Ecologies of Use and Design: Individual and Social Practices of Mobile Phone Use Within Low-Literate Rickshawpuller Communities in Urban Bangladesh

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ABSTRACT

Making technology accessible to low literate users and communities is an important challenge of ICTD research and practice. Past work in the field has addressed the problem of effective UI (User Interface) design under low literacy conditions, exploring graphic or audio alternatives to text-centered interfaces on the basis of studies that take individual users and user-interface interactions as their central unit of analysis. Our study complements this work through an alternative 'ecological' model, in which literacy-based barriers to technology use are encountered not by individual users but *embedded social actors* who draw on external networks, resources, and infrastructures to manage the problems that literacy poses. Based on a six month ethnographic study of mobile phone use within a low-literate rickshawpuller community in Dhaka, Bangladesh, we explore the literacy-based barriers to use experienced by our study population, and the external networks and connections that users draw on to work around such barriers. We conclude with design and wider research recommendations that may expand the toolkit of researchers seeking to better address these and other ICTD problems.

Categories and Subject Descriptors

H.5.2 [**User Interfaces**]: Theory and methods

General Terms

Design, Human Factors.

Keywords

Mobile Phones, UI Design, Low Literacy, ICTD, HCI4D, Social Design, Collaboration, Ethnography.

1. INTRODUCTION

A large number of people around the world are illiterate. There are many more who lack the literacy skills required to operate modern electronic devices, most of which guide people through text-based commands. We put these cases apart from digital literacy, which is more related to people's inability to operate digital devices although they are capable of reading (and/or writing). In the developing world, many people are illiterate (unable to read, write, and understand short simple messages) and semi-literate (struggling to read, write, and understand short simple messages). We use the term "low-literate" to refer to these two classes of people. With the burgeoning growth in the adaptation of mobile phones in those parts of the world, these low-literate people are an important growth sector among mobile phone users. Indeed, mobile phone infrastructures have reached low-income and marginalized populations in a way that few other communication and computing technologies have, leading to excitement and promising initiatives in the ICTD project space. However, with a limited capacity to understand the written contents on the display, low-literate users often struggle to benefit from these services.

A growing body of design research has addressed the challenges of mobile phone use among low-literate populations. As reviewed in section 2, most of this falls into two general classes: one focused on using effective graphical objects to help the users, and another focused on using speech or audio to route around the literacy challenges raised by text. However, most of these initiatives approach the use of mobile phones as a predominantly *individual* action, structured around the interplay between individual user and discrete device. Our research, based on a long-term field study of mobile technology use within a rickshawpuller community in Dhaka, suggests an alternative approach. Instead of considering mobile phone use as an individual act (and the task of design to support and augment this individual experience), we approach low-literate users as *embedded social actors* who draw on external networks, resources and infrastructures to manage the problems that literacy poses. Our study documents the predominantly social strategies by which such users learn operations, access content and knowledge, and deal with the breakdowns and failures that sustained use inevitably entails. The result is a wider "ecological" model, in which individual uses, capabilities and devices are embedded in wider social networks, infrastructures, and relationships. Attending to this ecology, and not only users and devices in their individuated form, may suggest different possibilities of design and practice. In this paper we suggest an alternative design paradigm where the interface of mobile phones can allow low-literacy users to draw on help from social peers and other actors in their social environments.

The paper that follows explores these ideas. In section 2 we review literacy-related experimental, design, and ethnographic

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work in the ICTD literature. Section 3 describes our field study and research methods. In section 4, we introduce our participants and main field site, a Rickshaw Garage in Kamranchirgar, Dhaka. Section 5 explores the main uses of mobile phones among our study participants and details the principal literacy-based barriers that challenge or limit such use. Section 6 details the wider networks of support our users turn to in managing such problems. In section 7 we discuss the implications of our findings for future design work in this space, and for ICTD research and theory more generally. In conclusion, we summarized the findings of this study and the design recommendations that we made. We shared our optimism about the social design process suggested in this paper that, we believe, could be instrumental in designing and developing a set of tools and techniques for the developing regions.

2. BACKGROUND AND LITERATURE

As mobile phone use has exploded across the developing world over the past decade, the challenges and opportunities confronting mobile phone use by low-literacy users have emerged as a central topic of ICTD, HCI, and information science research. Early work by *Chipchase et al* [2] charted varieties of mobile phone use among illiterate users, discovering that while some functions (e.g. turning on the phone and accepting incoming calls) were relatively simple, others (such as dialing a number from saved contact lists or sending and receiving text messages) were much more difficult or not used at all. Subsequent work by commercial phone vendors to produce cheap and usable mobile phones (e.g. the Global Handset Initiative) have sought to overcome such problems through contact lists designed with illiterate users in mind; however, these initiatives appear to have met with limited success [5].

Subsequent research in this area has been motivated by the idea that people with low literacy could benefit from user interface and navigation strategies that rely less on text and more on graphical objects. But the apparent self-evidence of visual representation has proven sometimes difficult to implement in practice. *Medhi et al* [11, 12, 13, 14] studied the use of graphical objects in the mobile phone interfaces for illiterate people and had some interesting findings. It came out from their studies that one of the big challenges in using graphical objects was the absence of universally accepted picture codes for some particular functions. The meaning of the symbols and graphical objects are often culturally situated, and in many cases those vary from person to person even inside the same cultural territory. Low-literate people often misinterpret the meanings of these pictures, and that leads them to troubles. This leaves a big challenge in designing effective UI that would help a big community of low-literate people. With the introduction of newer functions on mobile phones, newer symbols have become necessary to convey the meanings to the low-literate users. However, choosing the proper symbols in every case and teaching those to the users still remain a challenge in this area of research. However, using hand-drawn icons instead of photos, and using moving icons instead of still pictures were found to be more effective in their studies [13, 14]. Joshi [8] designed an icon and color based visual phonebook for illiterates and showed that colors could help them sort and identify contacts, though within a limited range.

A second line of work in designing UIs for illiterate people has pursued the proposition that audio commands require less literacy to make [4, 13, 16, 21]. Studies in this area have produced some important findings: for example, that shorter audio commands are usually more effective than longer ones [17] and that illiterate people often just perform initial commands if there are more than one commands required for execution of a particular function. [21]. Sherewani et al [17] showed that a well-designed speech interface significantly outperforms a touch-tone equivalent for both low-literate and literate users. In contrast, work by [21] based on a longitudinal study of the "Avaaj Otalo" project in India, found that, sound interfaces were more error-prone than touch-screen options, struggling in particular with failures of speech recognition and inability to deal with variations in colloquial language. These limitations impose practical challenges in using sound/voice as the primary UI tool for low-literate populations.

Other work has sought to bring these findings together, looking at how better combinations or configurations textual, graphic, audio and visual elements might better address literacy-based barriers to use. Wiedenbeck [22] designed a phonebook with colors and icons and got preliminary success with illiterate users in managing their contacts. Medhi et al [13] presented a quantitative evaluation of mobile interfaces that encompassed the full space of designs, spanning text, audio, and graphics. They concluded that richer information was not always good for illiterate users. Findlater et al [3] explored how semiliterate users with very little education might benefit from a combination of text and audio as compared to illiterate and literate users. They found that there is a difference in performance between illiterate and semi-literate users if audio is accompanied with texts. Illiterate users were disturbed by the texts added with voice interface, while the semi-literate users got that helpful. In a recent study, Medhi *et al* [13] used visual demonstration of the healthcare issues to the illiterate users. They found that the audio explanation helped the users to understand the content of the videos clearly, and they were more prone to commit mistakes without audio guidance. Recently Knoche and Huang [10] studied mobile use patterns among illiterate immigrants in Switzerland, examining how illiterate users received and placed calls and managed contacts. They developed an application that allowed illiterates to listen to received SMS and compose text messages by augmenting words with touch-initiated text- to-speech support, icons for frequent phrases and by re-using words from previous messages. Their studies showed that illiterate people could also use SMS if provided with appropriately supportive UIs.

In all of this work, the individual user and user-interface interaction is taken as the primary unit of analysis, and design efforts are oriented to augmenting or supporting this key individual action: by working around barriers posed by literacy, by augmenting the capabilities of users through graphic or audio means, or both. However, a growing body of ICTD literature has explored the proposition that such individual user models may be limited or misplaced, and may not in fact accurately reflect the conditions of technology access and use in many developing world locations – perhaps especially under the conditions of economic marginality often associated with low literacy. Burrell [1], for example, has investigated shared access to mobile phones in different cultural contexts, arguing that technology use is often a distributed phenomena, anchored in complex social, economic, and moral relations (including gendered divisions of power). Jackson et al [6, 7] have documented the "repair worlds" that support and sustain mobile phone use in rural Namibia, arguing that individual acts of use need to be located against the backdrop of the networks and infrastructures that (often invisibly) sustain them. Rangaswamy et al [18] have studied broadly similar dynamics in rural India, detailing the role of small mobile phone shops in supporting users through a variety of different services.

Kumar et al [9] have arrived at broadly similar findings around the nature of musical consumption and sharing through mobile phones in India, detailing the necessary network of actors engaged in producing and sustaining 'individual' acts of consumption. Sambasivan et al [18] reported how skilled users of a technology help other unskilled people to get the benefit of technology in urban slums of India. These all indicate the fact that the use of mobile phone technology is often not individual in nature, especially in the developing world. Rather, it should be considered as a social practice.

Our study builds on and extends this body of work, while connecting it to the individualistic assumptions that have tended to characterize studies of literacy and technology use to date. We report on an ethnographic study of mobile phone use among low-literate rickshawpullers in Dhaka, Bangladesh, pointing to both barriers experienced by this population and the wider social ecology in which such problems are embedded and frequently resolved. We emphasize in particular the potentially social or collaborative nature of individual use, and how low-literate users draw on resources in their environment to resolve the barriers low literacy produces. – a point that shifts focus from understanding the contents of the UI, to the availability, distance, and expertise of the helpers. Building on this idea, we introduce design recommendations meant to tap and facilitate such distributed support through social connections. Finally, we discuss how this shift of perspective from 'individual' to 'social' frames of reference might contribute to problems in ICTD and HCI4D research more generally.

3. OUR WORK

3.1 Participants and Methods

For more than six months, we conducted ethnographic fieldwork with the rickshawpullers of a garage of Kamrangirchanr. We will refer that garage as RG in this paper. In the first phase of the study we conducted 10 semi-structured interviews, a much larger volume of informal discussions and observations, and one focus group discussion. For the one-on-one interviews and informal discussions, we went to RG and talked to rickshawpullers who were available and willing at that time. For the focus group discussion, the rickshawpullers were invited to the university of the investigators. Based on these initial results, a second round of interviews was added with members of the support networks identified by our participants. These included: 1) the owner of RG, 2) the owner of a mobile phone recharging (commonly known as "Flexi-Load") and money transferring shop, 3) a shopkeeper of a computer shop, 4) and a technician of a mobile phone repairing shop. Both the interviews and the focus group discussions were conducted in Bangla by native speaking members of the research team. Interviews and focus group discussions were audio-recorded and later transcribed and translated by three native-speaking investigators to ensure accuracy and cross-validation.

Our study was divided into three phases. In the first phase we interviewed 10 rickshaw pullers in Kamrangirchar, a low-income neighborhood in the southern section of Dhaka. At first the owner of RG was informed about our study and was asked for permission to conduct the study in his garage. Special efforts were made to establish a good relationship with the RG owner because his cooperation was critical for the success of our study. He was requested to invite some rickshawpullers from his garage for the interviews. From there ten rickshawpullers were selected randomly and interviewed. Our interview sessions were divided into five broad sections: a) introduction, b) biography of the participants, c) motivations behind using a mobile phone, d) usages of the memory of the mobile phones, and e) learning techniques. The interviews were conducted in Bangla and at the residences of the participants, and lasted approximately one hour. For each of the rickshawpullers we also interviewed their family members or roommates, too. We asked them about the basic purposes of their using mobile phones. We also wanted to know how they operated their phones. They told us how they placed or received a call, how they played music or videos, and how they saved contact addresses. In some cases, they demonstrated us the process by using their mobile phones.

In our second phase, we invited five rickshawpullers from the same garage to one of our laboratories at our university and had a focus group session. This time we had a semi-structured discussion focused on the people they would take help from while using mobile phones. From those stories, we identified basic nodes in the network of support they turned to for help in using their mobile phones - fellow rickshawpullers, the RG owner, a nearby computer shop where they load media files to their cell phone, a local repair shop, and the shop where they recharge the balances needed to maintain their mobile phone use.

In our third phase we revisited Kamrangirchar and talked to the people who helped the rickshawpullers learn the operations and use of their mobile phones. At first, we interviewed the RG owner at his garage. We then visited the nearby mobile phones' balance-recharging center located next to the garage. Next, we visited the nearby computer shop, from where the rickshawpullers would load media files (for example: audio songs and movies) to their mobile phones. Finally, we visited the nearby repair shop where the rickshawpullers would go to fix their broken mobile phones. In each of these places, we interviewed people and learnt how rickshawpullers received support for operating their mobile phones.

4. DESCRIPTION OF OUR STUDY

4.1 Rickshaw

Rickshaws are one of the most popular means of transportation in Dhaka and other urban settings throughout South and Southeast Asia. A feature of urban life since the late 1930s, cycle-powered rickshaws are three-wheel vehicles with seats for two adult passengers either behind or in front of the driver (though in many cases more than two passengers can be found on a single rickshaw). The drivers of the rickshaws are called 'Rickshawala' in Bangla, a term most commonly translated as "rickshawpuller" in English.

Rickshaws are slow and range-limited vehicles used primarily for short distance travel within the urban core or adjacent neighborhoods. The advantage of a rickshaw is that it can be found anywhere and can go anywhere, no matter how narrow the streets are. Rickshaw fares are not set in advance but rather fixed through bargaining between rickshawpuller and customer before the trip; the final fare is determined by factors including distance, weather, traffic conditions, number of passengers, the skill or reputation of the rickshawpuller, and the knowledge and bargaining skill on either side of the transaction.

Figure 1. A rickshawpuller pulling a rickshaw with passengers.

Figure 2. Rickshawpullers resting at the Kamrangirchar rickshaw garage.

4.2 Kamrangirchar Rickshaw Garage

Kamrangirchar is a small and low-income area in the greater Dhaka metropolitan area, the national capital of Bangladesh. An estimated 400,000 people live in this 2.87 square kilometers area making it one of the most densely populated areas in Dhaka (and indeed the world). A 2006 survey [15] also found that the single largest concentration of slums in the Dhaka Metropolitan Area was in Kamrangirchar, and reported that of the approximately 300,000 people living there, 265,000 were slum dwellers. Kamrangirchar has an average literacy rate of 28.56% (compared to a national average of 32.4%) making it an ideal place to study on urban illiterate population in Bangladesh. According to that survey, this area had 213 Rickshaw garages in 2005. Rickshawpullers keep their kart or rent karts from those garages. From our field study we learnt that their daily income ranged between 300 Taka [approx. $3.80] and 800 Taka [approx. $10.00].

The owner of RG grew up in Kamrangirchar. He is also illiterate and has been in this business for the last 13 years. RG had 73 Rickshaws and was managed by the owner of RG and a manager. About 70 rickshawpullers worked in that garage. Most of them were from Pabna district, located in the northern part of the country. Rickshawpullers rent rickshaws from RG either for the full day or for half of a day. For the full day they have to pay 110 Taka (approx. $1.30) and for one half of a day they have to pay 60 Taka (approx. $0.80) to the RG owner, who also owns the rickshaws. Apart from renting rickshaws the owner of RG also makes new Rickshaws. There is facility for accommodating single Rickshawpullers in RG. For this they have to 5 BDT to the owner. About 60 - 70% of the rickshawpullers of that garage has at least one mobile phone of their own. The rickshawpullers who have no mobile phone usually communicates through their garage owner's mobile phone. [Taka is the currency of Bangladesh. 80 Taka is approximately equivalent to 1 US Dollar at the time of the study].

4.3 Typical Life of a Rickshawpuller

To understand the life of a rickshawpuller, we present here a short life sketch of one of the rickshawpullers who works at RG. We have referred to him as Mr. B in this paper.

Mr. B is one of the rickshawpullers of RG. He is not quite sure of his age, but he guesses he is almost 45 years old. He has been pulling rickshaws for more than 22 years.

Mr. B was born and brought up in a village at the northern part of the country, the eldest son in a family of 6 siblings. Mr. B's father worked as a village Police and had a monthly salary of 150 Taka (approx. $1.90) in the year of 1973. That part of Bangladesh is renowned for growing tobacco, and many people there earn their livelihood by engaging themselves in tobacco business. Mr. B's family was not an exception either. To add to the income of the family, his elder sister would make 'Biri' out of tobacco at their home. Mr. B would help her whenever possible. He was sent to school and he continued up to Grade 2, when he realized that he did not have much interest in education. Also, soon after the marriage of his elder sister he needed to earn money as the eldest son of the family. So he discontinued his education and started producing Biri at their home.

During 1987, Mr. B met a person who had a tobacco business at Dhaka. He needed some laborers to work in his factory. Mr. B migrated to Dhaka with that person and started to work in his factory for a daily salary of 120 Taka (approx.. $1.50). Although the salary was good, he was not enjoying this job. In 1988, there was a devastating flood in Bangladesh and the whole country went under water. Mr. B lost his job, returned to his hometown, and started to produce Biri again. During 1991, he migrated to Chittagong to work as a laborer in the shipyard. This was a very much labor-intensive work and he could not continue that for long. So, he came to Dhaka again and this time he got a job as a construction worker. Although this was comparatively easier work for him, the salary was not good enough. So, he was looking for another job.

Mr. B had a friend who used to pull rickshaw at that time. So, Mr. B started considering the possibilities to switch to that profession. He did not know how to pull a rickshaw before. So, he used to practise with his friend's rickshaw whenever possible. He said,

"*I was practicing pulling a rickshaw on that road. All on a sudden, I got a passenger at the "Section Road". I pulled for almost one hour, and I got around 80 to 90 Taka. Then I set my mind that I would be pulling Rickshaw from then on. I would earn good.*"[80 and 90 Taka are approximately equivalent to $1.00 and $1.10 respectively]

Since then, Mr. has been pulling a rickshaw at Dhaka. It has now been almost 22 years, and Mr. B is now living in a slum at Kamrangirchar with his wife and five children. He earns more than 500 (approx. $6.20) per day, of which he has to pay 80 Taka

(approx. $1.00) to the RG owner, who also owns the rickshaw that he drives. He has television, radio, electric fan, electric light, and mobile phones for three of the members of his family. His eldest daughter has recently gotten married at the age of 17. His youngest son is only 6. All three of his sons go to school.

Mr. B is willing to get a job at a garment factory since they pay a better salary; but considering the current situation of his family he is not being able to do that right now. Mr. B tells us that he believes something very good is waiting for him in future, since he has always been faithful and pious in his religion.

5. INDIVIDUAL USE OF MOBILE PHONES

From our individual interviews with the rickshawpullers, we came to know about the usage of their mobile phones. The rickshawpullers mentioned the following uses of their phones:

i) Talking: This is the most important and most frequent use of their mobile phones. They both place and receive calls to their friends, family members, and to other people. Sometimes it is important for their profession, too. One of them said,

"*When I am on the street, and get some problem either with my rickshaw, or with the traffic police, I just call my owner of the garage. He tells me what to do."*

Almost all of them have their close relatives living in the rural areas outside Dhaka. They use mobile phones to communicate with them. One of our participants said,

"I call my mother whenever I remember her. They also call me whenever they need money."

They also keep communication with their wives and children whenever they are out to pull rickshaws.

ii) Listening to Radio and Music: Most of them love to listen to the programs broadcasted by the radio channels. Their mobile phones have the option of playing radio. They like the programs that have lots of songs from Bangla movies. Sometimes they keep on listening to the radios when they pull rickshaws. But most of the time they listen to radio when they take rest in their leisure time. Rickshawpullers are also big fan of music. They listen to music on their mobile phones. They get the songs from different sources (described later in this paper) and listen to those even when they pull rickshaws.

iii) Watching Movies: One of the main attractions in their mobile phones is watching movies. They usually watch Bangla movies, which they get installed on their mobile phones from computer shops as described below. One of them said,

"We don't watch televisions much these days. Instead, we watch movies in our mobile phones. The advantage is, now you can watch movies whenever you want. The screen is a small one, but if you hold the phone away from you, you can watch the movie with other people, too."

iv) Sending Money: Most of the rickshawpullers use their mobile phones to send money to their relatives living in rural parts of the country. Recently, a mobile phone based money-transferring service has been introduced in Bangladesh. Using that system anybody can send money to any other person with a mobile network of a particular type.

v) Taking Pictures: In occasional cases, they take pictures. Most of them do not know how to take pictures. The rest take pictures of their children, or of themselves when they go to wedding parties. They watch those pictures every now and then and show those to their friends. One of them reported that he had printed one of his pictures taken by his mobile phone. But he was unhappy with the quality of the picture.

5.1 Interacting with The Memory

Beyond these general uses, we were also interested to understand how our participants interacted with the memory of their mobile phones, through operations that involved storing, navigating, searching, and retrieving contents that were often textual or numeric in form. In our first round of interviews, we asked participants to walk us through a variety of such operations and the strategies they adopted for accomplishing them (in particular while operating without help from others). We got some very interesting results. Some of these – memorizing the image of the numbers, searching sequentially, and searching on trail-and-error basis – follow the general findings of Medhi et al [7]. In other cases, however, a somewhat more novel set of findings emerged. Hence our study reconfirms the behavior of low-literate people with the memory of mobile phones. However, in some cases we got some interesting new ways, possibly invented by the local people.

5.1.1 Contact Search

Memorizing Last 2/3 Digits: Most of the participants were found to use this technique. They would memorize the image of the last 2/3 digits of the contact numbers. They were not aware of the fact that more than one contacts could have the same last 2/3 digits.

Serial of the contact: Some of our participants would depend on others to get the contacts saved in their mobile phones. In this case, they would remember the position of the contacts in the contact list. They would do the same while searching a contact from their recent calling history.

Memorizing the Contacts' names as Images: Some of the participants were found to use this strategy. They would memorize the contacts' names (saved by others) as images. They would try to remember how the letters look like when they were put together to construct the contacts' names.

Frequency of Letters: Some of the participants, instead of memorizing the whole name, would memorize the image of individual letters and would try to search contacts based on the frequency of a particular letter. For example: "ABBAS" has 2 "B"s in it.

5.1.2 Remembering Own Phone Number

Carrying a Paper With the Number: Many of the participants were found to carry a paper with them, which had their phone numbers written on it.

Service from the Operators: Some of the participants were found to use the service of the mobile operators for getting their own number. For example by pressing '*566#' they could see their own number on the screen.

Rhyming with 2 digits: Some of them were found to memorize their own phone numbers just as a rhyme of pairs of numbers. They were found to be more comfortable in memorizing their phone number as a song or a rhyme of foreign words (the numbers). In each of the lines of that rhyme they used two

numbers. One of them said, *"My number is, 'TwoTwo-OneOne-ThreeNine'"*, for example.

5.1.3 Searching Music and Video

Thumbnails: One of the easy ways for searching videos was to look at the thumbnails. Most of the participants whose mobile phones would support thumbnails adopted this technique.

Content Ordering: Once again the relative ordering of the media contents in one's mobile phone often helped one to recall any particular media content. Some of the participants would remember the serial of each of the media contents and thus access those.

Trial-and-Error Search: Many of the participants were found to make exhaustive sequential search to find desired song or video, since they had no other way to do that. With the increase of the length of the list, this task becomes more and more difficult and time-consuming.

Memorizing the File Name Visually: In a few cases, they were found to memorize the file names (or last 2/3 digits) as an image to help search the media contents. This particular process was found to be similar to one of the techniques they would apply for searching a contact's number in the contact list.

6. SOCIAL SUPPORT

Our user interviews provided useful insight into the strategies by which low-literate users overcame or worked around barriers posed by literacy to achieve workable (if not always elegant or efficient) solutions for basic mobile uses. But they also left many questions unanswered. For example, how had they learned these basic operations? How had they first acquired and saved the numbers and files in their phones? Who did they turn to for support or guidance when their workarounds broke down or when new problems were encountered? To answer these questions, we invited five of our original participants to our university to have a focus group discussion. We had an hour-long discussion with them regarding these questions and we discovered the social bonds that help them consume the services of the mobile phones.

The rickshawpullers told us how they save a number in their mobile phones. Most of them had some basic level of education and they were familiar with the English alphabet and numbers. However, they did not know how to read or write a word constructed with more than one letter. We asked them how they would save the mobile phone number of one of the members of our research team. They said they would type the numbers using the keypad, and then save it with the letter 'b'. The rationale was the name of our university starts with 'b'. This raised two questions in their mind: 1) How did they learn this mechanism of saving the number, and 2) What would they do if they had been told to save the phone numbers of more than one people of the same university (or indeed some other entity whose name started with the letter 'b')?

In reply to our first question, they disclosed the fact that they had learnt this strategy from the owner of their garage. He had been using mobile phones for more than 20 years and knew almost everything regarding how to use mobile phones. The RG owner saved the important numbers in their mobile phone whenever needed. They also learnt this process of saving the number from him.

In reply to the second question, they told us that they would use a separate letter or symbol (such as, '*') to save the number of the second person of the same university. They would keep in their mind the meanings of all these letters and symbols. But they also accepted the fact that they could not remember many contacts in this way. One of them said,

"We keep in mind which letter and symbol mean what. We do not have many contacts. You do not need to talk to many people, too. Sometimes we make mistakes as well. We place a call to a different person while calling another. This happens all the time. We apologize to them and explain what has happened."

Figure 3. Five Rickshawpullers in a focus group discussion at the investigators' university.

We had similar questions regarding songs and movies. We learnt about another interesting character at that time. The rickshawpullers go to a local shop where CD/DVD, etc. are rented and sold. They called it the "computer shop". The person who works there installs songs and movies in their mobile phones. The rickshawpullers do not know how to install those. That computer person shows them how they will play the songs and the movies. One of them said,

"You will get 200 songs for only 5 Taka. And for the movies … lets say, each movie is 5 Taka. You give him the money and he will take your mobile phone and put those into the phone. He will also show you how to play those. You cannot take more than one or two movies at a time. They give us whichever songs they wish. We always want new songs. They know which ones are new. For movies, they ask us the names. If they tell a name that I do not know, this means we did not watch that movie. So, we take that. We only watch Bangla or Hindi movies."[5 Taka is approximately equivalent to $0.06]

Although the person at the computer shop shows them how to play a song or a movie, it is not always easy for them. In fact, they face frequent problems in remembering the methods. One of them said,

"Once I forgot the exact sequence of buttons they told me to press. Maybe I pressed one button instead of the other. I was trying to listen to a song, but all the songs got deleted from my phone. I had no clue."

Our next question was regarding the money-transfer service of the network providers that the rickshawpullers use for sending money to their relatives in remote places. They explained to us how they take the help of a shopkeeper for this. That shop is a stationary shop where household stuff is sold. The shopkeeper also offers this service of sending money to another mobile phone. They go to that shop with the money and give the shopkeeper the phone

number, which will receive the money. That phone number usually belongs to some other shopkeeper in that village who knows the relative of the sender. They first call to that remote shopkeeper and inform them that they are going to send some money to him and ask him to give the money to their relatives. Then they request the local shopkeeper to send the money. The local shopkeeper uses his own mobile phone to transfer the money to the remote one. The rickshawpullers then call to the remote shopkeeper again to make sure that the money was successfully received.

Our next set of questions concerned issues of maintenance and repair around their mobile phones. We were interested to know what they would do if their mobile phones stopped working properly. They introduced us to the local repair shop, where they go whenever they have any problems with their phone. The two most common reasons for having problems in their mobile phones are: 1) the phones drop from their pockets when they bend to pick something up from the street; and 2) water enters into the phone when it rains. One of them said,

"*Whenever I find any problem with my mobile phone, I go to the repair shop. I do not understand what actually happens. So, I have to believe whatever they say. I pay them the bill they demand for fixing the phone. But at the same time, I start looking for another guy for selling the phone. I know that a repaired phone will not last long. So, I try to get rid of that as soon as possible."*

We also asked them if they collaborated amongst themselves in using mobile phones. It turned out this was an important and ongoing aspect of use. The younger members of their community were more interested in checking out different features of the mobile phones, and were often more knowledgeable than senior members. Often times they helped others to store numbers or to find songs. One of them even knew how to use Bluetooth. He said,

"I went to school till I was in Grade 5. I know Basic English. I know the alphabets, but I struggle in reading the whole word. But I can make the guess. I can tell you if the word is "save", or "call". I like passing my leisure exploring different functions of the phone. I learnt how to use many of the applications while exploring. Now I know about mobile phones a lot more than the other rickshawpullers here. So, they come to me if they need help. I try to help them whenever possible."

After this focus group discussion, we understood that the use of mobile phones in this rickshawpuller community is not solely depended upon the individual users. Instead they use their social peers to help consume this technology in their day-to-day life. To understand this collaboration in a better way, we went to the people they mentioned to get help from.

6.1 The Garage Owner

The owner of RG, Mr. G, is about 45 years old and has been in this profession for more than 22 years. His father also owned a rickshaw garage. Mr. G. started a garage at a different place in Dhaka, but then due to some problems he had to move RG here. Mr. G has no formal education and has never attended school. He lives near RG with his wife, two sons and one daughter. He spends most of his time in RG.

Mr. G counts himself one of the early adopters of mobile phones in Dhaka. He has changed his mobile phones many times in the last 20 years. Nowadays he uses smartphones. His wife, elder son and his daughter also use mobile phones. Since he has been using mobile phones for such a long time and has used so many sets in this period of time, he claims to know most of the functions of most of the mobile sets. He learnt the basic operations when he first bought a mobile set, and that was easy since the sets had very few functions then. Later, new sets came into the market and Mr. G also updated himself with the new features.

Mr. G helps the rickshawpullers in his garage in using mobile phones. He mentions four main situations in which rickshawpullers turn to him for help: 1) when they need to save a new contact to their mobile phone, 2) when they need to play a song or a movie, 3) when they need suggestions for buying a new mobile phone, and 4) when their mobile phones do not function properly. Mr. G tries his best to help them. He said,

"They do not learn the process. They will come again and again for the same reason."

Mr. G also tries to fix their mobile phones although he does not have knowledge in repairing those. He feels that he should help them; because there is no other way those people will be able to get rid of their problems with their mobile phones. He considers himself the guardian of the rickshawpullers. He said,

"*No matter how much modern mobile set you build for them (rickshawpullers), you will always need somebody to help them."*

6.2 The Money-Transferring Shop

We went to the shop that offers the service of transferring money through mobile phones. We talked to the person who looks after the business there, Mr. T. He is about 35 years old and has been doing this business for last 11 years at the same shop. He does not have any education beyond the primary level. Beside this service of transferring money, he also offers the service of recharging the balance of pre-paid mobile phones. He also sells chargers, wires, and some other necessary accessories of mobile phones in his shop.

Mr. T started this business 11 years ago when the use of mobile phone was increasing in the country very rapidly. There were not many services at that time. One of the mobile network providers started the service of recharging the account with any amount of money. That company called him to their office and trained him how to offer this service to the customers. The employees of the company also remain available on the phone to help them whenever needed. People usually come to him for these two services. He gets 2.75% of any balance that recharges a mobile account. He also receives a percentage of money that is transferred to another mobile phone. He said,

"Around 200 customers come to my shop every day. About 7,000 Taka is loaded every day, while 40,000 Taka is transacted every day through BKash on average. Most of my customers ask for Flexi-load." [BKash is a money transferring system; Flexi-Load is the balance recharging system, 7,000 Taka, and 40,000 Taka are approximately equivalent to $87.50 and $500, respectively]

Rickshawpullers often visits his shop to recharge the balance of their mobile phones. They also come to the shop to send money to their relatives living in different locations. Mr. T makes a small profit from each of these transactions. However, besides the monetary benefit, Mr. T explains that he feels a moral obligation to help these people. He realizes how important it is for those people to send the money to their relatives. He tells us that he always makes sure that their monies reach their intended

recipients. He also helps them using different functions of their mobile phones whenever they seek help.

6.3 The Computer Shop

Mr. C is about 30 years old and a relative newcomer, having operated his current business for only 6 months. He sells CDs and DVDs of Bangla, Hindi, and English movies in his shop. At the same time, he loads these movies into the memory card of the mobile phones. While he used to work at a computer shop before he started this business, he does not have very deep knowledge of computers, and cannot use the Internet independently. He has to take help from other computer technicians when he needs to update the operating system of cleaning viruses from his computer.

Mr. C takes a minimum of 15 Taka (approx. $0.20) from each customer who comes to get movies from him. The exact amount depends on the number and type of movies or songs that are being taken. He usually gets the movies and songs from CDs and DVDs that he buys from other shops. For the audio, he only uses the MP3 formatted files. For movies, he prefers 3GP or MP4. People usually come to him for Indian or English movies; local Bangla movies are not in high demand.

Mr. C tells us his shop is a favorite among the rickshawpullers, in part because of the support and help he offers. He shows the rickshawpullers how to watch movies or listen to the songs each time he loads those to their mobile phones. But he also receives complaints if they cannot play those later. In most of these cases, the customers make mistakes in operations. The rickshawpullers often do not know the names of the movies. They might know the name of the actors, or some songs of a movie. Based on those clues, Mr. C figures out the name of the movie. Sometimes, he also makes his own suggestions to the customers. So, besides supplying movies to the rickshawpullers, he also needs to keep himself updated with the information of the movies.

6.4 The Repair Shop

The repair shop that the rickshawpullers in our study most commonly use has one technician and two apprentices working under the owner, Mr. R. Mr. R is also a technician himself. He is about 40 years old. He has been living in Kamrangirchar since 1994. He did not continue his education after the high school, as he did not get any interest in it. Then he took both formal trainings and apprenticed at different places. Finally he set up this shop and started his own business. Besides this shop, he also owns a construction business, where he spends most of his time during the day. He comes to this shop every evening and often stays there well into the night. His employees usually look after the shop during the day.

Mr. R knows that many of his customers are rickshawpullers. He mostly receives complaints with their inexpensive mobile phones. Most of the complaints are related to ICs or accessories of the phones. So, their responsibilities are mostly to replace those parts. They make the bill including the price of the new parts and the labor cost. Usually they try to make a profit of 100 Taka (approx. $1.25) from each of the customers.

Besides repairing, Mr. R often gets requests from them to show how to use different features of the phone. He said,

"They usually ask me to show them how to save contact numbers, read text messages, set FNF and caller tunes, play media files etc. They ask me to teach them only those functions, which they consider necessary. I show them accordingly. Smart ones learn quickly and the dumb ones keep coming back again and again." [FNF means "Friends and Family", a prioritized contact list]

He tries to teach them the operation of the functions in an easy way. He said,

"*I set the functions they use frequently in the navigation keys and show them "If you press "right" videos will be played ... If you press "left" audio songs will be played" – this way. To recognize a function I suggest them to look at the icons. For example, if you find a picture of nut bolts this means it is for settings.*"

Besides the commercial scope, Mr. R tells us that he considers it his moral duty to help these people who do not have enough literacy to operate a mobile phone.

As these findings suggest, the rickshawpullers in our study draw on a wide network of people in their local environment to help manage and maintain effective use of their mobile phones, including to address problems of use that other more literate users might handle independently and as a matter of routine. This is not a panacea – social dependence to accomplish these basic tasks could in theory impose additional costs (though most assistance rendered here appears to build costlessly from existing social relations, or follow from other kinds of commercial transactions (buying music, recharging minutes, etc.). Under more negative conditions, social dependence could also subject low-literate users to additional risks, through forms of over-charging or cheating that exploits their dependence.

There was no evidence of either of these problems in our current study however. The lessons we learnt studying the roles of these people in the practice of using mobile phones in the rickshawpuller community, go far beyond the scope of narrow analysis of give-and-take relationships. These people surrounding the social life of the rickshawpullers, although have formal roles mostly defined by economic transactions, have formed strong social ties with the rickshawpullers. These are the ties that are often helping the poor low literate rickshawpullers to overcome the barrier of illiteracy and get access to the service of mobile phones. Recognition of these social ties as a potential factor for designing technologies hence could open a newer possibilities for the developing world.

7. IMPLICATIONS FOR DESIGN AND RESEARCH

We observed the difficulties that the rickshawpullers confront while interacting with the memory-based services of the phones. They cannot save many numbers because of the way they save the contacts and memorize those. They often struggle while placing a phone call correctly to a person in their contact list. They often lose their audio and video contents because of some unwanted mistakes in their operations. They have to have a great deal of trust and dependencies upon the repairers and other service providers because of their lack of necessary literacy to operate mobile phones.

From our study and analysis, we draw the following implications to the design of mobile phones' interfaces and interactions for the rickshawpuller community that we have studied. Some of these design recommendations are not new, and our study just strengthens the previous results. But in other cases, we propose novel ways to help people overcome the barrier created by their illiteracies.

Bangla Fonts: In our study we found that the rickshawpullers are more familiar with Bangla letters and symbols than English ones. In our focus group discussions, one of them said,

"If those were in Bangla, it would be easier for us. We can understand some Bangla words. We know those by faces."

Bangla fonts would give them an opportunity to pick up small letters and words they might be familiar with. Also, they have a common feeling that English is more difficult to understand than Bangla, although they are not able to read in either of these.

Graphical User Interface: We observed that the rickshawpullers are good at interpreting graphical objects. This particular observation supports the findings of Medhi et al. [4]. So, we propose to have a set of local graphical code (as opposed to 'universal') to guide them in the mobile interfaces. We should be careful to limit the use of graphical objects in the interfaces, because memorizing too many graphic codes would create a pressure on the users.

Screen Sharing: This is arguably the most distinctive of the design recommendations advocated here, and the one based most centrally on the distributed model of use encountered in our fieldwork. Since we have found the rickshawpullers taking help from others for some specific purposes, we propose a system that shares the mobile screen of the rickshawpuller with potential members of their social support network. The mobile networks, Wi-Fi, Internet, or Bluetooth could establish the connection between their phones. We explain our proposed system in the following paragraph through a hypothetical scenario.

Assume a rickshawpuller, *R*, needs to call a person, *P*, and for this he wants to take help from RG owner, *G*. We assume that the contact information of *P* has been saved in the contact list of the mobile phone of *R* from before. So, when *R* feels that he should call *P*, he goes to the call option. A call will automatically be placed to *G*, and the mobile screen of *R* will be shared at *G*'s mobile phone. *R* requests *G* over voice to place a call to *P*. From the shared screen, *G* finds the contact number of *P* and places the call. The call is then automatically directed to *P*. Similar operations can be designed for saving a contact, searching a movie, or reporting complaints or problems with phone use.

Beside these direct design implications, our findings around the socially distributed nature of mobile use and support among low-literacy users may suggest larger implications for ICTD research and practice. Some of these include lessons for education and government policy. For example, our field data showed that many of the rickshawpullers had children going to primary schools. However, they do not get any sort of training of using necessary electronic devices there. Under the distributed support model outlined here, if a single family member knew the use of the mobile phones that would help the whole family in technology consumption. Whether we should incorporate this sort of training in our primary education would encourage a detailed investigation of the current relationship between educational practice and policy and the real-life needs of marginalized and low-literacy communities. Our work might also suggest the need for governmental or industrial initiatives to ensure the robustness and access to the wider support ecologies noted here, perhaps especially in low-income and low-literacy districts like Kamranchirgar. This could include efforts to proactively foster such social support mechanisms the social extension of capabilities such forms foster; or alternatively, efforts to ensure that the types of dependency on external social actors in local business environments did not lead to more negative examples of abuse and exploitation.

At the broadest level, lessons from our study align with a larger body of findings around the distributed or social nature of ICT use in many developing world settings. From our field study, we understood that interactions between rickshawpullers and their mobile phones should not be considered as solely individual efforts to engage a challenging but valuable technology; rather they should be considered within a wider ecology which includes their own understanding of letters and symbols, help from their peers, support from their garage owner, and the formal and informal services provided by the money-transfer, computer, and repair shops outlined above. We observed how the bonds in their social network support them in consume the mobile phone technology. We observed how knowledge is shared, transfused, learnt, used, and forgotten within this wider system. So, instead of considering the use of mobile phone as an individual activity, we would consider this a social process of consuming technology where members of local social networks collaborate with each other to produce more satisfying, seamless, and effective technological encounters. The structure of this ecology may have as large or larger an influence on the ultimate usability of devices among low-literate and other kinds of users than design-level affordances built into the device itself. As suggested above, taking such ecologies seriously may also point us towards new and different kinds of design interventions..

One of the main contributions of this paper is the idea of exploiting social bonds to support people using technologies in developing regions. Instead of a heavily practiced design model of increasing individual capabilities through technically enriched devices, we bring here the idea of looking at technology as a social practice. This particular change in the perspective allows us to re-conceptualize how technology is being consumed in developing countries, most of which have very strong social ties among the people. Consequently, this increases the "capability" of an individual of a society by accepting his social capital. This realization hence lifts some burdens off the technical devices and puts more emphasis on social structure. As a result, we can expect low-cost, simple, and sustainable technologies, meaningful for the people of those places.

The design proposed in this paper is more about facilitating collaboration among people to get them united to overcome the struggle imposed due to illiteracy, than to help individual users through design interventions. We emphasize the role and value of ethnography (alongside more individualized user studies) for this sort of design, since ethnography can help to reveal the social structure, culture, and patterns of interaction in which individual acts of technological use or consumption are located. Instead of considering technology as a "remedy" to a "problem", we call attention to the embedding of technology in specific social practices and relationships. Appropriate technology design would take such embedding seriously, and seek to leverage and possibly enhance such sociality, supporting strategies which unite people and help them overcome their barriers together.

The shift in perspective from individual to social necessitates a critical investigation of development models in general, and the design interventions coming out of them. The emphasis on individuals in Sen's Capacity Approach (CA) model [19] is often reflected on technologies with a narrow focus, being oblivious of the social factors associated with them. Ironically, those technologies often struggle to strengthen individuals due to ignorance of the wider social relations in which such capacities

are grounded. We argue that defining individual capacity by what a person can do alone may be short-sighted, and out of step with the conditions of distributed use and support which may in fact characterize many developing world settings (and certainly the context of mobile use among the rickshawpullers of our study). Instead, one's capacity in those contexts can be better defined by the summation of one's own ability and the social support one receives. Hence, a platform that facilitates collaboration among people can make each of the individuals more capable. A technology that binds together a society with strong bonds of cooperation, collaboration, and mutual support, not only creates more capable individuals, but may also promote a united community capable of fighting against their problems.

8. CONCLUSION

This study has reported the ways that low-literate rickshawpullers in one garage of Kamrangirchar use their mobile phones. We have described the literacy-based barriers that such users encounter. We have also described the forms of external support such users regularly turn to in dealing with such problems, and shown how capabilities absent in the user may be present in the local environment and tapped to overcome the obstacles that low-literacy creates. This inspired us towards design proposals that take account of and leverage such resources, including a recommendation to incorporate collaboration in the interface of mobile phones so that low-literate users can exploit the benefit of their social connections more effectively. We have also argued more broadly that design operates (or should) within wider ecologies of use that are potentially richer and more promising than the simplified set of actor and device, user and interface, acknowledges. Our current work acts on this proposal, designing and field-testing forms of collaborative functionality suggested through our ethnographic work. In spring 2014 we will return to Kamrangirchar and several other low-literacy sites to further test the propositions and design interventions identified here.

Beyond its implications for the immediate context studied here, we believe our study has wider import for ICTD work in general. While the rickshaw-pullers of Kamrangirchar represent a highly specific community, we believe the wider pattern identified – of the socially embedded character of use and users, and the function of wider networks in supporting and filling in capabilities and resources absent or unavailable to individual users – has bearing on a much larger range of ICTD contexts and problems. This paper lays out a platform for future designers by showing the prospects of leveraging extant social networks to enhance the effectiveness of technology. Further comparative and longitudinal investigation is needed to understand how effective this design paradigm can be in the real world.

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