Ethnography of the telephone:
Changing uses of communication technology in village life

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ABSTRACT

While mobile HCI has encompassed a range of devices and systems, telephone calls on cellphones remain the most prevalent contemporary form of mobile technology use. In this paper we document ethnographic work studying a remote Mexican village's use of cellphones alongside conventional phones, shared phones and the Internet. While few homes in the village we studied have running water, many children have iPods and the Internet cafe in the closest town is heavily used to access YouTube, Wikipedia, and MSN messenger. Alongside cost, the Internet fits into the communication patterns and daily routines in a way that cellphones do not. We document the variety of communication strategies that balance cost, availability and complexity. Instead of finding that new technologies replace old, we find that different technologies co-exist, with fixed telephones co-existing with instant message, cellphones and shared community phones. The paper concludes by discussing how we can study mobile technology and design for settings defined by cost and infrastructure availability.

Author Keywords
Development, ethnography, telephony, Mexico

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms
Human Factors

INTRODUCTION

Mobile HCI encompasses a range of different technologies and applications, yet it is the mobile phone that has always been a central focus– both as a device in its own right, as well as a platform for deploying innovative software. Although recent research has focused on different applications that can run on mobile devices, there is a longstanding research interest in the role that the basic telephone itself plays, as a carrier of voice communication

[22, 26, 27]. Despite the prevalence of smartphones and advanced mobile phone functionality, phonecalls are still the key defining functionality for the majority of mobile phone use worldwide. Even in the United States in 2009 the number of mobile voice calls (2.26 trillion) exceeds the number of SMS messages (1.81 trillion), whereas so called 'smartphones' only account for 19% of global cellphone sales [2].

This paper explores the developing use of the telephones, and phone calls, over a three year period in a remote Mexican village. In Mexico, telecommunication companies hold stable monopolies with few incentives to offer a full range of services in rural areas [6]. Yet in more remote or resource-poor regions practices of voice communication are still evolving, as costs change and new technology changes how systems are used. Drawing on ethnographic data we describe how the mobile phone has come to be used alongside a range of other competing communication technologies. Much of the existing literature on communication in developing and intermediate economies has focused on the mobile telephone. In this paper we explore how the mobile phone is only one of the many important communication technologies used in transitioning regions [11, 31]. By analyzing communication practice we unpack how different communication technologies depend upon and interact with each other, particularly in remote regions where technology might not work as smoothly as it does in infrastructure-rich regions, where different technologies have different cost advantages and disadvantages.

As Edgerton argues [14] new technologies co-exist not only with older technologies but with a variety of hybrid technologies. Cellphones and the Internet frequently interact with each other in use, and also existing communication systems such as land-line telephones and postal letters. Over the three years of our study the village youth that we studied dropped much of their cellphone use, adopted landline communication and embraced instant messenger. Communication practices changed not only due to technological change, but due to the changing economic climate. Communication choices depended upon a balance of what technologies worked where, cost, regulatory and market issues, pre-existing practices and even international demand for labor.

The village studied for this paper is based in the far south of Mexico, in the region of Oxacca. Bicuhuini (the

annonymised name of the village we studied) is positioned at the meeting point of two mountain ranges, La Sierra del Sur and Madre de Oaxaca with a varying population of between 500-800. Like many other Oaxacan villages, the people of Bicuhuini are from an indigenous background, and the village itself is geographically landlocked in a region where is it is difficult to grow enough food beyond a subsistence lifestyle, and in a broader region with few employment opportunities. As with Mexico generally, much of the economic opportunities for its inhabitants (and youth in particular) are shaped by migration to the United States [19]. One result of migration is a relatively high level of communication technology use considering the economic level of life in the village. Remittances from Mexican migrants are the second largest part of the Mexican economy and keep many villages like Bicuhuini financially afloat [32]. In Bicuhuini, over 71% of the remittance money is spent on subsistence, such as food and water [10].

This paper presents findings from ethnographic work looking at the variety of ways the internet works to supplement and at times replace the use of cellphones for youth in Bichuhuini. In particular, the youth of the village, have become regular users of the internet, moving from the cellphone to instant messenger as a supplementary and at times a dominant form of communication. The cellphone is not only more expensive, but less practical because of the need to find good enough signal strength while in the village or in transit, the need to keep it charged, and the need to maintain enough credit. Instead of cellphones replacing computers [18] we find that communication practices span a range of new and older technologies – including fixed radio phones, instant messenger and shared community phones alongside the cellphone. The different resource and infrastructure demands of different communication technoloiges are traded-off to support both international and local communication links.

Our work builds off of existing research studying Mexican migrant communities [7, 15]. As mobiles and internet access has become more globally accessible in the last few years, research attention is being given to communication technology usage in Africa, Asia, and South America. Much of the existing literature on telephony outside the West discusses the usage of mbile phones, particularly the use of mobiles in managing market transactions [11-13, 21, 25, 31]. Many of these studies try to answer whether mobiles reduce poverty in low-resource areas [8] or increase social capital [16, 25]. While these scholars have been hopeful about the potential of mobiles to aid in poverty reduction or ease economic transactions, other researchers have tried to capture complex ways that mobiles are insinuated into everyday life among new users. These studies analyze how communication technologies are embedded in local spaces from use among families [20, 34] to urban settings [30] to immigrant communities [5, 9, 17, 22, 36, 37]. These studies all agree that mobiles are adopted for local situations with a multitude of strategies depending on the specific context.

METHODS

Our original visit to Bicuhuini came as part of a research project collecting data examining how internationally dispersed families from Oaxaca worked around barriers to communication. This work documented rural Mexican families used the single landline in the village alongside international and local text messages and internet cafes to communicate with family members working over the border. Since then we have spent three months in Bicuhuini, distributed over three visits. In each visit we have interviewed a range of different members of the village, focusing on understanding the life of the youth of Bicuhuini - 14 to 27 year olds, most of whom are either attending a junior school in a neighboring town (and so travel back and forth each day) or whom are staying home because their family can no longer afford the monthly school fees (which comes to about $20 per month). Supplementing this fieldwork we have also interviewed individuals from Bicuhuini who are based in the US, as well as keeping in regular contact with youth in the village from the US over MSN instant messenger. During our first visit to Bicuhuini in 2008, we conducted 98 ethno-surveys to residents between the ages of 15 and 65. The one to two hour survey asked straightforward fact-producing questions about wages, migration history and education. At the same time, we engaged in 10 interviews with youth, 10 interviews with adults and 40 hours of participant observation with youth.

After returning to the US we contacted the families of the residents of Bicuhuini in Southern California and conducted eight interviews and participant observations (30 hours) with the families in the US. We also engaged in instant messaging contact with three chief male informants (16 to 19 years old) from the village through MSN Hotmail Instant Messenger (which will from now on be referred to as IM). 50 hours of conversations were logged over a period of 11 months for over 30 chat sessions. In the second visit in 2009, we focused on interviews with members of the village, alongside participant observation in the town's public spaces. We conducted 10 informal interviews with youth cellphone owners and non-owners between the ages of 14 and 22 years, alongside 40 hours of participant observation conducted in the village and 10 hours of participant observation traveling with youth to the nearest internet cafe 30 minutes away.

In contrast to the two previous visits, on our third visit we focused primarily on participant observation of non-public interactions. We spent over 100 hours with families and individuals over the course of one week by immersing ourselves in the private everyday life activities of families. We lived with two families and were invited inside the houses of five other families for meals. We carried out various activities with families from cooking to cleaning to celebrating holidays and digging water holes. In addition, we conducted 23 informal interviews. Lastly, between our second and third visit we conducted a design workshop with two representatives from Bichuhuini who were attending university in Oaxaca. Although this informs our discussion, this workshop is not a focus for this paper.

THE VILLAGE

Being geographically isolated, Bicuhuini, deals with similar issues that other isolated villages experience. Access to quality education, availability of timely news and the weak local economy are all areas of friction. Despite the strong emphasis on education, its 'landlockedness' prevents the youth from having access to the same types of schools that urban youth may have. Many families are unable to send their children past the equivalent of junior high. Bicuhuini is 15 minutes away from one town with a population of 2,000 people, and 30-40 minute away from a second town with 20,000 people.

Prominent in the life of those in Bicuhuini is migration by males to the US. The village started to send immigrants to the United States around 40 years ago and migration has resulted in stark changes to village demographics – with nearly all men over 20 having migrated to the US to support their family. Without papers, migrants must cross the deserts in Arizona, California or Texas with the aid of a professional border crosser, known as a "coyote". The trip from Oaxaca to the United States is long and dangerous, lasting around a week or two. Once in the US, migrants with papers can afford to return to Mexico and re-enter the US legally every few years. Migrants without documentation either stay in the US or return to Bicuhuini eventually, but without papers it is very rare for them to voluntarily return to Bicuhuini and to make a second crossing back to the US. Bicuhuini families with members in the US sending remittances are overwhelmingly more economically well off than families who do not have this source of income. Without remittances, it is difficult to live beyond a subsistence lifestyle. During our first visit the only young males in the village were ones who had not yet migrated to the US. According to the 2005 Mexican Census taken in Bicuhuini, there were 60 youth between the ages of 10-14 years old. The youth population dropped by two-thirds for the 25-29 age group, with only 13 youth left in this age range. On our second and third visits, however, the composition of the village had started to change as older youth had been deported from the US returned to the village, although usually only for a short time before they would attempt to migrate back to the United States. Traditionally in Bichuhuini only men migrated to the United States, and women stayed at home to look after children, although this had started to slowly change particularly amongst women who had US visas.

RESULTS

We discuss our results in three sections – each of which covers one of our three fieldwork visits to Bichuhuini. Since there was a year between each visit (2008, 2009 and 2010) there were many changes in the village, in particular in the different communication technologies use. Even though Bichuhuini is remotely located, it depends very much on its connections, both social, family and financial, with the rest of Mexico and the US. These changes in communication technology thus had impacts broadly on village life. In discussing the first visit we introduce the use of mobile phones, but also 'the caseta' – a shared community phone. In discussing our second visit we introduce the increased use of IM amongst youth in the village. Lastly, when describing our third visit we introduce 'the fijo', a GSM radio based household phone.

For our first visit (2008) there was just one landline telephone in the village at the local "caseta" (telephone shop) that was installed 15 years ago. The village received television signal for one channel that shows nightly news, some telenovelas and educational programming. However, not all families can afford to purchase a TV and pay for the electricity required to power the TV. Cellphone signal in Bicuhuini was very weak and in most places unavailable. Despite this nearly all the youth owned a cellphone, and proudly displayed their phones on request. These phones were seldom used, yet during our time in the village the caseta was in almost constant use. This had changed by our third visit (2010). While cellphones were still unreliable, around ¼ of homes had a fixed 'fijo' telephone system installed, and this had resulted in much reduced use of the caseta. The youth of the village had also become heavy users of the Internet, through their regular travels to local towns to attend school. The cellphones that had been ubiquitous now were left at home, discarded or broken.

Along with this description of the technologies used we draw on biographic methods to contextualize life in the village. In particular we will discuss the experiences of Gabino, one young member of one of the more financially secure families in the village. We contrast Gabino's experiences to those of Juan, who had been pulled out of school as his family lost there source of income, Diego who had found work in a local travelling band, and Orlando and Fedro who had adopted both fixed and mobile communication technologies in different ways. While each of these youth were unique in many ways, they illustrate common practices and problems across the village.

Gabino - an early adopter

We start by focusing on Gabino – a 16-year-old teenage boy who lives in Bichuhuini but attends high school in a local town. He is the oldest male and the second oldest child of five children. His father lives and works in the US, sending remittances back to the family. Miguel has US citizenship, therefore is able to return to Bicuhuini every 3 to 4 years. His family lives in a two-story concrete house that is directly on the main village road. On the front side of the first story of his house is their store and caseta. His family owns the caseta, the only analog telephone line in Bicuhuini. Due to a policy of Telmex, the privatized phone monopoly in Mexico, villages with a population of fewer than 1000 are only supplied with one landline.

Since Gabino's family owns the only caseta in Bicuhuini, which also serves as a supply store, his family were one of the better off families in the village, although they were not in any sense 'rich', even relative to the other families in the village. Their financial stability, however, meant that Gabino could continue with his high school education at the closest high school in Juxtlahuaca, a town 30 minutes away from Bicuhuini. This town has the several internet cafes, several high schools, markets and regional administrative government buildings. During the weekdays Gabino lives

with his uncle in Juxlahuaca and during the weekend he returns home to Bicuhuini to work at the caseta. Gabino goes online at the local internet cafes after school everyday. When we first met Gabino, he was constantly playing with his cellphone in his hand. During this first field visit, we never saw the cellphone leave Gabino's hand except for the night of the village dance. Yet we never witnessed Gabino actually use his cellphone in Bicuhuini. He reported that he only used it when he left the village to stay in touch with his mother back in Bicuhuini. He also said that he used it to send text message back and forth with cousins. After we left the village the first time, we continued to stay in touch with Gabino via IM. When we asked what he doing online every time, he usually said that he was looking up information for his homework or for school related information. When we asked whether his teachers required students to use the internet to finish their homework, he laughed and said that it wasn't his school that required him to go online, but rather he was curious to learn other things.

Our observations of Gabino's technology usage were consistent with the young males we spoke to in Bicuhuini. Although his family is in an exceptional economic position of being the caseta owners, Gabino himself shares similar traits with other male youth in Bicuhuini such as being male, the first cellphone user in their family, the primary person in charge of the cellphone in the family, and the first in the family to attend high school. Like Gabino, several males in his same age range have a father and/or older brother working in the US.

Mobile phone use - changes over time
We found that the early adopters of cellphones and the internet were primarily youth who travel to other towns. On our first visit we never witnessed a female youth with a cellphone. Each family owned one cellphone and the son was in charge of the phone. Like Gabino, when they were in public space, they were almost always holding the cellphone in their hand, turning it around and playing games, and looking up addresses. We never saw anyone making a phone call while in Bicuhuini. Gabino told us that they only used their cellphones when they were away in another town and they used it to place a call back to their home. Many reported occasionally placing 1-2 text messages per week to friends or relatives in nearby towns.

Most youth reported going online a few times week while they were in Juxtlahuaca or a town big enough with several internet cafes. Even though their schools did not require for then to use the internet, they liked to go online to look at music videos or news. We stayed in touch with several of the youth after we left Bicuhuini, and we spoke to them via IM several times a week. Every time we shared information about each other's families, world news, and emerging music artists on YouTube.

Whereas most of the recent literature on ICTs has shown that early adopters tend to be business owners [1], our first fieldwork trip revealed that in Bicuhuini it was mobile youth were the first adopters. Business opportunities are limited in rural Mexico where most economic activity is based on subsistence and remittances, opportunities for 'mobile professional' are limited. While youth thus take the place of the first adopters, the youth are not earning money and must rely upon remittances from the US. These remittances enable some youth to attend a better, but more costly school outside of Bicuhuini, to own a cellphone, or to surf online. A second explanation for youth as first adopters is that adults over 40 years old are not fully literate. Those older than 40 years old are more than likely to be illiterate and speak Mixtecan as their first language.

One finding was the extent of symbolic usage of cellphones that we witnessed in Bicuhuini. A possible explanation for all the public display of holding and playing with the cellphones in their hand (as reported by other studies on youth cellphones use) is that cellphones clearly have a symbolic role in youth interaction [24]. At least during our first visit in 2008 youth wanted to be associated with 'the new' and for the youth of Bicuhuini, cellphones were items of novelty to display as status symbols. Although Bicuhuini is geographically isolated, the cultural concept of the cellphone as a modern object is widely marketed in the nearby town of Juxtlahuaca on television commercials, street advertisements and cellphone stores. The youth who were in the position to show off cellphones came from economically well-off families who had fathers sending remittances. Even if one could not afford to use a cellphone's communication functions due to weak signal, there is related functionality that can make the telephone (perhaps initially) something that can cause amusement. This includes games, clocks and timers, but also activities such as adding (and deleting) names from the address book. As Taylor discusses, who is in your address book can be a topic of some amusement or controversy [33].

In addition to the cultural explanation, we also believe that the quality of the telecommunication infrastructure, the number of friends who have cellphones in their network, the economics of maintaining enough credit and the mother's role for purchasing the cellphone all play a large role in their non-use of cellphones. When we were there the first time, the cellphone signals were so unreliable and weak that it was difficult to sustain a voice call. There were only a few places in the village that could hold a call. Many of the youth also explained that it was expensive to make a phone call and that they wanted to maintain enough credit in their account. Since none of the youth were working, they were not responsible for paying for the credit or even buying the phone. All of them said that their mothers bought the cellphone for them and instructed then to use only when they needed to call back home to Bicuhuini, yet they all reported using text messaging to contact their friends. While it did not cost money to receive, it did cost to send. Therefore, it was difficult to maintain a more chat-form of text messaging that we have seen in the West [24].

The Caseta - the local phone shop
We also found out that none of the youth or their families used their cellphones to maintain any form of contact with their fathers in the US. Even though all of them said that their fathers had cellphones, most of the time they did not have their cellphone number. When we visited their fathers

in the San Diego area after we left Bicuhuini, we found out that indeed most of the fathers had cellphones but they also said that they did not use it to call Bicuhuini. Due to cost, both sides were relying on the local caseta in Bicuhuini. When a family receives a call at the caseta a loudspeaker is used to announce the call, and a family member must come to the caseta to actually receive the call (for which they are charged). As the only fixed telephone line in the village, particularly during our first visit the caseta would regularly announce waiting calls for family members.

Because of the caseta, cellphones did not radically change the way families communicated with each other across the border. The US side still relied on discount telephone cards to make calls on landlines, and the Mexico side was still relying on the local caseta. The regular routine on a Sunday evening would be for fathers who worked in the US to phone their families in Bicuhuini, using the lowest cost method – using a phone card to call the caseta. The timing of these calls was not entirely predictable, and even though the calls would be the only route of communication for most children with their fathers, the frequency and the length of the calls would be highly constrained. Indeed, these calls were highly emotional and would be a challenge for all those involved – the mothers would make requests for resources to be sent from the fathers, the fathers would be reminded of the distance between them and their family. The children themselves would have to engage in a difficult conversation with a absent parent who in reality they might have spent very little time with. The caseta then was a site that reminded all involved of the difficult economic and emotional situation that migration imposed on Bicuhuini families.

Second visit: problems with cellphone use

Introducing Gabino, as well as the use of cellphones and the caseta, gives some picture of both life in the village, as well as the use of different technologies to stay in touch with those in Mexico and the US. On our second visit we found that the picture of technology use had changed somewhat, as had the experiences of Gabino. We returned to Bicuhuini exactly one year after our first visit. Returning to our informant Gabino, he clearly exhibited a different relationship with his cellphone compared to our first visit. This time we never saw Gabino with his cellphone in his hand. Even when he was working inside the caseta during out first visit, he always had his phone on the counter recording the length of each phone call and charge the person accordingly.   When we saw him working at the caseta during my second visit, we never saw him with his cellphone. When he was working the caseta counter, he used the clock behind him to keep the time for incoming caseta phone calls. When we traveled together for the one-hour trip to Juxtlahuaca, both times he did not carry his cellphone on him.   On asking about this change Gabino explained that he didn't carry his cellphone around that much anymore because he doesn't need it - shrugging his shoulders as he replied.

After one week together, we learned some of the reasons why Gabino left his cellphone at home. When we texted him to arrange our travels he never replied - he explained that he did not receive the message, because his phone wasn't charged, and moreover that he did not even have enough credit to text back. With the problems of inconsistent cellphone signal, it is possible that a sender's message could take a few hours to be sent. The sender is never absolutely sure a message is received unless the receiver texts back a reply to the message. This form of SMSing, as reported by Gabino and others, is an "un-instantaneous" form of texting as opposed to the instantaneous nature of text messages in areas with consistent cellphone signal. Gabino explained that he knew that we would already be in Bicuhuini in the morning, therefore we would have already been in touch before leaving for the internet cafe in the afternoon. Not only did he not have credit to return my message, but also he felt no need to reply.

Changes in cellphone use

We noticed similar changes among all the youth who were cellphone users the previous year. This year, none of them carried it around in their hands or inside their pockets. It was as if all the fascination with the cellphone last year had disappeared. When we spoke to the youth, all of them said that the signal was still too unpredictable in Bicuhuini. When asked, each youth had a different response for the best locations for maintaining a cellphone call in Bicuhuini. Some said that there were only three places in the entire village that could hold a signal. Others said that the signal was better during the night than the day. Others said that the signal comes and goes so they constantly keep an eye on their cellphone to catch a signal. Even though all of them said that the signal has improved from the year before, the cellphone was no longer a novel piece of technology in the village. Like Gabino, most of the youth said that text messages were not reliable and that they did not always have enough money in their account. In addition to noticing that youth no longer carried their cellphones with them everywhere, we also noticed that the youth displayed a much more nuanced understanding of periods when their cellphones were most useful. It is not the case that they had abandoned the cellphone, but rather that they used it when appropriate, balancing its costs and benefits, and social context - of course, new mobile users often adjust their expectations of use over time although perhaps not to this degree [28].

During our first visit, another young member of Bichuhuini, Juan, then 14 years old, was always gaming and playing with his phone. One year later he did not even carry it around anymore. We found out that Juan was no longer a student in Tenotepec. The US immigration authorities had just deported his father after 5 years of working in the US - his family lost their entire income overnight. They could no longer afford Juan's high school expenses as they needed to save the money for his younger brother's school fees. Now that Juan was no longer commuting to school 15 minutes away, he was not seeing his friends face-to-face on a regular basis. He stayed home and helped his mother around the house. He used to call his mom when he went to school in

Tlacotepec, but now he primarily used his phone to stay in touch with school friends who he could no longer visit.

Juan's story elucidates how he managed to stay in touch with his friends in a town that is only 15 minutes away. He was not able to see his friends anymore, since he was no longer in school and his Juan's daily activities no longer involved commuting 15 minutes away to Bicuhuini. To deal with this social landlockedness, Juan was able to text his friends and maintain some of the ties that he had created over the last two years of attending school in Tlacotepec. However, since his father was no longer working in the US when we spoke to Juan's mother, we found that his family was pressuring him to migrate to the US. Since Juan was born in the US he was under pressure to make use of his US citizenship by leaving his family and replacing his father's remittances from the US. Yet when we spoke to Juan, he made it clear that he did not want to go the US to work, since his friends and family were all in Mexico. Yet with a US passport and citizenship and his father no longer in the US, it was likely that Juan would not be able to resist migration. In the meantime, to hold off having to move, Juan explained how he was looking for a job in Mexico, giving out the phone number to caseta to potential employers. He explained that he did not give his mobile number, since the signal was not reliable enough and he did not always have enough credit. Juan thus used his cellphone to maintain friendship ties, while the caseta was used for creating economic opportunities. Yet with little economic opportunities, Juan would likely have to give up his resistance to migrating. The fixed communication methods were still the most reliable and affordable communication tool. In this way while Juan used the cellphone amongst other communication methods, it was no longer the central technological device that he uses.

A third youth we interviewed was Diego - he articulated a nuanced use scenario for the cellphone. Diego is 18 years old and is a member of a traveling band. As the only band member living in Bicuhuini, Diego is quite isolated from his other band members who live in Juxtlahuaca. For him Bicuhuini was a place for rest in between performances. Diego saw his cellphone for work related reasons and for making meeting arrangements with friends when he is staying in Bicuhuini. He explained that despite having his father's truck he could use to drive to see his friends, having a cellphone allows plans to be made more quickly when he is Bicuhuini. But he says that for calls to family, he primarily uses the caseta because it is less expensive. Diego is already a very mobile youth with his entire band traveling to various cities in Oaxaca. What is interesting is that when he returns to Bicuhuini, he sees it as a place of rest and as a place that is disconnected from the rest of the Mexico, where his work takes place. He manages this disconnection through the caseta for calls to his family and the cellphone for text message to his friends and for business.

Instant messenger use amongst the youth
In between the first and second visit, we were able to stay in touch with several of the youth over MSN messenger, chatting with them when they were online. This allowed us to extend our fieldwork and maintain weekly contact with at least 3 of the 10 youth we had focused on. Every time we chatted with the youth, we asked them what they were doing and where they had just come from. Most of them got online after their classes and they used the internet primarily to go to Spanish language Wikipedia, check the news, online chat with other friends, and look at YouTube music videos. Instant messenger was heavily used by many of the youth to stay in contact with cousins around Mexico and friends in Bicuhuini or Juxtlahuaca. They were not using IM to stay in touch with family or friends in the US since their fathers in the US did not own a computer. Accordingly they were not using the internet to communicate internationally, rather they reported going online to do research for homework or to read about things that they were interested in, or watch music videos on YouTube. Their time online would vary from 15 minutes to one hour once or twice a week, usually after school before traveling back to Bicuhuini.

When we returned for our second visit, we wanted to find out more about their IM activity and Internet use. We traveled a number of times to the internet cafe with youth from the village. One of the key things that we found out was that the youth relied mainly on IM to maintain contact with friends for what we would consider to be informal 'chatting'. When they logged on they would start by initiating chat with all their other contacts who were online, chatting opportunistically with whoever was available. The youth who spent the most time in Juxtlahuaca were the more frequent IM users, in part because they spent most time in a town with internet access. This included students who attended high school in Juxtlahuaca and students who commute between Bicuhuini and other towns and use Juxtlahuaca as a stop point on their commute.

As the youth readjusted their expectations for their cellphones, new expectations were put into place for IM'ing as something to be used in addition to the cellphone. Upon further observations, we began to understand why Gabino did not "need" to bring his cellphone on him to maintain contact. We travelled three times with Gabino to the local internet café. We found that during this journey he would run into friends nearly continually - on the street, in the local park, and in the internet café. Being a small rural town there was a strong sense that 'everybody knows everybody'. Even when we got online with Gabino his first action was to open MSN messenger and start talking online with a friend who had moved to the US. After these journeys with Gabino we realized that IM seemed to be used for non-urgent chat conversation with friends, while the traditional phone lines were reliable for getting in touch with his family. IM complemented the face-to-face interactions that he experienced as he went about his day.

Two other youth we interviewed, Fedro and Orlando, had made similar choices in their use of cellphones and IM. Orlando reserves his cellphone for work purposes, he uses the caseta to call his family and makes use of IM as a way to have conversations with friends, as he put it: "my cousin and I utilize the internet every Sunday when he gets

online...well, I Only use it [IM chat] to have conversations with other people" This shows that IM is used more frequently for 'chat-like' conversations. Whereas in many places cellphones appear to be the key 'chatting' technology, in Bicuhuini, IM'ing at the internet cafe is the tool most likely for time-based chatting. This combination of different communication methods can also be seen in Fedro's technology use. He is an 18-year-old teenager and works Mondays through Fridays in a town with no cell signal. His girlfriend lives in Oaxaca city and he uses the cellphone on Fridays to arrange a time on Saturday to spend one hour chatting with her through MSN messenger. They both chose an internet cafe that offers video cameras. When we asked him why they did not text or send pictures through the cellphone, and they told us that the costs were too high.

For all these youth, Gabino, Orlando, and Fedro, they all use IM as a way to stay in touch with friends around Mexico. In addition, they use IM more specifically to communicate with friends, caseta for family, and the cellphone as a quasi-intermediary tool for non-urgent communication.

The third visit: the move to a fixed phone
Our first two visits gave us an overview of the changing communication practices in the village, but also of how much the economic wellbeing of those in the village depended on the world around. While 'landlocked' in some senses Bichuhuini was still very much connected – be it through Gabino searching on Wikipedia, or conversations between family members across the US border. Our third visit to the village, again a year later, underlined that the village was also a site where technology itself was rapidly changing. To those used to the trajectory of technology change in the west, these changes seemed in some senses reversed to those we expected.

The most immediate technological change on our third visit was the increasing prevalence of the 'fijo'- a GSM radio based fixed phone installed in about 1/3 of the villagers' homes. Payment for calls was arranged with prepaid cards, much like mobile phones, with free installation of the phone. As a 'fixed' phone the deployment of it in the village might appear something of a retrograde move. Yet, it changed much of how those in the village communicated. The caseta had fallen out of use, since even for those who did not have a fijo installed they could make use of their neighbors' phone. Unlike the expensive mobile phones, the fijo phones were relatively affordable to both receive and make calls. We found that several families had a similar set up where a fijo was shared among 2-4 different families that were all close to each other. For example, Fedro's mother has a fijo installed in her house. Both her daugher and son lived close by, so they would come over to make and receive calls.

For fijo users, one of the biggest changes was the privacy that the fijo afforded over the caseta. Several of them expressed that they no longer had to worry about the caseta operator (Gabino's family) over hearing their conversations. Sensitive situations, such as deportations, could be more directly reported to the family, instead of through the caseta. There seemed to be some underlying resentment against the owners of the caseta for always being able to overhear conversations and at times beprivy to information before other families.

Another change was the convenience in making and receiving calls. One teenager, Starla, explained that with the fijo she can now just make a call when she wants to as opposed to walking 10 minutes to the caseta. Since the fijo is less expensive than the caseta, she can also contact her father in the states more often. We also gained the perspective of the effect of the fijo on someone living in the US. Carla, a teenager living in the US was visiting Biuhuini when we visited her house. She has full US citizenship so she can travel back and forth to see her relatives in Bicuhuini. The fijo changed the way she stays in touch with them because she no longer has to call them at the caseta, hang up, and then call again 10 minutes later.

For our main informant in the village, Gabino, the fijo greatly affected his family's livelihood, as they were no longer making as much money from the caseta. His family was planning to introduce the Internet to the village as a replacement for the caseta but this relied on some sort of Internet connection to the village being installed. However, the likelihood of this happening soon seemed low because of the current policy of Telmex, the primary telecommunication provider. Thus the very policies that allowed Gabino's family to have a caseta and in effect have a monopoly on all landline communication for the past 15 years was now ironically preventing their family from offering internet services.

We also noticed other changes with cellphones and computers. Young girls in the village started to own mobile phones – for example Starla, a teenager with a father working in the US and a mother in the village, found a way to purchase a relatively expensive cellphone. Her family won the lottery to be a part of Oportunidades, a government welfare program that pays family with cash in exchange for consistent school attendance, health care visits and nutrition for children. She found a way to use the cash payment to buy a 1200 pesos cellphone.

DISCUSSION
Turning to a tiny village, in a remote area of Mexico, might seem an unusual site to develop lessons for Mobile HCI. Indeed, many of the problems and experiences we document above are likely peculiar to Bicuhuini, or at least to towns where migration is common. As with any ethnography, however, its value rests not on the simple typicality of Bicuhuini and its youth, but rather in how we can use the specifics to draw insights broadly – drawing lessons for understanding how technology is used in a variety of settings. We draw on our experiences in Bicuhuini to reflect on the nature of Mobile HCI in three ways. First, we discuss notions of the 'stages of technology', second the 'costs of mobility', and lastly the challenges in designing for a resource-poor village like Bichuhuini.

The value of 'old' technology

It is tempting when discussing technology to see it as a matter of particular stages, with smartphones replacing conventional phones, mobiles replacing land lines, and so on. Even if we acknowledge the co-existence of different technologies it might seem that most innovation happens with newer technologies, or that they offer the most potential for innovation. As our examples shows, however, there are many more complex interactions between different technologies that can emerge. In this particular field site poor wireless signal, combined with severe cost concerns, resulted in a mix of technologies that were adopted and discarded. It was not that mobile phones were *not* adopted, but rather that their use was restricted to certain situations and types of communication. For many of the families these situations were sufficiently rare that it was not worthwhile keeping the phone charged (both in terms of credit and power). For others the mobile phone would only be used in certain areas or times.

One key argument in the development literature technology is the notion of 'intermediate technology' – technologies which while not being necessarily more advance, fit with the specific context of the developing world [14]. As the success of the 'fijo' shows it is also possible for "older" technologies to radically change how a village communicates. Indeed, it appears that fixed telephones have had a much more radical impact on the communication patterns of the village than the cellphone, in part because of the poor signal in the village, but also because of the cost of receiving and making cellphone calls. As Edgerton points out in his book *the shock of the old*, often the biggest advances to those in resource-poor areas can come from 'end of life' innovations to conventional technology, rather than on the latest advances to the most recent technology [14]. Even the somewhat neglected fixed telephone can have enough value to change how a village communicates. Moreover, as technological advances in cellphones have moved beyond a focus on voice it is worth emphasizing that for most telephone users it is still voice that is the predominate use. Again, as technical opportunities and challenges move on to more advanced uses (such as location based services), it is important to still acknowledge the value of the basic point to point voice-based phone call.

The costs of mobility

Mobile HCI has, as is evidenced by its name, put great importance and emphasis on mobility. Certainly, mobility is a prevalent and valuable part of life and work. While mobile phones bring a collection of different technologies it is mostly that they are mobile that they have become such a success. This ethnography provides an opportunity to reflect on the *costs* of mobility. In particular, for areas that are relatively resource and infrastructure poor, static technology may come to replace mobile technologies because they are cheaper or fit better with local infrastructure. It is not that they would reject, say, the mobile Internet but rather that this would require the greater deployment of scares resources, or the deployment of uneconomically viable infrastructure. At times mobility is worth it – such as for Juan who no longer goes to school

and needs the mobile to stay in touch with his old school friends. Yet in many cases the benefits of mobile technology for those in Bichuhuini often do not exceed the costs, and for this reason their internet use and voice calls remain resolvedly non-mobile.

One key value of mobility, amongst others, is that it supports a timeliness of communication, in that one can get hold of those who might not be near a fixed communication channel - reducing 'telephone tag'. Yet for the forms of communication that the youth of Bichuhuini engaged in there was little in the way of urgent or time sensitive information being communicated. Rather their IM conversations were about 'catching up' and passing on family information that had no particular urgency. Even communication with the youth's fathers who were based in the US was of a routine nature and was seldom urgent - news could wait until the next routine call. In this way mobility was perhaps not as valued as might have been in other situations, where a call might be necessary to arrange or cancel a meeting, or where future actions might depend on that communication. In Bicuhuini life continues without that call, and one might bump into a friend the next day or next week. The nature of the social relationships that the youth were emeshed in did not demand mobility in the way it might for those in other towns or cities.

The importance of cost and infrastructure

A final point concerns the value of mobile HCI in this context. Much of the use of communication technology in Bichuhuini was determined by infrastructure and cost. Since the limited infrastructure was in part due to its prohibitive cost in such a mountainous region, this is in many ways about *costs* –financial, social and temporal. It might seem an obvious point to make but in resource poor areas the costs of technology are very much more important simply because there are few excess resources to go around.

If we are interested in the development of mobile HCI for settings such as Bichuhuini this presents some interesting challenges. A standard method used in Mobile HCI, and HCI more broadly, has been the technology trial where a trial system is introduced into a setting [4]. Yet in these cases infrastructure and cost are important but difficult to research. It is rare to charge participants for their use of technology, and building infrastructure is usually outside the scope of a single trial (although see [3] for exceptions). If a particular system is paid for by researchers, then this would fail to investigate the question of whether for those using the system the realistic costs are more than the benefits. Technology trials where new systems are introduced in poor regions can thus suffer from an inadequate engagement with cost, particularly if a study introduces some new prototype system.

Most prototypes would be prohibitively expensive - $300 would be much more useful to those in Bichuhuini than even the most feature rich smartphone, however well designed the software might be. One approach might be to only work with technology that is already common place in the setting being studied. This said, it is clear that technology was of direct benefit and value to the villagers,

and they were eager to adopt new systems that might help support their communication situation. Over three years or so they had adopted new technologies such as mobile phones, IM, and fixed phones – and the youth in particular were curious and eager to explore whatever might help their situation. There is a clear role for mobile HCI in designing, understanding and attempting to make better the communication practices of those in rural remote settings.

CONCLUSION

Our fieldwork has revealed that youth manage their communication with their friends and family within a complex eco-system of ICT tools. They do this through the caseta, cellphone and IM. In looking at these youth who are the first adopters of cellphones, we find that cellphones are a part of larger ecosystem of technology that includes use of older and newer technologies. IM has been adopted as part of their communication practices to supplement face-face chatting and interaction. Only when we examine the use of all these tools together do we get a more accurate picture of how youth from more economically well-off families can afford these tools and use them in innovative ways to work around policy, pricing and signal.

The youth manage a communication eco-system that is specifically tailored to the geography of Bicuhuini. This attempts to weave together their Bicuhuini form of "connected presence" - their presence to others in online, phone and face to face forums. Whereas "connected presence" has been used to discuss how Western families manage various forms of communication from face-to-face communication, non-verbal gestures, and ICTs, "connected presence" is also something managed for the youth and their families of this study [23]. Our fieldwork shows how they are inventing specific ways to manage their rich social ties in a resource-poor area to carve our a livelihood that could support their family, and how they try to stay connected to their village and to information beyond the village. Our findings are also consistent with research that argues that communication technologies are embedded in local contexts and while they cannot solve existing infrastructural problems, users find innovative ways to make them useful for their everyday lives [29, 34, 35].

For our key informant, Gabino, technologies have inspired him to change his career plans. His original plan was for a stable career in Mexico's tourism industry, a career that is valorized if he were to learn English and become a waiter. But being a waiter was not his passion – by looking up information on Wikipedia and IMing with friends plans, Gabino had decided instead to pursue a degree in biology at university. In ways like this, even youth who live in rural Mexico are using technologies as a way to increase their access to information, manage their communication and expand their career options.

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