Where There's a Will There's a Way: Mobile Media Sharing in Urban India

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ABSTRACT

We present the results of a qualitative study of the sharing and consumption of entertainment media on low-cost mobile phones in urban India, a practice which has evolved into a vibrant, informal socio-technical ecosystem. This wide-ranging phenomenon includes end users, mobile phone shops, and content distributors, and exhibits remarkable ingenuity. Even more impressive is the number of obstacles which have been surmounted in its establishment, from the technical (interface complexity, limited Internet access, viruses), to the broader socioeconomic (cost, language, legality, institutional rules, lack of privacy), all seemingly due to a strong desire to be entertained.

Our findings carry two implications for projects in HCI seeking to employ technology in service of social and economic development. First, although great attention is paid to the details of UI in many such projects, we find that sufficient user motivation towards a goal turns UI barriers into mere speed bumps. Second, we suggest that needs assessments carry an inherent bias towards what outsiders consider needs, and that identified "needs" may not be as strongly felt as perceived.

Author Keywords
mobile phone, video, Bluetooth, sharing, social networking

ACM Classification Keywords
H.5.m [Information interfaces and presentation]: Miscellaneous; K.4.m [Computers and society]: Miscellaneous.

General Terms
Design, Human Factors

INTRODUCTION

A growing body of work dubbed 'information and communication technologies for development', or 'ICT4D', investigates the design of technological systems for communities in developing countries, in the hopes that information technology can play a role in improving lives and alleviating poverty. The CHI community has shown a steadily increasing interest in this topic. Projects in the area often take the form of interventions, in which a novel technology is introduced into a community with the goal of improving its socio-economic situation. But as practitioners in this field are intimately aware, the proportion of ICT4D interventions which have meaningful, sustained impact is very small.

One well-studied example is the telecenter[1], in which a PC, often connected to the Internet, is meant to serve as the hub of socio-economic development activity, usually in poor rural or urban areas [24]. Telecenter projects are usually meant to provide social services such as remote healthcare, distance education, or e-government. However, research suggests that the vast majority of telecenters have little measurable impact [19], and that many, if not most, close operations within a few years. Failures are attributed to a multitude of issues, some of which are well within the bounds of consideration of HCI, including socio-cultural barriers, lack of demand, mismanagement, economic constraints, poor infrastructure, educational deficiencies of potential users, and absence of sustained political support [8,11]. These issues appear to plague projects well beyond telecenters, including some of those with an HCI focus.

Due to the difficulty of crafting successful interventions, developing regions are often described as environments

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[1] We use the example of telecenters here since there is a relatively robust literature in cataloguing their successes and failures. The same cannot yet be said for more recent projects in HCI for development.

which are unsupportive of or unprepared for advanced information technologies. Successful projects in ICT4D, in fact, are generally portrayed as those that not only provide new technology, but also intervene to overcome all of the associated obstacles [4,14,18,23]. Rarely do researchers ask whether these projects are meeting real demands.

This paper tells a different kind of story. We focus on the sharing and consumption of entertainment media on low-cost mobile phones, a practice which has evolved into a vibrant socio-technical ecology in urban India. With the availability of multimedia-capable phones for less than $50, many users who have previously owned simple bottom-of-the-line phones are upgrading. In turn, this expanding infrastructure is supporting a phenomenon analogous to the online file-sharing craze that developed on the Internet with the advent of Napster. But in India, where Internet access is not yet widespread, sharing is instead carried out via phone-to-phone file transfer.

The system we describe here is complex. It involves end users, who trade with each other; mobile phone shops, who sell content to end users; and content suppliers, who sell batches of content downloaded from the Internet to mobile shops. This system has grown up through organic processes, sanctioned or promoted neither by mobile phone manufacturers nor service providers. This has occurred in spite of the same myriad obstacles that interventionist projects like telecenters have faced—from the technical (interface complexity, limited Internet access, viruses), to the broader socioeconomic (cost, language, institutional rules, lack of privacy). The phenomenon also spans a range of socioeconomic strata, and includes users with limited incomes, education, and literacy skills.

The key difference between this video-exchange economy and those of many ICT4D projects appears to be one of motivation. Users themselves are strongly motivated by a desire to be entertained. On the other hand, the so-called user "needs" – of healthcare, education, etc. – addressed by interventionist ICT4D projects appear not to be *as* urgently felt, though they are undoubtedly important.

This raises several points of discussion. First, it suggests that the motivation to adopt, if powerful enough, trumps obstacles in the path of adoption—in short, *where there's a will, there's a way*. Second, it suggests that developing communities are more than capable of embracing advanced information technologies if the appropriate motivation exists. Finally, it suggests that we must reflect on the very concept of 'needs' in the context of technology and development: Are needs really more urgent than desires? Who defines which is which? Do researchers exaggerate the urgency of 'needs' due to their own biases and preconceptions?

In this paper, we discuss each of these questions with reference to the data we have collected on the aforementioned mobile media sharing phenomenon. We give special attention to the issue of usability, which appeared to be of minimal concern to the users in our study.

BACKGROUND

Technological innovation and popular media go hand in hand in India. In a 1993 book, Peter Manuel chronicles the rise of the audio cassette in northern India, finding that the low cost of cassette tapes had transformed the music industry from a near-monopoly into a near-free-for-all, with considerable impact on patterns of dissemination and consumption [12]. In fact, variants of many of the practices reported here have been observed in previous technological generations. Digital audio *and* video carried on multimedia-capable mobile phones exhibit many of the same characteristics as cassette media (cheap, easy to copy) and promises this time to affect both the music and film industries.

Mobile Multimedia Sharing

With the worldwide explosion of mobile phones and portable digital media players in recent years, it is not surprising that the literature on mobile multimedia is a rich one. Here we review selections that focus on media sharing.

Some of the earliest work in this area considered the experience of live television on PDAs or custom devices (e.g. [6,21]), but no wireless sharing was reported. Kindberg has presented an in-depth study of camera-phone use [9], but also did not find much evidence of file sharing, instead finding that most sharing was done on-screen.

Several other studies have investigated the potential of Bluetooth for communication with public displays. Chevrest et al. [5] built a system allowing users to send and receive files to and from a public photo display, while Maunder et al.[13] proposed a similar system which removed the need for special phone software. Neither of these articles dealt with phone-to-phone transfers.

At least two reports examined peer-to-peer Bluetooth media sharing in some detail. O'Hara et al. encountered the phenomenon in her study of U.S. and U.K. mobile video users [16], finding it to be common in high schools. Harper et al. observed Bluetooth sharing in a study of 'heavy mobile phone users' in the U.K. [7]. They dubbed the practice 'trafficking', remarking on its peculiar social, legal, and economic characteristics.

Our work is distinct from these studies for two reasons. First, whereas other studies encountered sharing only in passing, the sole focus of our study is media sharing, and this focus permits a deeper examination of practices on the ground and in the wild. Second, our work is based in India, a developing country, which features more barriers to the development of such an ecosystem.

Challenges and Motivations in ICT4D

A collection of ICT4D literature examines the all-too-common phenomenon of project failure. For example, Heeks has surveyed the success and failure of a host of e-government initiatives—those which aim to computerize

basic government services in developing countries—and painted a bleak picture in which 85% of projects were either total or partial failures [8]. He attributed these failures to "gaps" between project design and on-the-ground realities. Meanwhile, Brand and Schwittay provided an in-depth look at the failure of a single project—the LINCOS telecenter project in Costa Rica [3]—and blamed it on the project's techno-centric focus.

But a seemingly greater number of ICT4D papers, short of reporting failure, describe the challenges they have encountered during their efforts. This style of report is so popular that the narrative of 'challenges being overcome' seems to characterize much research in the field. For example, Prasad et al. attributed the mixed success of their video email technology to "surprising challenges," most notably the inability of illiterate users to "understand the notion of asynchronicity" [18], and suggested that further research is needed to overcome those challenges. Medhi et al. examined the "broad challenges" facing their concept of a job search system for low income domestic workers [14], including a lack of formal organization and human capacity. They went on to conclude that "computer-based systems to solve developing-world problems often require significant work above and beyond an implementation of the technology." Surana et al. described several challenges in establishing and maintaining a long-distance WiFi network between eye hospitals in rural India, the first of which is listed as "limited local expertise" [23]. Kumar et al. pointed to the "learning curve that is required" as an explanation for the limited adoption of text-based mobile applications by low-income users [10]. The challenges of ICT4D research are the sole focus of an entire article by Brewer et al. [4], which grouped them into three categories: technical, cultural, and environmental.

These reports imply that interventionist research and practice are challenging endeavours. We suggest, however, that the question of the *motivations* and *incentives* of the recipients of those efforts is often left out of these reports, or considered only in passing as another challenge to be overcome. We claim that a stronger focus on motivations would enrich the field of ICT4D.

Some articles have ventured closer to this discussion by pondering the seeming mismatch in the definition of 'needs' according to development experts on the one hand, and the recipients of development on the other. In an extensive review of literature on rural telecenter projects [11], Kuriyan and Toyama echo the usual refrain in reporting that telecenters are "difficult to sustain", but go on to remark that "what rural villagers want and what we [ICT4D experts] think they need are frequently different." They find that in some kiosks which offer various development-oriented content (government services, agriculture, healthcare, etc.), such content accounted for less than 10% of kiosk usage, with games, digital photography, and desktop publishing drawing most of the attention. Bailur's ethnography of an Indian village radio

station offers a similar story [2]. Initial funding for the project that created the station carried a strong social development agenda. That funding was later discontinued as the high demand for music and quiz shows edged out development-oriented content.

In this paper, we take this discourse a step further, and present a study of a successful and innovative technological system that has emerged in urban India. We offer our findings as compelling evidence that incentives and motivations are of paramount importance to technology adoption. Ironically, our report is cast in the familiar narrative of challenges being overcome, but with one key difference: the challenges in this case are overcome not by researchers or development practitioners, but by the users themselves.

METHODS

The work reported here comprises a set of informal preliminary interviews, a set of formal, semi-structured interviews, and several sessions of participant observation. Data collection took place over a 9 week period in Bangalore, India in the summer of 2009.

Bangalore, sometimes called India's Silicon Valley, is a thriving cosmopolitan city built on the IT boom in India in the 1990s. But despite its wealth, Bangalore does not defy Pareto's power law of wealth distribution. Among its residents, for example, are many low-income migrant workers employed in the city's service and construction industries. Mobile phone adoption there is also strikingly high even among low-income citizens, as in most of India's urban centres. An increasing number of phone users now possess multimedia capable phones, a phenomenon which gave rise to this study. It is thus an ideal environment for investigations into emerging trends in technology use.

Preliminary Interviews

The study began with approximately 30 short preliminary interviews, intended to build an initial understanding of the practices under study, and to identify potential participants for more thorough discussions.

Selection criteria. Interviews were conducted with passers-by on the streets of Bangalore and with support staff members at Microsoft Research India.

These were conducted mainly on the streets of the Shivajinagar and Yeshwanthpur neighbourhoods of Bangalore, both lower-income areas. Participants were passers-by and proprietors of mobile shops, photo shops, and Internet cafés. Two interviews were with members of the support staff at Microsoft Research India. Interviews typically lasted from 1-10 minutes and were conducted according to a rough script. Participants were not compensated. Data from these explorations were not formally analyzed.

Formal Interviews

Our initial interviews led to 25 more formal, semi-structured interviews. The guide for these interviews was

designed based on the information we gathered from our preliminary exercise. Participants were drawn from three groups: 16 users (those who consumed and traded media content on their phones), 6 providers (those who earned money from providing mobile content), and 3 miscellaneous (1 pirated DVD seller, 1 police officer, and 1 man who spuriously claimed to provide 'anti-piracy certification' services for providers). Four participants were female[2], 21 were male, and the average age of participants was 27. Interviews typically lasted about an hour, and were audio recorded. Participants were offered Rs. 200 (about $4)[3] as compensation. Both preliminary and formal interviews were conducted with the aid of a translator when the participant could not speak fluent English. This was the case in 19 out of the 25 formal interviews, and a similar proportion of the preliminary interviews. Alternate languages used included Kannada, Tamil, and Hindi. All questions were asked in English and responses were translated back to English.

Selection criteria. We were interested in users who were technology non-experts, and who might be typical participants in a development program—those of lower socio-economic status, limited household income, and minimal access to advanced ICTs (beyond mobile phones). Accordingly, participants in the 'users' group were selected based on the condition that they did not own a computer. They also had to possess a multimedia-capable mobile phone. We also deliberately sought a minimum of representation by women.

Most users were drawn from blue collar sectors, including 4 construction workers, 4 housekeeping staff, 1 driver, and 1 security guard. There were also 2 students, 1 fruit vendor, 1 salesman, and 1 homemaker. One participant was unemployed. While we did not use a hard income cutoff, the average monthly income of our participants came out to Rs. 8,300 ($166), which is approximately equivalent to the overall average for urban India [20]. Our sample thus included some participants below the Indian average, as well as some above it. However, none of our participants could be considered 'well-off'. All appeared to have minimal disposable income, and many were the sole earner for their household. It should also be noted that 'average' in India is still poor compared to developed regions with respect to purchasing power parity.

Sampling. Participants from earlier, informal interviews who met our selection criteria were asked to participate in a

formal interview. These initial participants were then asked to recommend others who might meet our criteria. This 'snowballing' continued until no new information was being gleaned from interviews. We felt that snowball sampling was especially appropriate in the case of this study, due to the questionable legality of the practices being studied. In many cases, it was clear that our interviews would not have been granted without a personal recommendation. However, we acknowledge that this method may not lead to a representative sample.

Participant Observation

Two sessions of participant observation were carried out at a Bangalore mobile shop. The first author sat behind the counter and observed as customers interacted with the employee in charge of mobile media sales. Each session lasted about an hour. Brief field notes were recorded, and subsequently expanded and incorporated into the analysis.

Analysis

Due to the relative novelty of this phenomenon, we avoided a hypothesis-oriented approach to analysis, and instead distilled themes of interest via inductive reasoning. This strategy is characteristic of several well-known techniques for qualitative analysis [22]. In an open coding exercise, all transcripts and field notes were read, and interesting excerpts or quotes were selected and assigned short codes such as 'innovative use' and 'privacy'. Following this preliminary scan, the list of codes was reviewed several times and similar codes consolidated. From this consolidated list, overarching themes were further distilled, and excerpts not matching predominant themes were discarded.

At this point in the analysis, several of the authors noted that many of the 'themes' that were uncovered could be cast as obstacles or challenges which had been overcome by users in constructing the sharing system, or motivations which had driven them to do so. Themes were thus recast as obstacles vs. motivations. It was further noted that the only fundamental motivator in this story is entertainment, as is described in the next section.

FINDINGS

Overview

Finding users with multimedia-capable phones was not difficult. A vibrant, semi-formal second-hand market supplies many such phones, often called 'camera sets'. Also, cheaper Chinese models, called 'China sets', were available brand new within the same price range. One mobile shop owner described how the China set was making more capable phones accessible to a new class of users:

> … if you go around 5 to 6 years back only rich [people] can have a cell phone with the touch screen that may cost around Rs. 27000, Rs. 28000, Rs. 30000 [about $560]. But this year and last year the same version like you can get around Rs. 5000 to Rs. 6000 [about $110]. That's a China made

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[2] The small number of female participants was due to the difficulty of finding females in our target demographic that engaged in these practices. Female participation appears higher among higher-income groups and college students.

[3] All monetary figures in this paper are given in Indian rupees with an approximate conversion to US dollars at Rs. 50 per dollar.

exported from China…. Most of them who works as a housekeeping, driver, they used to buy the same type.

The Chinese models offer many of the same features as so-called 'branded' handsets (albeit with dubious quality [17]). This study focused on two of the most widely used such features: multimedia viewing and Bluetooth file transfer.

By design, all the phones in our sample could both play and capture videos, audio, and still images. Each of these features was used heavily by many of our participants. Most had a small collection of captured photos or videos, usually of their family and friends. But non user-generated content was more common. Music in MP3 format was perhaps the most popular type of content. Several types of video content were in evidence, with music videos (or "video songs") most popular, followed by short comedy clips or funny advertisements as typically found on YouTube, and finally short clips of popular film dialogs. Users often also possessed several still images. Most popular were pictures of Hindu gods, film stars, and exotic cars and motorcycles.

It was clear from our interviews that the ability to obtain and consume such content was one of the main reasons our participants had purchased more advanced mobile phones. On being asked why he had gotten such a phone, one participant answered:

> All the effects is good, and the video is good, clarity is good, GB can be expanded.

The last part of his comment refers to the MicroSD expansion slot which was available on most of the phones we encountered. Most such phones had been outfitted with a 512MB or 1GB memory card, at additional cost to the owner. This extra space is more or less required for users interested in keeping multimedia content on their phones, since internal phone memory usually exceed 64MB on most models.

The second feature which emerged as highly important was Bluetooth file transfer. We found that peer-to-peer sharing of files in this manner is the main method by which users obtain their content. People share variously with co-workers, friends, and family. Though it was not a prerequisite for participation in the study, fully *all* of our participants were aware of this practice and regularly engaged in it, save for one participant whose phone was not Bluetooth-capable. All indications suggested that Bluetooth sharing was widespread among users with capable phones.

It was also clear that multimedia content was an important part of peoples' daily routine, as opposed to an occasional novelty. People reported listening to their music daily, and watching videos once every two or three days. One participant, a fruit seller, fired up his phone in the evenings when business got slow:

> In the night time the shop will be closed by 11:00 clock. By 9:30 I will start watching the music, videos, and all because there will be no customers.

Users also refreshed their content through Bluetooth trading on a regular basis, from once or twice a month to several times a week:

> Once in a week I will be changing the songs or videos. I will be refreshing the videos because since the MP3 is around 220 and videos clips around 21 that itself it takes time [to] watch. If I want within a weeks time [I'll] take new clip song.

As a further testament to the popularity of these practices, an informal economy has grown up around mobile phone multimedia. The most common commercial player in this market is the ubiquitous "mobile shop". Such shops are found with almost as much frequency as basic provision shops and restaurants in urban India. Their hitherto main services have been mobile phone sales and service, prepaid GSM SIM card sales, and sales of "top-ups", or prepaid mobile phone credits. In addition, many mobile shops now also offer "downloading", which is universally understood to mean transferring multimedia content to mobile phones. Prices for content vary, averaging about Rs. 150 ($3) for 1 GB of content, and Rs. 3 ($0.06) per song or video.

Obstacles

As noted, our thematic analysis revealed a diverse set of obstacles which were surmounted, often in innovative ways, in producing this system. We review each below.

Cost

Despite the reduced cost of multimedia-capable phones in today's market, buying such a phone still represented a considerable sacrifice for most of our participants. Phones often cost in excess of a month's salary. As a result, some participants were forced to save for long periods. Other participants took loans to finance the purchase:

> Yes it is one month cheque. … I will take the credit to lead the family. Suppose if I get my salary and from the salary if I buy the handset, the balance, if there is a shortage to run [support] the family I will take the credit from other family and run the family.

Purchase of second-hand phones was also common.

Interface Complexity

Bluetooth transfer is far more complex than making a phone call or sending an SMS text message, with as many as 19 steps required to send a file, and as many as 4 decisions points encountered in receiving one. Yet as stated, all of our 16 participants in the 'user' category reported sharing files via Bluetooth on a regular basis. This was despite minimal experience otherwise—none of our participants owned computers, most reported only occasional access to a computer via a friend or an Internet café, and few displayed a special penchant for technology. Most participants had learned how to perform all these steps from their friends, siblings, children, and co-workers.

Additionally, users had learned even more complicated procedures for obtaining content from the Internet. One user who had minimal previous computer experience had

learned from a colleague how to transfer videos from YouTube to his phone via a complex process:

> First I will go to YouTube. When I open the YouTube, at the same time simultaneously I have to open one more website .... I will copy and paste [the URL of the YouTube video] into that zamzar.com website. Then I will download it and I will put my email ID and it will direct it to my email ID.

Zamzar.com is a service which converts YouTube videos to mobile phone video format, and sends an email with a link from which the converted file can be downloaded. Upon downloading the file in this manner, the participant would transfer the file to the phone using a MicroSD card reader, which typically involves removing the phone's battery cover and battery to access the card. In one instance, the participant reported downloading an entire popular movie, in four 45-minute segments, one at a time.

Limited Bandwidth and Internet Access

Although Internet access is reasonably priced in India where it is available, its use is negligible among low-income groups. Even at mobile shops, the distribution hubs, Internet access can be scarce. Several shops we talked to had no connection, and another's was a split line from a neighbouring business and was slow and unreliable. The dominant operating practice for the shops we interviewed was thus to keep a large repository of content stored on a local hard drive, and to periodically update the repository from either the Internet (when access was available), by copying content from customers, or from a paid supplier.

Suppliers appeared to be the ones with the most Internet access and know-how. We interviewed one supplier, who sold bulk collections of content:

> I offer 15,000 MP3, 5,000 video songs, in any converted formats, and applications of any Nokia mobile, Samsung, any mobile category, applications, games, plus whatever, themes etc. I will charge about Rs. 2,500 [$50] for this.

He also provided a regular update service at Rs. 1,500 ($30) per update, once the base package had been purchased:

> Every month, new movies will be released, new applications will be released, like that. I will maintain relationships constantly with those customers, and I will visit their shop [every] two to three months.

This supplier reported obtaining almost all of his content from the Internet, especially via BitTorrent Web sites.

Thus, the replication of content from supplier, to mobile shop, and to hundreds or thousands of users via Bluetooth sharing, all originates from a single Internet download. The end result is an extreme savings on aggregate bandwidth costs, as the cost of one single Internet download is effectively distributed across so many recipients via Bluetooth or flash memory cards.

Legality

Unauthorized duplication of copyrighted material is indeed technically illegal in India. For proof of this, one need look no further than the pirated DVD sellers which dot the roadsides of Bangalore and other urban centers, keeping their wares neatly arranged on top of a plastic tarpaulin, ready to be bundled up and whisked swiftly down an alley when the police show up. One DVD seller we interviewed told of the weekly bribes he paid to the local police:

> Starting I used to pay around weekly Rs. 300 [$6], now I have become close friends to all the police and all with crime people … Now I pay around Rs. 50 [$1].

It was quite clear that this seller knew what he was doing was illegal. But curiously, the mobile shop content supplier we interviewed insisted his business was entirely within the law:

> Q: So then are [DVD pirates] similar to you?
> A: Actually no, they are only in that pirating business.
> Q: So how do you compare yourself to them?
> A: Actually I am not against the laws.

Indeed, this attitude seems consistent with law enforcement on the ground. One police officer we spoke to claimed that the police didn't bother with mobile shops unless they received complaints from copyright holders, and to date she knew of no such complaints. Only pornography, illegal to sell in India, would draw their attention, and sure enough, none of the mobile shops we spoke to admitted to selling it.

Still, digital transfers remain technically illegal, and one can only imagine that as this segment of the entertainment economy matures, it will come under greater scrutiny.

Time

As heavy users of Napster in its heyday likely know, obtaining and maintaining a sizeable collection of multimedia via informal channels can be a time consuming exercise. Our participants gave evidence of several time sinks in their practices. First, Bluetooth transfer itself can be slow, especially when large files are being copied. In tests we performed using typical phones, a 4.2 MB song took 2:04 to transfer, and a 6.0 MB music video took 2:49. Quick arithmetic suggests that transferring a large batch of content can take upwards of an hour. This is especially problematic when one works long hours or has a family to care for—often the case for our participants.

One mobile shop owner described a strategy for multitasking he had learned of from some construction workers who frequented his shop. During their day on the job, working side by side within Bluetooth range (approximately 10 metres), they would initiate large transfers and leave them running as they worked, with their phones in their pockets:

> I asked how did you send it via Bluetooth? I sold all these things [to him]. So I told him like if he is sending a 115 MB [file] through Bluetooth, how

long he has been spend a time across the phone?…
[He replied:] 'Ah I have switch on my Bluetooth and
his Bluetooth. We will be working with masonry
works and put it into the pocket. After it gets
transferred we get a message. I will just save it and
keep it; that's a simple sir!'

Construction workers we interviewed confirmed this
practice.

Several other participants described swapping memory
chips as a faster way to transfer larger files, since copying
data from the chip to the phone's internal memory is faster
than sending it over the air:

> We will put the chip and we will copy the contents
> to the phone. … In phone memory it will be free; we
> will copy to the phone memory. … If it is less, like
> one or two songs, we will share it via Bluetooth. ...
> If the Bluetooth is around eight songs then it will
> take one hour to transfer, and from the chip to phone
> memory eight songs will be around five to six
> minutes it will take to transfer.

Meanwhile, waiting for content to be downloaded at the
mobile shop can also be time consuming, so some
customers come with a prepared list of songs or videos,
written in the local script. They leave their memory chip
with the list, and come back to collect the full chip
sometime later.

Language
India's constitution officially recognizes 22 languages [1],
and speakers of many of them are easily found in
Bangalore, whose thriving economy is an attraction for
migrant workers. Most of our participants spoke at least
three languages.

Each language also has its own body of popular culture.
Many participants had content from several different
languages on their phone. When asked to categorize the
content on their phone, participants almost always did so
first by language, rather than by genre or era.

One mobile shop employee told us that his customers
usually wanted content in their native language:

> Here we have regional languages. Like as in your
> country there is only one language, but here we have
> each and every state we each languages. Bangalore
> is a place where all sorts of people come here. … So
> people come and they have various request, some
> people ask for [many different languages].

To service this diverse clientele, the employee had built up
a large repository of content in 13 different languages, often
by copying content from the phones of customers who had
travelled from other states. He also seemed proud of his
expertise in suggesting attractive content to his diverse
clientele:

> I need to attract customers. I need to understand
> their choice. This person had a request for only 4
> songs, … but I showed some [more] songs which
> he's interested in. These people who had migrated

from another place to Bangalore, … we need to
understand their minds.

Viruses
Nearly every participant mentioned fear of viruses as a
drawback of Bluetooth trading. However, it is unclear
whether the problems that participants described were
actually due to 'viruses' in the technical sense. System
errors or poor performance were likely more to blame. For
instance:

> Once or twice [a virus] has come to my cell, then
> immediately I used to switch off the cell, then on it,
> then that would have gone. So whenever I listen to
> the song and it used to get stuck and not go forward,
> then I'll switch off and switch on, then I will listen to
> the song.

But regardless of the cause, the fear and the effects are both
real, and the ecosystem has responded. Most mobile shops
offer a 'virus cleaning service'. Participants we spoke to
reported paying between Rs. 30 ($0.60) and Rs. 100 ($2) to
have a 'virus' removed. We note that this does not appear to
be deception on the part of the shop operators or error on
the part of users; only that the term 'virus' seems to have
taken on an alternate colloquial meaning in this context.

Other reported strategies for avoiding 'viruses' included
refraining from swapping memory chips with other users,
only sharing with trusted phones, keeping the phone's
Bluetooth function completely switched off except when
transferring files, scanning files on a PC before transferring
files to the phone, and refraining from Bluetooth transfer
entirely.

Institutional Rules
Several participants told of rules at their school or work
which forbade them to carry their mobile phones.
Housekeeping staff at one organization were asked to check
their phones with the security desk in the morning before
beginning work. Therefore, most of their trading took place
after work in the building's basement, where the workers
changed into their street clothes before leaving the
premises.

Many schools in Bangalore had also banned mobile phones.
One student we spoke to described the measures students
took to hide their clandestine phones from inspections.

> The best hiding places are the windows, the college
> classroom windows. Just open it out, there's a small
> space. We arrange all the mobiles, close the
> windows, and sit. So if they're checking the bag, if
> they check us also they don't get the mobiles.

Lack of Privacy
Several of our participants expressed concern that family
members would go through the content on their phone. This
usually came up when discussing pornographic videos, also
known as "blue-films":

> Q: So you've had [pornographic videos] but you've
> deleted them, is that correct?
> A: Yes, because my daughter, everybody used to

see. She is very clever, she will open the phone, oh ba!

That participant carried two memory chips—one in his phone, for normal use, and another in his wallet, where he kept any objectionable content. Another participant had created a folder with a diversionary name— 'Presentations'—in which to store his explicit content. To date, he said, the strategy had worked.

The Motivation: Entertainment

As mentioned earlier, interventionist ICT4D projects struggle with the kinds of obstacles that this ecology has overcome. If a single explanation could be offered, we propose that the motivation of entertainment is far more powerful than perceived "needs" of low-income communities. That Indians have embraced multimedia technology in service of entertainment needs is not surprising, given the renowned Indian affinity for popular film and music [12:xiii]. But as the popularity of YouTube demonstrates, people everywhere, when given a powerful tool, are as apt to use it for entertainment as for other "productive" uses.

One participant, when asked why he had bought such a nice phone despite his modest income, replied:

> I just took this because I want some entertainment…. Since the facilities is available in this phone so I took it. In the normal phone we won't have any timepass but in this phone you will have timepass.

"Timepass" is Indian slang for leisure activity which passes the time in a non-productive way. Timepass and entertainment are clearly related.

One participant singled out construction labourers as mobile phone entertainment seekers:

> From morning till evening they will be working hard and in the evening for them [they will watch videos on their phones] just for entertainment.

The overwhelming popularity of entertaining content on the phones of our participants was also telling. As stated, music, music videos, film dialogs, and comedy clips were the norm.

Such content is also cheap. While the cost of handsets may be relatively high, the cost of content for phones offers a considerable savings. DVDs cost at least Rs. 50 ($1), and the average reported cost of downloading a video using the mobile phone network was almost Rs. 40 ($0.80), an order of magnitude greater than purchasing the content from a mobile shop. As a result, very few of our participants reported ever having obtained, or even *knowing how* to obtain, content via mobile Internet (GPRS), or multimedia message (MMS), both of which deduct from one's prepaid balance.

> I don't have that kind of technology or knowledge to use it. If I use GPRS the amount will be cut so I don't want it to get cut.

While we heard no reports of private individuals paying for Bluetooth transfers amongst themselves, mobile shops report that downloading has become an important part of their business. This quote, from a supplier to several shops, literally sums it up:

> Yeah of course it's profitable. Actually, go for any mobile shop, ... they will charge you for 1 GB Rs. 150-200 [$3-4].To fill up that 1 GB memory card will be only 20-30 minutes. In one day they will get customers like that around 15-20 customers daily. Two hundred per head means how much?

Meanwhile, several participants stressed how appealing it was to be able to get their entertainment while on the go. Bangalore is beset with horrendous traffic problems, so commutes can be quite long. Long bus rides to native villages are also common. Prior to the advent of multimedia-capable phones, most of our participants would likely not have been able to afford a portable entertainment device (other than a simple radio) *in addition to* their landline or basic mobile. It is only the combination of media player with phone that makes portable entertainment affordable.

While the phone provides the convenience of mobility for some participants, for others the phone is their *only* source of multimedia entertainment. These include low-income workers who don't have a television, such as one participant who lived with his mother and sister in a small apartment:

> By seven o'clock I'll finish off my food and we'll sit round together, three of us, and I will tell my mother that see Mom, this is the new songs I've got it today, new video songs, and new MP3 songs.

Migrant labourers who live in makeshift accommodations on construction sites also fall into this category. One labourer said of his colleagues:

> No they don't have television—everything they have in their native place—they are leaving [coming to Bangalore] only with the mobile phones.

This scarcity brings about unique behaviours. One mobile shop owner reported regular requests from labourers who brought movies they had purchased on DVD and asked to have the *entire movie* converted and transferred to a memory chip to be watched on the phone.

Though we previously mentioned lack of privacy as a barrier to be overcome, we also saw evidence that the phone can provide privacy. Those same labourers, who live in a communal situation, benefitted in this way. One said:

> Televison like if you watch all of them in bigger screen it disturbs for every person who is sleeping.

The phone allowed them to access the entertainment of their choice without disturbing their bunkmates. Another participant, whose living situation entailed a family of four living in two small rooms, described taking his phone to a

private spot to watch videos when home life became too hectic:

> There is no place in the house since it is very small house …. Outside the house there is a stone and I will watch the video [there].

Frequent power cuts are another unfortunate feature of Bangalore. Several participants reported turning to the phone for entertainment when the power went out.

In summary, one can see why the desire to be entertained is expressed so strongly through the multimedia phone. Phones can provide entertainment anywhere, anytime, in public or in private, irrespective of unreliable infrastructure, and at little or no recurring cost. Stepping even further back, one also appreciates just how strong the desire to be entertained really is, having motivated the construction of such an elaborate ecosystem in the midst of considerable scarcity.

DISCUSSION

At this point, we return to the topics for discussion we raised at the outset of this paper.

First is the notion, suggested by our findings, that *motivation appears to trump social, technical, and environmental obstacles* to adoption of a new technology – particularly relevant to HCI is that complex UIs can be mastered by undereducated users. Several previous studies conclude that some systems are infeasible due to UI barriers lesser than that for Bluetooth file transfer [10,18]. While direct comparisons between projects in different contexts should be made only with caution, it is easy to imagine similar studies condemning Bluetooth file transfer as an unsuitable technology due to interface complexity. Yet, video exchange thrives in spite of the UI complexity.

The relative informality of the sharing system should also be noted here. It is not as though the basic motivation of entertainment was coaxed and cajoled toward Bluetooth media sharing by powerful promotional forces. Quite the opposite is true. During our 9 weeks in the field, we saw no mention of Bluetooth media sharing whatsoever from any official source, despite the constant barrage of advertisements and promotional offers from mobile service providers and other sources. While this is perhaps not surprising, since nobody but small-scale mobile shops stand to profit from the practice, it is further evidence that the entertainment motivation alone was responsible for this phenomenon.

Our second, related, point is that *developing regions are capable of embracing and building on sophisticated use of ICTs*. Perhaps the best evidence of this is the grassroots innovation we observed within the system. Examples include opportunistic use of hours spent working side-by-side on construction jobs to complete large transfers; swapping of memory chips and use of phone memory as a temporary buffer to avoid long transfer times; and the transfer of entire Bollywood films to mobile phones to be watched in cramped sleeping quarters. Moreover, these innovations were due to some of our lowest-status participants: construction labourers and housekeeping staff.

Our study is also evidence that this adoption can occur on a large scale. Although we do not yet have large-scale quantitative data, anecdotal evidence from three other metropolitan areas in India point to Bluetooth sharing being a widespread phenomenon, spanning several social classes and demographics. Though experience with Bluetooth sharing was not a prerequisite for participation in our study, fully *all* of our participants whose phones were capable of it had engaged in the practice to some degree. Aside from the findings reported here, we also draw on our collective experiences in other parts of India, including urban Mumbai and Delhi, and peri-urban areas of Tamil Nadu, in making this claim.

It should also be noted that this system is not necessarily an instance of 'leapfrogging', in which Indian users have somehow skipped ahead of those in the developed economies by watching and sharing videos on their mobile phones. To the contrary, the majority of mobile media in the developed world seems destined to be downloaded over unlimited wireless data connections. Instead, the system we have observed represents a unique response to the socioeconomic realities of urban India.

The third point for discussion calls for a *reflection on the concept of 'needs' in the context of development*. An interesting thought experiment here would be to imagine what kinds of need-oriented uses might have been envisioned for this technology by development experts. Language learning classes? Health information videos? Community media initiatives? We can say with confidence that each of these programs would indeed be beneficial to many of our participants. But we ask: Would any of these applications, noble as they are, have brought about the system we have described? In the event that they didn't, would the familiar cast of barriers have been used to rationalize the disappointment?

This is certainly not to say that development experts are never aware that the services they are offer may not be considered highly desirable by the intended recipients. In other words, we acknowledge that people from all walks of life sometimes prioritize short-term gratification ('desires') over long-term prudence ('needs'). On the other hand, we suggest that the perception of this reality as something to be rectified itself carries certain value judgments which are not necessarily universal. But the thorny philosophical dichotomies of needs vs. desires, utility vs. freedom, and so on, go far beyond the scope of this paper. Our point is merely that the complexity of technology should not be automatically blamed when adoption happens to fail.

A constructive corollary to this discussion is the notion that development practitioners and researchers could consider piggybacking on powerful motivations like entertainment in service of their goals. This has been attempted before with

traditional forms of entertainment, such as theatre [15]. We suggest that the mobile phone, and more specifically the highly developed infrastructure we have described, offer the potential for an electronic equivalent.

ACKNOWLEDGEMENTS

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