Mobiles, Music, and Materiality

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ABSTRACT

Building on recent HCI contributions that assert the materiality of digital information, we examine the material nature of digital media and information technology in the context of mobile music production, reproduction, and reception in rural and semi-urban India. We use ethnographic methods to study the recent adoption and use of mobile technology and discuss our findings in relation to the evolving materiality of music. We also investigate the sociotechnical configurations that emerge as a consequence of this materiality. Thus we contribute to HCI research by showing how the material representations of digital media affect the interactions of humans with technology.

Author Keywords

Materiality; Music; Mobile; Media; HCI4D; ICTD

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms

Human Factors

INTRODUCTION

We live in an age where it is commonplace to talk of information in terms of its immateriality. Recent human-computer interaction (HCI) research has been working on correcting this notion and exposing this *trope of immateriality* [1] by establishing that digital media cannot be stripped of its materiality because of the material constraints that underlie computing infrastructure. Dourish asserts the need for studies of materiality of information and information technologies to engage with the specifics of different properties, representations, and materialities of digital information itself, bringing these materialities to the center of investigation [2]. In this paper, we engage with the materiality of digital media, examining the "*aspects*" and "*effects*" of this materiality [3], and aligning ourselves with the recent shift in HCI from conversations about *materials* to discussions of *materiality*.

Materiality, as an analytic concept, has informed research in a list of domains, including interaction design, energy and sustainability, craft, etc. [5][6][7]. Its analysis holds important consequences for the field of HCI, as it draws attention to the specificities of digital culture, shaping the development of digital media and information technology, and how we frame and interpret the social contexts of their assembly and use. In this paper, we aim for a deeper understanding of the "*potentialities and constraints*" of the materiality of digital media, particularly in the context of emerging mobile music practices [2].

Our ethnographic findings from small town India show that the mobile phone is different from the media that preceded it for music consumption, primarily because its *affordances* [8] are many, as compared to other entertainment devices that have been dedicated music playback devices. Due to increasing affordability of multimedia-enabled phones and voice/data plans and wider penetration of mobile coverage, the mobile phone has quickly become the most prevalent digital music device in the infrastructure-challenged resource-constrained communities we study [13]. This is notably different from the western world where the Internet became prevalent before the mobile phone. A significant contribution of this paper is to draw attention to the material nature of this mobile phone and its impact on music procurement, consumption, and sharing practices.

Magaudda argues that while changes have occurred in music materialities and technologies have influenced practices of music consumption, "interpreting these changes as a loss of relevance in the role of material objects in shaping people's habits and cultures may be misleading" [4]. Building on his work, we discuss aspects of the changing materiality of music and its consequences on music production, reproduction, and reception in small town India. We also describe the sociotechnical configurations that arise from this change in materiality.

The rest of this paper is organized as follows. We first summarize prior research that informs our study, then describing our research methodology and the field sites we visited. Next, we draw attention to the materiality of music production, reproduction, and reception, describing relevant mobile practices in the context of our ethnography. We then describe the sociotechnical configurations – the *download market* and its related practices – that have resulted from

this materiality of digital media, before we discuss and summarize our findings.

BACKGROUND AND RELATED WORK

"We wake up to radio sounds, walk to music, drive to sound and often relax and go to sleep accompanied by reproduced sound. Music follows us to work and is there when we shop, when we visit pubs, clubs and theme parks. Yet despite this routinisation of sound in consumer culture, it retains a largely 'utopian' place in consumer desire [9]."

Bull has investigated the culture of mobile listening through the lens of the iPod, showing how the micro-management of personalized music gives users control over their "experience of time and space" [10]. Magaudda extends this work by establishing the material nature of music, using iPod adoption among Italian users as a case study [4]. We build on Magaudda's work by studying the changing materiality of music in the context of mobile phone use in developing regions. Using the production, reproduction, and reception of music in small town India as a case in context, we aim to provide the field of HCI with a better understanding of the advantages and limitations of the materiality of digital media.

Recent HCI research brings questions about the materiality of digital information to the forefront. These efforts include Blanchette's analysis of the materiality of bits [1], Dourish and Mazmanian's framework [2] that allows us to examine the potentiality and constraints of materiality, and Sundstrom et al.'s study of dynamic properties of digital materials [5]. Burrell's discussion of the *aspects* and *effects* of the material nature of digital technology also informs our work [3]. Drawing from these works, we contribute to an understanding of the materiality of digital representation of musical bits.

In performing a user-centered analysis of the materiality of the mobile phone as a medium for procuring, consuming, and sharing music, we draw attention to Gaver's definition of *affordances* [8], wherein the actual perception of affordances is "determined in part by the observer's culture, social setting, experience and intentions" to examine the aspects of the mobile phone that enable the music practices we study. Also relevant to our work is the idea of cultural constraints and conventions introduced by Norman [12]. Our use of ethnographic methods enables us to gain deeper insight into these affordances.

The sociotechnical configurations we investigate – that result from the materiality of digital music – have also been empirically explored by Smyth et al. [14] who study the role of entertainment as a motivator of technology adoption and in our prior work [15] where we examine piracy in the context of live and recorded folk music in India. We confirm these findings and extend this research to include both music and aspects of music consumption previously unexamined. We also draw attention to specific affordances of the mobile phone that have enabled a unique set of

listening and sharing practices. Having used the same field sites as in [15] owing to a long-term ethnographic engagement, we build on prior work and provide a more complete (and updated) examination of the local media practices, shifting focus to mobile affordances that impact consumption.

In addition, our work contributes to a growing body of ethnographic literature on mobile phone adoption and use in the developing world. This includes Donner's study of social uses of the mobile [16], Rangaswamy et al.'s study of the mobile phone store ecology in a Mumbai slum [17], and Sey's study of mobile phone adoption in Ghana [18], among other initiatives in the field of Information and Communication Technology and Development (ICTD).

METHODOLOGY

This paper presents findings from a set of semi-structured interviews, sessions of participant observation and group discussion, and mobile phone data collected at two field sites in North India. Our data was collected in multiple installments from 2011 to 2012, as part of an ongoing ethnographic engagement.

Our sites were selected for two reasons. First, they have both had a rich culture of listening to and sharing live and recorded music. Second, like much of India, they have experienced a rapid increase in the adoption and use of mobile phones, leading to a bustling *downloads industry* centered on the sales and distribution of various mobile media including songs, movies, wallpapers, and ringtones.

Participants and Field Sites

At each of our field sites, we sought two kinds of informants: music consumers in the age group 18-35 and *download operators* – individuals operating businesses that entail mobile phone sales, balance recharges, media downloads, application downloads, repairs, and other mobile-related services. In addition, we interviewed community members who have been engaged for several years with the local music industry and are informed of evolving trends in the consumption of digital media.

We visited 6 mobile shops at each site, targeting mobile hubs, and had detailed conversations with their shopkeepers and assistants (1-3 in every shop). For this paper, we draw from our interviews with 20 music listeners[1] (10 from each site) and 6 local music experts (3 from each site).

Maksi (Madhya Pradesh)

Maksi is a small rural town in the region of Malwa in western Madhya Pradesh. It lies within a network of

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[1] Participants were selected via snowball sampling, tapping into existing social ties to obtain access to youth from a common socio-economic and cultural background. In a snowball sampling approach, participant A leads us to participants B and C, who in turn lead us to participants D, E, and F, and so on.

villages that have cultivated a rich tradition of live folk music for generations. We conducted our fieldwork in two villages a short distance from Maksi. The community here is primarily agricultural, and literacy rates hover around 40% [17]. As in the rest of India, there is considerable mobile penetration. There are also 30 shops, located in every street corner of Maksi, that address all mobile needs.

Bikaner (Rajasthan)
Bikaner is a small semi-urban district in the northwest of Rajasthan that enjoys a wide listenership of music. One of the local music experts we interviewed estimated that Bikaner now has 3000 mobile download shops. He also claimed that every adult in Bikaner, rich or poor, owns a mobile phone. Access to technologies such as laptops, computers, and the Internet in general is much greater here. Literacy and awareness of technology are also higher than in Maksi. Professional backgrounds are more varied, as we found among our study participants. The socio-economic backgrounds of our Bikaner participants were somewhat better than those of our Maksi participants; they were relatively low-income in both cases.

Qualitative Methods
Our interviews were semi-structured, and lasted around an hour on average. Most were held one-on-one, although other individuals would frequently saunter in to see what was going on – especially when we were in the marketplace. This sometimes led to rich group discussions, though it also tended to discourage the quieter participants from openly sharing their inputs. Interviews with our music listeners took place in their homes or the homes of their friends. Our intention was to seek out adults who used multimedia-enabled phones (we did not focus on a younger population for it is yet to acquire personal mobile phones) but all the users we came across fulfilled that criteria. The language of mediation for all interviews was Hindi. No translation or interpretation was necessary since the first author is a native speaker.

We also observed the marketplace to better understand the transactions occurring within the shops we visited, as well as the clientele and the kinds of needs/demands they came with. These led to informative exchanges and enhanced the richness of the data we collected.

Without controlling for gender, all our participants ended up being male. This arose from various cultural and social norms in our sites, effectively preventing us from access to women unless we actively sought them out. For the purpose of this study, we chose not to specifically target women, though in future work we would like to examine women's ownership of multimedia-enabled mobiles and if there exists a gender bias in the consumption of digital content.

Emergent Themes
The interviews we conducted were transcribed and translated to English (by the first author). We then performed several iterations of coding to distill themes of

interest, analyzing and interpreting our data on the basis of a grounded theory approach [19]. Our focus was on understanding the changing practices of production and consumption of digital media in Maksi and Bikaner and how these are increasingly being mediated by the multimedia-enabled mobile phone.

FINDINGS
We now examine the evolving materiality of music in its *production*, *reproduction*, and *reception*[2], following that with a discussion of the sociotechnical configurations that result from this materiality.

The Materiality of Music Production
Magaudda [4] has shown that digital music cannot be separated from its material form. Building on this work, we first briefly present how this material form has evolved in the context of our ethnography, then discuss the effects of this materiality on current practices of production and reproduction of digital music. We draw from discussions with local music industry veterans who have been in this production for years, operating or assisting at local studios.

"First, it was the cassette…"
Maheshji, whose family has owned a local recording studio for over 40 years, reminisced:

"People used to buy cassettes, listen to good *music."*

He remembered the audio cassette era as the "golden era" of popular music when piracy did exist but was minimal (particularly because copying cassettes took more time and was thus cost-intensive), the efforts of local recording companies and studios were recognized and remunerated, and artists received the credit and royalty that was due. Manuel's account also credits the audio cassette for greater and wider consumption of regional music forms as well as Bollywood soundtracks in North India [22]. He verifies that people did indeed buy cassettes widely, as Maheshji claimed, because it was the first time this music was available to them at a reasonable cost.

It was after the entry of the compact disc (CD) (in '92-'94) that Maheshji believes the commercialization of music began. Pirated distribution first became commonplace primarily due to the price difference of an original CD and of (re)recording on a blank CD. While original CDs would cost INR 300-400 (USD 6-8), they could be reproduced for INR 20 (USD 0.40). The transition from audio CDs to MP3

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[2] We draw inspiration from Benjamin's historical work on the mechanical reproduction of art [23] where he quotes Valery thus: *"Just as water, gas, and electricity are brought into our houses from far off to satisfy our needs in response to a minimal effort, so we shall be supplied with visual or auditory images, which will appear and disappear at a simple movement of the hand, hardly more than a sign."*

CDs that followed made several more songs available on a CD and at the same cost. As Maheshji said: *"Earlier a CD would have 8 songs. Now it has 800."*

Though the market for CDs has certainly suffered, we found that regional production and sales of CDs continue. The large urban centers of Jaipur and Jodhpur still have markets that produce and package original CDs with regional and Bollywood content that are then transported to Bikaner and sold. The number of shops selling those CDs in Bikaner, however, has gone down from *"100 to 10-15"* we were told by Maheshji. He explained:

"If I try to sell one [original] CD today, it will reach 100 computer shops tomorrow and they will load this on to at least a 1000 [memory] cards by the end of tomorrow. How can one shop compete with that? The guy who makes pirated CDs – he will take this CD and copy it into 2000 pirated CDs. ... We are small hens. They [the pirates] haven't spared anyone. Computer is the main reason. Computer has become so cheap."

The transition that Maheshji highlights above of the material form from the audio cassette to the audio CD to the MP3 CD and finally to electronic storage has increasingly made music accessible and affordable to the masses, both because of the speed *and* the cost at which music can now be reproduced, thanks to the "computer." The most notable contribution in this vein, however, is that of the multimedia-enabled phone. Maheshji attributes the decline of the local music industry to the "mobile storm" and the proliferation of the cheap but powerful memory card:

"When mobiles began, things were fine. But when the mobile got a memory card, music production began to decline. Now the [original] market has come down to 10% of what it was originally, because of this memory card…."

In other accounts that we heard, the story was no different. Here we found that the changing material nature of music storage had effected a significant historic change for the local music industry. Maheshji's business practice is now limited to providing DJ services at local events. His shop was filled with CDs that no longer sell, and his recording studio services are availed of by only a handful of artists a year. Indeed his shop is not the only one where stacks of CDs and audio cassettes have been gathering dust. Ramesh, another studio owner we spoke to vehemently expressed his resentment by lashing out at the memory card:

"The memory card must be stopped!"

Here we see an instance of the "information metaphor" mentioned in [2]. Ramesh's resentment was not for the memory card itself, but metaphorically directed towards the form that the music industry has taken today, resulting in the decline of his business [2].

"Everything is on 'track'"
Not only does computing technology allow almost effortless reproduction of digital music, it has also enabled

an increase in the sheer quantity of music produced. The process of writing songs and arranging music has become more 'streamlined' with the use of synthesized 'tracks'. A process that would earlier involve time-consuming and painstaking collaboration efforts of up to hundreds of instrumentalists sometimes, the writer(s), and the singer(s), is now considerably simplified. The recording artist puts together a synthesized background track, obtains a written composition from an artist, and recruits a singer to render this composition over the provided track. The recording studio now invests much less time per song, incurs lower costs on vocalists and instrumentalists, and deals with fewer scheduling conflicts. In our fieldwork, as we listened to numerous such musical productions, we also discovered the process of *auto-tuning*. To glorify the quality of sound from a less accomplished artist or to hide his/her inadequacies as a singer, the vocals are synthesized into sounding warped, for lack of a better word. The impact of the "computer" is visible here as well.

Mohit, a 38-year-old local music enthusiast, who has worked for several years at recording studios in Bikaner, Delhi, and Mumbai spoke of this change with remorse:

"So much labor has gone, so much machinery has gone… So many people used to be employed. Now all that is gone. Earlier an audio cassette or CD would go from the original HMV [music company] to the original listener – like it used to come to me. Now why will I buy a cassette or CD?"

Mohit refers here to the lowered cost of digital music arrangement, as another effect of the changing materiality of music production. He views the originality of a musical work as compromised due to its low-cost production.

Music Theft
Even with the reportedly streamlined production, however, we discovered that original compositions are routinely lifted and reproduced. Once again, the ease of doing this overnight at low-cost has a major role to play. Thus, the materiality of digital music contributes towards music theft as well. Amit, a 31-year-old male and local recording artist who is well networked with local writers and singers, shared:

"Like we record a composition… tomorrow morning it will become public. If I am in the process of making a recording, someone else will leak my composition. Then they will make a copy of that recording and take it out in the market. This has happened numerous times in Bikaner… if we don't finish our production and sell quickly, it will be too late."

It is not only the ease of copying from the perspective of the material medium, but also the lengthy and tedious nature of the judicial process that plays a role. Most court cases around the infringement of intellectual property rights, we were told by the local businesses, are yet to reach conclusion. "There is no enforcement against this activity," Amit said, "and when court cases happen, they go on

forever. *There is no resolution.* Only those who have money or power can speed things up." The judicial process has yet to catch up with the demands that the changing materiality imposes on it.

The Materiality of Music Reception

To better understand the materiality of music reception, we focus first on the medium that our respondents use for listening to recorded music – the ubiquitous multimedia-enabled mobile phone. We highlight both the *aspects* of the material nature of the mobile phone and its *effects* on music reception.

The Multimedia Mobile Phone

As we mentioned, the mobile phone has replaced audio cassettes and CDs for music listening, particularly with the proliferation of the "memory card". We also summarized recent research efforts that focus on the adoption of mobile technologies in developing regions and the socio-economic motivations underlying this adoption as multimedia-enabled feature phones become more affordable and increasingly ubiquitous. Each of our respondents had one, and on being asked their motivations for acquiring this device, we received two responses – first, to listen to (and store) music on their personal device, and second, because their friends had one (and used it for listening to music). In the accounts below, we highlight the materiality of mobile media in relation to consumption, storage, and sharing.

Shyam, a 23-year-old working with a Bikaner-based non-governmental organization shared that he had never owned a music playback device before, and first bought a multimedia-enabled phone because it could store (and play) songs of his choice. When his friends began to play games on their phones, he had games downloaded on it as well. His phone, however, would not play songs at the same time that he played games, so he bought a new multimedia phone that would allow him to play music and games simultaneously. About listening to music, he said:

"There should be this much [using hand gestures to indicate a large quantity] music in the mobile. Whether we listen to it or not doesn't matter. That comes later ... When the mobile is brand new, then we want to use it all the time. All my friends feel this way…."

For Shyam and his friends (whom we interviewed by snowball sampling), mobile phone use is closely linked with the listening experience. While making phone calls costs money, they can use the phone to listen to music for as long as they desire. For these youth from low-income backgrounds, this affordance [2] of the mobile phone is significant and a key aspect of the phone. It also motivates the choice of phone to purchase, as in the case of Rajiv, a 27-year-old male from Bikaner. He bought a Nokia 5200 – a phone with single-touch music playback - because he "had no other medium for listening to music." Suresh, 32 years old with two kids, does own a CD player, but he bought a multimedia mobile phone because it was easier to operate this for music (in terms of storage and playback). He likes to store both film music as well as music locally produced in Bikaner particularly for his children's entertainment.

"My children like the popular film songs such as Munni and Sheila... *so I keep these on my mobile. They also listen to the devotional and folk songs that I listen to. ... We also have a CD player, but this [mobile playback] is the easiest thing to do. Because it is easy, it is best. Even children can find and play music on this. It is an easy medium."*

For Prakash, 22 years old and a resident of Maksi, the multimedia mobile phone is a "*jeb ka laddoo*" – 'candy in the pocket' since "you can keep your favorite songs in your pocket and, whenever you like, take out your phone and listen to them." For villagers, the portability of music and ready access are key affordances, since they allow farmers to listen to music while they are at work in their farms or traveling to sell their produce. The fact that these battery-powered phones are (at least in the short-term) immune to the frequent power cuts or lack of domestic power supply in rural areas makes them more reliable (*and* popular) than other traditional entertainment devices such as the CD player or the television. According to Prakash:

"Those who are from the village consider their mobile ready for use only after they have gotten a [music] download. That is when they believe that their mobile is complete. They do not leave the [mobile] shop otherwise."

In addition to stressing the close linkage of the mobile phone to digital music reception, each of the above accounts also emphasizes the materiality of this experience. In Shyam's case we see that mobile acquisition is closely linked with music acquisition, and the more attractive the mobile, the more attractive is the exercise of listening to music. Rajiv purchased a mobile phone that was heavily advertised as a music-listening device. Suresh was influenced by how easily his kids were able to use the mobile phone interface for listening to music. Prakash values the portability of this personal battery-powered entertainment device.

In line with our observations, Prakash also told us that in the villages, Chinese phones are commonly used. These phones come without warranty, are notorious for breaking down within months of their purchase, and are therefore cheaper. However, a critical factor that feeds their popularity is their speakers. According to Prakash, "these phones have 8-10 speakers on them… they are loud enough for the whole village." He went on to add that it was common for him or his friends to direct verbal abuse at someone by calling them a "China mobile" if they came across as too loud or obnoxious [2].

Here we also see a reference to the practice of listening collectively to music. On the one hand, as Bull reports in [10], the phone offers its owner personalized control over where and when one listens to music (on the move, in

gatherings with friends, at home over dinner, just before going to bed). On the other hand, it allows the user a collective listening experience with friends and/or family. This affordance allows our users to simulate the gatherings that they typically congregate in to listen to live music performances, as we saw in [15].

Sharing Practices

In addition to allowing these shared listening experiences, the material nature of mobile media also impacts sharing practices. As reported in [14], Bluetooth transfers and exchanges are conducted frequently to obtain music and other multimedia content from friends, and occasionally strangers. Sandeep, a 27-year-old in Bikaner who collects and listens to music on his mobile extensively, shared:

"The biggest thing about the mobile is Bluetooth. 'Give and take' takes place seamlessly and all the time. Everyone knows Bluetooth. If someone asks me for a song, it is up to me to decide if I want to give it to him or not. If I want something from him, I will give him the song he wants."

Another young adult from Bikaner shared his experience with conducting music transfers:

"I often go to the market. People come to these shops when I am sitting there. People are very fond of music. It plays all the time. If I hear something and think 'this is a good song,' then I say 'friend, give it to me.' He gives it to me via Bluetooth. ... Whoever has multimedia has Bluetooth. If they don't know how to use it, I take it and teach them how to do a transfer."

In the traditional case of cassettes and CDs, 'give' and 'take' would involve a physical exchange. Something would have to be lost in the process, by one or both parties. With the digital representation of mobile media, however, the giver does not lose while the taker still gains. As long as a single party is aware of the mechanism of conducting a transfer, songs can be transferred seamlessly and without a financial cost. The material nature of the music file makes its presence felt when the size of the file is large enough to take more than a few seconds to transfer, but with songs/song videos, this is almost never the case.

Quality vs. Quantity

The size of the music file and its infinitely reproducible representation in bits can matter when it comes to building a personalized collection of music, which according to Bull's study [10] is a considerable affordance of a mobile listening device. The ubiquitous nature of the multimedia phone as well as the ubiquitous desire to load this phone with digital music, both ease the task of building a personalized collection. With the near-zero cost of digital reproduction and the seamless process of conducting Bluetooth transfers, there is a race among users to build the best, most current, most eclectic mobile music collection within their social circle. Vijay, 24 years old from Bikaner, has a great passion for music – but more than listening, he enjoys collecting music (stored on his 4GB memory card),

because his current job doesn't give him the time to listen to music as he "once used to have". We heard several accounts where, while the consumption of music would wane with the excitement of owning a mobile music device, there remained a desire to own large libraries of songs. Somesh – a download operator in Maksi – claimed that villagers are wont to compete with each other over the number of songs they have: "Even if they listen only to 2, they want hundreds in the phone." He stated a typical exchange as follows:

Villager #1: "What do you have on your mobile?"
*Villager #2: "I have **300** songs on my mobile!"*
*Villager #3: "That's it? I have **600** songs on mine!"*

Somesh's customers prefer low-quality MP3s and low-resolution 3GP videos to high quality MP4 files so they can cram more content onto their memory cards, exhibiting thus an awareness of the material form of this music and the fact that it occupies space, which is in limited supply. Here we confirm the findings of Oeldorf-Hirsch et al. who show in [11] that users are indeed willing to compromise on quality for quantity.

"Too Much. Enough."

We saw that the acquisition of large media libraries may have little to do with the frequency of listening. We found that it has little to do with the appreciation of music as well. Although recorded music has never before been as widely affordable and accessible, appreciation for it is said to be suffering. With ready access to Bollywood film music, listeners are eager to obtain the latest soundtrack on their phones and listen to its songs on repeat until the next major soundtrack is released (typically within a week, we were told). We heard from several of our respondents that the "life of music" has gone down. Maheshji said it has become *"too much… enough."* He spoke of the obliteration of the singer's identity, as listeners focus on the music alone. He asked us:

"Have you heard the song Munni Badnaam Hui? *Do you know who sang it? The song is the biggest hit of the year, but ask anyone – no one knows who sang it. (Even I don't know who sang it.)"*

New soundtracks are released at a pace that makes it hard for listeners to keep track of the singers or the album. This was reflected also in the obscure filenames that we found, while conducting a survey of mobile phone data to see what kind of mobile media was being consumed, e.g. "j.mp3", "djmazaa.mp3", etc. "With so many new songs available every week, " Maheshji said, "only a few songs become popular… *others flow away like rainwater."*

Rajan, a download operator in Maksi, laughed at us when we asked him if his customers voiced an interest in knowing whose music they were listening to. He told us that his customers were either illiterate or ignorant by choice: "Either they don't know how to read, or they don't

want to read." According to him, they only listened to the music (going from "next song to next song to next") and did not care to identify the singer or album. Music, according to Rajan, is a "thing to use and forget, not a work of art anymore." This lessened appreciation for music in the mobile age came across to us as one of the notable consequences of its material form.

Common Perceptions

Having discussed the wide affordability and accessibility of digital music, we now shift our focus to the perceptions of our respondents about the proliferation of this music and their understanding of 'piracy', both in the context of physical media such as audio cassettes and CDs *and* in the context of non-physical digital media. While they had no trouble answering what the piracy of cassettes and CDs meant, the piracy of digital media was a grey area for many and often those who were consuming pirated content were not aware that they were doing so.

Our respondents had a strong association between piracy and "poor quality" (whereas pirated digital media is commonly of high-quality as well). This association may have stemmed from the fact that "cheaper" is typically associated with "poor quality" and pirated music is cheaper. Below is a conversation we had with Yogesh – a 20-year-old avid music listener in Bikaner:

Q: "What do you think piracy is?"
A: "What I like to hear... the quality is really poor."
Q: "How do you get good quality, then?"
A: "Filter out. I listen to 10 [duplicate] songs. If I don't like the quality of something I want, I buy the original."
Q: "Is the original available?"
A: "Yes. Sometimes. But in very few places and much less than before."

From Yogesh's account we also note that while the availability of *low-quality* recordings has gone up, the available of *high-quality* recordings has gone down. Original versions were always more expensive, but they often also occupy more storage space. By reducing the sampling rate, download operators such as Sonesh are able to (store and) sell more music. Original copies of CDs, DVDs and other content are no longer available in these non-urban, more remote parts of India.

Using GPRS for free music downloads appeared to create more confusion, we found. Mukesh, 23-years-old, one of the few GPRS users in the village of Luniyakhedi (near Maksi), believed that he was paying for all the music he downloaded online. Mukesh's understanding was that since he paid his GPRS provider a monthly fee for accessing 1GB of downloaded data, it was the provider's "responsibility to pay the Internet" for the songs he downloaded up to 1GB:

"They [the Internet provider] should pay for the songs since I am using the Internet through them."

Another common perception emerging from the materiality of mobile media was with regards to the emission of "radioactive rays" from the mobile phone, which affect the brain. Several of our respondents believed that the prolonged use of the mobile phone (whether for talking or for listening to music) affected the natural environment as well:

"The waves are not eliminated, nor are they destroyed. They keep circling in the atmosphere. The practice of listening to music on the mobile generates sound pollution. ... Earlier, we could hear the birds chirping. The chirping has gone down a lot. There used to be a small bird – Gauraiya. *It is disappearing day by day due to these mobile radioactive emissions."*

THE DOWNLOAD MARKET

We have examined the role of the mobile phone in the current practice of music production, reproduction, and reception. We now turn our attention to the sociotechnical configurations that result. Having talked about the mobile medium, its affordances, adoption, and use, we now discuss the *download economy* that has emerged as a consequence of the changing materiality of recorded music.

The Jain Market in Bikaner, also widely recognized as the *download market*, lies just outside the old city walls. It is comprised of a two-storied building, with one long corridor of shops on both levels. At the entrance off the main street, one set of stairs leads to the upper level while the other goes down to the lower level. Each of these levels houses around 20-30 full-length multi-purpose shops selling hardware, shoes, clothes, etc. while the walkway in-between is occupied by a series of portable chairs and tables. These are for the *download operators* (as they are popularly called) who pay the shop-owners approximately INR 250-400[3] (USD 5-8) on a daily basis to set up their laptops and run their temporary businesses outside these permanent shops.

From 11am to 8pm, Jain Market remains loud and congested. It is filled with customers – from Bikaner as well as around 20 neighboring villages, whose residents are easy to identify in their traditional white farmers' garb. This market is the local hub for mobile phone purchase and repairs, and also for obtaining *downloads* of audio/video content, wallpaper images, games, software, etc. onto mobile phone memory cards. The makeshift arrangements and small daily fee are indicative of the minimal overhead required to set up this business. Download operators do not have the same set-up daily, and at any given time, only around half of them may be present. Several of them are students, pursuing correspondence courses and conducting this business on the side. In the past there has been some police trouble due to sudden raids looking into illegal operations (such as their pirate practice). As a result, the

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[3] Those who are located closest to the entrance pay INR 400, while those farthest from the entrance pay INR 250.

mere hint of a police officer in the vicinity is enough to make the tables and chairs quickly disappear. The operators are gone without a trace and the download economy appears not to exist.

Prior examination of similar mobile download practices in Indian markets [14][15] discusses the manner in which customers purchase memory card downloads of pirated content from the operators. In Bikaner and Maksi, this business has been around for 5-7 years, catering to an ever-expanding local mobile phone customer base. At one of the Jain Market businesses we visited, the owner succinctly expressed the rising popularity of this marketplace:

"The price of mobiles has gone down, so the customers have gone up. Earlier memory card phones were too expensive. Now all phones have a memory card."

The demand for entertainment media thus continues to rise. On the supply side, there are more download operators today than ever before. Even in a nondescript rural town like Maksi, the number has tripled (from 10 in 2009 to 30 in 2012). With increased competition among the suppliers, prices have also dropped considerably. The operator who used to charge INR 80-100 (USD 1.6-2) per GB in 2009 now charges INR 30-40 per GB (USD 0.6-0.8).

Specialization of Roles

We briefly discuss the factors that enable this download economy from the perspective of the suppliers of this media. The music collection that the download operators base their businesses on must be procured, stored, transferred to memory cards, and also augmented. Here we add to the findings reported earlier in [14][15].

Almost all download operators we interviewed – in Bikaner and Maksi – have access to a wide variety of multimedia content. While earlier, the major operators would obtain their multimedia libraries from content suppliers in nearby cities [15], easier and affordable Internet access has enabled them to obtain more of their libraries through online downloads (although regional content is still primarily procured through CDs produced and sold locally). Those operating on a smaller scale (e.g. out of their homes with a laptop) continue to source libraries from larger businesses operated by friends or family.

Rahul is 34 years old and was one of the first adopters of a mobile phone in his village, approximately 10 years ago. He comes from an educated and relatively affluent background (his home is the only concrete, or *pukka,* house in the village), and has keenly followed the growth of the mobile market. He believes that the skills required to operate a mobile downloads business are minimal:

"50% of the download operators [in Maksi] don't know how to download anything; don't know how to put software in phones. Different mobile phones have different formats. There is an anti-virus software for the mobile. There are many more softwares. They don't know all these details."

Despite the lack of knowledge, however, they are reportedly successful in operating their business. In addition, they are quickly learning – for there is a rise in the number of courses being offered on mobile downloads and repairs (we found posters to this effect plastered all over the market areas of Maksi and Bikaner), and these appear to be the gateways for most operators into this market. Rajesh, an operator in Maksi, shared the history of his shop with us:

"First we sold SIMs. Then we sold balance. Then mobiles entered the [local] market, so we started selling mobiles. My brother went to Ujjain for a year's training to learn how to do mobile repairs. He got a diploma. Then we expanded our mobile business."

What lies ahead?

Several download operators were of the opinion that the mobile downloads business had peaked, not because the demand for recorded music had suffered, they said, but because consumers were now able to find cheaper means to meet their media needs, for "the net is everywhere." As GPRS becomes ubiquitous and data plans continue to lower their prices, more and more users will be able to access the Internet on their mobile phones. Not only, numerous Mobile Value Added Services (MVAS) aim to cater to the growing demand for mobile media with innovative business plans that target the low-income consumer. Solanki, a 23-year-old download operator in Bikaner said:

"In the last one year, the market of downloads has gone to half. Company is giving 3G, so you can access the net and download songs from there."

Although it is rare at present to find mobile Internet users in the income group we looked at, the number is steadily rising. The mobile phone is increasingly becoming the youth's gateway to the Internet. We mentioned Mukesh from Luniyakhedi who downloads music from various online sources. An advantage that stems from Internet downloads is that listeners find themselves empowered to select the music they wish to own, while download operators often impose their own assortments on their customers. Suresh – a 27-year old male who regularly listens to music on his mobile phone – told us about his transition to the Internet:

"When I first got a memory card, I got a [music] download at the shop. It was a 1GB card. He [the operator] filled up the card according to his whim. 75-80% of the songs were useless. I hit delete-delete-delete. Then later, I got a computer, I got the net installed. Now I can get the songs I want on my phone."

The majority of our respondents, however, still found the process of conducting their own mobile downloads a challenge, such as 32-year old Vinay in Bikaner, who goes to Magna Mobile (a rare permanent download shop) 2-3 times in a month. In addition to purchasing music, if there is a CD of a particular song he desires, e.g. a Rajasthani

folk song, he takes it to Magna Mobile and has it downloaded onto his mobile.

Music and Services

The download business is not about music provision alone. Other services are sometimes offered free of cost as well. A 70+ year-old customer we interviewed in a shop we visited in Maksi told us that Raju, the "boy" who ran the business was "good to him and resolved all his mobile related problems". Whether it was an accidentally activated caller tune[4], difficulty using the phone instrument, or the download of devotional music of his choice, Raju assisted the gentleman with all his mobile needs, allowing him to pay as he liked for this service. Indeed, in an increasingly competitive download market, improved customer service and carefully fostered relationships have become primary differentiators, particularly because the users we study are new adopters of technology, and lack the technological expertise that is becoming second nature to their urban counterparts. Ajay, a Maksi operator, shared his opinion:

"If we treat the customer well, ask them what they want, what they like, he/she will come back to us. Whatever the customer wants to know, we have to tell them. Whatever he wants to see, we have to show. This is how we increased our number of customers."

Legality and Enforcement

Having examined earlier how the listeners perceive piracy, we now look at piracy practice from the perspective of the distributors – a key aspect of the sociotechnical configuration that is a result of the evolving materiality of music. A mobile shop we visited in Bikaner had stopped dealing in downloads 6-7 months prior to our visit. The owner informed us that a recording company representative had visited them, demanding an arbitrary yearly flat fee of INR 10,000 (USD 250) if the shop sold any pirated copies of his company's songs. He added, "We cannot afford to pay such a large yearly sum to every recording company. It is better to quit this business." They focus now on mobile phone sales and repairs instead.

Police arrests of download operators do take place but are infrequent and done primarily with the intent of "creating a feeling of terror among the download operators," as we were told by Ramesh, who used to work for a download shop. He explained the phenomenon of "setting" that controls the dynamic between the cops and the operators:

"This 'setting' affair is intriguing. None of the download shops are doing legal business. Whenever the recording companies ask the local police to do a raid, the police and the download centers agree on some 'give and take' and 'set' the affair. An arrest takes place only when the operator does not agree on a deal with the police."

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[4] Caller tunes are activated by a person so that whoever calls him/her will get to hear this tune.

The larger, permanent shops (outside Jain Market in Bikaner) have an understanding or arrangement with the police that enables them to operate without fear. The Jain Market operators on the other hand, in their makeshift establishments (as described above), experience more arrests and court cases. We interviewed Raja – a download operator in Jain Market who shared with us the story of his arrest, court case, and acquittal. We summarize this below:

"A man came from the 'companies' and said he had been authorized to have me arrested in violation of the Copyright Act of India. He said the songs I was putting into the mobile from the Internet could not be used for commercial purposes. I was in jail for one night, then got bail. They did a court case on me. This was 11 months ago. In court, the judge asked the cop: 'Take out your mobile. Do you have songs on it?' Of course the cop did. The judge told the cop that he was a criminal too, and dismissed the case."

We use this example to illustrate, in closing, that mobile media distribution has such extensive reach that it is increasingly being accepted into the social fabric, circumventing legality. Moreover, in relatively remote sites, there is little compassion or understanding for losses incurred by distant recording companies.

DISCUSSION

While recent HCI efforts highlight the materiality of digital information, we extend this discourse with a discussion of the changing materiality of digital information by offering an ethnographic study of music practices in small town India. HCI research shows that it is important for designers and researchers to be sensitive to the affordances of the material. We stress, in addition, the importance of focusing on the affordances of varied media to understand how material differences impact cultural adoption and practice. For instance, digital reproduction enables the deliberate loss of information (by downsampling) in ways that analog media did not, and this affordance allows our study participants to support their social and aesthetic preferences as they pick quantity over quality, a tradeoff that was previously inaccessible to them. This becomes particularly relevant when we note that the material culture of music consumption and sharing in the West evolved differently, where widespread Internet preceded the memory card.

Our research aims also to further develop the analytic lens of materiality. Dourish and Mazmanian [1] have proposed five conceptualizations of the materiality of digital information – the material culture of digital goods, transformative materiality of digital networks, material conditions of IT production, consequential materiality of information metaphors, and materiality of information representation. Our findings fit these categories, but also show that the categories share blurred boundaries, and in fact continually act on one another. For instance, the economics of rural mobile phone coverage and the affordability of mobile devices make them increasingly ubiquitous, also leading them to acquire symbolic meaning

as social status indicators. This, in turn, leads to the emergence of particular metaphors (such as "China mobile"). Focusing not just on these categories in isolation, therefore, but actually observing how they relate to and build upon each other can be helpful for understanding sociotechnical phenomena and technology adoption, as we demonstrate with our research.

In underserved regions like ones we examine, where technology users are subject to various socioeconomic constraints, the materiality lens allows us to analyze their navigation of these constraints towards appropriating technology to address their needs. Our ethnography not only describes the music practices of individuals from these parts, but also highlights what these practices are not, in that they differ starkly from music practices in the West that the HCI domain has traditionally focused on, and focus on different affordances of the material. As the field of HCI4D grows, designers and researchers in the developed world stand to gain from exposure to work that emphasizes how different users and user preferences are in different parts of the globe. More attention to these differences will help us as HCI researchers veer away from traditional one-size-fits-all approaches and progress towards truly placing the user at the center of user-centered design.

CONCLUSION
Building on recent HCI research that seeks to expose the trope of immateriality and highlight the material nature of digital information, we examined the changing materiality of digital media and information technology in the context of mobile music production, reproduction, and reception in small town India. Through an ethnographic study of the recent adoption and use of mobile technology in this infrastructure-challenged terrain, we studied the *aspects* of the changing materiality of digital music, the *effects* of this materiality on media consumption and sharing practices, also investigating the sociotechnical configurations that result as a consequence.

ACKNOWLEDGMENTS

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