & Kraut, 2000).

In the developing world, informal help goes far beyond spot assistance and is a *fundamental* enabler of technology use and access for a vast number of people. Reporting the results of my ethnographic study in two urban slums of Bangalore, India, I explain how literate members with technology-operation skills enable technology use for persons whose technology access is affected by factors such as non-literacy, non-numeracy, lack of digital operation skills, financial constraints affecting technology ownership, and socio-cultural and empowerment issues including gender, employment, and social status. *Intermediated interactions* enable technology use for such persons by means of a third party (see Figure 9, bottom). In my findings, for example, unconnected





**Figure 9:** Direct interactions (top), and intermediated interactions (bottom)

households routed information from the Internet through intermediary NGO members. These intermediated interactions coexist with the traditional one-to-one, direct interactions.

Individual ownership of technology, textual literacy, and digital literacy are not necessarily the norm in the developing world. For example, despite the recent figures on steady growth of mobile phones in India (TRAI, 2011), the aggregate number of devices owned is still small. Telecom penetration is 36% in India (Trading Markets, 2010) with a literacy rate of 66%, with the penetration for poorer communities being even less. While many people lack textual and digital literacy, low-income communities are diverse and often include at least some literate members with technology-operation skills. These members overcome some of the above deficits and act as “bridges” between technology and community members lacking these skills.

In the developing world, many technologies that are perceived as “single user” in the West are involved in more complex human-mediated relations that we need to understand. This suggests a serious re-examination of current designs and design assumptions if they are to cater to the needs and existing technological practices of the developing world.

I seek to understand intermediation in day-to-day technology usage practices in economically disadvantaged neighborhoods of India. I uncovered several distinct forms of intermediated interactions: intermediation in inputting intent into the device in *proximate enabling*; intermediation in interpretation of device output in *proximate translation*; and intermediation in both input of intent and interpretation of output in *surrogate usage*. I examine some of the consequences for user interface design, and the broader effects of intermediated interactions. Finally, I suggest some implications for design of intermediated interactions.

## **3.1 Background**

### ***3.1.1 Related Work***

#### *Intermediation in ICT4D*

Human mediators constitute an important part of information and communication technologies for global development (ICT4D) projects, because they transfer technological benefits to grassroots levels, ensure that projects run smoothly, and contribute to their sustainability. Digital Green (Gandhi *et al.*, 2007), DakNet (Pentland *et al.*, 2005) and Babajob (Babajob, 2012) are some projects where field staff contributed to data collection and information dissemination. James discussed the importance of intermediaries in reaching “non-user beneficiaries” in development projects (James, 2008). However, the information needs of the community were placed ahead of

those of individual persons.

As noted in Chapter one, Parikh (2006) and Sukumaran (2009) examined intermediation in institutional or commercial contexts. I add the very real case of intermediation in the ecology of slum habitats, that occurs “in-situ” and organically. My goal in this endeavour is to study the information and communication needs that occur in economically disadvantaged settings and the various technologies, practices, actors, and relationships involved in fulfilling them.

### *Intermediation in HCI*

One thread of investigation examines setting up home networks, where technically knowledgeable users assist family members in setting up networks (Chetty *et al.* 2007). Poole *et al.* (2009) examined the factors involved in giving and taking informal help in tech support. The cost and know-how in seeking formal resources motivated help-seekers to look for informal help within social networks, whereas reputation, technical expertise and obligation motivated help-givers to provide help. In my study also, beneficiaries relied on social networks for informal help. Lee (2002) discussed the relation between social cost of seeking help and gender in a hospital environment. I remain sensitive to such gender issues and highlight them where perceivable. Twidale (2005) examined spontaneous workplace learning through help-giving around computer screens. Over-the-shoulder learning also features in my work. Eveland, Blanchard, Brown, & Mattocks (1994) described the importance of “high providers” (helpers) in linking help seekers to resources for CSCW applications. They found that users ask for help from people nearby and from people with similar work tasks in preference to more remote but much more expert users/help staff.

My study examines intermediation in resource-poor settings, where beneficiaries lacked literacy and technology-operation skills. I examine the role of intermediation in fundamentally *enabling* technology usage where it was previously impossible, not just in trouble-shooting technical issues. I examine communities of slums, broadening the scope of investigation from the unit of domestic household to the neighbourhood.

### ***3.1.2 Information ecologies***

As noted in chapter two, I conducted fieldwork with twenty-two domestic workers for 110 hours, through interviews and spending time in the communities. Slum households were highly cramped, resulting in social activity on the doorsteps and by-lanes.

Information is an important component of communications, livelihoods, entertainment, and commerce. Information ecologies offer a lens for examining the interdependencies and interactions between people and technologies (Nardi & O'Day, 1999). Ecologies denote continuous evolution and influences that shape and direct technologies and settings of use. These ecologies incorporate policies, social values, politics, legislature, and economic formations.. This understanding is important to supplement, compliment, or rethink interactions in UbiComp.

The complex and dense information environments in these slums are patchworks of social actors, technologies, and cultural norms. Information flows in these communities were heavily human-centered and governed by limited literacy, resources, and pre-ICT dynamics. Cable TV and radio channels provided a variety of information, especially mid-day shows for women, local news, healthcare broadcasts, and fashion programs. In addition to these media outlets, my data point to

other information agents at work—family (parents, spouse, siblings, children, and relatives), non-family peer (neighbors, friends, co-workers, employees, or persons of other communities), and non-family expert (NGO worker, doctor, teacher, employer, and priest).

In direct interactions (Figure 9, top), the person extracting value from a technology directly manipulates the technology. In intermediated interactions (Figure 9, bottom), an intermediary-user translates the beneficiary-user's intentions to an interface command or task. *Human-mediated computer interaction* is the model of intermediated interactions that forms a subset of HCI.

### *3.1. The socio-technical infrastructures of urban slums*

Infrastructures are typically thought of as tangible artifacts at the periphery of our awareness: electric grids, optical fibers, computer networks, roads, and pipelines. They are substrates of technology over which applications are delivered. However, a broadened understanding of infrastructure is possible—one that includes shared social practices, flows of information and materials, and the creative processes that are engaged in building and maintaining these substrates (Sambasivan & Smyth, 2010) (Star & Bowker, 1999) (Star & Strauss, 1999). These infrastructures may be a combination of the physical, the institutional, the symbolic, and the human (Mark, Al-Ani, & Seemaan, 2009). They are the underlying foundation of a social system constituted by the pattern of relationships of people, through various networks and social arrangements. Residents in a society may depend on human infrastructure for a range of activities in their daily lives, i.e. for work, socializing, education, health care, entertainment, and so on (Mark *et al.*, 2009).

In my sites, in some cases, the social system may itself have become a substrate on top of which technological infrastructures can be built. These human infrastructures are in some ways more robust and pervasive than technology networks—they overcome several constraints in access and use, such as high costs of devices and content, instability of networks, textual, and numeric literacies, precarious electricity, and technological unfamiliarity (Sambasivan & Smyth, 2010). Socio-technical infrastructures may not only be created by technologists, but they may already exist in social life and contribute to cultural production.

Resource constraints give rise to as well as shape these human infrastructures. As Graham & Thrift (2007) note, this is manifest in urban economies, both formal and informal, through efforts to deal with continual interruptions of mainstream systems that sustain major economic sectors: personalized boreholes, ‘non-legal’ taps of power, water flow and satellite access points. Endless improvisation surrounds the distribution of scarce water, sanitation, communications, energy and transport making it “impossible to ignore techno social architectures of urban life dominated by and constituted through a giant system of repair and improvisation” (Graham & Thrift, 2007). I attempt to foreground the social system of human actors, relationships, activities, spaces, and networks in everyday life in the slums I studied. The human infrastructure reading points to *creative*, *gap-filling*, and *subversive* practices and workarounds at play in the face of resource constraints.

*The cultural production of infrastructures:*

In my sites, where economic and technical resources were limited, people employed a combination of human and technical infrastructures to extend the access and use of technologies to unconnected

community members. For example, in the urban slums, the mobile phone penetration was 36% (i.e., ownership statistics) among the female domestic worker population. However, through the social process of intermediation (making use of third parties for technology use and access), technological benefits were extended to the remaining members of the community. Intermediation is a form of socio-technical infrastructure already existing in the day-to-day life of Bangalore slums. The cultural production of social capital among community members is woven around this socio-technical infrastructure. The communal nature of these sites often meant that their embedded infrastructures, dependent upon social and technical resources, were sites of broader cultural production of social capital and group membership. ICT4D researchers have recognized the value of "human access points" and technology savvy community members in supporting design interventions (Marsden, Maunder, & Parker, 2008).

*Local, non-legal hooks to infrastructures:*

Hooks to electricity and basic resources were often non-legal or made possible by people with vested interests in the community. Several households accessed electricity by paying a commission to the local electricity agent. While corruption (bribery here) acts as a catalyst in service delivery, it is a normative component in interactions with nation-state and corporation officials.

In other cases, locals with political muscle created hooks to electricity and other welfare resources. For example, a local politician who resided in the urban slums provided access to ration cards (for state-subsidized groceries) for the residents. She also connected the residents to electricity and water infrastructures, and provided greater access to political networks for securing government benefits. One of the residents, Swapna, 45, noted,

*“I retired as a domestic worker three years ago. However, like several other members of this community, I attend local political meetings to get access to the local leader. She has improved our lives by giving us access to water and ration supplies. ”*

In both slum communities, NGO workers provided access to formal banking infrastructures otherwise inaccessible to community members. Self-help groups have been set up within the community to collect money, and the NGO workers deposit the amount on a monthly basis.

### *Gap-filling infrastructures*

Institutional arrangements and ecologies often marginalize low-income communities in providing connections and services allowing a flourishing culture of *alternative* infrastructures under these severely constrained circumstances. They enable innovative and creative production and distribution channels to circulate content and services. Alternative infrastructures are borne not merely out of resource constraints but are also flavored by these constraints. Constraints in accessing institutional infrastructures can enable innovative and creative production and distribution channels in producing, distributing, and circulating content and services.

Pirating is a common technique to create infrastructures to get access to other infrastructures. It is useful to shift the conversation away from legality to analyze the creative processes of piracy (Liang, 2005). For example, in developing cities like Bangalore, when a movie is released, a human constellation of movie capturers (in cinema halls), disc burners, transportation and distribution agents, and small-business marketing and point-of-sale agents is created. While these value chains may not direct the profits back to the original author or artist, they exist, in the first place, because the legal prices are forbiddingly high. For example, when the Tamil movie *Pokiri*



was released, local copies of the movie circulated freely in these local markets, making forays into slum household televisions. In illegitimate ways, these technologies make entries, often with high speeds of distribution that regular media and content do not. These highly complex processes in which piracy creates recreational venues and profits for low-capital enterprises, is, in many ways, what legitimate means cannot accomplish. Artifacts travel, yielding new mobilities and connections across infrastructures through production, distribution, and circulation, transcending and transgressing legal and geographical boundaries. Piracy creates different means of acquiring and maintaining infrastructure that are useful to consider in the purview of technology design.

Consider the following story of the VCD, illustrative of the modes, channels, and agents involved in the grey industry.

#### Production

Three years ago, residents of the slums of Ragigudda and Nakalbandi did not even dream about VCD players. However, in 2007, the local electronics store in Ragigudda announced a new installment scheme. They were selling VCD players for Rs. 100 per month for the next three years (consider that the average income per family is between Rs. 3000 – 5000). Word spread about the scheme. The store had picked the right time to market the appliance—Diwali (the Indian festival of lights), when it was traditional to buy new goods. The highly local process of peer influence eventually led roughly 55% of the households to purchase a VCD player. The rest are on their way. For now, they will leverage their social networks to share the device. None of these players come from reputed companies. They were assembled in Bangalore, with components imported from Singapore. The shopkeeper purchases the components from a relative who lives in Singapore.

### *Re-production*

Any pop culture media piece released for public view, or sometimes in its pre-release stage, is immediately tracked down and copied. This process involves several steps: one takes a video camera to the cinema hall to stealthily tape the film (it is quite funny to see human figures walking across the hall, laughing out loud and cheering in film videos). Depending on their access, a hacker may also download content from the Internet. Mobile repair shops and cyber cafes double up as pirates, because the price of Internet infrastructure forbids the domestic slum-dweller from subscribing to connections. Reproduction involves substantial infrastructure, often assembled from used parts in practice. Slightly older movies are also ripped from original DVD sources. Next, a cover for the disc sleeve (usually a copy of the poster of the movie) is printed on a color printer. The file is burned in Video CD format using pirated CD-burning software. The end-product is a VCD that competes for market space with an original DVD, costing five times less.

### *Re-distribution*

The VCD has shifted the site of the marketplace from air-conditioned showrooms to makeshift banal spaces, such as street corner bazaars or rented spaces. VCDs are sold in trains, railway stations, public monuments, street vendor stalls, and in regular market. It creates a whole new infrastructure and ecology of agents in its marketization. The VCD ripper who travels to cinema halls, the VCD creator, the VCD seller, the player seller, the CD sleeve printer, the CD cover photo printer, the innumerable distribution agents, the delivery persons, and the logistics/management persons. Thus, it makes the economy more inclusive, providing several thousand jobs. The effects are profound. What was once regulated to the urban elite through formal distribution channels and

centralized marketplaces, is now decentralized, democratized, and decoupled from the central market. The result is that a significant portion of the urban consumer population is low-income, yet striving to be upwardly mobile.

At the level of everyday life, this has created several mobilities: the physical mobility of the VCD, allowing a free movement of goods that transgresses several boundaries—nation-state, legalities, technologies, freight packages, economies, and localities. The VCD has also invoked the grand narrative of the “imagined community” (Anderson, 1991) that seeks upward socio-economic mobility, often viewed as consumerization. The imagination is projective, creating visions of class mobility and material attainment. Appadurai is helpful, once again—he argues that the mass media provokes resistance, irony, selectivity, and more importantly, agency (Appadurai, 1996). The imagination is property of collectives, creating new sodalities for the community as a whole. There is a growing corpus of work that shows the benefits of television or media on social participation and aspirational imagination. Jensen and Oster (2009), economists, have shown that watching soap operas reduces tolerance of domestic abuse. In my own ethnographic experience, I was told so by Mani, who was referring to the protagonist on television:

*“I really admire Abhinaya. She goes through all the day-to-day struggles of a middle class woman, including alcohol abuse and financial difficulty. She is a genuinely good person, fighting the evil of society. I look up to her as my role model.”*

Mani’s quote on the technology is enlightening:

*“I love movies! Who doesn’t? But ticket prices are very high, and we cannot afford them. I bought the VCD player on installment in 2008, as soon as I found my first job as seamstress. Everyone in this neighborhood has one. It gives me dignity and pride. ”*

The content of the VCD also results in locative mobility, in watching a world (Singapore, Switzerland, or Spain) that could only be dreamed of. A viewer knows little about the journey of the content on the VCD, before it reaches the television screen. Escapades to foreign locales through the eyes of the cinematographer provide relief and respite to the domestic worker after a long day at work.

Anthropologist Bill Maurer (2010) argues that instead of approaching lack of available services as illnesses—problematic absences—to be treated, a better question is to ask how to harness the inventory of social assets. People send out grappling hooks of their own making into the institutions and processes of modernity, thus making it anew. This network can be visualized in the complex and unexpected infrastructures that poor people around the world create for themselves all the time to gain access to utilities like water or electricity. Designing savings services for poor people in the developing world might learn from these existing alternative infrastructures by which people already manage, for example, financial volatility.

### *Infrastructures and identity*

Technologies can act as “identity accessories” (Turkle, 1997). Connections and connectors to infrastructures play significant roles in low-income settings in communicating identity, aspiration, and class. For example, in the urban slums, some of the residents would stack up their old, broken or dysfunctional radios and video players (as seen in broken video players and mobile phones in figure 10). Yagi-Uda antennas that provide connections to Doordarshan, the Indian national television broadcaster, and cable television wires, crisscrossing each other and entering homes,

entering through no less conspicuous points such as windows and door sunshades, are visible representations of the underlying networks. Sangeetha, 35, notes,

*“Oh my mobile phone is not usable anymore. It soaked in the rain and I lost Rs.3000 over it. It will cost me a lot of money to repair it; I might as well buy a new phone. But I don’t want to throw it away, for people may think that I have two phones and am always connected.”*

Mundane artifacts, though dysfunctional or seemingly un-decorative, here signify connections to infrastructures, and convey broader meanings of social and economic class.

Aspirations in the low socio-economic strata and technologically unstable environments described here are increasingly incorporating the technological dream. Technologies are vehicles for aspiration, self-reinvention, and projective imagination of the self. In my ethnography, one of the key threads that emerged was the role of ICTs and media in shaping public imagination. As noted in the previous chapter, the domestic workers looked up to TV soap opera characters as their role models. Aside from their functional value, ICTs have symbolic value tied to social and economic ascendancy (Pal, Lakshmanan, & Toyama, 2009). Embedded in these technological environments are notions of change and hope for the future.

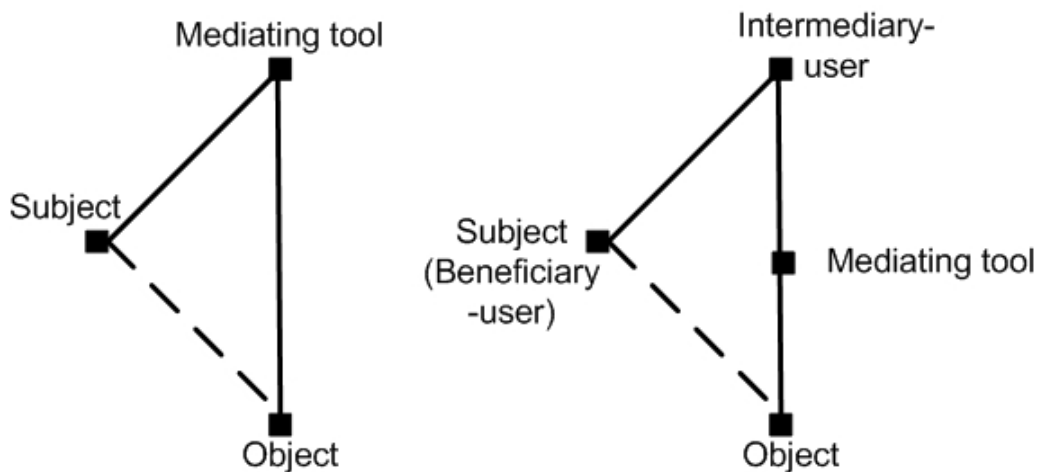


**Fig. 10.** (Left) Broken video players lined up over an amplifier, and (right) dysfunctional mobile phones from the slums.

### 3.1.3 Mediation in Activity Theory

In order to explain intermediated interactions, a useful comparison could be drawn with the related term *mediation*. Mediation forms one of the core principles of Activity theory, which is an approach to understand individual human beings as well as the social entities they compose, in their natural everyday circumstances, through an analysis of the genesis, structure and process of their activities. The concept of *activity* is fundamental to its analysis, which not only signifies human activity but also activity of any subject in general. Activity theory accounts for social, cultural and psychological aspects of user in the context (Nardi, 1996).

Activity theory incorporates a strong notion of mediation—“all human experience is shaped by the tools and sign systems we use. Mediating tools connect us organically and intimately to the world; they are not merely filters or channels through which experience is carried” (Nardi, 1996). Human activity is mediated by both external (like a hammer or scissors) and internal (like concepts or heuristics) tools. The subject user acts on an Object through a mediating tool (see figure



**Figure 11:** (left) Mediation of technology, (right) intermediation through intermediary-user.

10, left). From this perspective, intermediation creates *second-order mediation*; the subject acts through the additional layer of the intermediary-user, who in turn applies a Mediating tool, to an interface object (see figure 11, right) (Kapetlinin, 1996). For the purposes of this chapter, I define the mediating tool as any technology that cannot be operated solely by the user without assistance, such as VCD players, television, or radio. The subject is the user seeking technology assistance through a third party. The object is the literate user with technology-operation skills who assists the subject. Intermediation is when users enable mediation. Human-mediated computer interaction suggests that a layer is to be negotiated between the beneficiary-user and technology.

I refer to a person possessing technology-operation skills and possibly textual literacy who enables technology usage for other persons as an “*intermediary-user*.” I refer to a person who derives value out of technologies through third parties, typically affected by non-literacy, non-numeracy, lack of digital operation skills, financial constraints, and socio-cultural and empowerment issues, as a “*beneficiary-user*”. The intermediary-user supports the interaction in various ways, by handling some or all of the direct manipulation of the interface. The interaction depends on the intermediary-user; it would not succeed without the intermediary-user.

### ***3.1.4 Use and users***

*Human-mediated computer interaction forces us to rethink the concept of “user.”* Bannon (1991) defines a user as “someone who uses a particular computer system or application”, but in this case “use” is split between at least two people: Beneficiary-users instigate the interaction and derive direct value from it, while intermediary-users often are closer to directly interacting with the device.



Studies of intermediation in community development projects tend to view the beneficiary as being a passive recipient of information from the intermediary, in commercial or developmental contexts. My study reveals that (i) beneficiary-users were highly resourceful in finding the appropriate intermediary-users for the right tasks. For example, Gauri, 52, sought out the help of her 8-year old grandson in operating her mobile phone, and her 10<sup>th</sup>-grade educated neighbour in operating the VCD player. Beneficiary-users seek help based on prior rapport and trust. (ii) They exhibited *agency* in controlling the interaction process, not passively receiving information, and reciprocated the favour, leading to a peer-to-peer model (Bauwens, 2009). My study in the slums shows that beneficiary-users were typically above thirty years of age, with little to 10<sup>th</sup>-grade education, in the local-language medium of instruction. Older women tended to seek more help.

An intermediary-user operates the system for the benefit of a beneficiary-user, and she may derive value out of the second-order effects of the interaction, through direct information gain, reputation management, sense of doing good, or welfare of community. These users were typically young (school-going to mid-thirties), but older intermediary-users were not uncommon. Intermediary-users were skilled at operating particular technologies or applications (mobile phone recharge, sending/reading SMS, storing contacts, etc.), or possessed particular technology-operation skills (access, evaluate, debug, simplify, translate and so on). The actors involved in intermediation are diverse and comprise the organic everyday of the slum communities, as opposed to interventions by the state or nation. They live, work, and contribute to these communities.

It is important to consider a broader definition of use in intermediated interactions that scales beyond the simple notion of the human accessing the interface, to one that encompasses the wider socio-technical system. Use of a system by a beneficiary-user implies (i) *participation* with the system, by having a say over the purpose of the interaction, as well as providing feedback to the intermediary-user to influence the input. I borrow this term from the study of youth appropriation of online communities by Ito *et al.*, where “participation” is used to describe the different modes or conventions for engaging with new media. Instead of looking to rigid categories that are defined by formal properties, genres of participation are a way of identifying, in an interpretive way, a set of social, cultural, and technological characteristics that participants recognize as defining a set of practices (Ito *et al.*, 2009). (ii) A degree of social, cultural, or economic *usefulness* of information is maintained, which could be driven by recreation, livelihood, or communication needs. In other words, intermediated use of technology mirrored everyday activities and needs in my sites, as I note in (Sambasivan, Rangaswamy, Cutrell, & Nardi, 2009).

### ***3.1.5 Factors motivating intermediated interactions***

Intermediated interactions reflect the state of uneven textual and digital literacies in a community. So long as they remain, intermediated interaction will continue. Despite an individual’s limitations, the overall community typically possesses a greater amount of digital proficiency that could be considered its collective digital proficiency. Some of the factors that drove intermediated interactions in my sites were:

#### *Fear of the technology*

A combination of unfamiliarity with technology and lack of self-efficacy (*i.e.*, confidence in one’s

ability) intimidates many people lacking technology-operation skills from direct usage. The effort of acquiring the skills required to operate the device is also perceived to be high. The easiest alternative, then, is to find a technologically skilled person.

*Saroja, 67: "My son recently purchased a phone for the family. My husband and daughter-in-law leave the phone at home when they head to work. I don't know how to use it to make calls. I am a woman of those days. These things (technologies) are too hard to handle. I ask my young neighbour to dial my calls."*

#### *Lack of textual literacy, numeracy, or digital operation skills*

Non-literacy limits the ability of some users to understand the features, functions, and outputs of technologies. Numeracy is an essential skill in number-based operations, such as dialing phone numbers and operating menus. This is further compounded by the skills required to operate technologies. For example, Sujatha, 49, was non-literate but numerate, so she could read the time from a wall-clock but not set the alarm.

#### *Habits of dependency*

Pre-existing habits of dependency, not always regarding technology, transfer to device interactions. Factors such as age, lack of self-esteem, social order gave rise to dependencies on other community members. Local experts acted as enablers of information and communication access, through existing relationships. For example, Vijaya, 65, depended on her son for financing her monthly expenses. In turn, she turned to him for help with using her mobile phone.

#### *Cost of owning a technology*

The cost of ownership of a device was sometimes forbidding—not just in terms of initial purchase, but also in maintenance, subscriptions, updating, or repairs. Among the families I interviewed, with

an average income of Rs 5000, roughly Rs.4500 was channeled into in to basics such as food, education, rent, groceries, and electricity bills, leaving little for phones and PCs. This was further compounded by the expenditure on alcoholism in the neighborhoods.

### *Access constraints*

Age, gender, and financial capability influenced access to technologies. Women, elderly, and children were less prone to owning technologies: 36% (N=8) of the women owned phones, as compared to 82% (N=18) of their husbands (note that the sample included domestic workers, who were employed and financially independent). Intermediated interactions helped in overcoming access constraints, by expanding the resource base through device and skill sharing.

*Shobana, 42: “We only have one phone, and my husband carries it to work. So if I want to make a phone call during the day, I have to either walk to the PCO (paid telephone) or borrow my neighbour’s phone, so I just use my neighbour’s phone.”*

Intermediated interactions are *workarounds* that subvert the above constraints, which reflect social, cultural, technical, and economic barriers.

## **3.2 Findings**

I present three interaction mechanisms uncovered in my sites—remote access in *surrogate usage* implying access “on behalf of” or “in benefit of” in inputting and interpretation, collocated access in *proximate enabling* in inputting of device output, and collocated access in *proximate translation* or interpretation of output. These mechanisms vary with respect to intermediation in access, ownership, and skills in operating technology. These mechanisms reflect my findings; it is possible

for permutations of these interactions to exist elsewhere. They are examples of intermediation and not a neat partition of all possibilities; the boundaries between them are porous.

The three mechanisms represent a range of technology access, varying from remote to collocated presence of technology, and a range of technological skills, starting from lack of digital skills to digitally skilled, marked by non-literacy. Thus, the three mechanisms represent a trajectory of skills, with each stage being a transition from one to another. The three mechanisms are delineated without being tied to specifics of technologies. The actors profiled under these sections represent a wide variety of field subjects, based on age, education, family profile, skill-sets, occupation, power relations, and so on. Specifically, I considered (i) various *relationships* between actors, such as family (spouse, siblings, children, grand-children, and relatives), non-family peer (neighbors, friends, co-workers, employees, or persons of other communities), and non-family expert (NGO workers, doctors, teachers, employers, and priests). (ii) I analyzed various *locations* of intermediation, such as home, public space, and work places. (iii) I considered various situations of *use*, such as information requests, dialing phone calls, and recreational usage. (iv) I consider several situations of *impact*, such as achieving communication with family members in native villages, networking for job opportunities, awareness through specialized television programs, and so on.

My findings reflect that many intermediary-users were conversant in multiple technologies in the slum setting (typically mobile phones, VCD players, televisions, radio, and home theatre), but the usual case was that of being skilled at using a specific technology. Categories are not fixed;



**Figure 12:** Sharanya reads out to the women from printouts

therefore, a surrogate intermediary-user could also serve as a proximate enabler in another situation.

### ***3.2.1 Surrogate usage***

Lakshmi, 22, a call center employee, was among the rare few to be educated past high school in Ragigudda. Computers had not yet penetrated into the community. However, her sister, Bhagya, and brother, Vijay, routed their computer-specific information needs through her.

*Lakshmi: “I was lucky to attend college, and my mother has worked really hard to make this happen. I also attended computer classes to keep up with the times. I have done well for myself by joining a call centre. When my sister wants information on*

*the latest Vijay (actor in the Tamil film industry) movie, or my brother on cricket scores, I use my computer at work to look that up. I call him up because he wants instant scores”*

In this case, Lakshmi acted as a surrogate to seek her family’s information needs. The defining characteristic here is that the beneficiary-user never came in direct contact with the technology. In this kind of *surrogate usage*, the beneficiary-user depends on intermediary-users for technology access (see Figure 12). The intermediary-user in turn relies on 1) technology-operation skills, and 2) physical or financial access to technologies unavailable to the beneficiary. Beneficiary-users were aware of the function and purpose of technologies, and identified the right intermediary-users for specific tasks. This model overcame technology deficits, creating last-mile connections between the technology and unconnected communities, through intermediary-users.

*Surrogate usage* expands the information boundaries of the community otherwise closed to it. With the increasing interest among the younger generations to acquire technology-operation skills, and subsequently finding jobs in the information technology sector, or being able to access cyber cafes, this modality finds a home in communities of uneven technology penetration and technology-operation skills.

Information needs were sometimes identified by the intermediary-users themselves. Sharanya, an NGO worker, doubled up as a surrogate intermediary-user by consulting the Internet to meet information demands coming from the community of women who were her NGO members (figure 12).

*Sharanya: “Sometimes I am not in a position to advise the women on certain topics, such as reproductive problems. In such cases, I look up medical websites, take printouts, and read them out to the community” (see figure 12).*

### **3.2.2 Proximate enabling**

Sushila, 45, a mother of three, never attended school. Her job as a domestic worker brought her in close contact with her employer, a retired government officer.

*Sushila: “My daughter lives in Senji, Tamil Nadu. When she was here last, she put (stored) her name in the phone (Contacts list). I belong to the old generation, and did not attend school. These (technologies) are very difficult to use. So whenever I want to make a phone call, I get my employer to get my daughter’s number from the phone and dial the number. She also ends the call once I finish talking. If I am at home, I ask my youngest daughter.”*

We see how Sushila was able to use the mobile phone through her employer’s *proximate enabling*. The complexity of the user interface was hidden from her in the usage. The interaction was actively motivated by Sushila, but was made possible only by the intermediary-user. The beneficiary-user might have physical access to the technology, but does not know how to use it (see Figure 13).

Limited operational knowledge or unfamiliarity with using certain interfaces resulted in dependencies on digitally capable members for application navigation. Intermediary-users in proximate settings, such as family members, neighbours, colleagues, or employers often bridge the skills gap, by rendering certain interactions possible, such as in user interface navigation, and presenting the desired state of interaction to the beneficiary-user. They shield some of the UI complexity from the beneficiary-user, but allow the beneficiary-user use some of the application directly.



*Proximate enabling* allowed users lacking technology-operation skills, with access to technologies, to successfully use technology. This hybrid interaction created a direct engagement during use of technology. Although the steps to achieve an interaction were obscured to the beneficiary-user, she knew about the outcome of the interaction.

When Lakshmi helped her mother watch movies: “My mother knows nothing about playing audio CDs in my stereo system, but she loves to listen to music. Sometimes when her chores are done, or after a long argument with my father, she wants to relax. She will then ask me to play her favourite music—old songs from MGR movies.”

### **3.2.3 Proximate translation**

Janaki, 35, mother of three, was educated in the regional language medium of instruction (Kannada) up to 10<sup>th</sup>-grade. She recently purchased a DVD player, which was primarily used for playing audio CDs of devotional songs. She narrated an incident where her sister had mailed her a Video CD of a hit Tamil film freshly-released into the gray market.

*Janaki: “From my earlier experience with using the buttons on the DVD player, I knew how to eject the tray and insert the disc. I hit the mukkonam (triangle—play button) and a coloured box (menu) showed-up on the TV which I could not understand. Fortunately, my friend Suguna’s 10-year old son was around, and he was able to play the menu. I watched what he did—he pressed the mel pakkam kuri (Up-arrow), pressed the vattam (circle) button, and then the mukkonam (play button). From then onwards, every time I played the disc, I remembered that.”*

Here, the 10-year old enabled Janaki’s usage of the television player. Her technology-operation skills and textual literacy were not adequate enough for her to operate the DVD player entirely on

her own. We see a rote memorization of the procedure to play a VCD. Janaki used her existing digital literacy to make sense of the boy's actions with the DVD player. This procedural knowledge would then be applied to future encounters with VCDs. The limiting case is a differently designed menu, with different order or extra options. Here, Janaki's digital literacy would have to be extrapolated, failing which; help is always at hand in the form of an intermediary.

*Proximate translation* is characterized by operational knowledge and inability to understand system output. The beneficiary-user has some technology-operation skills, but lacking textual literacy, runs into an interactional *cul de sac*, when device output is unfamiliar. The intermediary-user functions as a translator of system output to a more familiar, verbal form (see Figure 14)



**Figure 13:** Sangeetha's children read out from a newspaper



**Figure 14:** Saroja’s neighbour sets up the camera of her phone, while children look on.

*Proximate translation* enables beneficiary-users with access to and operational knowledge of using technologies to use them. They rely upon the intermediary-user’s translation skills and ability to simplify the interface or information output.

When I interviewed Mythili, 30, her mobile phone started beeping. Due to an increase in income from working for an extra household, Mythili had recently subscribed to a new cellular plan, after leaving her phone unused for 5 months. She initially ignored the beeps, but started paying attention to them the third time. She used her judgment and hit the center button, but was unable to

understand the text message's contents. She immediately yelled out for her 12-year old daughter, Priya, and proudly mentioned to us,

*Mythili: "She learns English in school! She can understand everything!"*

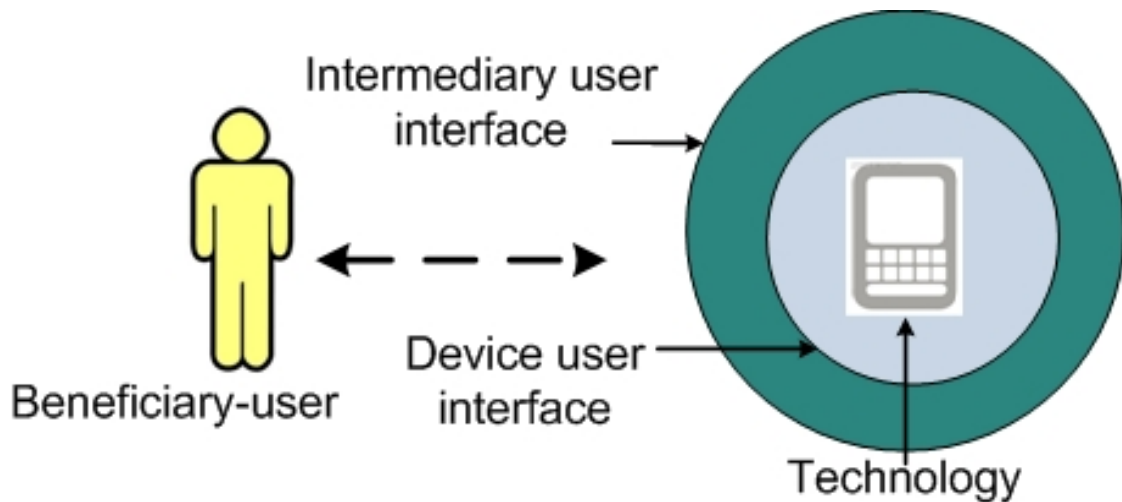
Priya was then assigned the task of reading out the SMS, which she promptly did. The mobile service provider had kindly reminded Mythili that she had a balance of Rs5 left.

### **3.3 Design space**

The intermediated "user interface" is a combination of the intermediating channel and the actual device user interface (see Figure 15). To work with the system, the beneficiary-user has to control and assess the state of the system. Hence, there is a dependency on the intermediary-user to mediate the input or the feedback. Under interaction analysis, I consider the *process* of handling input and output of the interface, and under information analysis, I consider the *actual* input and output. I consider some of the traditional heuristics of user interface design and the resulting design mismatches of intermediated interactions under the direct interaction designs.

#### **3.3.1 Interaction analysis**

The usefulness and usability of the system is determined by the capability of the intermediary in simplifying the interface and information, inasmuch as it depends upon the actual interface itself. The following are some factors to consider in the user experience and interaction of intermediated interactions.



**Figure 15:** The intermediated user interface

### *Engagement*

Standard, direct interactions are first-person interactions in that they allow the user to directly manipulate the technology. Intermediated interactions create a degree of separation from the technology, instead, spurring indirect engagement. They create a wider rift in the “gulf of execution” (1985) by increasing the gap between goal formulation and the means to execute it—the beneficiary-user has to communicate the high level information goal to the intermediary-user, who then has to break down the goals into intent, and perform interface tasks accordingly, and translate the results for the beneficiary-user. Because the beneficiary-user may be unable to evaluate the system output, perception and interpretation lie in the hands of the intermediary-user. The evaluation check is performed on the oral information provided by the intermediary-user.

### *Availability*

Direct interactions allow “anytime” and sometimes “anywhere” usage of devices, due to the personal, private, or portable nature of device usage. In contrast, intermediated interactions are limited by the availability of the intermediary-user. The number of digitally skilled members is gradually increasing with education and career choices; nevertheless, they remain scarce in these

communities. This is further constrained by the nature of the relationship between the two sets of users, which can either allow or inhibit the possibility of an interaction at a given time and place. Furthermore, the intermediary-user is not always present in the neighborhood, in which case the beneficiary-user may have to wait or find another locally skilled person. Interactions are negotiated and constructed around the intermediary-user's availability.

*Janaki: "Sometimes when Suguna and Sangeetha's families are not in town, I feel uncomfortable asking other women or children here to help me with playing DVDs. Then I just put it off until they return."*

*Lakshmi's sister, 18: "If not for Lakshmi, I would not ask anyone else to lookup film releases. There are not many people here working with computers."*

### *Usability*

Usability in direct interactions is concerned with ease of use of computing applications. In intermediated interactions, in addition to the first-order usability of the application towards the direct user, two more dimensions of usability need further examination—the human relationship between the intermediary-user and the beneficiary-user, which can inhibit or promote access, and the second-order usability of the application for the beneficiary-user. An asymmetry of interactions is created due to the control by the intermediary-user. They may do more to hide the complexity of the interfaces, instead of explaining their interactions with the technology. In turn, this abstraction makes interactions far less “usable” for the beneficiary-user.

*Shankar, 25, an intermediary-user: "Whenever they (neighbours) call me for help, I just perform the tasks. The other day, it had rained heavily and I was called for ghost correction on TV. I helped them out, but I did not give them details on how to do it. It might have confused them."*

### **3.3.2 Information analysis**

Interpretation and translation of information at both the input and output ends is carried out by the intermediary-user. The following subsections examine the consequences of conversion of information from a technological medium (of the device) to a non-technological medium (once translated to the beneficiary-user).

#### *Accuracy*

Information accuracy in direct interactions depends entirely upon the accuracy of the information source, *i.e.*, computing application. Intermediation adds an onus of information accuracy to the intermediary-user. Even if the information source has high veracity, specificity, and quality of content, the intermediary-user packages the information into an oral format. Therefore, the accuracy of information is dependent upon the intermediary-user's technology-operation skill sophistication, and his comprehension, interpretation, and translation of information to the beneficiary-user. Despite the best efforts of the intermediary-user, information loss does occur in this transfer process. Lack of consistency and resultant errors may pose serious problems to the beneficiary-user, depending upon the nature of information.

In the case of surrogates, the information travel distance is increased since the intermediary-user transports the information. This adds an additional layer of information loss over the already susceptible information transfer. The retention format of the intermediary-user plays an important role in reducing information loss. Printouts (like we see in Sharanya's case), phone calls (like in Lakshmi's case), and word of mouth were typically employed, with the second and third being lossier formats than the first. Physical memory aids like slips of paper were also employed. There

are varying degrees of information quality loss corresponding to retention format as well as distance from technology. Proximate interactions are less influenced by information travel distance than their surrogate counterparts.

### *Storage*

Direct interactions permit the ability to create and re-create interactions. The limited repeatability of intermediated interactions is overcome by physical storage. Once the beneficiary-user received information, it was accumulated in human memory instead of technological media. Numeracy was also seen, but without textual literacy it was only constraining. As an example, I found that Sushila, who was numerate and non-literate, could not write names to associate with the phone numbers she had jotted down on the wall. The Address Book in the mobile phone was not directly accessible to her, either, because her daughter had stored the contacts, and she could not read the entries. Therefore, the dependency on the intermediary-user continued to be sustained for information retrieval, in addition to technology usage.

### *Privacy*

In direct interactions, privacy concerns lie in large part in securing information on the system side (such as encrypting data or deleting cookies) and sometimes in guarding the physical space of the user from intrusion. The human mediated nature of intermediated interactions immediately implies that privacy is socially constructed between the intermediary-user and beneficiary-user. The actions involved in creating an interaction varied anywhere from looking up a contact from the Address Book to reading out printouts on health problems. Here, the privacy concerns are not just limited to revealing of the content to the intermediary-user, but also involve more complex nuances of social dynamics, power relations, and gender.



*Shankaramma, 65: “Usually I ask my grandson or daughter to make the phone call (dial the number) and I speak to relatives in my native village near Madurai. But I will not ask my neighbour, since she may overhear and spread rumours.”*

### **3.4 Broader effects of intermediation**

So far I have illustrated the various intermediated interaction paradigms and the interface-level challenges in designing for them. In this section, I list the broader effects of intermediation in a community. I describe how these interactions are reciprocated and sustained, how the benefits are distributed, and the learning that results from the process.

#### **3.4.1 A give-and-take economy**

A sharing economy evolves in human-mediated computer interaction. The intermediation process facilitates exchange of values. A shared infrastructure is created through individual ownership. Characteristics of a gift economy (Mauss, 1922) are visible—a notion of reciprocity is maintained rather than a *quid pro quo*. For example, when I asked Janaki how she perceived the help from her neighbors,

*Janaki: “When Suguna or Sangeetha helps me out, I may not be as talented as them in operating these devices, but I try to return the favour in other ways. I take care of their children when they are late from work, or share my food with them, sometimes.”*

However, the reciprocity is not always on a one-to-one basis, and not mandatory. Reciprocity also manifests as diffusion to other members of the community, *i.e.*, passing relevant and valuable information to co-members who may also benefit from it, through word-of-mouth. For example, members active within the NGO would transmit the information collected from meetings to non-attendees.

Although the intermediary-user does not always directly benefit from intermediation, social capital—infrastructure of social relations as well as the information that is transmitted between actors via their social networks (Granovetter, 1973)—helps in sustaining the interactions. The motivations also vary according to the nature of the relationship between the intermediary-user and the beneficiary-user—activists, employers, colleagues, friends, neighbours, or family members are all differently motivated to provide access, such as investment in labour skills, altruism, activism, and social ties. Recognition, reputation, and social good are drivers for contributing to the shared economy (Bauwens, 2009). Community members, expanding as well as strengthening social networks, provide recommendations of local technology experts. Intermediated interactions are atomic and limited to a bounded social network. This is because intermediation is a local process, requiring a social foundation of trust and familiarity. Stickiness in information distribution is seen in spreading and distributing information only within the bounded network.

Human relations set the foundation for intermediation. Interpersonal and institutional trusts are prerequisites for intermediated interactions. The setting of the slum fosters a shared understanding of context and stratum, contributing to institutional trust. Interpersonal trust between the two sets of users help in guiding the beneficiary-users to the appropriate intermediary-users. Together, these trusts influence the information flows and channels. Recommendations from members of the community are used to find new intermediary-users. These interactions build upon associative trust and shared institutional context. Relationships with intermediary-users grow and strengthen with time.

*Chandrika, 46: “When we bought this (stereo system), I could not figure out how to use it. I did not know whom to ask for help either. My sister, who lives in the neighbourhood, mentioned that the grocery store owner’s son usually helps them with electronics. So I went up to him and asked him for help. Ever since then we always run to him for electronics!”*

### **3.4.2 The multiplier effect**

Intermediated access creates a multiplier effect for the benefits of technologies through sharing. With a bare minimum of technologies, intermediary-users act as gateways between unconnected households and ICTs. For example, a great number of people actually benefit from mobile phones, even when there are so few. In Ragigudda, among the 12 women I interviewed, only two of them possessed their own phones. Even in households with sufficient technology penetration in Nakalbandi, not everyone was positioned to enjoy access to technology. Most husbands owned mobile phones and carried them to work. However, the women not only borrowed but also sought the help of their neighbours and employers in fulfilling their communication needs. Thus, intermediation helps in extending the benefits of technologies to a wide range of users. The Grameen Village Phone is built upon the model of sharing one phone with an entire village (Sullivan, 2007). The telephone operator is a permanent intermediary who helps the villagers with their communication needs. Intermediation overcomes highly stratified power structures that stymie the community members from access.

The secondary diffusion of information contributes to its extensive reach. For example, due to the space constraints in slums, interactions were often carried out on doorsteps or communal spaces such as temples and water pumps. Accumulation of groups of bystanders and passers-by was common; these persons gained from the interactions, especially community-related ones. In addition, active members helped in diffusion of information.

### ***3.4.3 Digital habituation and skill building***

Proximate access to technology and demonstrative actions of technology usage sometimes led to learning by observing. Janaki's case in *Proximate translation* is an example of digital habituation, *i.e.*, it allowed her to respond to the VCD player spontaneously and engage in a slow process of familiarization with the technology, as she learned basic navigation features and what the technology could be used for (Ratan *et al.*, 2009). By watching the actions of the intermediary-user, Janaki was able to map tasks to function, and memorize the sequence for future use. Collocated intermediated use, whether conspicuously demonstrative or not, exhibits the sequence of steps in executing a task, when the technology is collocated. Over time, it may lead to an internalization of the actions required. The familiar face of the intermediary-user also reduces the barrier to learning the actions. However, dependencies on intermediary-users may continue to be sustained, as these persons are easy to find. The threshold for independent use is a function of interest, ease of learning the task, and necessity to learn the task. It also depends upon the capability for ownership of the device.

### ***3.5 Conclusion***

Although technology users everywhere make use of intermediaries from time to time, intermediated interaction appears to be more pronounced and more deeply embedded in low-income communities. Even if access to and familiarity with the technologies is limited to a few individuals, demand for their benefits exists across the community. Thus, intermediated interactions increase the number of people who can benefit from these technologies.

Intermediated interactions are an example of a larger class of alternative infrastructures created under resource constraints. Limitations such as financial constraints, talk-time depletion, and network failures are present, and use of technologies is constrained as well as flavored by these limitations. Thus, several technology access and use mechanisms are created, including grey market infrastructures and illicit electricity or cable television connections. Technologies are creatively and actively consumed in these environments, and this is made possible by human-mediated computer interaction. Usage is underscored by cultural principles and norms (Sambasivan *et al.*, 2009). Aspirations of upward socio-economic mobility in the low socio-economic strata described here are increasingly incorporating the technological dream. Taken together, these access mechanisms are merely manifestations of the primacy of technology in low-income settings, sometimes over other needs. A dichotomous model like the digital divide, then, is deeply problematic, for the technologies have already pervaded geographical locations traditionally considered to benefit from their presence. A constructive reformulation of technology access and usage could start from considering people of low-income communities as *users*, not *beneficiaries*. Western world HCI techniques are not always applicable to these communities, due to profound differences in users, needs, contexts, practices, and goals of products. Field studies of technology practices are necessary to understand the contextual realities, and for bidirectional communication between designers and the user communities.

I have presented three distinct intermediated interactions in low-income communities: intermediation in inputting intent into the device in *proximate enabling*; intermediation in interpretation of device output in *proximate translation*; and intermediation in both input of intent and interpretation of output in *surrogate usage*. While I spent 4 months doing in-depth

observations in the slums, a great direction for future research is in longitudinal studies and cross-cultural studies. Intermediated interactions pull apart the standard notion of a user into a beneficiary-user and an intermediary-user, who each fulfill different roles that a single, direct user would fulfill entirely by herself. This fact opens the door to a wide range of new research for HCI, whether it is in understanding how such usage proceeds, or to design UIs that cater simultaneously to two, users who are not peers with respect to the technology. In turn, such research could help lower barriers to technology-based services for many people in the developing world.

## Chapter 4: Dual lives, dual SIMs

In this chapter, I discuss another low-income user group, a highly unique and challenging one—urban sex workers. Here I am interested in answering the question—*when* does sharing take place (and where does it break down)? Unlike the domestic workers, the sex workers are heavy technology users, and in most cases own two mobile phones, one for work and another for home. At the same time, they are a highly vulnerable group in society. In collaboration with Microsoft Research India, I designed and built a phone broadcasting system that sends out audio reminders for healthcare and microfinance. The system was not only a design response to the conditions and problems of sex workers, but was also designed as a probe to understand the users, use, and contexts in the sex workers' lives.

Governmental and civil society organizations for socio-economic development organize and support target communities, helping them access a broad range of services such as health care, education, and business development (Patel, Chittamuru, Jain, Dave, & Parikh, 2010). Communication infrastructures are crucial in reaching out to these communities for notifications, announcements, advertising, reminders, and emergency services during crises. Communications are also used for disseminating information about welfare services and for effecting behavior change (e.g., public service announcements). Organizations use several mechanisms to communicate with their members—television and radio advertisements, Internet services, Short Messaging Service (SMS), printed flyers, word-of-mouth, and so on.

In the developing world, organizations working for socio-economic development are stifled by several factors in their communication reach, including literacy and infrastructure constraints.

Moreover, broadcast media are not always relevant to the entire target population: they can be impersonal or non-local (e.g., radio and television); programming can be expensive (e.g., television); and content may rely on literacy (e.g., textual flyers and SMS).

Mobile phones present an excellent opportunity to reach out to target populations in the developing world. As of July 2010, the overall tele-density in India was 58.17% (688 million subscribers with 2.5% monthly growth rate) (TRAI, 2012), with arguably a larger actual usage base due to shared and pay phones (Sambasivan *et al.*, 2010). By using voice content, phones are unconstrained by literacy concerns and they support the existing oral formats of everyday conversation and radio listenership (Cervantes & Sambasivan, 2008) (Patel *et al.*, 2010). By featuring the voice of a familiar leader or peer, phone systems can provide a rich means to leverage existing institutional and interpersonal trust. Moreover, by modifying content, targeted or personalized message broadcasts can be scaled to very large audiences.

I designed, implemented, and observed a phone-based broadcasting system for Pragati: a non-profit, healthcare project targeted at Urban Sex Workers (USWs) in Bangalore, India. USWs constitute a unique and particularly challenging group for socio-economic development work: they are highly marginalized by society, vulnerable to HIV and other Sexually Transmitted Infections (STIs), and are often very poor. At the same time, USWs are technologically well-connected, with an exceedingly high mobile phone tele-density of 97%. The Pragati project currently reaches out to its USW members through word-of-mouth via its field workers, who in turn communicate and disseminate HIV treatment and prevention strategies. However, the project faces several challenges in connecting with USWs. Word-of-mouth scales poorly, with



delays in communication, especially for emergency notifications. In addition, USWs are highly mobile and there are specific dependencies on their schedules for when they may be available for contact.

I adapted an automated calling system to make phone calls to Pragati's USW members and play a variety of pre-recorded audio messages for different reminders and announcements. In addition to common developing-world impediments (e.g., resource and educational constraints), I needed to accommodate the maintenance of dual identities of USWs (not revealing their professional identities to their families), scattered populations, urban migration, and privacy concerns.

I believe that my findings can generalize to other populations that may be vulnerable, mobile, untrackable, or nervous, and to the institutions trying to reach out to them, such as migrant Bangladeshi workers in India, war-torn Sudanese nomads, and homosexuals in Saudi Arabia. My motivation to work with the USWs stems from the fact that despite their social marginalization and economic and health vulnerabilities, they have very high telecom penetration. I believe that USWs present us with a unique opportunity to augur technological ideas for other user groups facing similar socio-economic issues, but where technology is steadily penetrating. I feel my primary contribution is the design of a broadcasting system for a marginalized population; I also identify the unique lifestyle issues and design implications of interactive systems for invisible and wary populations.

In this chapter, I report my ethnographically inspired study and field trials of the phone-based broadcasting system. I describe some of the challenges in designing for USWs. I describe four

different deployments of my system—a pilot announcement for an event, microfinance loan payment reminders, HIV testing advertisements, and announcements for a computer training event. I conclude with some broad lessons for the HCI4D community, including reflections on trust, mobility, ubiquity, and privacy for developing world populations.

## **4.1 Background**

### ***4.1.1 Phone-based systems***

Much of the prior work on phone-based communication systems has focused on sending automated reminders for appointment keeping (Hashim, Franks, & Fiscella, 2001) and for medication regimen adherence, including HIV (Puccio *et al.*, 2006) and Tuberculosis (Tanke & Leirer, 1994). Such attempts have disseminated through text messages and voice messages, including Interactive Voice Response (Hashim *et al.*, 2001), albeit, through automated or impersonal voices of hired callers. All of the above studies have shown some success in improving baseline rates with the help of technology.

Several researchers have designed interactive voice-based mobile applications for the developing world, such as (Cervantes & Sambasivan, 2008) (Patel *et al.*, 2010) (Sherwani *et al.*, 2007). In their studies of usage of phone-based asynchronous voice message forums for small-scale farmers, Patel *et al.*, (2010) point to the importance of complementing social media with traditional media, such as radio. Sherwani *et al.*, (2007) have designed and deployed a phone-based speech interface for health workers to access replies to health queries, in spoken conversation format. Sambasivan and Cervantes (2008) have designed a phone-based user-generated audio classifieds service for the economically poor. I add the case of design and study

of a one-way phone-based communication system keeping the constraints of a special population in mind, like USWs.

#### ***4.1.2 Non-profits and ICTs***

In their work on resource-constrained non-profits, LeDantec & Edwards (2008) note the importance of ICT integration for co-ordination and communication among non-profits, and its role in providing coordinated care to vulnerable communities. To the best of my knowledge, no prior research has explicitly designed or studied outreach or co-ordination of non-profits with target populations.

#### ***4.1.3 Project pragati and urban sex workers***

Project Pragati (meaning “progress”) is a healthcare project for USWs, primarily targeted at HIV prevention and treatment. It also provides auxiliary services, such as microfinance banking and counseling. Pragati was created in the year 2005, when Bangalore was surveyed and an HIV prevalence of 12.1% among USWs was noted.

Employees both from within and outside the sex worker community constitute the Pragati organizational structure. The head office administration comprises non-community members and community members. As the structure gets closer to grassroots, community members essentially run it. In particular, outreach workers (*Jananis*) and field workers (*Jeevikas*) are chosen from the sex worker community.

Jeevikas, or fulltime field workers, are senior USWs who may continue to practice their trade in their free time. They are chosen from the community based on criteria like friendliness with other USWs and local expertise. They visit the field regularly during times when USWs are available in the field, i.e., soliciting clients. This poses a logistical challenge, since USWs are usually busy and not always available. Jeevikas monitor health checkups, distribute condoms to USWs directly and place condoms in strategic public areas (like paid restrooms and parks), offer counseling, and monitor monetary payments. Jananis, or outreach workers, monitor and train Jeevikas as well as visit the field themselves. Currently, the Jananis and Jeevikas, who deliver information back and forth to the grassroots and Pragati officers, largely drive dissemination.

#### *Field methods*

I employed non-participant observation at the zone 3 Swati Manne, or the drop-in shelter, which houses some beds, a microfinance payment collection center, health checkup center, and counseling center. I spent 3 months at the zone 3 Swati Manne, attending meetings, helping at events, observing transactions and checkups, and ‘hanging-out’ in general. Interviews were conducted in Tamil, Hindi, and Kannada by the first author. I also conducted non-participant observation at client solicitation locations, on streets and at homes and bus stops. I conducted semi-structured interviews with 21 urban sex workers at these locations.

#### *Public secrecy and defacement*

Theoretical explorations in public secrecy (Taussig, 1999), privacy (Tefft, 1980), and defacement (Douglas, 1996) provide a broader lens into these specific characteristics in the sex workers’ lives, with regard to maintaining dual lives and taking on a stigmatized profession.

Michael Taussig (1999), in his book, *Defacement*, examines the concept of *negative*, through the conceptual apparatus of “public secrecy”. He defines this term as that which is generally known but cannot be stated. For example, adults pretend that children are pretending to believe in Santa Claus (but they do not, really). Inspired by Elias Canetti’s dictum that “secrecy lies at the very core of power,” Taussig argues that the public secret forms the basis of society, social formations, and their attendant knowledges. The public secret involves the creation of social subjects who “know what not to know”. It institutes a ubiquitous “epistemic murk” whose core is dialectic of concealment and revelation. Taussig lends a relevant perspective to the maintenance of dual lives in the sex workers lives—it is not entirely impossible for their spouses and children to not know about their sex worker professions, over the decades. However, they may choose to not talk about the “public secret”.

In *Purity and Danger*, Mary Douglas (1996) provides an ethnographic account of taboo and pollution. She traces the words and meaning of dirt and pollution in different contexts. By considering dirt in context and drawing differences between primitive and modern cultures, she attempts to clarify the differences between the sacred, the clean, and the unclean in different societies and times. She complexifies ritual, religion, and lifestyle to challenge Western ideas of pollution, to show how the context and social history is essential. Such a lens also strengthens her argument that impurity plays an important role in maintaining social structures around the world.

Douglas argues that dirt is that which must not be included if a pattern is to be maintained. She borrows the term “medical materialism”: from William James to connote the place of religious rules against defilement at bottom practical hygiene rules for avoiding disease. She cites the example of not eating pork in hot climates as being attributed to unhealthy. She argues that our attitudes towards hygiene may not necessarily be only motivated by practical reasons such as hygiene, but they hygiene itself could my symbolic. She then describes our (western) association of dirt with bacteria and argues that it is a 19<sup>th</sup> century development. In the western culture, dirt is essentially a question of 'matter out of place', of that which we find inappropriate in a given context.

*“Dirt, then, is never an isolated event. Where there is dirt, there is a system. Dirt is the by-product of systematic ordering and classification of matter, in so far as ordering involves rejecting inappropriate elements.”*

Douglas’ argument that something is not impure or dirty in and of itself, but is treated so in context is important. Disorder is dangerous and powerful. Cultures try to tame it or use it as a creative ground from which order can re-emerge through ritual. How does such a framing help us thinking about illicit and anomalous communities such as secret societies, drug dealers, sex workers, or criminals? How, then, do sex-workers deal with normative notions of purity, social acceptance, defilement, and defacement? How does thinking about as careerist versus victimized allow us to see the economics and mechanics of the trade?

## **4.2 Design space**

### ***4.2.1 Potential application areas***

From my ethnographic observations, I found that Pragati’s communication ecology was prone to several problems: the Jeevikas were unable to always reach out to the USWs because of their

busy work schedules and scattered lifestyles. Large-scale communication took several days to transpire. Communicating an urgent message to all members instantly was next to impossible.

For the services provided by Pragati, the USWs tended to forget the dates for monthly HIV and STI medical tests. Several STIs are non-symptomatic, which pose severe problems when undetected. Members would discontinue their treatment upon success from the first dosage (for example, syphilis requires three Penicillin shots, but the women stop at the first shot, which is ineffective at curing the disease). Another problem area was that of microfinance monthly payments for loans. With compounding interest, missing the deadline for a repayment can be costly, given the poverty-stricken conditions of USWs. Consequences for missing a deadline include ineligibility for loan requests for the following two months.

Mobile phone penetration among Pragati USWs is self-reported by Pragati administrators at 97%, which is an unusually high number for both: a developing nation population (the average wireless tele-density in India is 55.14% as of July, 2010 (TRAI, 2012) and women (who are 37% less likely to own a mobile phone in South Asia, as of February, 2010 (Vitalwave, 2012)). Mobile phones are excellent tools for reminders and announcements, since they form a pervasive infrastructure, are very effective at delivering short messages, and are portable. For the above-mentioned problem areas, I took into consideration the exceedingly high mobile penetration among USWs and narrowed down on designing a reminder and announcement system. USWs lead busy and nomadic lives; therefore, the system seemed better poised at sending short, effective messages rather than behavior change through sex education or financial literacy. I picked two areas—microfinance and healthcare reminders—as focal points for my system.

#### *4.2.2 Design constraints*

Designing a system for USWs entails dealing with unique lifestyles. I generated a socio-cultural analysis that highlighted possible dimensions where my design response needed to be particularly sensitive. I list them below:

##### *Multiple devices*

While the USWs I met were exceptionally technology-reliant, there are other challenges to consider with such perpetual usage. A salient finding from my ethnographic observations is that the maintenance of multiple identities follows that multiple mobile phone identities are maintained, for work and for family. This could mean either two separate devices, or dual-SIM phones. Work phones are strictly switched off and hidden at home; however, there is some seepage at times.

In addition, mobile phones are heavily prone to theft and misplacement. It is estimated by Pragati that roughly 2-3% of their USWs lose their phones per month. Moreover, mobile numbers are constantly changed for a variety of reasons, such as purchase of a new phone, avoiding contact with partners or pimps, or circumvention of suspicion.

##### *Invisibility*

Many USWs lead double lives, maintaining different images, stories, and logics at work and home. Identities switch, information does not flow, and networks are disconnected, across infrastructures. Work identities are protected from the family. Boundaries are established



between the legal and illicit, not as forgery, but as a necessary occupational measure. How do we think about fuzzy properties in technology design?

Associated with the invisibility realm are several issues that have implications for technology design. There is a stigma of being attached to formal institutions for fear of identification. Within the Pragati project, there is a common binding thread (sex work) and mechanisms are in place to verify the reputation of a member before formal transactions, like loans. How can we create a trustworthy system that will carefully balance existing relations with the NGO and remain sensitive to the nature of the USW work, not jeopardizing their lives?

#### *Migration and scatteredness*

Most USWs are migrants from villages and towns in Karnataka and neighboring states. Mobility is a prime part of the street-based USW lifestyle; many of them live out of a suitcase. It is common for USWs to leave with their partners for several days at a stretch, or travel to where their work takes them.

Unlike populations that cohere through shared spaces, such as neighbors, street-based USWs are either homeless or scattered across the city. There is a pronounced lack of social capital that is built from sharing a geographical space. This poses a challenge for accountability for institutional transactions.

#### *Timing*

Home-based USWs operate at regular hours, similar to day jobs (as part of their story of working as domestic help or seamstresses). Street-based workers usually operate at night, and rest during the day. Consequences of intervening at an inappropriate time, hence in an inappropriate geographical space can include revealing protected identities. Due to the flexible working hours and nebulous times when sex work is actually carried out, timing is a crucial in designing for USWs.

### *Availability*

As the developing world users move towards new ICTs, how do people negotiate their availability around these devices? What happens to technologies designed to be “always-on” (Weiser 1994) when they move to disruptive, unstable environments? When does a connection or disconnection occur on the user’s own terms? What are the social expectations and individual responses to communication? Is there ever a down-time? We found that turning off phones was normative practice for sex workers; clients expected their sex worker patrons to go “offline” after 5 pm. In turn, sex workers, constructed narratives around who they received calls from when explaining the calls to their husbands and family members.

### ***4.2.3 Design process***

As a design response to the problem of reaching out to the USWs, we designed, implemented, and began evaluations on a phone-based broadcasting system. It was designed to call several mobile phones at once, and play audio messages upon feedback from the receiver.

I was interested in porting a mass-media approach over to a device that is, in some ways, designed more around mutually-accepted coordination and exchange than one-way large-scale dissemination, and in understanding its effects.

I employed human-centered, ethnographic action-research in the design of my system. I integrated my initial ethnographic findings into the system design. I deployed the system between July–September 2010, for various application areas that I will note in the next section. I constantly sought feedback from my users and iteratively revised the features. Jeevikas and Jananis helped us gather phone numbers of their members, for my phone system. I also transcribed paper-based microfinance and health records into my database.

In the current setup, the Jeevikas and Jananis go out to the field and act as communication agents between Pragati and the members, i.e., a person-to-person model. Implicit in this setup is a high level of trust in field staff and Pragati. My system was not meant to be a replacement for the current communication processes; in fact, I wanted to leverage the actors in the loop and the trust placed in them. In the next sub-section, I discuss the various design criteria that I chose from my study results.

#### ***4.2.4 Design criteria***

##### *Build a phone-based, server-side infrastructure*

Owing to the ubiquity of mobile phones, my system was envisioned to work on telephones. In order to avoid compatibility issues, I decided to build a server-side infrastructure.

### *Leverage audio*

My system would solely make use of audio messages, to avoid literacy issues and make use of the familiar oral format. Text messages were another possibility, but they rely on literacy.

### *Leverage institutional trust*

One of my key motivations in building the system was to leverage the existing institutional and interpersonal trust. I recorded audio messages using the voice of the friendly Field Coordinator of Zone 3, who was a highly visible and much-liked person. This ensured that Pragati approved my content, since I was reaching out to their members.

### *Keep the calls short*

I wanted to keep the audio messages short, hoping that it would interfere less with the USWs' lives as well as motivate listening to the content end-to-end. I decide to intersperse the voice content with classical music in the background.

### *Keep the content anonymous*

In my attempts to respect the privacy of the USWs, I decided to make the content non-linked to the receiver and not divulge identifying or criminalizing information, such as names, sex work, or HIV records, while still being clear to the recipient what the message was about.

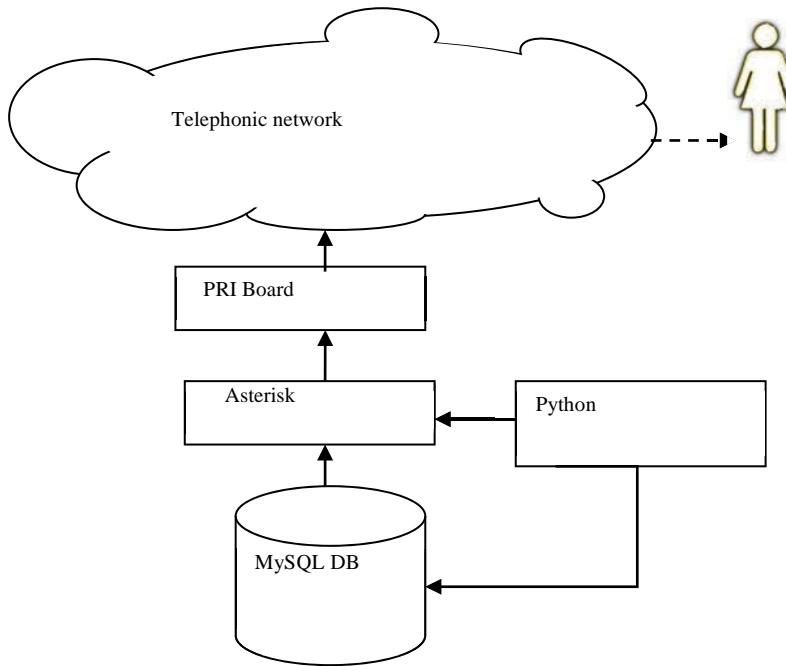
### *Find a good time to call*

Based on the overlap between street- and home-based USWs, I decided to broadcast the audio messages at late afternoon-evening. During these timings, home-based workers solicit and street-based workers relax or get ready for their night shifts.

#### ***4.2.5 Implementation***

I built a broadcasting system using off-the-shelf components and custom scripting (figure 16). I used Asterisk (Asterisk, 2012), an open-source telephony software, on Linux to make the outgoing calls. I utilized a Primary Rate Interface board (2000 Media Series from Dialogic, Inc.) to allow up to 15 phone calls in parallel. I wrote Python scripts to automatically generate call files from a phone number input log, and to dial the numbers in parallel. The system played pre-recorded audio messages upon hearing any feedback noise from the receiver side. I produced audio as 8 KHz, 8-bit Pulse Code Modulation wav files.

The system enabled simple logging of the outcome of each call, including whether it was answered, time of dialing,



**Figure 16:** System architecture

and the total duration of each call. Organizations can easily adapt the system by supplying their own audio recording and list of telephone numbers to call; the rest is automatic.

### 4.3 Deployment

For my deployment, I chose my applications areas, depending upon the purpose, scale of phone numbers, nature of communication, and relation to existing information sources (standalone or complementary to field workers). Table 2 explains the breakdown of my deployments. Table 3 explains their results.

My system was designed to serve as an effective broadcast communication system. Towards this, I was interested in understanding the following: the percentage of the population that was reachable; the effect of timing on reachability; and the percentage of the reached population that

listened to the content entirely. I was looking for behavior change to whatever extent possible, but were acutely aware of my time limitation of three months. I used a mixed-method approach to understand how, what, why, and when the system intervened into the USWs' lives.

### *Structured interviews*

I conducted interviews both in person and over the telephone after each deployment. In-person interviews were conducted at Swati Manne premises. Interviews over the phone were sufficiently modified to respect privacy of informants. I asked for the person's name from my phone database, and then revealed my identity if the person confirmed that it was indeed the right person. If a male voice picked up the phone, I simply mentioned that I was one of the USW's friends.

My interviews probed into the information ecology, context of receiving the call, mobile phone profiling, reactions to the call and audio, and the after-effects of the call.

### *Data records*

<b>Deployment</b>	<b>Target</b>	<b>Nature of communication</b>	<b>Stand-alone?</b>
<b>Pilot: Swati Manne inauguration</b>	Selected #s, one-time (n=35)	Reminder	No
<b>Microfinance loans</b>	Loanees with #s, one-time (n=23)	Reminder	No
<b>HIV testing</b>	All numbers, one-time (n=230)	Advertisement	No
<b>Computer training session</b>	All numbers, twice (n=627 in total)	Announcement	Yes

**Table 2:** Breakdown of deployments

I collected and transcribed medical and financial records from Pragati. As a baseline, I analyzed the financial health (i.e., their average rate of repayment, days before or after deadline, outstanding amount, length of the loan period, etc.) and created portfolio profiles for the members (reasons why they borrowed the money, typology of sex work, and neighborhood). For the medical tests, I analyzed the frequency of testing.

#### *Phone logs*

Finally, I monitored and analyzed the master call log maintained by Asterisk. Here I looked for duration of listening to the voice messages, number of calls that were answered, and the time of dialing.

#### ***4.3.1 Swati Manne Inauguration reminders***

In July 2010, Pragati was opening a new Swati Manne in zone 3 (figure 17). A cultural program was organized, which included *pujas* (worship), talks, and lunch. Jeevikas and Jananis deployed my system alongside traditional communication methods of face-to-face announcements. I collected the phone numbers of 35 USWs through Jeevikas and Jananis.



	Swati Manne inauguration reminders	Microfinance loan reminders	Medical testing advertisements	Computer training announcements
Members	35	38	230	627
Members w/#	35	23	230	627
%Reachable members	NA	61.00%	NA	NA
Connected calls	29	22	207	441
Finished content	27	20	121	354
%Finished/Connected calls	93.10%	90.90%	58.54%	80.27%
%Connected calls/Members	82.85%	95.65%	90.00%	70.33%
Audio message length	19 seconds	13.2 seconds	31 seconds	15 seconds

**Table 3:** Summary of results from the four deployments

For the content, I recorded the voice of the zone 3 field coordinator. I faced several challenges in this simple task. I recorded the message at the Swati Manne premises, to fit with the schedule of the Field Coordinator. However, the environment was prone to perpetual and random background noise, such as auto-rickshaw and bus horns, metro rail construction, and the regular buzz at Swati Manne. I overcame this issue through a combination of noise removal, voice amplification, and background music.

Another design challenge was to keep the message succinct and clear. I avoided talking about the organization or motivate the members about the event explicitly. My recorded message was:

*“Namaskaram [Greetings]. My name is Geetha, and I am calling from Swati Manne, Zone 3. I are shifting our old Swati Manne to Rajaji Nagar. The inauguration program is tomorrow at 11 am. Lunch will be served. I request you to kindly attend. Thank you.”*



**Figure 17: Swati Manne inauguration**

*Results*

Of the 35 members I contacted, 29 calls were answered (table 3). 5 phones were switched off.

Twenty-seven members (93.10%) listened to the entire audio.

Ten out of 29 contacted attended the event, out of which 5 had not heard through field workers.

9/10 people reported distrust in foreign and male voices and several interviewees liked the short

length of my messages (at 19 seconds). Many members were traveling or soliciting at the time of receiving the call.

#### ***4.3.2 Microfinance reminders***

My second deployment was targeted at loanees of *Swathi Jyothi*, the microfinance (MFI) wing of Pragati. Individual loans are taken out for mortgage, children's education, starting new part-time businesses and so in. Built on a joint liability model, 3-4 members get together and form a group. While the members do not have to save to form a group pool, they commit themselves to repay each other's loans, should there be any defaulting by other members of the group. Failure to repay on time also means that loanees cannot request loans for the next two months. My interviews reflected some confusion among the USWs in recalling their loan deadlines, attributable to their non-literacy and lack of financial visibility.

*“The [loan] dates keep changing each month and I often forget when the repayment is. Some days I barely make anything, so paying the fine is an additional problem.”*

I was motivated to modify the broadcasting system to send out reminders for deadlines. I collected as many phone numbers of loanees as possible (23 out of 38 loanees) from *Swathi Jyothi*, the MFI at Pragati. I sent out reminders one day before the deadline. The voice message conveyed that a payment was due on the specified deadline. I did not include names of the loanees in the messages.

#### ***Results***

Twenty-two out of 23 members were reachable, out of which 20 members (91%) listened to the content entirely. In general, I found no difference between payment rates of members who got

	<b>Avg. # of months</b>	<b>Avg. # months on time (%)</b>	<b>Avg. # of days paid on time (days)</b>	<b>Avg. # on time in August (%)</b>	<b>Avg. # of days paid on time in Aug (days)</b>
<b>Call</b>	4.7	86.78	-1.66	77.27	0.23
<b>No call</b>	5.4	87.65	-1.99	77.77	-0.88

**Table 4:** Analysis of financial portfolios (Average # of months is length of loan so far and average # of days paid before deadline, negative for early, positive for late payments)

the call (payment on time = 77.77%) and the 15 who did not (payment on time = 77.27%) (table 4). Two women that I had called were hospitalized after HIV and one USW’s grandmother had passed away, which brought down the overall average by 16, 17, and 7 days each. Without these 3 loanees, the average payment with calls was made 1.59 days in advance, compared to 0.88 days in advance without the call. However, my interview findings unanimously indicated that the microfinance reminders were useful at reminding loanees:

*“I have a slip of paper on which the due dates are written, but I often forget to pay with all the tension at work and home. I have been paying late for the past 3 months. This call really reminded me to pay on time.”*

Another interviewee spoke of how the system helped her remember without incurring a due.

*“I was in the Ghati Subramanya temple for a worship. I got this call and I immediately took the bus back to Bangalore to pay my fees, since I had forgotten by then. I remembered the amount, not the exact date. I was very happy to get the phone call.”*

However, payments are a function of availability of funds. Interviewees noted that reminder calls one-two days in advance were sufficient, re-affirming my design decisions.

#### **4.3.3 Medical testing reminders**

My third deployment was focused on sending out medical testing advertisements to the USWs. Pragati encourages HIV and Syphilis testing once every 1-3 months, depending upon the volume of sex work and age of the USW. From my interviews with Pragati staff, it was noted that they found it difficult to remind the women about their tests, since the dates varied each month and there was a general lack of interest in getting tested. I sent out advertisements to motivate the USWs to attend the medical examinations. I was interested in understanding whether the calls were reaching out. Note that this phase targeted all Pragati members of zone 3 whose numbers were collected.

For the audio message, I was faced with the challenge of including content that would communicate in a relevant and appropriate fashion, but at the same time, not reveal details about HIV or other STIs or risky information. In consultation with the Pragati staff, I decided to model the content similar to radio advertisements promoting medical examinations. My message read as follows:

*“Namaskaram, I am Geetha speaking from Swathi Mahila Sangha. We are organizing healthcare camps. They are taking place at the following locations: every Sunday at the Leprosy hospital, every Wednesday at Swati Manne, every Thursday at the Kamkshi Pallaya government hospital, every Friday at the Ayurvedic hospital, and every Saturday at the Kamala Nagar BBMP hospital. We will conduct blood tests and health examinations. Please attend without fail. Thank you.”*

	<b>Friday</b>	<b>Monday</b>
Members w/ #	297	330
Connected calls	122	319
% Connected calls /Members w/ #	41.07%	96.66%
Finished content	106	248
% Finished/Connected calls	86.88%	77.74%

**Table 5:** Results of Friday and Monday announcements

## *Results*

Out of the 230 numbers contacted, 207 connections were made (90%). One hundred twenty one members listened to the content in entirety (59%). Note that the audio for this deployment was longer and more detailed compared to other phases, at 31 seconds. The content was not targeted at any individual in particular, and medical testing was only recommended, not compulsory. Not surprisingly, the listenership dropped slightly, compared to other phases.

*“I think the reminders are a very good thing. But I am perfectly healthy. I use condoms with clients 100%. Why should I go get tested? Why go through the pain when I know I am okay?”*

### **4.3.4 Computer training announcements**

For my final deployment, I made use of the broadcasting system to make announcements about a free computer training session arranged by us. These announcements were made solely via the system, without the regular announcements by field workers. My motivation in this field trial was to explore the possibility of a phone-only information source and to make the announcements a few days prior to the event. For the event on Tuesday, I called the Pragati members of zone 3 on the preceding Friday and Monday of the week. My audio message included details on the event, including time, location, and lunch.

## *Results*

For the computer training, I initiated two sets of announcements on two days (on Friday and the following Monday) (see table 5 and figure 18). The numbers called on Monday were the same 297 as those on Friday with 33 additional numbers for a total of 330. In fact, on Friday 87% of those reached listened to the message entirely. Since Friday and Monday calling were cascading



**Figure 18.** Computer training deployment.

events, there was some repetition between Friday users and Monday users (hence the lower listenership on Monday). Of the total number calls dialed, 63 people (19%) attended the training.

We provided basic computer skills training, printed material and lunch. For the training, my modules included MS-Word, MS-Paint, MS-Excel, and YouTube. Except for one person, no one had touched a computer before. All participants indicated that they found the session to be useful. Even though the training lasted the afternoon, I later discovered that several USWs showed up after the training was over, because of their schedules.

#### **4.4 Findings**

Overall, my results indicate that the broadcasting system is effective at reaching out to members with phones and delivering content: I connected with 85.25% of members who provided phone numbers. 80.7% members listened entirely. I notice that short, interesting messages got across (88.09% listened entirely on average for phases 1, 2, and 4, of 12.73 seconds average) and detailed messages got hung up on sooner (58.54% listened for 31 seconds in phase 3), amidst subject material, day/time of call, and being the first call received versus a later call received. The system was widely accepted by Pragati staff and USWs, attributing to its non-intrusiveness and minimal time requirement on part of staff in recording, and users in listening.

My deployments over multiple development verticals (namely, healthcare and microfinance) are relatively rare in HCI4D; I was keen on learning about the nature of the unsolicited broadcasts across healthcare, microfinance, and training.

#### ***4.4.1 Reactions to unknown numbers***

One of my main findings was the mixed reaction to getting calls from an unknown phone number (i.e., from our outgoing number). From my ethnographic interviews, I had learned that mobile phones are key instruments in contacting customers. However, not all USWs distributed their professional phone numbers to their clients. Therefore, not all women were used to getting calls from unknown numbers (albeit the occasional wrong number) regularly.

First-time reactions to my calls were a combination of curiosity and doubt. Interestingly, from my interviews, I learned that several USWs would call either the zone 3 Pragati office or their local point of contact (Jeevikas or Jananis monitoring them), despite the fact that the number was



that of our research unit. With subsequent calls, they had learned to recognize the number as one associated with Pragati. I expected users to show less interest in listenership with time.

However, the later deployments reflect that while the percentage of reachable connections was still high (SD: 10.92% across deployments), the percentage that actually finished the content varied (SD: 15.80%). I learned that this number depended on content (relevance and interestingness) and institutional affinity.

#### **4.4.2 Trust**

Using the field coordinator's voice invoked positive responses. My system was amplified by the familiarity and trust built by the Pragati staff, over years of working the USWs, in its reach and authenticity.

*“If not for the voice of madam, I would not be sure. We know her and respect her. If it were someone else, I would be really suspicious. I took the message seriously only because of madam.”*

Taking a cue from large advertising campaigns, I initially thought that using the voice of film stars or popular personalities may be more effective in getting the message across. However, given the sensitive nature of the content, I found a strong proclivity towards using a female voice.

*“Since the messages were about health and money, if it were a male voice or a film star's voice, then I will be really suspicious because the content is so sensitive.”*

This quote suggests that popular voices may actually be counter-productive—a trusted, well-recognized voice works better for sensitive material. Using Geetha's voice also gave the

impression to the members that they were “taken care of” (in the words of a Swati Jyothi cashier). Another interesting finding is that several members mistook the automated recording to be a live transmission. Even though my system sent out broadcasts, the findings are a strong indicator of how members reach back to Pragati. This is only possible because of the previously established foundation of relationships.

Anchoring with the NGO helped us not only augment their own reach to their members, but also made our system more acceptable and in sync with established practices.

#### ***4.4.3 Timing rhythms and control***

One of my initial concerns in designing the system was that of being sensitive to various social infrastructures, such as home and work. My members unanimously voiced that the system was effective at reaching out to them, without any side-effects. Since the users themselves had agency in controlling their technology usage, by switching off phones when not at work or rejecting the calls, the connections that were established were non-perilous to their lives. Such control has implications for the fraction that is actually reachable, despite the ubiquitous mobile phone penetration.

One way to counter the timing issue is to call on different days, as evidenced in my computer training calls. For the computer training calls, on the Friday, I reached 41.07% users (122/297 calls), whereas on Monday, I reached out to 96.66% (319/330 users), even though I called during the same time slot of 3 – 5 pm. Added to this, several mobile numbers were non-functional. A

viable solution here may be for the user to register herself, if she gets a new SIM, perhaps by providing a missed call to the number.

#### **4.4.4 Diffusion**

USWs present a unique case of multiple devices per person. In addition to reaching out to individual members through their mobile phones, I noticed a diffusion effect among other members. Several interviewees noted that they called their friends to convey the message. Such a diffusion effect helped surpass actual technology penetration through a social infrastructure, as also noted in (Sambasivan *et al.*, 2010). Indeed, for the computer training event, 5 of the 68 who attended did not receive the call and had heard about it through other means.

*“I called my friends in my group [joint-liability group] when I got the call about the loans. I called my close friends when I got the call about the computer training. This [system] is very useful to us. It helps me learn about important events over the phone itself. I did not want my friends to miss out on such useful events or forget to pay their loans. It will earn us a bad reputation if we forget.”*

My interviews indicate that heavy diffusion occurred among the USWs for the pilot and microfinance deployments. In two cases, 2 women who did not receive calls had made loan payments upon being reminded by their group member who received the call. Three women who attended the Swati Manne inauguration were persuaded by their friend, for whom the call legitimized the event.

*“After getting the call, I thought it was an important event for our community to attend. I convinced my three friends to come.”*

#### **4.5 Conclusion**

In this chapter, I presented the design of a phone-based broadcasting system and the results of our deployment at an NGO catering to urban sex workers. I articulated the challenges in

designing for USWs and the organizational constraints in reaching out to them. I presented the results of four deployments of the system, in sending out reminders, advertisements, and announcements.

USWs present a severe case of problems that plague the developing world, such as poverty, health concerns and social marginalization. Yet they also represent a unique demographic for high technology penetration, multiple devices per person, and intensive usage in their everyday practices. While the developing world is not yet saturated by technology or concerned with technology-mediated privacy yet, it is likely that various user groups will meet some of these issues sooner or later. Looking explicitly into the design concerns for such groups may pave the way for designing new technological interventions for a variety of at-risk populations where mobiles are the only personal communication devices available.

## Chapter 5: Negotiation in shared technology use

In the third and final study of my dissertation, I studied airtime sharing among urban low capital, informal microenterprises in Chennai and Bangalore, India. After answering what kinds of shared usage take place among domestic workers and when and where it takes place among sex workers, I was interested in asking “*how* does the sharing take place”. They form the concluding comparative arc in the point (sharing among domestic workers), counter point (siloed sharing among sex workers), and point (airtime sharing among employees of a microenterprise, with airtime provided by the employers) trajectory. I ethnographically studied a spectrum of microenterprises (along the income axis), comprising both genders, across the two sites.

Airtime is the unit of connectivity for mobile phones. Airtime connectivity profoundly impacts its users, especially in the developing world where mobiles are major ICTs, e.g., by leading to livelihood productivity gains (Jensen, 2003) and amplifying social networking (Horst & Miller, 2005). In Human Computer Interaction, airtime connectivity is assumed to be readily available to individual subscribers on their personal and private devices. However, in developing countries, the connectivity infrastructure is fraught with high ownership costs (Burrell, 2010) (Sambasivan *et al.*, 2010). For example, in the United States, airtime expenditure is 2% of the average income of lowest income segment; in contrast, despite being the fastest growing mobile market in the world (TRAI, 2012), airtime costs in India can be greater than 10% of the average low income. Note that the average annual income of the lowest quintile in the USA was \$22,629 (New York Times, 2005). The average cellular package is \$40 (ATT, 2012). The average annual Indian income of a microenterprise employee in our study was Rs. 36000 (800 USD) whereas the Arjun

Sengupta report (NCEUIS, 2007) estimates that 77% of Indians live on less than Rs. 7300 (162 USD) a year. Average airtime costs were Rs. 300 (6.66 USD) per month in our study. Shared access or multiple users for a single airtime resource is a prominent mode of phone use in these contexts.

To the best of my knowledge, this chapter is the first to study airtime sharing in the commercial enterprise in the developing world. I report the results of my fieldwork on airtime sharing practices in a spectrum of 58 microenterprises in two cities in southern India. In India, a country of over 1.2 billion people, microenterprises account for over 90% of the total enterprises (MSIM, 2012). Airtime impacts several functions of the microenterprise, such as procurement and sales of goods; and better price information exchange (Donner & Escobari, 2010). Understanding the usage practices and design space of airtime sharing in the microenterprise could impact livelihoods of millions of people in the developing world. I seek to understand how airtime is shared, apportioned, and controlled among member of an enterprise, supplementing, complementing, or opposing the rules of an enterprise. Sharing airtime bits across a network pipe leads to new tensions, negotiations, and usage practices. My study points to the foundational phenomenon of *negotiation* in airtime sharing—wherein multiple users repurpose airtime usage towards personal interests—by taking advantage of the opacity of airtime in showing usage of multiple users, cost and infrastructure constraints. Shared access, then, involves complex and messy social and technological practices that complicate design notions and representations around multiple users.

I present a spectrum of airtime sharing practices across informal enterprises in the wild—sharing airtime, airtime subsidy, and device provision. I show how accountability of employees, subterfuge of employees, airtime economics, and access control of airtime are negotiation mechanisms in the enterprise. Airtime sharing is fundamentally *bandwidth* sharing and the design space is relevant for various kinds of bandwidth sharing, beyond just the microenterprise. I feel my primary contribution is the introduction of negotiation as the foundation of airtime technology sharing in the microenterprise. I contribute to the HCI for Development (HCI4D) discourse on livelihoods by providing an account of technology access and benefit through airtime sharing in the microenterprise. Finally, I discuss design for airtime and bandwidth sharing in low-income communities.

In the remainder of this chapter, I report the results of my survey and fieldwork on airtime sharing practices among 58 microenterprises in India. I situate my research amongst other contributions on technology sharing, explaining how non-remunerative sharing takes place in commercial environments. I provide a brief orientation to the airtime landscape in India, followed by a characterization of the types of microenterprises I studied. I then present my findings on the various ways in which negotiation takes place in airtime sharing, such as tracking, seepage between home and work domains, and economics of airtime. I conclude with some thoughts on design, including designing for negotiation and shared usage.

## 5.1 Background

### 5.1.1 Negotiation

Negotiation is the “discussion between two or more parties with the apparent aim of resolving a divergence of interests” (Pruitt & Carnevale, 1993). Fisher, Ury, & Patton (1991) note that a good negotiation should satisfy three criteria: produce a wise agreement if agreement is possible, be efficient, and not damage the relationship between the parties. In a related strand in HCI, Gaver *et al.*, (1999) call for ambiguity in system design, arguing that leaving interpretation open to people allows for greater conceptual grappling and deeper, personal relations with the system. Aoki and Woodruff (2005) note that while participants in an interaction observe and account for the actions of others, it is not always desirable for all parties to be able to account accurately and precisely. The ambiguity discourse offers us relevant and useful concepts, such as openness in interpretation and reduced communicative clarity, which I extend in my work.

I define negotiation in airtime sharing as the repurposing of airtime usage towards personal interests. Negotiation occurs when there are conflicting technological goals, user interests, or activities. When there is a gap between the expected social norm and the user’s action, the subsequent process of achieving the user’s expected goal or a compromised version of the goal is negotiation. For example, while the microenterprise expects the employee to use his airtime for professional calls, the employee may repurpose airtime towards making personal calls. An employee’s daughter may call her boyfriend surreptitiously on her mother’s phone. The daughter may account for her usage by claiming to make a call to a client or supplier. It is not just the *process* of achieving the goal, but also the supporting *narratives*, *tensions*, and *re-alignments* in interactions that constitute a negotiation. Negotiations are built upon trust and social



understandings. They are ongoing dialogues, with constant back-and-forth between the two parties, be they between employer-employee, family members, or coworkers.

### ***5.1.2 Studies of sharing of technology***

Previous studies in HCI have examined technology and content sharing among multiple users. Past research in ICT4D has predominantly focused on the household and village communities. Bell's examination of households across Asia suggests that the community or clan is the basic unit of most Asian cultures; not the "individual" (Bell, 2006). In her examination of shared access of mobiles among Ghanaian households, Burrell (2010) describes multiple roles in mobile phone usage—the user, purchaser, owner, possessor, or operator. Steenson & Donner (2009), in their study of urban middle-class Indian families, argue that mobile sharing is born not merely out of economics, but may also be influenced by cultural factors. Sambasivan *et al.*, (2010) describe intermediated usage, a shared usage phenomenon in low-income communities where digitally skilled users enable technology use to those without devices or necessary skills. The Grameen "Village Phone" extends technology sharing to village communities through paid phones (Donner, 2005).

Yet, little is known empirically about sharing in the low-income enterprise, where sharing is neither borne out of tight family structures nor remunerative. It is in this context that I wish to explore how microenterprises share airtime, the ways in which they share, and what the notion of airtime sharing means to them.

### ***5.1.3 Airtime technology***

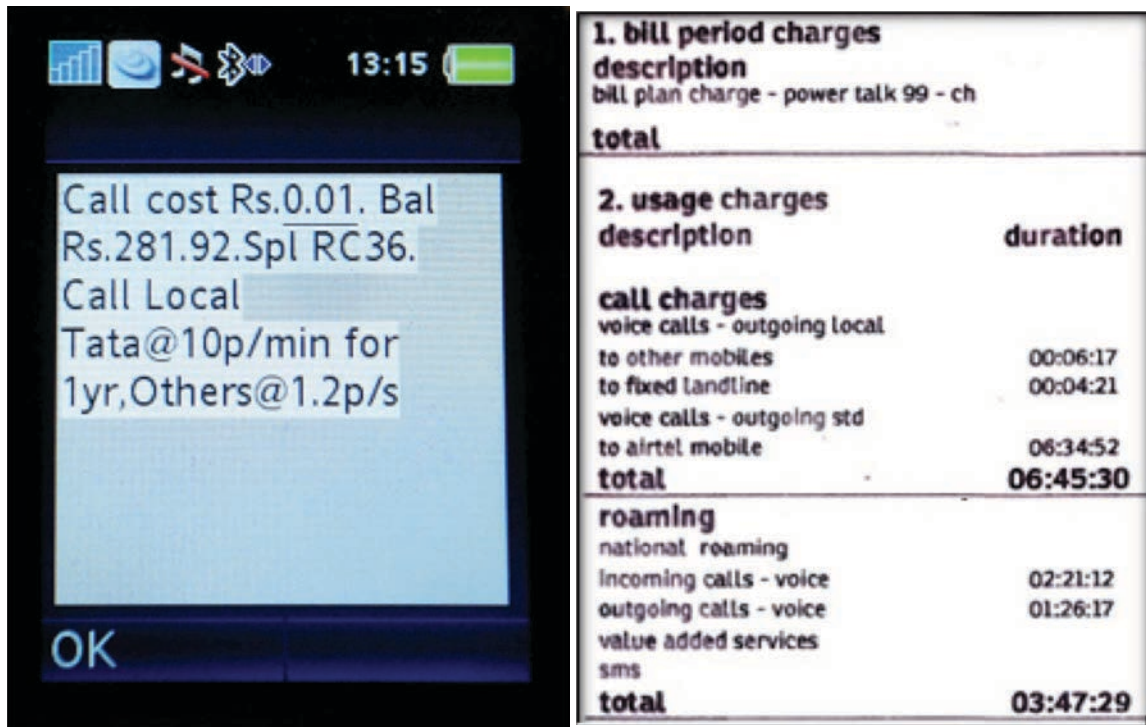
I refer to the credit (measured in minutes) used for services spent on the phone as airtime. Note that airtime is different from talk-time, which is the maximum expected duration a fully charged battery is expected to last under perfect conditions. In the UK and USA, airtime refers to the minutes spent on a call, whereas in India, airtime is fungible—it is currency for a number of services, such as outgoing calls (incoming calls are free unless the user is “roaming” outside a prescribed area), SMS, MMS, mobile Internet, ringtones, data services, and subscription alerts. As of March 2011, airtime was provided by sixteen Cellular Service Providers (CSPs) in India, covering 811.59m subscribers, out of which 381.40m used data services on their mobiles (TRAI, 2012). Airtime can be loaded on a phone in two ways: postpaid and prepaid recharges.

#### *Post-paid airtime:*

Post-paid connections charge the subscriber on a monthly basis for usage of mobile services. These are similar to cellular plans common in countries like the USA, except that the subscriber sets a maximum credit limit on the account. Postpaid airtime can only be purchased at dedicated CSP outlets. The postpaid model offers the subscriber an option to view per-call billing history on a monthly basis for a fee.

#### *Pre-paid airtime:*

Prepaid subscribers dominate the Indian airtime landscape, comprising 96.81% and 95.30% of the GSM and CDMA total subscriber base (TRAI, 2012). Pre-paid airtime allows a variety of tailor-made recharge coupons with different denominations, starting at as low as Rs. 10 (0.25 USD). Airtime is loaded in three steps: first, the user purchases minutes by acquiring a PIN



**Figure 19:** (Left) Prepaid and (right) postpaid notifications

number; second, she dials the recharge number; third, she enters the PIN she purchased. Mobile Internet is available both as integrated with prepaid and in standalone packages, starting at Rs. 9 (0.20 USD) for 10 MB, making access affordable. Usage tracking in pre-paid is fairly limited. The CSP sends out notifications after terminating every call, reflecting the current airtime balance, previous call duration and expense (see figure 19).

## 5.2 Sharing ecology in the microenterprise

In my study, I define a microenterprise as an urban, non-farm enterprise; with 10 or less employees; without a formal payroll; and sometimes tax-paying. Recall from the second chapter that I studied a continuum of microenterprises in Bangalore and Chennai, using revenue as a defining axis. Airtime sharing practices and the social norms around them extend from and modify the existing ways of sharing non-technological goods in the microenterprise, such as

sharing a cup of tea or lunch, looking after each other's shops, borrowing bicycles, as well as other cultural productions such as gossip and humor.

### ***5.2.1 Values in airtime sharing***

Airtime sharing is built upon a shared value system and cultural understandings. I encountered a range of values underpinning the airtime sharing ethos including trust, reciprocity, symbolism, and communal shareholding. Depending on who was sharing what with whom, values varied. Motivations to share at work varied from social ties to obligations to colleagues. For example, Raman, a young employer in T2 shared his Nokia C7 with his employees so he could

“Make them feel comfortable, make them feel that he is like their elder brother [...] unlike older bosses who are not very friendly with employees.”

In contrast, Mohammed, an employer in T3 was hesitant about sharing his mobile, stating that,

*“I already pay my employees, so I offer my phone to them only when they ask me. It's not nice to say “no”.”*

In T1, I observed that family ties largely motivated sharing in businesses.

Airtime sharing was reciprocated in several ways, in the form of airtime, favors, content, and gifts. Airtime sharing reciprocation was not on a quid pro quo basis and not mandatory (Sambasivan, 2010). Shankar, an employee in T2, told us,

*“Sometimes I borrow my neighboring seller's phone to make STD (long-distance) calls to my village when I run out of airtime and need to talk urgently. These calls are expensive. Then I buy him tea or lunch or let him use my phone when I recharge.”*

Airtime sharing also led to turn-taking in recharging. Chandrika talked about her reciprocity, noting,

*“I use my mother’s phone for business calls, but when I save up enough pocket money or part-time job pay, I buy some currency [airtime]. I have no father, so I try not to burden my mother.”*

### **5.2.2 Location, timing, and users**

Shared access to airtime varied with time and location of both the owner and the borrower, as a result of varying relationships, devices, communication needs, and accountabilities across work and home spaces. For example, 6 am sharing was different from 6 pm sharing; sharing in the street-side shop was different from sharing inside one’s home. The results of our mobile diary exercise show that all seven participants shared their phones at home with their family and at work, including two participants in T1 whose family members were also coworkers. On average, two family members and one colleague shared the mobile phone every day, in addition to the device owner.

A total of 302 calls were made by the participants, out of which 176 were professional and 126 were personal calls. Calls were dialed across home, work, supplier stores, delivery locations, temples, and relatives. Professional calls were more frequent during mornings and nights. They tended to be short in length (avg. call length = 2 minutes) and were largely coordination calls for deliveries and supplies. Airtime sharing with coworkers was seen during these times. Personal calls were made during afternoons and nights, and tended to be longer (avg. call length = 4 minutes), but fewer. Airtime was shared heavily with family members at nights. Our findings point to boundary-crossings between personal and professional airtime usage.

### *5.2.3 Typology of sharing in microenterprises*

I limit sharing to instances where shared usage happened more than once or on a recurring basis. I present a range of technology sharing within the microenterprises I studied (Table 1). Traditional sharing co-exists with technologies provided by the enterprise.

#### *Shared airtime*

Shared airtime occurs when multiple users share a connection or airtime minutes. Airtime may be shared either by allocating a particular device as the shared instrument (at work or home) or by freely sharing all instruments for calls. Shared airtime is independent of device ownership, i.e., each user may own their device and SIM card yet share airtime on other phones. Shared usage occurs throughout the five tiers, but is pronounced in T1, which consists of close-knit family members. In other tiers that are more formal, shared airtime coexists with professional sharing. Rules of access govern shared airtime usage. For example, the mother keeps a watchful eye on the son's usage of the phone.

#### *Airtime subsidy*

Airtime subsidy occurs when the employer provides a nominal amount of money every month to the employee towards professional airtime. An allowance of Rs. 200-300 (5-7 USD) is provided each month. Employees own their mobiles and SIM cards. Airtime subsidy comes with an expectation that the employee will make instrumental (professional) use of the subsidy. In T2, employees purchase dual-SIM phones and use one SIM towards personal and the other towards professional calls. In tiers 3 and 4, employees own a mobile each, and the subsidy is used to top-up the existing airtime minutes.

### *Device provision*

In the case of T5, dedicated mobile phones with postpaid connections are handed over to the employee for professional calls. In addition, employees own personal mobile phones. Shared devices allow tighter control for the employer. There is some understanding between employers and employees that a certain percentage of phone calls is towards personal purposes.

### *Trajectory of microenterprises*

As we move from tiers one to five, we notice a change in devices, technology behavior, and practices (Table 1). Technologies become more sophisticated with each tier, although the big leap from personal to productive use of Internet happens only in T5. We see shifts in airtime technology from prepaid to postpaid; in device models from low-end to high-end smart phones; and in infrastructure from WAP to Wi-fi/3G. Technologies shape the negotiation process: with more capabilities and skills, there are stronger accountabilities, novel responses to accountabilities, and complex accounts of usage.

## **5.3 Findings**

Shared access in low-income communities is a site of contestation, where a technological resource is shared among multiple users with various capabilities and interests. The personal and professional coexist in microenterprises, resulting in further conflicts and tensions. Negotiation in the microenterprise entails activities that modify and stretch the properties of technology towards gainful use, amidst checks and balances, rules of access, and cost constraints. In our study, airtime negotiation revealed itself as a set of complex practices. Salient among them were

four negotiation mechanisms: accountability of employees, subterfuge of employees, the economics of airtime, and access control.

### ***5.3.1 Accountability***

By accountability I refer to the ways in which the employee is obligated to use airtime towards professional purposes and the checks and balances involved in doing so.

#### *Tracking airtime*

Enterprises had several ways to maintain airtime expenditure within limits. Since prepaid airtime offers limited means to track airtime, employers checked on their employees through conspicuous and “innocuous” means. Employers in tiers 2 and 3 sometimes checked on dialed numbers in the phone. Anbu, an employer in T2, noted,

*“I give Rajesh [his employee] an allowance of Rs. 300. [...] Sometimes when I see him, I ask if I can borrow his phone to call, but look up the dialed numbers.”*

Airtime tracking was more common in T1. Since members shared a device for work, there was increased surveillance in checking recently dialed and received calls, as compared to the other tiers.

In T5, airtime tracking was better supported by the CSP. Selva, a manager, gave out five post-paid phones to his marketing employees. Monthly bills usually came up to Rs. 5000 (110 USD) per phone. Selva pointed to the Airtel CSP bill and said,

“I could trace individual calls by requesting a detailed call history from Airtel for an additional Rs. 30.”



*He went on to add, “I usually don’t do it [...] not unless it’s [the bill is] outrageous. I allow anywhere between Rs. 250 – 750 on personal calls per month.”*

He detected personal calls on the list by looking at call lengths and frequencies. He noted,

*“Relatives from native villages usually want to talk for a long time and don’t hang up. Professional calls don’t last longer than 2 minutes. One usually just coordinates when and where to meet.”*

In reality, however, he did *not* request detailed call history for phones. Accountability belies the nuances of social understandings and trust, wherein Selva *allowed* personal calls and did not exercise his ability to check calls unless the bill skyrocketed.

I created a design provocation to help employers allocate airtime to employees and track individual usage (Figure 4). Our design was deliberately “extreme” in being intrusive and violating privacies of employees. I was interested in understanding the social context and values that airtime sharing is embedded in, not a response to the usability of our designs. While the sentiment of apportioning resources and knowing how airtime was used struck a chord with the employers, they seemed ambivalent about the idea of tracking minutiae of employee usage.

#### *Limiting calls beforehand*

As a preemptive measure, some employers provided airtime by estimating the number of professional calls for the month. In tiers three and four, the frequency and timing of communication were estimated to calculate airtime minutes. Swarna, owner of a vegetable wholesale store, noted,

*“My delivery boys call up our customers to first decide the time to deliver. Later, they call me next to notify whether it is done or not. Sometimes I make the calls to customers on my phone. This is cheaper for the boys and makes my life easier. I*

*give them Rs. 200 per month regularly because they cannot possibly exceed the amount even if they make five calls a day.”*

In practice, airtime sharing rested in a gray area where Swarna could guess the number of professional calls, but saved her delivery boys a little money, and coordinated better by allowing them to borrow her phone.

### *Reportage*

In a few stores in T2, employers required daily and weekly reports of airtime usage from the employee. Shahul Hameed, owner of a street-side jewelry store, sometimes asked his employee how he had spent his day’s airtime during the daily sales report. Employers were not interested in accuracy in reportage; rather they made an attenuated enquiry into usage as an accountability check, yet respecting the social relationships. As a repeated social process, this became a less effective means to check usage, as employees learned to invent narratives to account for usage, as we shall see in the next section.

### **5.3.2 Subterfuge**

As an oppositional move to counter the employer’s ways of airtime accounting, employees created inventive ways to hide, camouflage, and subvert their personal usage.

### *Deleting phone numbers*

Since prepaid does not provide detailed accounts of usage and the CSP notifications after each call are transient (they disappear after ‘OK’ is pressed), deleting numbers was a commonly employed strategy. In T2, Sujan was paid for professional airtime but used the minutes to call his native village friends and those working on the same street to coordinate for lunch or to chit-

chat. Sugan regularly deleted his friends' numbers from call history on his phone, leaving behind only family and professional calls. He told us,

*“Sometimes owner Sir visits and uses my phone to make calls [...] I don't want him to think that I am gossiping here. I want him to know how hardworking I am. Family is OK. It shows that I talk to my mother and father, but friends [...] he may think I am wasting time.”*

Sugan maintained an impression of being a diligent employee by appropriating the phone content to his advantage. Negotiations in airtime sharing are concerned with what *kind* and how *much* information to reveal.

### *Exploiting illiteracy*

In the lower tiers, where employers were educated in the regional language or were non-literate, employees crafted their usage stories to avoid raising suspicion. Contacts were generally not stored on the phone due to non-literacy or complexity of the phone interface. Phone numbers were either freshly dialed or retrieved from the phone history. Ammulu, daughter of one of the flower-sellers in T1, was a heavy phone user. She attended school and helped out her mother in the evenings. Ammulu had a boyfriend from the neighboring school. She said,

*“My mother asks me, “Whose number is this?” My mother does not know how to read English. I tell her it is one of the customers or flower suppliers. Since my mother may eventually recognize the number, I alternate between my boyfriend's mobile and his best friend's number that I have stored as different supplier names. I only call him when I am at work.”*

Ammulu created a perfectly logical narrative for her mother, taking into account how her mother may recognize names and numbers through symbolic literacy, repetition, and numeracy; the credibility in calling professional contacts; and economizing her and her boyfriend's airtime by taking turns—all without raising an eyebrow.

### *Misnaming contacts*

In T5, where employers had college degrees and were more familiar with the read-write functions on the phone, storing contact names was a common practice. In enterprises where employees were expected to submit weekly reports, employees forged friends' and family names as supply chain contacts like customers, suppliers, or company agents. In the words of Satish, an employee in T5,

*“If my boss checks my calls, he will see that I have been calling only my clients and agents.” When asked if his employer would suspect, he replied, “No. I store friends and family as frequently dialed clients [...] I add a CSP to differentiate, like Arun Airtel [customer] and Arun Reliance [brother]. So instead of three calls to Arun, my boss would see four.”*

We see how T5 employees and Ammulu leveraged the legitimacy of professional contacts to camouflage and negotiate personal use.

### *Self-regulation*

Employees negotiated, managed and regulated their usage of airtime through self-created personal-professional quotas. These quotas were usually informally fixed per month. In the words of Sukan:

*“Each month I use about 30 minutes of [professional] airtime to call my friends and family. My boss pays me Rs. 300 per month. But when I exceed 30-35 minutes, I start using my personal SIM. I want to be true to my conscience and job.”*

Sukan created a moral threshold above which surreptitious usage of professional airtime for personal calls became “wrong.” Within this self-regulated framework, airtime quotas were carried over from one month to another. Sukan added,

“But if I use only 10 minutes this month, I will try to use 50 minutes next month to made up for it.”

Sugan’s words were echoed by Akhil, a tier two employee,

*“Arre [Oh], my boss does not even pay me enough to survive. I have to care of a wife and three kids in Rajasthan. So I try to be make good use of [justify] the minutes he gives me, but after that it is for my calls to family.”*

Our designs for employees were created keeping in mind the delicate, inconspicuous balance between personal and professional airtime. Employees responded positively to the idea of differentiating and tracking the two and receiving warning SMSs without the employer’s knowledge. Such responses point to the problematic nature of current airtime technology in supporting different *kinds* of use that coexist, but are siloed into public and private.

### **5.3.3 Economics**

As we have seen, airtime sharing is negotiated by the push and pull of employers and employees. But how is the valuable resource of airtime managed with multiple users amidst cost and device constraints? Recall that airtime expenditure constitutes over 10% of the microenterprise employee’s salary.

#### *Airtime repurposing (switching SIMS)*

Different CSPs charge differently for calls, motivating employees to switch between networks to keep costs minimal. In T2, dual-SIM phones used SIMs from two different CSPs. Vijay, an employee, swapped between two SIMs. His professional SIM (subsidized) had cheaper calling rates, whereas his personal SIM had lower SMS rates. So he tended to send text messages and get incoming calls on the personal SIM and make outgoing, including personal, calls, on the

professional SIM. Arul in T5 owned a personal phone and used a postpaid work mobile. He received missed calls on the personal phone and called the person back using the work mobile or landline.

### *Reading usage*

Given the constraints of limited resources, low incomes, and opacity of airtime usage information in prepaid airtime, I found that microenterprises went to extra lengths to make airtime usage more visible and cost-effective. When an airtime pipe was shared, keeping track of individual and total usages became important to keep costs down. One of the commonly employed techniques in tiers one-three was to jot down minutes spent in a notebook. Alongside the name of the person who made the call, the dialed phone number and whether it was a local or STD call were noted.

Our informants had several ways of discerning airtime usage. When the balance notification showed a drastic decrease of 100 minutes after a 2 minute call, Pushpa, an owner in T1, immediately suspected her son of calling his friends when she was not around. She told us,

*“Such thiruttu [sneaky] usage drives me mad. If I knew how much was spent by whom, I can show them proof and keep the costs low [...] as it is I make very little money [...] I don’t want to waste it on the phone.”*

In another case, Shekar, an employee in T5, told us how he figured his son used the phone while he was taking a bath. The phone battery had drained out suddenly and the instrument was warm.

### **5.3.4 Access control**

Airtime sharing, like other forms of communal sharing, is governed by rules of access. Negotiation involves ways of creating adherence to the rules, as well as the transgression and circumvention of them without damaging the social relationships among multiple parties involved.

#### *Physical access*

Many informants reported exercising additional control over usage through physical presence. According to Ammulu, her mother made it hard for her to make personal calls, because, “She is always around me, so I can’t call my boyfriend whenever.”

Shanthi, an employer in T4 told us,

*“I allow my employees to borrow my phone, but I am present when they make calls [...] sitting at the cash counter [...] they cannot exploit the phone when I am there.”*

In T5, some employers required phones to be returned at the end of each working day. The device boundaries were the data boundaries, since data does not exist on the network, yet; anyone using the device had access to all the data stored on it.

#### *Permissiveness and exclusivity*

Some of our informants reflected upon social conventions of permission before sharing. Permission control was largely seen in co-worker relations, and less so in families. Both employees and employers reported asking the other’s permission before sharing a device, except when it was marked as a shared technology. In T1 and T2 where sharing communes were

formed, airtime sharing outside of the communes was uncommon. Roles and privileges of access were evident—not everyone was allowed commensurate access to technologies. In T5 stores, postpaid phones were not shared with non-marketing employees. As shown elsewhere (Sambasivan, Weber, & Cutrell, 2011), sharing occurs freely within certain realms whereas tight control is exhibited in others.

#### **5.4 Design space**

This study reveals how airtime sharing is a set of complex, conflicting, and contested practices. Airtime sharing is an instance of bandwidth sharing in general, where multiple users share the utility of a volume of data. Understanding the design space in airtime sharing may be relevant to other kinds of bandwidth sharing, like shared cable/DSL Internet and TV and radio on-demand in the home. Interfaces for these infrastructures are typically designed for personal and private use, and suffer from scalability for supporting multiple users. Bandwidth is a scarce resource with usage caps in place in several countries (Chetty, Banks, Brush, Donner, & Grinter, 2011); multiple users for bandwidth calls for better representations of usage. Some questions emerge: what does it mean to share a connection? How can we design for multiple users when the subscription or profile is customized to the logged-in user? Moreover, the “user” is not a single person, but an address of a general entity (family, enterprise, or coworkers).

As more users in the developing world subscribe to data services (indeed our study points to the definite entry of mobile Internet (Table 1) and 100% airtime penetration among our informants), understanding the user and usage of these infrastructures is crucial to HCI. In the developing world, airtime sharing is a prominent mode of infrastructure access and coexists with direct



ownership and usage. Our study points to problem areas in resource contention among multiple users, the conflict between personal usage and *expected* usage, economics of managing a constrained and valuable resource, and mechanisms to control access to the resource. We see how negotiation is a *fundamental* means to secure a resource for use and to stretch the use within socially accepted limits in a multi-user setting.

## **5.5 Conclusion**

Our chapter explored airtime-sharing practices in low-income microenterprises in India. Specifically, I examined the phenomenon of negotiation in airtime sharing. Our work shows us how shared resources are used towards personal interests amidst tensions and value conflicts, by adapting, modifying, subverting, and repurposing technology. By being sensitive to social relationships, practices, and values, negotiation in design allows room for diversity and individuality of multiple users by carefully balancing technological encoding with social dialogue. While microenterprises are sites of heightened personal-professional conflicts, there is always a conflict of interest in shared systems. Our research points to new ways for the HCI community to think about shared use by building social negotiation into design that go beyond personal profiles. To the HCI4D community, I highlight emerging ways of accessing airtime and bandwidth in the microenterprise, where mobiles are the primary ICTs. Our study suggests that building negotiation, improving usage readability, and supporting resource management are important design concerns for airtime and bandwidth sharing systems.

## **Chapter 6: Production of Use**

In this dissertation, I critically examined technology use in low-income contexts to reflect, analyze, and redefine notions of people interacting with technology. Specifically, I carried out ethnographic fieldwork and employed mixed methods to provide a lens into very local processes of interactions with interfaces as well as to gain insight into the richness of human activity in the broader infrastructural, economic, cultural, and social contexts. My findings on usage emerged from three comparative research studies. First, I examined how people socially produce use by making use of skillful intermediaries in accessing technology in resource-constrained slum communities. Second, I observed messy yet deliberate demarcations of domains of sharing across work and home among low-income sex workers. Third, I studied the negotiated aspect of shared use among multiple users in microenterprises. I contend that Production of Use offers us a constructive way of examining usage of technology that goes beyond simplistic and narrow imaginaries of “the user”, which rests on the assumptions of personal-private ownership and use. Production of Use is an analytic to understand multiple as well as individual users, a combination of which is common in low-income contexts.

My work only scratches the surface of possibilities in this area; the empirical evidence from my fieldwork and design explorations suggests there are more complex issues to investigate about the HCI vocabulary for the developing world. This chapter deals with answering some of the questions on relevance for design, undertaking and scoping a research enterprise on the basis of Production of Use, implications for HCI4D and ICT4D, and avenues for future research.

## **6.1 The analytic**

### ***6.1.1 Theoretical motivation***

The motivation for the arguments in this dissertation stems from a growing discontent in the field of HCI with its historically limited design formalizations. In the past two decades, we see a turn in HCI in going beyond simplistic and narrowly conceived practice-oriented design strategies to considering the broader social context in which technology is situated, including Human Needs HCI (Nardi & Kapetlinin, 2012), complex mediation (Bodker & Andersen, 2005), activity theory (Bardram, 2005; Boer, van Baalen, & Kumar, 2002; Gay & Hembrooke, 2003; Volda, Mynatt, & MacIntyre, 2007), Value Centered Design (Friedman, Kahn, & Borning, 2006; Johri & Nair, 2011), Human-Centered Interaction Design (Bannon, 2011) Hybrid ecologies (Crabtree & Rodden, 2008), Genre tracing (Spinuzzi, 2003), Product ecology (Forlizzi, 2008), and Sustainable interaction design (Blevis, 2007). The “user interface” is a very small aspect of our experience with crucial everyday information systems. “The user-“ {interface, experience, and studies} is a key point of inquiry for HCI, concerned with notions of efficiency, precision, and predictability (Weinschenk & Barker, 2000). However, in reality, as Nardi and Kapetlinin (2012) point out, rather than being "adaptable," "customizable," or amenable to "interpretive flexibility," on the contrary, systems exhibit considerable rigidity, usually making it impossible for users to fix errors (e.g., banking errors or misinformation about one's medical status or criminal history) without engaging large and sometimes daunting institutions. They further note that these systems do not exhibit HCI's optimistic notions of user control, choice, and preference; instead they lead to serious risks of wrongful caching and leaving traces of consequential information.

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Of particular interest to me are the global world contexts and problems we, as HCI researchers, are beginning to tackle. There are two inter-related strands: firstly, we are taking on hard problems of global development, such as poverty (Toyama, 2010) (Sambasivan *et al.*, 2009), healthcare (Ramachandran, Canny, Das, & Cutrell, 2010), microfinance (Parikh, Javid, Sasikumar, Ghosh, & Toyama, 2006), and sustainability (Blevis, 2007). This implies thinking of real-world analytics that go beyond the interface and delve deeper into lifecycle, such as impact or development indicators (loan repayment, household wellbeing, HIV incidence), capacity building (locally trained experts), and sustainability of technology once researchers have left the field.

Secondly, we are seeing an increased amount of research in developing contexts, both in developing countries (Dias & Brewer, 2009; Sambasivan *et al.*, 2009; Toyama, 2010) as well as "backyard" populations in developed countries marginalized by economy or society (Cervantes *et al.*, 2011; Dombrowski, Volda, Hayes, & Mazmanian, 2010; Le Dantec & Edwards, 2008; Roberson & Nardi, 2010). Research of this kind is attuned to conditions of the environment and

people, such as skills and capacities (literacies and digital technology skills), infrastructural conditions (usually of constraint—electricity and networks), and low costs. At complete odds with this new boundary crossing is the idiosyncratic individualism inherent in the personal and private assumptions of HCI theory and practice. People can act alone or in groups (Burell, 2010), responding to the immediacies of the environment and materiality of the technology. My own work with three different user groups has demonstrated that sharing is a common practice in working with a technology.

Chrisanthi Avgerou (2010), in her examination of the discourses on ICT and development, classifies ICT4D research into two types: the transfer and diffusion approach frames the relationship of ICT and culture in terms of transferring ICT applications into a non-Western national culture which, more often than not, is seen as posing obstacles to innovation (Straub et al., 2001), reducing national cultures into variables (Hofstede, 1984). The other, contextual view examines ICTs as socially embedded and is concerned with the construction of new techno-organizational arrangements in the local context of a developing country. She argues that we need more systematic theorizing efforts of the latter contextual view, to understand how the socioeconomic context enables or constrains meanings and actions of ICT innovation that contribute to life improvements in developing countries and to test the explanatory capacity of such theory.

It is important to note that there is no homogeneity in users or usage even within the developing world. The root of the problem is that designers are embedded within their own technological infrastructures that differ greatly from their users in socio-economically different contexts. The

disparity between the infrastructures available to designers and users often results in technologies that are unsuited for the context of users in more constrained settings. This is especially amplified in developing country contexts, where there is typically limited interaction (or parachuting) between designers in Silicon Valley and the users. Designers often overlook the efforts needed by users to create, maintain, and access the infrastructures that support technology, once it leaves the laboratory or company. It is not always oversight on part of the designers or developers; sometimes, pragmatics of a project may affect design decisions too. In addition to the social and cultural distances, often, travelling to the location of interest is challenging due to time and budget constraints. Patterson, Sim and Aiyelokun (2009:86), note that despite their extensive groundwork in California, such as interviewing NGO members and mobile healthcare companies and researching related work, conditions on the ground in Africa were completely different than what they had imagined. In particular, they point to the problematic nature of categorizing people into broad-based user groups:

*“In our case, we also erroneously perceived the distance between ourselves and “Africa” as being greater than the distance between “Zambia” and “South Africa.” This perception subtly created in us a belief that we were one type of user, and Africans were a homogenous “other” kind of user. This was our implicit justification for doing initial background investigations with people from places as varied as Sierra Leone and Kenya, even though these were not the environments in which we were planning to deploy our technologies”*

However, critically checking assumptions and using comprehensive analytics in the design process can possibly avert mischaracterization; for example, assumptions such as people are already creating and working with infrastructures, users are not necessarily the owners, or that users are not a homogenous lot can productively shape design. Production of Use is a response to these mischaracterizations.

### ***6.1.2 Production of Use as a design analytic***

Based on empirical findings and HCI theory, I proposed “Production of Use” as an alternative analytical tool to the analysis of “the user”. To be clear, Production of Use includes studying users. It is motivated by the fact that when the user is multiple, the resources, access mechanisms and capabilities, interfaces, and information and communication needs change correspondingly. Fundamentally, Production of Use analyzes use as a *relational* concept by considering users and their relations with each other, technologies, and the broader socio-cultural context of use.

Multi-user interactions involve the following set of concerns:

*Different levels of granularity:* The unit of users may not necessarily be singular. It is possible for multiple users to make use of the same device, with different ownership and access configurations. Multiple users may further constitute either a single user group or multiple user groups. Recall from the earlier chapters how the domestic worker Lakshmi was always involved in helping her mother watch old Tamil movies on the DVD player. Contrast this “one device, two users” interaction with how Sudha, the sex worker, is the sole user of her professional mobile phone, whereas the home mobile is freely shared with other members of her family (first device, one user, second device, multiple users). Consider a third example of Jaya, the sex worker’s dual-SIM mobile, where she is the sole user of two phone networks and numbers (one device, two networks, one user). The current view of HCI and UbiComp considers an individual user to be a part of a device ensemble (Schilit, Sengupta, Anderson, Chang, & Mainwaring, 2004) or own a set of devices that can spontaneously recombine (Newman, Izadi, Edwards, Sedivy, & Smith, 2001): in other words, the devices themselves have granularity depending upon the context (a user can choose between cell phones, laptops, or iPods depending on what they are

trying to accomplish, and these devices can recombine in an ad-hoc fashion). However, without understanding the dynamic *granularity of users*, how they combine into groups, split into individual users, recalibrate their goals, and the resources involved in these rich interactions with a set of technologies, we can hardly claim to understand our users well. Previous work has explored multi-user collaboration as a feature of large displays (Huang, Mynatt, & Trimble, 2007; Russell and Gossweiler, 2001), however, granularity is not necessarily limited to large displays. We need to take into account the how and why of user groups in interactions with everyday devices (Karlson, Brush, & Schechter, 2009; Sambasivan *et al.*, 2010).

In addition, by moving away from the traditional individual user to considering user groupings, we begin to see that a group of users is not a homogenous block of skills, information and communication needs, or capabilities. As noted in the previous examples, Lakshmi was educated up to the 10<sup>th</sup> grade and is well-versed with a certain set of technologies, whereas her mother, although a regular user of the DVD player, has not picked up the skills to use it (it is another thing that she knows to *find* Lakshmi or her neighbors whenever she wants to use the device, more of which is described under the “agency” sub-section below). Although Jaya is a 5<sup>th</sup> grade dropout, her technology skills are superior when it comes to juggling between two SIM cards and storing numbers using symbolic literacy. Multiple users come with heterogeneous digital skills and textual literacy in successfully utilizing devices.

*Dynamism:* It is important in a shared use scenario to examine usage over time and space. Single snapshots through time may mislead the design. For example, a mobile phone in Radhika’s household functions as an FM radio in the morning; travels with her plumber husband Shankar to



work, acting as his point of contact for clients; becomes a “stationary” landline for the family when he returns home and helps Radhika reach relatives in her native village; becomes a gaming device for her children to play Snake in the evening; is used to send an SMS to the local radio station for a contest, with the help of her literate neighbor; and the wallpapers and ringtones are changed with the help of her children or husband. The device interfaces with several users and is put to different uses through various times and spaces. Inspired by the development principle in activity theory (Nardi, 1996), which insists that designers examine technologies over time, I argue for tracking changes over time and space to capture the dynamism in shared use.

*Agency:* It is important to recognize that people bring in their own powers and agencies to technology interactions, modifying and appropriating in creative and innovative ways. People appropriate technologies everywhere, but this is highly visible in the developing country setting, where resource constraints are ubiquitously present. As noted throughout this dissertation, users clearly recognize the purposes to which technology can be put to use and the resources that they have at hand, matching the two creatively. In chapter three, we saw how users do not passively consume information; rather, they *participate* with the system, by guiding the interaction. Beneficiaries are smart about finding relatively empowered (skilled) intermediary users for various technology needs (repairing a TV versus entering a phone number entail different intermediary helps). We saw how people in slums engage in gap filling, by appropriating electricity or installing water taps through non-legal means, building infrastructures or hooks to existing grids or water pipes. We saw how low-cost VCDs decentralized, democratized and decoupled films from the central market distribution system, bringing the latest movies to every slum household and creating a thriving informal business enterprise. We saw how the NGO field

worker was resourceful about bringing the printout to the meeting despite the lack of computers in the slum community. We saw how sex workers create workarounds in their unmixable personal and professional lives by using low-cost dual-SIM phones and learning the necessary skills to operate and switch between them. We saw economically poor employees appropriating airtime provided by their employees by making personal calls under the hood. Such agencies must be acknowledged and incorporated into design, instead of dumbing down or diminishing powers.

It is important to consider the scale and scope at which we want to study agency. Burrell (2008) argues that technology is realized in its use. Technology and people mutually shape each other (Orlikowski, 1992). But how is use negotiated when there are multiple interests? Scale lends us a useful lens into how a group collectively defines use or how a local user negotiates the usage to cater to their interests. In other words, it is important to study how the scale of the collective interest is created, modified, negotiated in use, or how the interest of an individual user scales up to the shared use interaction. The inputs and outputs, properties, relevance, ownership, and maintenance are negotiated socially, making scale of agency an important factor to consider. The scale of studying agency of configuration is defined dynamically, for example, whether we want to watch an interaction for 5 minutes or 2 years, with one or ten persons, depends on what we want to study.

*Resources:* It is important to recognize the various material (technologies or physical media) and non-material (skills, economics, or social infrastructures) resources utilized in accessing a technology. While technical resources, such as broadband network cables, configuration of the

computer, software installed, and so on, are important to consider, non-material and physical resources are paramount in interactions in low-income contexts. Paul Dourish (2004) puts forward the notion that context is an interactional problem. Depending upon the context, there are different resources for different users. For example, post-paid professional airtime becomes a resource to be expended for making personal calls to friends and relatives in tier five. Intermediaries to operate technologies are different from repair experts.

Production of use is a multi-user design analytic that examines the relational aspects of user groupings, technologies, and resources, and how they together produce use. “Production” analyzes how the use of a device is *created* through a set of material and non-material resources. Traditional HCI tends to consider conditions of use as a given, limiting the analysis to the mutual relationship between functionality and utility of the technology and the needs of a user. However, carefully analyzing how the use is produced, including the infrastructures, power relations, capabilities, and resources involved in an interaction can lead to a more productive framing, especially in developing contexts where use may not always be ready-to-hand. “Use” is concerned with the *utility* of the technology, in applying its functionalities and affordances towards fulfilling a purpose. Taken together, Production of Use considers use as a *process* of user groupings using technology with their resources, instead of considering the standalone interactions between users and devices.

Production of Use is:

- a) *emergent* and *relational*: it arises from the activities and interactions between the various entities, i.e., it is not a given. It considers the agencies and power dynamics of the various

users of the system.

- b) *temporal* and *spatial*: its considers use as a temporal and spatial process, instead of a standalone interaction between users and technologies. By examining how use is produced over different times and spaces, the analytic helps us understand not only the various resources in creating the use, but also in carefully studying multiple users interfacing with one device.
- c) *not artefact-centric*: it allows the designer to consider a web of artefacts and their relations with users and resources.
- d) *not form-centric*: it allows designers to consider information in various forms. It takes advantage of the translatable and fungible quality of information and the interpretive flexibility that HCI theories have already established.

By starting off an HCI analysis with “how is use produced?” we generate an expansive set of directions to understand the interaction within a particular socio-cultural context. I present four guiding design framings to analyze technology production in developing contexts. I step through each point with an example from the sex workers case study:

- 1) The *various groupings* (single, collectives, ensembles) and types (primary/direct users, intermediary users, beneficiary users, passive on-off users, tertiary users, or non-users) of people engaging with the technology?
  - a. What are the various interests of the groups?
  - b. What are the social relations, roles, and responsibilities among the collective?
  - c. What are the resultant agencies and technology needs of the social unit?

- d. How do these personal interests get negotiated with the group interests, whose interest gets relegated, and what determines the interaction?
- e. When is use personal and when is it shared?

As noted earlier, consider the fact that sex workers typically freely share their family mobiles at home, but maintain their professional phones as personal devices. Production of Use would consider usage across various contexts, such as home, work, commute, or social spaces, drawing a rich portrayal of the devices in sex workers lives, moving from single user to multiple users, and the agencies and interests involved in determining the interactions. We saw how sex workers regulated their devices as well as the phone calls they received without violating their privacy.

2) What are the *resources*?

- a. What are the various technological skills, textual and symbolic literacies, and numeracies of the users?
- b. What are the various physical resources at hand?

Although most sex workers were non-literate or school dropouts, and given that previous research shows that women in developing countries are less prone to owning devices [Vitalwave, 2010], they had discovered the value of mobile phones in fulfilling their communication needs with clients and family members. Sex workers had developed the necessary skills to operate these devices and to successfully switch between them across different contexts. In relation to our prototype phone broadcasting system, we found that using the field coordinator's voice was important to establish trust.

- 3) What are the various *access and ownership* configurations?
  - a. What is each user's relationship with the technology? Who are the owners? Who are the users? Is access gated? If so, how and who is responsible?
  - b. What are the various subversive ways of accessing or using technology? What are the tools, regulations, social actors, and institutional settings that operate in concert in this infrastructure creation?

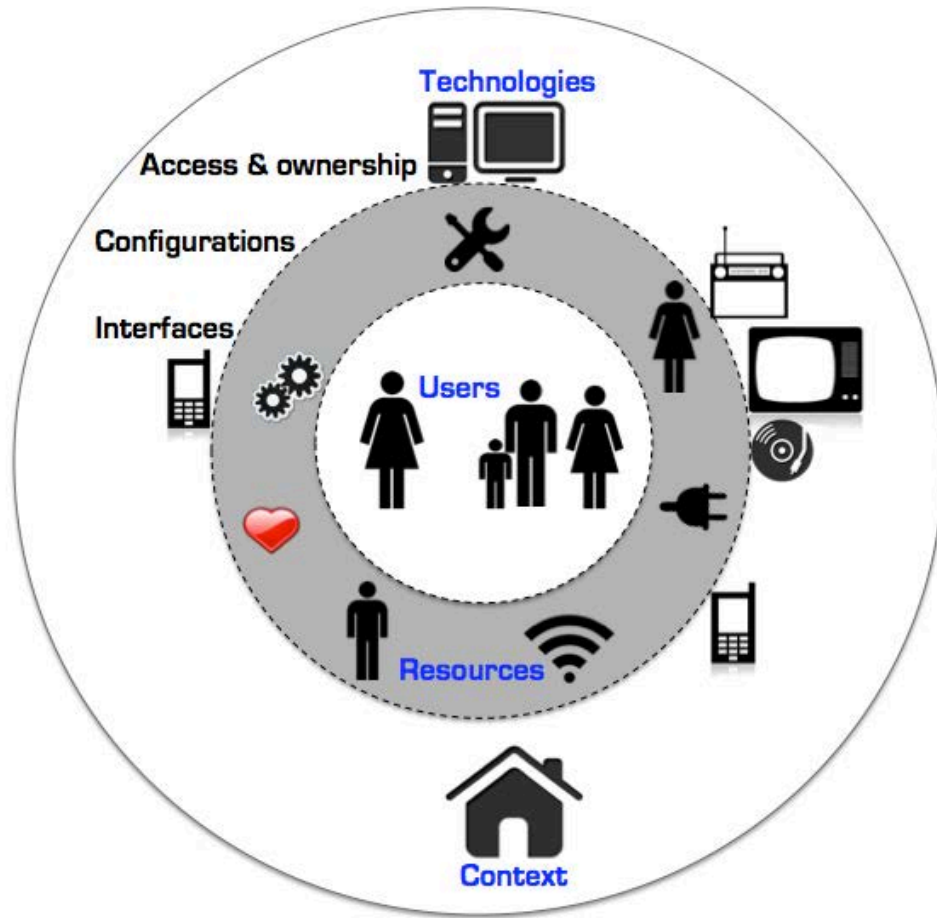
In the sex workers' case, although each of them owned two devices or dual-SIM phones, access was still created in subversive ways, unbeknownst to their family members. The social narrative of working as a domestic worker was maintained by hiding the work phone at home. The sex worker community and neighborhood mobile phone and multimedia stores (shops where one can upload the latest music and videos to their phones, commonly found in India) enable the learning and consumption processes.

- 4) What are the various *interface arrangements* for different user configurations?
  - a. What are the various modifications and experiences of the technology for each user or user group?
  - b. What are the patterns and practices of interaction and exchange around the technology?

Phones interfaced with different users and was put to different uses at various times and locations. For example, tracking a mobile phone over time was important for sex workers, in order to figure out when the phone is personal and when it is shared, to find the right time to call.

<b>Features</b>	<b>Characteristics</b>
Levels of granularity	Various interests of the groups Social relations, roles, and responsibilities Resultant agencies and technology needs of the unit Negotiation of personal interests with group interests Personal versus shared use
Resources	Non-material resources (technology skills, textual and symbolic literacies, and numeracies) Material resources (physical resources and technological resources)
Access and ownership configurations	User's relationship with the technology Owners and users Forms of access Subversion of access norms
Interface arrangements	Modifications and experiences of technology for each user or group Interactions and exchange around the technology

**Table 5:** Production of Use and its various features.



**Figure 20:** Production of Use is a function of user groupings, technologies, and resources in context and the access and ownership configurations and interface arrangements in accessing them.

It is important to consider a broader definition of use encompassing the wider socio-technical system. Use of a system by a beneficiary-user implies (i) *participation* with the system, by having a say over the purpose of the interaction, as well as providing feedback to the intermediary-user to influence the input. I borrow this term from the study of youth appropriation of online communities by Ito *et al.*, (2009) where “participation” is used to describe the different modes or conventions for engaging with new media. Instead of looking to rigid categories that are defined by formal properties, genres of participation are a way of identifying, in an



interpretive way, a set of social, cultural, and technological characteristics that participants recognize as defining a set of practices. (ii) A degree of social, cultural, or economic *usefulness* of information is maintained, which could be driven by recreation, livelihood, or communication needs (Sambasivan *et al.*, 2009).

Let me illustrate with a few examples from my own research. During my fieldwork in one of the slums, in one of the weekly NGO meetings that I attended, an NGO fieldworker read out from a printout (recall from chapter three). The printout contained detailed information on bacterial vaginosis, its symptoms and cures. One of the women in the community had wanted to know more about this issue, so the fieldworker retrieved information from a nearby Cybercafe (note that there was zero penetration of PCs in the slum). Now let's consider the Production of Use of Internet, transformed into a printout. The various groupings in this case were the intermediary fieldworker and the beneficiary slum community members (the lady wanting to know more about the issue was the direct beneficiary and the co-present members were second-order beneficiaries). The use of technology was driven by the beneficiary's information needs, operating over a social infrastructure. The technological skills of the NGO member in converting an information need into a technological need, accessing a computer, looking up information, porting it into the community through paper form, and presenting it as a more usable format complements the agency and resourcefulness of the beneficiaries in driving the interaction, resulting in a technology experience that is driven by various members' interests. A change of state from text on paper to speech allows more users to access the utility of the technology (albeit it has undergone two form changes: web text to paper print and paper to speech). Production of

Use provides a lens into the larger social processes, resources, users, and even a twice-modified technology, which a traditional personal-private use analytic would not provide.

Consider another observation where members of a family-run microenterprise selling flowers on the street-side utilized airtime in a mobile phone (recall from chapter five). I observed a Nokia 2600 passing through the hands of different users, i.e., a mother and her teenage daughter. The mother first used the mobile to call her clients in the neighborhood to confirm the types of flowers and amount. Then, the daughter, Ammulu, quickly borrowed the phone and took it to a corner to call up her boyfriend. While the mother was busy weave garlands, Ammulu had spoken for five minutes, erased the number from the dialed calls log, called up one of the clients and had terminated the call before it could ring on the receiver's side. We see the interplay of personal interests and putting on an appearance of productivity along with not raising the mother's suspicion. When her mother asked Ammulu who she called, Ammulu coolly replied that one of the clients (that her mother had just called) called back to confirm an order. We see that as users construct the use of the phone, its properties and information, along with the supporting narratives, also change. Here we find that Production of Use offers us continuity into the analysis as multiple people use the device.

Several analytical concerns may arise. How can we define the scope of the study if we want to examine use? Is it the whole world? Is it Africa? Is it Ghana? Is it a village in Ghana? Is it a household in the village? In other cases, the scope of analysis may have less to do with geography and more with the number of users (one, two or twenty) or the contexts of use (living room, in the bus, or at night).

Design analytics and practice are involved in a recursive relationship, where they must mutually develop and respond to each other's changes. Design practice is concerned with formalization of requirements into attributes that can be built into artifacts. As noted earlier, Production of Use considers use as a relational activity between people, artifacts, and resources. Some activities lend themselves more to answering not only the how, what and why, but also the who and where. However, the descriptive may not always lead to the prescriptive, and its power may lie in the analysis (Anderson, 1994; Dourish, 2006).

In many cases, the analysis may directly lend itself to design formalizations. A great example is the introduction of dual-SIM and triple-SIM phones or hacked phones that can support two SIMs in the original form factor, supporting multiple users, multiple networks, and multiple phone numbers on the same device. These devices allow users to switch between networks in a cost-efficient fashion, to maintain different social networks or identities as we saw, keep costs economical, or to extend network coverage when one network fails (Chipchase, 2009). Another simple modification in mobile phone design could be to program multiple contact lists, allowing the same device to serve multiple users.

Major operating systems allows multiple users to create user profiles, allowing them to customize the appearance of the desktop or Start menu to their taste. However, one key component that is missing but is crucial in everyday reality is the interactions and relationships between multiple users, or how users are connected to others who are using the same device. Instead of treating users as unconnected entities, looking explicitly into their interactions, both individual and collective, can help guide design decisions, for example, disk space allotment,

communication, or security settings. Methodologically, a corpus of data lending itself to be analyzed by Production of Use is somewhat different from single-user data, in that designers should spend time in different contexts, studying use at various times and locations.

Production of Use may help understand conditions of constraint, but its application is most effective in comprehending the responses to constraint, such as shared bandwidth, modifying usability of the interface to best suit people's needs, and access control among multiple users. Such forms of use, however, are not limited to the emerging low-income use, but are more widely prevalent in HCI in general. Portable devices, for example, are used in different spaces at different times for different purposes. Production of Use provides us a handle on these changing conditions. Even in the western scenario, technologies may not always be restricted to personal-private use (Kiesler *et al.*, 2000; Poole *et al.*, 2009), where Production of Use may be a relevant tool to understand shared use.

## **6.2 Designing for shared use**

### ***6.2.1 Separation of use, authority, and ownership***

As noted in the previous chapters, shared usage is a common mode of technology access in low-income communities. Shared usage occurs when the utility of a device is shared among multiple persons. It significantly increases the economic performance and utility of a resource as well as the flexibility of artifact. Shared usage results in differentials and conflicts between different users, because of various levels of ability and experience, differences in expertise, and personal expectations.

Shared usage implies that a person, who is not necessarily the sole user or consumer, typically owns the device. Whereas the owner of the device is typically the consumer in the personal-private model, we find a separation of ownership, authority, and usage in the shared use scenario. Differential access emerges from the negotiated configuration of who owns the device, who has authority, and who has usage. Thus, a shared use scenario is fundamentally different from the personal-private, direct interaction scenario. This, then, begs the question: what really is shared use? Is it a case of separation of ownership and usage? Is it a case of multiple users? Is shared use a question of separate authority and usage? How do we think about co-owners (Sambasivan *et al.*, 2009)? Or co-authorities? Who is responsible for procurement, maintenance, updating, or repairs? Each one of these configurations deserves a closer, empirical look. Each one of these relationships to technology is borne out of financial constraints or social access (gender, for example).

Design for shared use is already advocated in urban design among urban planners and traffic engineers (de Neufville & Belin, 2002) to control traffic. The biggest constraints in shared use design are the prevalence of the traditional personal-private user interface design and lack of analytics to understand shared use.

From my previous studies, it seems that the prevalent mode of technology access in low-income communities was and will continue to remain intermediated/shared, although leaps occur with increased literacy. In the following section, I ask how we can design systems differently to better support intermediated interactions and shared usage. The challenge is to design under resource

constraints such as obsolete technologies, irregular infrastructures, grey market goods, low literacies, and uneven familiarity with user interfaces.

### ***6.2.2 Thoughts on design for intermediated interactions***

#### ***Design for multiple users***

Intermediated interactions involve multiple sets of users—the intermediary-user and the beneficiary-user(s). In addition, there are various intermediary-users (different experts for different devices), and this affects how and where people take part in intermediated interactions. Designing for the intermediated ecosystem broadens the scope of design from use, users, and products to access, beneficiary-users, and co-created systems. Much of use in developing countries is underscored by sharing of resources. An interesting avenue for future work would be to consider the design requirements and possibilities for supporting a more engaging, interactive and efficient model for multiple users, across various technologies.

#### ***Positioning and reorientation***

Overcrowding from increased migration in the slums evolved into congested spaces, fitting in roughly 4-7 family members into each household. The likelihood of finding a digitally capable person was enhanced by both the sheer number of inhabitants and the compact nature of settlements. Space constraints shaped groups into shoulder-to-shoulder formations. Positioning and directional orientation of technology can allow better “sharing” of an interface across multiple users (Sukumaran *et al.*, 2009). They can also indicate the state of the system and attribute the user, for example, the intermediary-user can turn the mobile screen orientation around upon a key press, to indicate that an operation is done and the beneficiary-user can proceed to use the system.

### *Persistence and storage*

Design must take into account that sharing implies a changing set of users and contexts of use. By allowing portability of information, history of use and stored information could persist. Combining the physical and digital could be one possible way. For example, as I noted earlier, numbers were noted on the walls without meta information. By porting the numbers to a tiny booklet instead, and designing a slot on a mobile phone to hold it, transactions become portable and memory-enabled. Numeracy of the beneficiary-user could be augmented by the textual literacy of the intermediary-user, and this could be used in keeping track of phone calls aided by the intermediary-user, maintaining an address book, or recording talk time. An NGO field officer could potentially prescribe and write down the name of a fertilizer for a particular crop, which could be taken to the nearest outlet for purchase. This is in line with existing practices and is a simple increment to the existing design, which could add to the storage, transparency, and engagement of the interaction. In addition, this supports various literacies through mutual assistance and social solidarity—the foundation of intermediated interactions.

### *Design for symmetrical engagement*

Intermediated interaction involves the co-existence of three interactions—the intermediary-user-computer interaction, the intermediary-user-beneficiary-user interaction, and the beneficiary-user-computer interaction. Only the first interaction is traditionally designed for. “Absent presence” is seen here (Gergen, 2002): although the beneficiary-user is physically a part of the experience of using the technology, the intermediary-user is part of the inside space, excluding the beneficiary-user into the outside space. Inasmuch as the beneficiary-user drives the interaction, she still has to

wait for the intermediary-user to finish the interaction, and explain when done. The challenge here is to design for equitable engagement between the three entities.

### *Legibility*

Legibility in interactions can contribute to better comprehension of system actions by the beneficiary-user. The use of visual and auditory cues (Medhi *et al.*, 2008) can help the secondary user “see” the interface output. Existing infrastructure, with a few enhancements, could be used to create more engaging interfaces. For example, with the addition of a low-cost processing unit, a television screen could be used to map and render (intermediated) operations on a DVD player to corresponding animations, or text messages could be automatically converted to voice, which may eventually build up to learning by the beneficiary-user. Interfaces must be designed in formats readable by both sets of users. Extracting representations, resemblances, and components of the physical world and combining them with digital technologies could leverage symbolic literacy. Greater transparency and usability may in turn create more trusting social bonds between the two sets of users. Legibility in interface design may also lead to error reduction in translation of system output by intermediary-user or interpretation by the beneficiary-user, leading to better communication practices. Feedback from the beneficiary-user may contribute to a more positive environment.

### *Involve the beneficiary-user*

Creating user experiences that allow the beneficiary-user to take part in interactions, could allow us to conceive more engaging experiences. In incremental steps, this could also lead to digital habituation and skill building. Since many of the operations are routine, such as playing media,



retrieving content, and calling people, and certain devices are marked for sharing, these experiences could be automated.

### ***6.2.3 Thoughts on design for the private-shared separation of mobiles***

What can the design of a broadcasting system for USWs teach us about designing systems for other vulnerable or nervous populations with similar design constraints, or even Mobiles for Development (M4D) in general?

#### *Challenges for ubiquity*

Due to their far-reaching penetration, mobile phones are met with great optimism by designers of technologies for developing countries, especially in the M4D space (Gitau, Marsden, & Donner, 2010). However, design in developing countries is not simple; mobiles neither always constitute neat one-to-one, private use configurations (Sambasivan *et al.*, 2010), nor are they being shared freely all the time. Their use is determined by complex, socio-economic negotiations. USWs' use of mobile phones at home and work highlight some of these tensions.

Mobile connections are unambiguously based on the user's own terms. Mobile phones exist across several social infrastructures. The challenge is to make the applications relevant within each socio-technical system, yet meaningful across these infrastructures. In my case, it was often critical that information remained siloed for different contexts. Women work very hard to keep their work secret from their families, and their use of phones reflects this segregation of communication. Privacy, trust, and timing issues are not unique to USW communities. While mobile phones transcend many facets of people's lives, some boundaries may be permeable, but

others need to remain fixed. Failure to respect these boundaries can be dangerous and potentially detrimental to the users.

### *Caveats in shared-use models*

Prior research has underscored the important role of shared use in developing communities, as seen in (Burrell, 2010; Sambasivan *et al.*, 2009). Indeed, in my study, we see that sharing is not necessarily a defining, normative, practice within the socio-cultural milieus of USWs. While the USWs share within certain realms and social groups, like home and family, tight control is exhibited when they do not wish to share: for example, family members are not allowed to pick up their work phones, by making them invisible. Contrary to the obvious, economic challenges do not always drive shared technology usage in poor communities, as we see how USWs are very poor yet technologically well-connected; as a counterpoint to the expansion of reach through intermediated, shared access in other communities (Sambasivan *et al.*, 2010) Such caveats emphasize the need for further work in sharing, such as the work by Steenson & Donner (2010) on mobile sharing in middle-class households.

### *Phone numbers and identities*

Phone numbers are increasingly used as identities, such as in mobile Internet (Gitau *et al.*, 2010) and mobile banking (Hughes & Lonie, 2007). My study alerts us to several challenges in using mobile numbers as identities, such as timing and permanence. Mobile phones are fluid and ever-changing. In the case of USWs, they are explicitly forked for a separate identity. Moreover, phones are easily lost or numbers are changed. Our deployments point to the fact that a synchronous, broadcasting system such as ours simply cannot reach all users, unlike e-mail,

voicemail, or asynchronous, stored mechanisms, leaving us looking for a middle ground. Using mobiles as intervention channels for vulnerable, migrant, un-trackable or low-literate populations, where the mobile is the only personal communication device, requires designers to carefully balance approachability, permanence, and identity.

Unlike the technical view of identity or privacy management in the western world, where the technology is a proxy to the construction of identity, we see that identity and privacy around mobile devices in developing countries are socially negotiated (Sambasivan *et al.*, 2009). Users run up against the system in forging their identity and privacy. They adopt specific strategies in coping with their identities, not dissimilar from teenagers coping with privacy, victims of domestic violence, people managing sexual or other controversial lifestyle choices, or those seeking confidential medical information such as HIV or psychiatric problems.

#### ***6.2.4 Thoughts on design for bandwidth sharing***

##### *Designing for shared usage*

Bandwidth sharing occurs when multiple users share a network pipe. It occurs in several forms: one device, multiple users; one device, multiple SIMs; and one SIM, multiple airtimes. Unlike using a dedicated device for home Internet sharing or TV viewing, airtime can be shared through multiple devices and multiple users, adding complexity to use.

Our findings point to a problem area in current airtime technology for apportionment, brokering, and management among multiple users. Resource management systems with social accountabilities may allow for better apportioning and tracking. Profiles have been suggested as

a means to customize individual use on shared devices (Rangaswamy, 2009), but studies have shown that users do not always prefer profiles (Brush & Inkpen, 2007). I suggest airtime quotas as an alternative approach. Allocating multiple users with individual airtime quotas and numeric passwords may help resolve contention and confusion in apportionment. The community may regulate information by deciding the quota limits, accountabilities, and penalties. A snapshot of the various users and their usage can help in understanding resource consumption. Such a system can scale up to other domains where bandwidth is shared, such as Internet and TV on-demand.

Shared usage is a complex socio-technical process. People create several rules of access to help distinguish between different types of relationships—be they professional co-workers, friends, family members, or strangers. Sharing depends upon the user, time of day, and location. As more devices become mobile, such as laptops, mobile phones, and tablets, application designers for bandwidth management should take context into account when designing for multiple users. In addition to the user's identity and their device model, when and where they use the device matters. For example, usage varies tremendously across home and work; usage depends on whether it is their own phone, employer's phone, or a family member's phone. How can we design services for personal use that can be used on professional phones, or vice versa? For example, can we create websites that consume bandwidth according to the facet of the phone used—a Facebook application that consumes less bandwidth if used on an employer's phone so he/she does not notice? Can we think of a URL that appears inconspicuous to the employer? Perhaps we can design a missed call (Donner, 2007) application to communicate with friends on a family phone?

### *Improving readability of airtime*

Current airtime systems are highly opaque in providing usage and expenditure information. As a result, people compensate for airtime tracking through non-technological means, such as notebooks, looking for drops in airtime balance, and checking battery levels. Such compensatory checking may provide imprecise readings. As noted earlier, airtime expenditure is substantial for the microenterprises I studied (roughly 10% of the monthly income). Richer information systems for reading airtime balance are needed to save airtime amidst constraint. Current notifications in the prepaid model provide individual call statistics, whereas postpaid does not allow instantaneous tracking. An aggregate account of usage per day or week may help the user evaluate how airtime was spent and make decisions to spend the valuable resource constructively.

Our study points to certain parameters that may be useful to know in tracking: how much airtime was spent per day or week; dialed calls; call lengths; the breakdown of calls, messages, and data; and the current airtime balance. By visually reifying airtime spending, the user is presented with better tools for decision-making on expenditure. The system can reside locally on the device and extract call logs to avoid network overheads. These parameters can be broadly applicable to improving readability of bandwidth in general, especially in emerging infrastructures like mobile Internet that suffer from opacity in showing usage.

### *Designing for negotiation*

Broadband technologies like airtime and Internet are not neutral media; they are entrenched in the value systems of the users and designers. Any airtime design intervention should take into

account the politics, ethics, and value conflicts embedded in the infrastructure. As political theorist Langdon Winner argued, “the process of technological development is critical in determining the politics of an artefact; hence the importance of incorporating all stakeholders in it” (Winner, 1980), a design solution for the microenterprise should arise from a dialogue with both employers and employees.

I propose negotiation as a design feature. Our findings show how forging contacts, deleting calls, and creating narratives around airtime appropriation negotiate the bulk of the sharing exchange socially. A potentially dangerous solution to information asymmetry between various users (vis-à-vis the owner) is information transparency (Aoki & Woodruff, 2005). Design should be careful to not introduce friction or fear of the enterprise among employees. By showing less yet pertinent information and allowing room for social negotiation, design could prevent misuse of information. For example, while the employers were aware of employees making personal calls using professional airtime, knowing exactly who was called and how long the calls lasted may be incriminating to the employee. A safer approach may be to show aggregate call information instead of individual calls (instead of ‘1 call to X for 50 minutes’, show ‘5 calls today for a total of 120 minutes’). A coarse-grained approach is one where the employer can assign upper limits for personal and professional calls and be notified when usage exceeds the quota. The system could support interpretation and dissembling in ways beneficial to the employer and employee. This is in line with the current practice of allowing personal calls within limits.

A design approach here could be to start by negotiating how many minutes could be spent on personal calls per month. A mechanism for compromise can be built in, where the employee can

negotiate with the employer if the personal quota is underused (carry forward to next month) or overused (ignore or deduct from salary) for the month. For the employees, showing personal/professional airtime usage and action items ('You just exceeded 20% personal usage. Restrict your personal calls') resonated with their current methods of controlling personal quotas. By controlling the quantity and presentation of information and by introducing social negotiation, airtime and bandwidth systems can be rendered useful where multiple users, different domains, and cost constraints collide.

Contention arises in any shared technology usage, beyond just the microenterprise or talking to customers and relatives. Whenever a resource is shared among multiple users, the technology is appropriated towards their personal interests. In some cases this involves explicit repurposing, such as using professional airtime towards personal calls, whereas in some others it is customization of a device. Negotiation is highly relevant to the design of bandwidth sharing systems, where multiple users share an invisible infrastructure and interfaces can foreground selective aspects of usage, users, and analytics of the network.

### **6.3 Implications for ICT4D**

The previous sub-section in this chapter illustrated that intermediated interactions increase the range of use and users of technologies. This suggests a re-examination of current indicators of technology access and use.

### *Ownership is just one part of technology access*

Prevailing statistics of technology access and penetration quantify ownership—telephone numbers, Internet subscription, or device ownership. This represents only part of the picture, because intermediated interactions expand the reach of the resource to a wider cross-section of users. If a locality has X% mobile phone penetration (quantified by ownership), then Y% of people also benefit from the device due to intermediated interactions, and Z% benefit from the beneficiary-users through word-of-mouth interactions. These secondary Y% and tertiary Z% uptakes of technology broaden its reach, penetration, and use. In the tertiary level, information diffuses among individuals and collectives. Thus, the “collective access” is increased, and information reaches wider audiences through sharing and inter-mediation. The beneficiary-user or secondary user is an active driver and recipient of the technology.

Ownership statistics distort realities by not counting those who may use technology but not have the capability to own it. Recall that only 36% of the women owned their phones, and the rest of the women used technology through intermediation. Non-ownership does not necessarily imply digital exclusion. Sharing mechanisms help in extending technology benefits to a wide range of people.

### *Limitations of the user/non-user dichotomy*

The dichotomy of use and non-use conceptualizes use as direct use and non-use as lack of use. It reinforces the concept of digital divide, by counting users as X% with, non-users as Y% without (Donner & Toyama, 2009). Some regard the divide as one that leads to inequities, whereas others consider it to be a symptom, not a cause of the inequities (The Economist, 2005). Whatever be the case, this divide/dichotomy does not clearly unfold as a binary in developing communities, where



the user is a direct user, beneficiary-user, or tertiary user, and the non-user is degrees away (conceptually) from the user. At the level of the tertiary user, the scope and quantification of use becomes fuzzy.

I propose a new metric for quantifying access, by moving away from ownership paradigm to measuring the ability to benefit from use. This inclusive quantification provides a more realistic metric that reflects use as-is in developing communities. A breakdown of the dichotomy requires a quantitative-qualitative bridging exercise (Donner & Toyama, 2009). Studying intermediation opens us up to the possibility of users, non-users, and all those in-between who benefit from technologies.

#### **6.4 Recapitulation**

In summary, this dissertation has tried to re-conceptualize the analytic of “the user” in developing country contexts. As technologies penetrate new contexts and find new users, the question is whether prevailing imaginary of “the user” influenced by personal and private assumptions can apply to these emerging contexts. My work in this dissertation shows us that we cannot simply extend these notions into new social, cultural, economic, and infrastructural contexts where technology is produced emergently. I do this by starting with a historical overview of the imaginary of “the user” and show how it originates from high-income groups with high technology familiarity and literacy rates in the Silicon Valley. I argue that HCI analytics cannot be extended to emergent technology user groups in developing countries, but need to fundamentally re-grounded within the new conditions of use, which are characterized by constraints of resources and ownership and normative notions of sharing.

Employing a comparative approach, I critically re-examined the concept of “the user” in three low-income sites (domestic workers in urban slums, sex workers, and informal microenterprises) in urban southern India. The comparative method allowed me to examine similarities and differences across the three technology groups productively to create a nuanced understanding of digital technology use. Using the ethnographic technique, I examined individuals interacting with the interface as well as the broader collectives, infrastructures, cultural logics, and economics that configure use.

This dissertation makes four key contributions. First, it suggests that in low-income contexts, intermediation is a primary mode of access in addition to direct interactions. While intermediation may be prevalent throughout classes and nations, in low-income households, it increases access to technology when it is not present within, due to access and ownership constraints. Thus, intermediation opens us to the possibility of multiple users in a traditional interaction, viz. the intermediary and beneficiary users.

Second, while intermediation is an instance of the larger phenomenon of sharing, this dissertation highlights the ways in which sharing does and does not occur in low-income contexts. I studied urban sex workers, a highly marginalized and stigmatized population, yet a heavy mobile technology user group. My findings point to the siloed use of technology across home and work domains. While this may be a consequence of the nature of their professions, it points us to the ways in which sharing is not a given in all cases, but needs to be carefully considered depending on context, co-users, and technology needs.

Third, I show that when technology (in this case, bandwidth) is shared among multiple users, negotiation is the key process by which it is used, wherein each user repurposes the utility of the artifact towards their personal interests. Particularly in the commercial environment, my findings point to how shared resources are negotiated through accountability mechanisms by employers, subterfuge mechanisms by employees, guided by economics and access control. I highlight how in any network pipe shared by multiple users; differential access emerges amidst tensions and value conflicts, by adapting, modifying, subverting, and repurposing technology.

Finally, and most importantly, I propose Production of Use as an alternative analytic to the personal-private assumption that underlies “the user”. As we steer away from the personal-private model, we begin to see that multiple users may constitute an interaction, changing the interface, its inputs and outputs, access mechanisms, and ownership with each user / group. The unchanging, one-to-one analytic of “the user” begins to break down because it does not capture the dynamism that is inherent in shared use. Production of Use considers the process of production of usage, by analyzing use as emergent, relational, spatial and temporal, non-artifact centric and non-form centric. It considers various user groupings interfacing with technologies through various material and non-material resources.

Production of Use analyzes use as a continuous phenomenon through time and space, tracking changes through multiple actors and resources. It helps us understand various direct users, intermediaries, beneficiaries, tertiary users, and non-users. It helps us go beyond the “technologically literate” assumption to examine more deeply the technological skills, textual

and symbolic literacies at hand, and the various physical resources employed in accessing the interface. It helps us understand ownership and access, not as a given, but to understand where access is provided and where it is taken or subversive. If social norms are subverted to access technology, then it helps us analyze the tools, regulations, and people involved in these interactions and infrastructures. Finally, Production of Use helps us understand how interfaces are re-arranged and re-configured with each user.

My hope in articulating usages and outlining the analytic of Production of Use is to create a conversation among researchers of technology about the diversity and heterogeneity that characterizes technology use and in moving the field ahead towards a global community.

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## **APPENDIX A: Study methods and material**

### **Study 1: Intermediation**

#### **Profiling**

Age

Marital status

Profession -- maid-servant

    Cooks

    Nannies

    Construction

    Others

Children -- age of children

    Labour? School? College?

Religion

Language

Place of origin and generation

Income

Education

#### **Sociality and community:**

Whom do you talk to for -- support

    Movies

    Authority

## Grievances

What topics?

### **The familial units:**

What is the structure of the family?

Who is the bread-winner?

Who provides financial and social support?

**Triangulation:** Elicit directly from informants about what info they'd like to share with public.

What target communities? Who are producers and receivers?

**Consumption:** *cell phone examinations*-- whom do they call?

Who owns them?

How long are conversations?

How often do they call them?

Which features are used?

Look for presence of DVDs, T.V., Radio, bicycle, moped, type of stove, fan, lights, showcase, mixers. What do they signify about socio-economic status?

What programs are watched on T.V. or heard on radio? What times? Why? Are there any rituals?



**Scenarios:**

What did you do when --

Someone in your family fell sick

Finding jobs

Children -- dealing with education, modernity, sickness

Personal care or welfare

Savings

Domestic violence

Festivals -- Diwali -- gift-giving, sweets, appliances purchased, family expenses, fireworks

Birthdays

**Aspiration:**

What do you aspire for your children?

What do you aspire for you in 5 years from now? 10 years from now?

Your spouse? Your parents?

How important are computers according to you?

**Information Sources:**

Tamilselvi is a 28-year old woman, working three shifts as domestic worker. She is originally from the Kanchipuram area in Tamil Nadu, but migrated to Bangalore after her marriage. She is a devout Hindu. She is a 2<sup>nd</sup> standard dropout. She earns about 2,000 INR per month. She has three sons – in 4<sup>th</sup>, 6<sup>th</sup> and 8<sup>th</sup> standard in the Chamundeswari Government School, a Kannada-

medium school. Her husband works as a construction worker, who seasonally finds a contract whenever the Engineer calls him. He spends all of his money on alcohol and regularly beats up his wife and children. Tamilselvi leaves for work at 8:00 a.m. and returns at 2:00 p.m., after washing clothes and tidying the house at a Doctor's, tidying the house at an old lady's, and cooking lunch for two bachelors. Then she rushes home to carry out domestic chores like washing clothes, cleaning up the house, cooking lunch, collecting water, and fetching her kids from school. Tamilselvi regularly suffers from headache and back pain. She watches Kasturi, Anandam, Tirumathi Selvam and Meghala on Sun T.V. whenever she gets the time. Lately, Tamilselvi's life is fraught with many problems. Imagine you are Tamilselvi. What would you do when:

1. Your son has been suffering from fever and shivering lately. You suspect he is down with Malaria. What would you do?
2. You have been suffering from bouts of fainting. In addition, you have noticed an excessive amount of white discharge. What would you do?
3. Your youngest son is has repeatedly failed in English, a language you are not too familiar with because you studied in a Tamil-medium school yourself. His teacher has complained to you in the parent-teacher meeting, and has warned you that he may not be allowed to sit in the Annual exam unless he passes his model exams. What would you do?

4. Someone in your family has met with an accident. It is not fatal, but the leg is damaged and the operation will cost you Rs. 50,000. How will you find the money?
  
5. Your husband regularly beats you up. Yesterday he hit you with a vessel, and you lost quite a bit of blood. You are sick of his drinking habits. He maybe a good father, but he beats his kids and calls them names. What will you do?

**Trusted sources**

<b>Source</b>	<b>Degree of trust</b>	<b>Information received</b>
Mother/Father		
Husband		
Sister/Brother		
Children		
Relatives		
Sister-in-law/Brother-in-law		
Newspapers		
Cinema – film stars		
T.V. serials		
N.G.O. workers		
Doctor or nurse		

Teacher		
Priest/Religious actor		
Neighbors		
Women of other communities		
Employers		

**Information gaps:**

**Performance in school**

1. What do you do once your child returns from school, to ensure his good performance in school?
2. Are you happy with the current performance?
3. Is there anything you should do to improve the performance?
4. What do others do?

**Workers relationships with employers**

1. What do you do to ensure smooth relationships with your employers?
2. Are you happy with the current relationship?
3. Is there anything you should do to improve the relationship?
4. What do others do?

**Healthcare and personal welfare**

1. How do you maintain your personal health as well as that of your family's?
2. Do you follow any healthy recipes or exercise?
3. Are you happy with your current health?
4. Is there anything you should do to improve your health?
5. What do others do?

### **Career options**

1. What are your various sources of income?
2. Is there anything you should do to increase your income?
3. What do others do?

## Study 2: Urban Sex Workers

**Aims:** Generate a cultural analysis and design response to sex workers in the context of the following (possible) dimensions:

- Identity and behavior
- HIV/AIDS treatment and prevention and the clinical encounter
- Poverty and development
- Conceptions of risk
- Religion, morality, and ethics
- Communal and national belonging and globalization

**Questions:** The questions move from high level questions about the project in general, to general questions about sex work research, to questions that can be posed during interviews.

How do we see sex workers as more than just victims of their circumstances? Undoubtedly, sex workers enter the trade out of economic necessity (Whelhelan, 2001), but framing the decision as one borne out of lack of alternative viable options trivializes the problem. It is also a part of the informal economy—one that does not require formal training, tax payments, or high capital. Studies indicate that women overwhelmingly enter sex work through contact with someone either in the trade or via an individual supporting their entrance (Sharpe, 1998).

- How do sex workers enter and survive in the trade?
  - o What led you to choose sex work as a profession?

- What impact does age have on economics?
- Did you willingly enter the profession?
- Whom did you contact to enter the trade?
- What are your tactics in protecting yourself?
- Do you manage your profession yourself or do you make use of pimps or madams?
- What are the timings of sex work? What if you get several clients a day? How would you divide your time?

What is the place of public secrecy in illicit trades?

- What are the mechanisms by which sex workers guard their identities?
  - Does your family know about your involvement in sex work?
  - Why do you trust the NGO with sensitive information? What are the assurances of guarding the information?
  - How do you maintain “normalcy”? How do you answer phone calls at home from your clients? Where and how do you solicit customers?
  - Does your family suspect? Does the police keep a tab on you?
  - Where are your sites of sexual activity? How do you ensure that people do not suspect in these sites? Do you maintain a cordial relationship with the owners of such places?

- What does your family think you are doing to earn money?
- Do you negotiate your secrets with your husband's? Do you both mutually agree upon not asking each other?

What is the design and developmental space in sex work?

- What is the knowledge space?
  - What do you know about sexually-transmitted diseases? What steps do you take to prevent them?
  - What technologies do you use to solicit clients?
  - What technologies do you use to get advice to seek support?

**Methodological points of inquiry:** Inquiry into sex work from the vantage points of:

Information flows across infrastructures, identities, networks, and institutions. Secrecy, public secrecy, privacy, and negotiation of such information across various domains (keep in mind that most of them do not tell their families).

Structures of traditional life. Boundaries between different forms of work and home. Boundaries between legal and illicit forms of work.

Points of entry into the trade, levels of expertise, tricks of the trade, solicitation of clientele, and negotiation with various parties (NGOs, madams, pimps, clients, and families). Relationships with the police, use of service providers, and work in the legitimate labour market. Lifecycle of



sex work (initiation, youth, retirement and exit). Pay scales in various phases. Sites of sexual activity (lodges, hotels, homes, or where?).

Physical, financial, and emotional security. Tactics to counter violence or rape. According to Phoenix, the illegal nature of the earnings makes it difficult for women to open bank accounts, apply for credit cards, get a cell phone account in their name, and apply for housing without employer references. Thus, the fast cash that is made through sex work is spent even faster (Phoenix 1999). Savings and protection of money. Methods of dealing with extra income.

Knowledge of contagious, sexually-transmitted diseases. Prevention of transmission of such diseases to legal partners (husbands), if any.

Patterns of sexual activity, networks of clients, loyalty to clients, and condom use in their sexual lives.

Dealing with purity, social acceptance, defilement and defacement.

Careerist versus victimized points of view. Economics of sex trade.

## TECHNOLOGY SURVEY

Name:  
Location:

### *I. Socio-economic profile*

1. Age	years
2. Gender	1) Male 2) Female
3. Married	1) Yes 2) No
4. Profession (primary)	
5. Profession (others)	
6. # Members in the family	#
7. # Earning members in the family	#
8. Spouse's occupation	
9. # Children	#
10. Children (ages)	#
11. Children (education)	1) 2) 3)
12. Place of origin	
13. Generation	#
14. # Years of schooling/college	School / College:
15. Medium of instruction	Government school-regional / English medium
16. Income (monthly)	Rs.
17. Income (real estate or farm)	Rs.
18. House	Own/rented
19. Savings	Gold / bank / send money home

### *II. Consumer ownership and spending*

1. LPG	Y / N
2. Mixer/Blender	Y / N
3. Bed	Y / N
4. Fridge	Y / N
5. TV	Y / N
6. Cable	Y / N
7. DVD/VCD player	Y / N
8. Washing machine	Y / N
9. Mobile phone	Y / N
10. Land line	Y / N
11. Two-wheeler	Y / N
12. Car	Y / N
13. Computer	Y / N

For the last month:

14. Food	Rs.
15. Housing	Rs.
16. Electricity	Rs.
17. Telecommunication	Rs.
18. Loans	Rs.
19. Entertainment	Rs.
20. Transport	Rs.
21. Travelling home	Rs.

For the last year:

22. Schooling	Rs.
23. Clothes	Rs.
24. Festivals	Rs.
25. Medical bills	Rs.

### **III. Technology usage**

1. Technologies at work	Computer / Mobile phone / Calculator / TV / Radio / others
2. Ownership	Owned / rented
3. Mobile phones & models	#   Model #
4. Where did you buy?	Official store / dealers / friends / others
5. Year purchased	1) 2) 3)
6. When did you buy your first mobile phone?	
7. First phone model	
8. How many phones have you had?	
9. When/if did you shift to camera phones	
10. Phone services used	1)SMS 2)Browser 3) Games 4) Online games
11.	1)Camera 2)Video 3)Radio/Music 4) Calendar 5) Notes 6) Torch 7) Reminders 8) Alarms
12. Frequency of making calls or texting	Several times a day / once a day / many days a week / weekly
13. Mobile Internet?	Yes / No
14. Websites / IM accessed	
15. Who do you call for business on the phone?	
16. Technology expert	

### **IV. Employee 1**

1. Relationship	Family / employee
2. Family relationship	Father / Mother / Wife / Husband / Son / Daughter / Cousin / Uncle / Aunt
3. Role	Sales / Delivery / Accounting / Sourcing / Processing or servicing / other
4. Technologies used for business	Mobile phone / Computers / Calculators
5. How do you communicate?	In person /over the phone
6. How often?	Several times daily / Once daily / few days a week / weekly / bi-monthly / monthly
7. Share talktime?	Yes / No
8. Usage model	Shared / loaned / purchased for

**IV. Employee 2**

1. Relationship	Family / employee
2. Family relationship	Father / Mother / Wife / Husband / Son / Daughter / Cousin / Uncle / Aunt
3. Role	Sales / Delivery / Accounting / Sourcing / Processing or servicing / other
4. Technologies used for business	Mobile phone / Computers / Calculators
5. How do you communicate?	In person /over the phone
6. How often?	Several times daily / Once daily / few days a week / weekly / bi-monthly / monthly
7. Share talktime?	Yes / No
8. Usage model	Shared / loaned / purchased for

**IV. Employee 3**

1. Relationship	Family / employee
2. Family relationship	Father / Mother / Wife / Husband / Son / Daughter / Cousin / Uncle / Aunt
3. Role	Sales / Delivery / Accounting / Sourcing / Processing or servicing / other
4. Technologies used for business	Mobile phone / Computers / Calculators
5. How do you communicate?	In person /over the phone
6. How often?	Several times daily / Once daily / few days a week / weekly / bi-monthly / monthly
7. Share talktime?	Yes / No
8. Usage model	Shared / loaned / purchased for

**IV. Employee 4**

1. Relationship	Family / employee
2. Family relationship	Father / Mother / Wife / Husband / Son / Daughter / Cousin / Uncle / Aunt
3. Role	Sales / Delivery / Accounting / Sourcing / Processing or servicing / other
4. Technologies used for business	Mobile phone / Computers / Calculators
5. How do you communicate?	In person /over the phone
6. How often?	Several times daily / Once daily / few days a week / weekly / bi-monthly / monthly
7. Share talktime?	Yes / No
8. Usage model	Shared / loaned / purchased for

**IV. Employee 5**

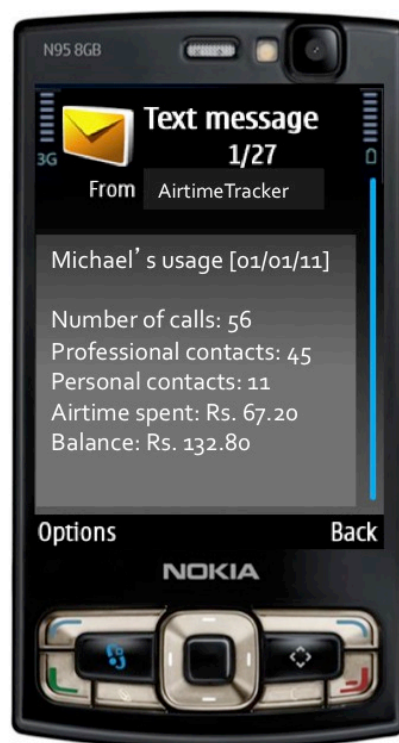
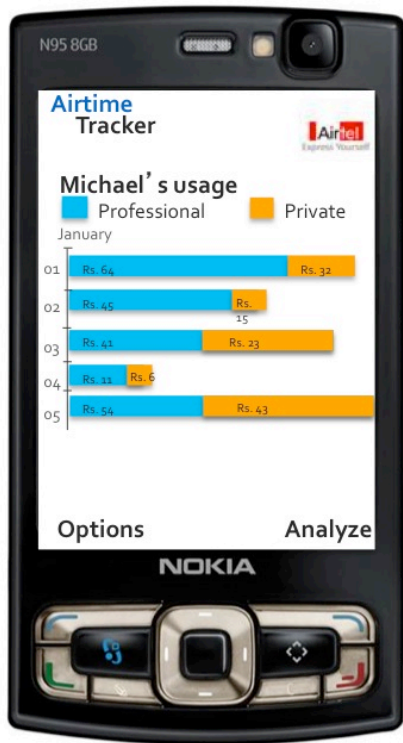
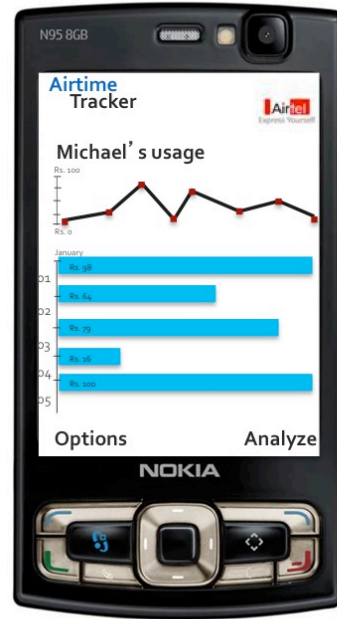
1. Relationship	Family / employee
2. Family relationship	Father / Mother / Wife / Husband / Son / Daughter / Cousin / Uncle / Aunt
3. Role	Sales / Delivery / Accounting / Sourcing / Processing or servicing / other
4. Technologies used for business	Mobile phone / Computers / Calculators
5. How do you communicate?	In person /over the phone
6. How often?	Several times daily / Once daily / few days a week / weekly / bi-monthly / monthly
7. Share talktime?	Yes / No
8. Usage model	Shared / loaned / purchased for

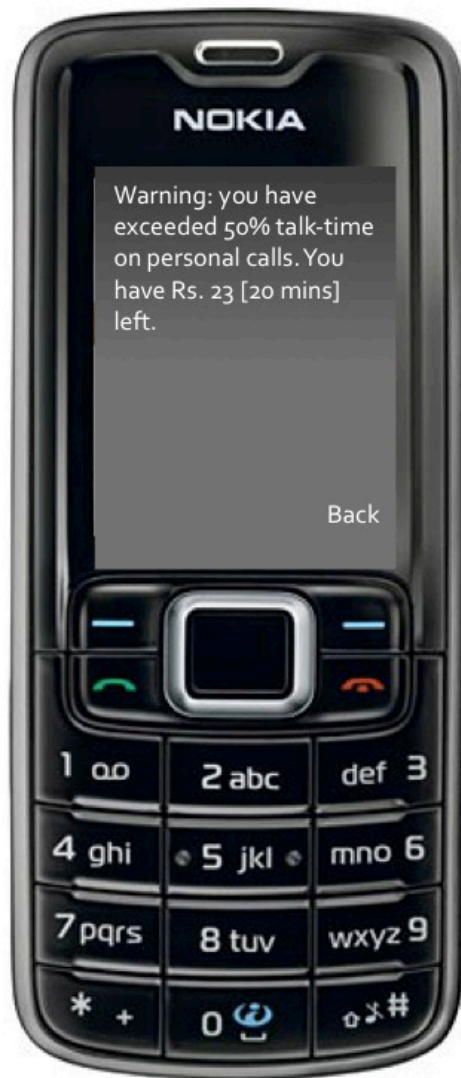
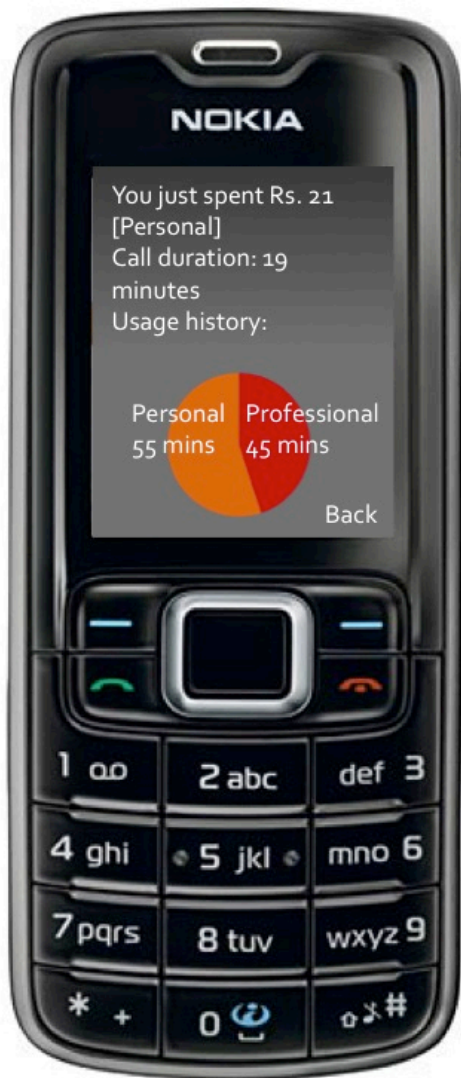
**IV. Employee 6**

1. Relationship	Family / employee
2. Family relationship	Father / Mother / Wife / Husband / Son / Daughter / Cousin / Uncle / Aunt
3. Role	Sales / Delivery / Accounting / Sourcing / Processing or servicing / other
4. Technologies used for business	Mobile phone / Computers / Calculators
5. How do you communicate?	In person /over the phone
6. How often?	Several times daily / Once daily / few days a week / weekly / bi-monthly / monthly
7. Share talktime?	Yes / No
8. Usage model	Shared / loaned / purchased for

**IV. Employee 7**

1. Relationship	Family / employee
2. Family relationship	Father / Mother / Wife / Husband / Son / Daughter / Cousin / Uncle / Aunt
3. Role	Sales / Delivery / Accounting / Sourcing / Processing or servicing / other
4. Technologies used for business	Mobile phone / Computers / Calculators
5. How do you communicate?	In person /over the phone
6. How often?	Several times daily / Once daily / few days a week / weekly / bi-monthly / monthly
7. Share talktime?	Yes / No
8. Usage model	Shared / loaned / purchased for





























































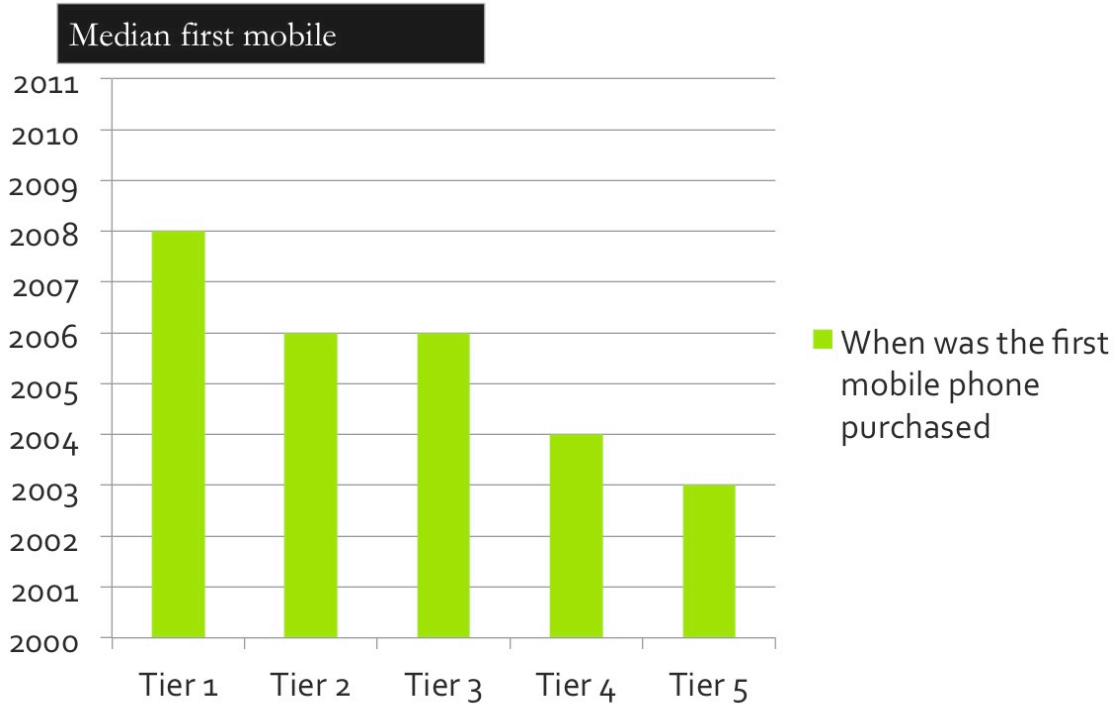
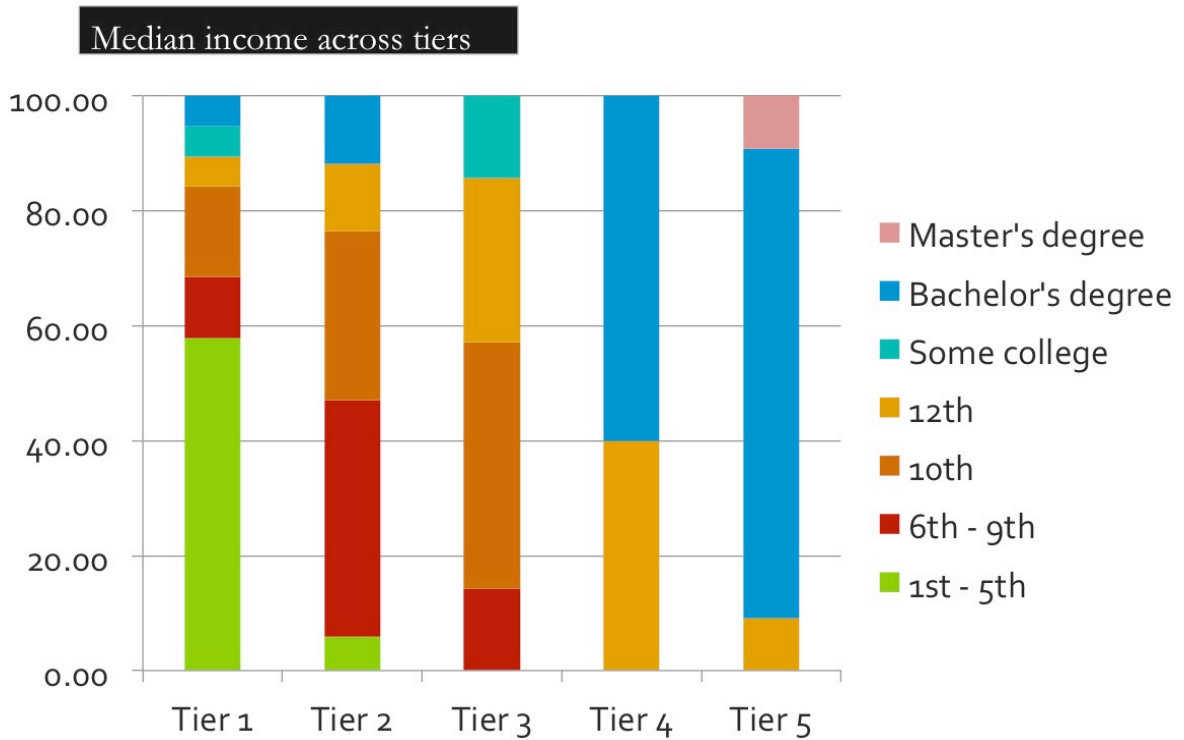


August 22 <sup>nd</sup> Monday தினங்கள்	Who used? யூஸர் பண்ணுது யாரு ?	Purpose எதுக்கு	Business/ Family call? தொழில்/ குடும்பம்	Location எடம்	Duration எவளோ நேரம்
	1		Business / Family		
<b>6:00 - 9:00</b>	2		Business / Family		
	3		Business / Family		
	4		Business / Family		
	5		Business / Family		
	6		Business / Family		
<b>9:00 - 12:00</b>	1		Business / Family		
	2		Business / Family		
	3		Business / Family		
	4		Business / Family		
	5		Business / Family		
	6		Business / Family		

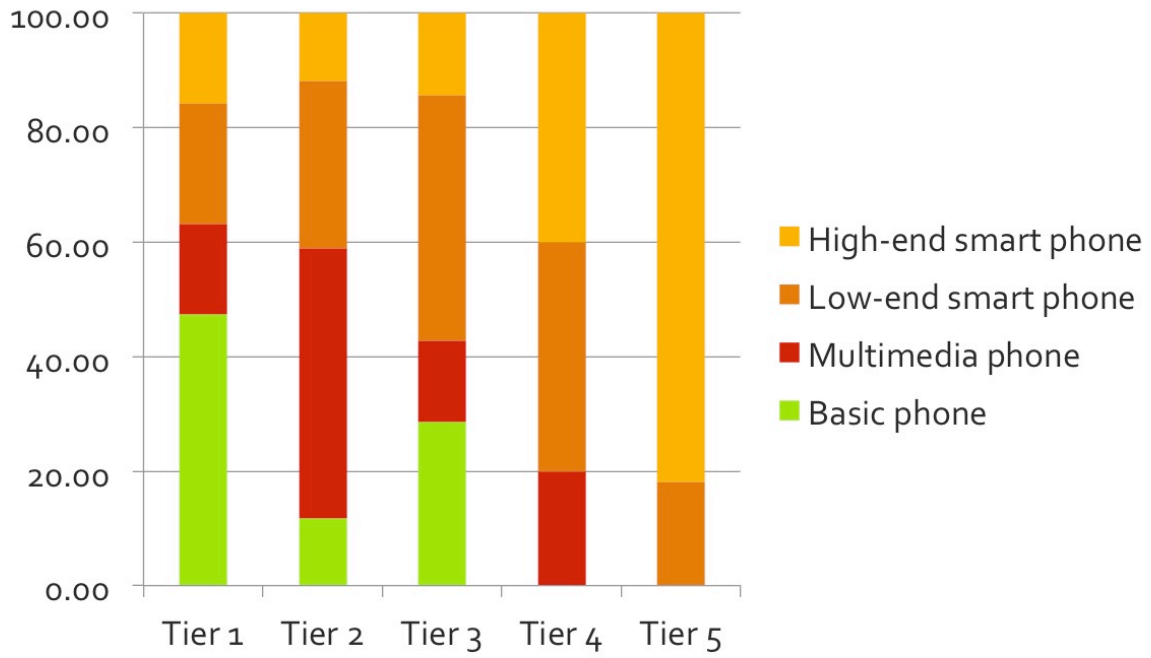
August 22 <sup>nd</sup> Monday தினங்கள்	Who used? யூஸர் பண்ணுது யாரு ?	Purpose எதுக்கு	Business/ Family call? தொழில்/ குடும்பம்	Location எடம்	Duration எவளோ நேரம்
	1		Business / Family		
<b>12:00 – 3:00</b>	2		Business / Family		
	3		Business / Family		
	4		Business / Family		
	5		Business / Family		
	6		Business / Family		
<b>3:00 – 6:00</b>	1		Business / Family		
	2		Business / Family		
	3		Business / Family		
	4		Business / Family		
	5		Business / Family		
	6		Business / Family		

August 22 <sup>nd</sup> Monday திங்கள்		Who used? யூஸர் பண்ணுது யாரு ?	Purpose எதுக்கு	Business/ Family call? தொழில்/ குடும்பம்	Location எடம்	Duration எவளோ நேரம்
	6:00 - 9:00	1	   	Business / Family		
	2		   	Business / Family		
	3		   	Business / Family		
	4		   	Business / Family		
	5		   	Business / Family		
	6		   	Business / Family		
	9:00 - 12:00	1	   	Business / Family		
	2		   	Business / Family		
	3		   	Business / Family		
	4		   	Business / Family		
	5		   	Business / Family		
	6		   	Business / Family		

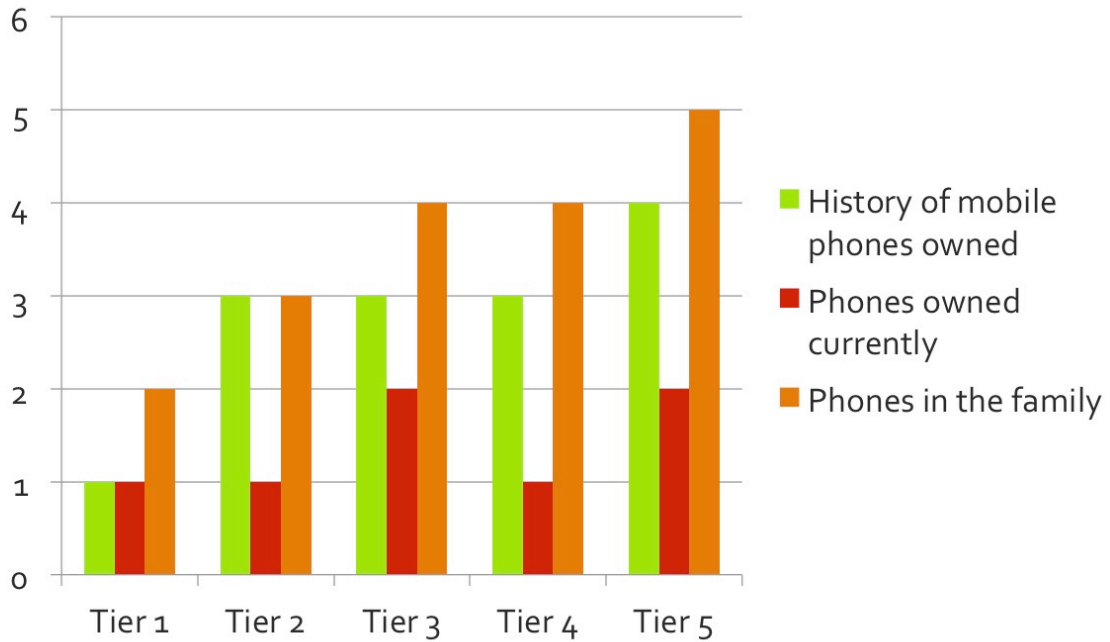
## APPENDIX B: Results from microenterprise survey



### Mobile phone ownership

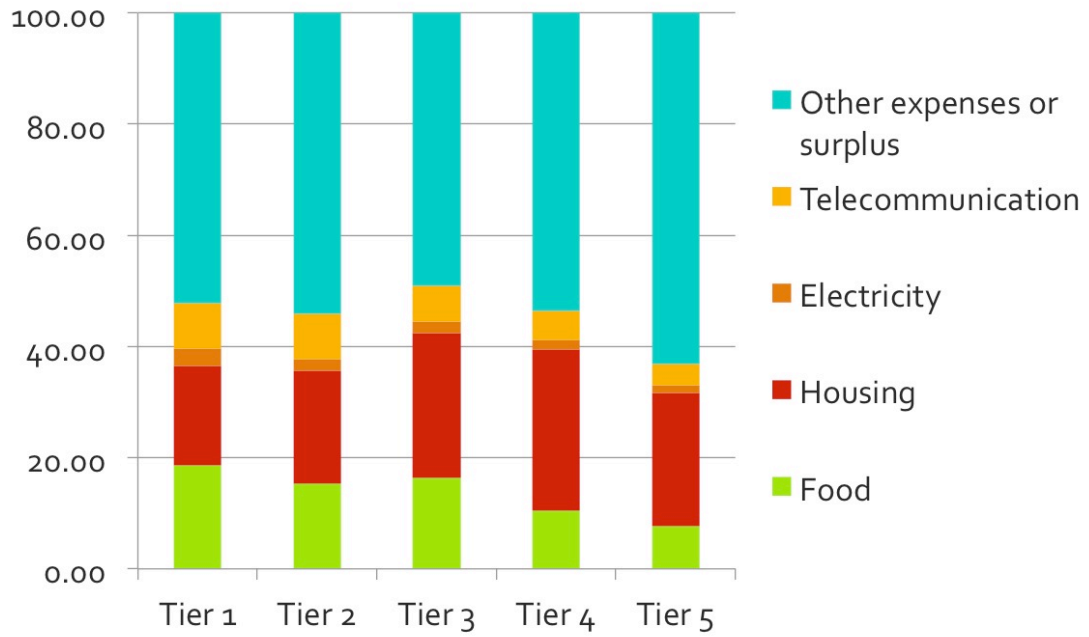


### Median mobiles owned





### Household consumption



### Household consumer goods ownership

