The Viability of Mobile Phones for Language Development:

a Grassroots View from Four African Countries

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Abstract

Between July and September, 2011, an International Literacy and Development (ILAD) team traveled 4000km each by bus across Africa to determine if mobile phones and other Internet devices are a viable tool for minority language development. Tanzania, Kenya, Uganda, and Chad were visited.

Extant statistics on phone penetration are commonly based on the number of SIMs and overstate actual phone penetration in Africa because multiple SIMs are commonplace. However, more than half of the adult population own a phone in most regions, and this is ample to make minority language development use feasible. Multimedia-capable mobile phones are widespread. Android-based smartphones are already widely available in some countries and will become standard in 2012, replacing “dumb” feature phones.

Standard short-wave radios which are widely used throughout the developing world now feature SD and USB interfaces for playing MP3 files. This provides a culturally appropriate way for people to listen to minority language materials in groups without requiring donation of western audio equipment.

All African countries visited are ready for MP3-format minority language materials. Kenya is ready for minority language materials in EPUB digital book format; Tanzania will be ready shortly, while Uganda will take several years. Chad will not be ready for EPUB format materials for some time.
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Page 2 of 61
# Table of Contents

Introduction and Purpose of Trip............................................................................................................. 6

Methodology........................................................................................................................................... 7

Definitions............................................................................................................................................... 8

Security.................................................................................................................................................... 9

How Mobile Phones Work In Africa..................................................................................................... 10

Study....................................................................................................................................................... 12

Ubiquitous Features............................................................................................................................... 12

Advertising............................................................................................................................................ 13

Vouchers................................................................................................................................................ 13

“Beeping”.......................................................................................................................................... 14

Notable Hardware................................................................................................................................ 14

Nokia 1280............................................................................................................................................ 14

Huawei IDEOS U8150......................................................................................................................... 15

USB/SD SW Radio............................................................................................................................... 16

Universal Battery Recharger............................................................................................................... 17

Digital Quran....................................................................................................................................... 18

Tanzania.................................................................................................................................................. 19

Dar es Salaam...................................................................................................................................... 20

Arusha............................................................................................................................................... 22

Town..................................................................................................................................................... 24

Villages.................................................................................................................................................. 25

Hamlets............................................................................................................................................... 27

Kenya.................................................................................................................................................... 28
**Introduction and Purpose of Trip**

The rapid expansion of mobile phones is a mega-trend which has transformed Africa. According to Tom Phillips, 90% of the world's population now has mobile phone signal coverage (2009, p4) and in *Measuring the Information Society*, the International Telecommunications Union (ITU) predicts “it will rise to almost 100 per cent by 2015” (2011, p15). Wireless Intelligence reports that five billion of the world's seven billion people own a mobile phone (BBC, 2010). IT News Africa reports, “Africa has become the second most connected region in the world in terms of mobile subscription count... There were over 616 million mobile subscriptions in Africa at the end of September, 2011.” (2011) GSMA's *African Mobile Observatory 2011* shows that Africa now eclipses North America and Europe, and is second only to Asia in mobile subscriptions (2011, p8).

However, these statistics are, to a great extent, from businesses and trade organizations with vested interests in boosting mobile phone and Internet use. Likewise, they are often top-down driven statistics, reflecting the broad theoretical usage without accounting for various forms of wastage or the difficulties encountered by real people in the developing world. ILAD questioned whether the developing world was ready for the investment of resources in self-sustaining phone-based minority language development projects.

The purpose of the trip was to answer the questions, “At the real-world ground level, are mobile phones, tablets, and other Internet devices a viable tool for minority language development work in Africa? If so, what audio and textual formats are most practical? Specifically, ILAD has literacy and language development educational materials in both audio and digital textual formats. Is Africa ready for this
Methodology

Over the course of six weeks in July and August, 2011, a team of six people traveled four thousand kilometers each by bus across four countries in East and Central Africa. We explored a diverse range of settings, from rural villages to towns and cities.

The study took a two prong approach. One aspect was exploring what phones and devices were available in the local marketplaces, and what signal strength and bandwidth was like for the common people. The other side of the coin was interviews with relevant technical people; most of these were preplanned, but a few were discussions of opportunity.

A short form was prepared for each market vendor. However, the team quickly determined that most vendors wanted nothing to do with it, yet they were not turned off by a casual conversation about the same topics. It also was not prudent from a safety standpoint in some locations. Likewise, photography was similarly problematic.

Therefore, the standard methodology for marketplace interviews was to do the interviews without recording devices, then scribble brief notes after leaving the area of the vendor. Most of these were within fifteen minutes of the interview, but sometimes longer, especially in areas with lots of vendors. Then, in the evening the entire day was written up and emailed to an administrative assistant.

For the technical interviews, there was also a preplanned questionnaire, but it intentionally included many open-ended questions and sought to draw the interviewee into broad discussions of Internet
accessibility topics.

After returning from Africa, followup questions were sent to a number of people, both in these countries and other developing world countries, to get additional information and to try to understand in greater depth some of our observations.

Where prices are mentioned, the currency in which the price was listed is given first, followed by the USD equivalent in parenthesis. Where only the USD price appears, the listed price was denominated in US dollars.

### Definitions

Census figures are often imprecise or unreliable in Africa. The following terms are used in a specific sense throughout this document.

A *city* is a major urban center. It has a metropolitan business district, a section for the embassies and government offices, and, inevitably, large slums. A distinguishing characteristic of cities from the point of view of this study is their large permanent marketplaces and commercial activity. The cities encompassed by this study are Dar Es Salaam and Arusha in Tanzania; Nairobi, Kenya; Kampala and Entebbe, Uganda; and N'Djamena, Chad. Entebbe and N'Djamena are regarded as cities primarily for administrative and governmental purposes, but resemble towns from an economic standpoint.

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<td>Informal: CFA</td>
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A *town* is a community with a small downtown business area and daily market, and surrounded by large residential regions of varying economic quality. It may have a downtown similar in size to Wooster, OH or Shelbyville, KY, but supports several hundred-thousand people in the general vicinity. Most of the towns visited are provincial (state) capitals. Towns in Central Africa are in many respects more similar to large villages in East Africa.

A *village* has a smaller downtown, and has few, if any, multistory buildings. It may be one street full of shops. It does support a regional market which generally meets on one day a week (often, but not always, Friday). It may have a smaller section of the market which is open on all days. A village may look fairly small, housing only a few thousand people or less in the direct area, but can support as many as 10,000 people, including those on the outskirts and the surrounding countryside.

A *hamlet* is a wide spot in the road with six or eight huts. Hamlets often actually have more huts hiding deeper in the bush, but don't really have an independent economic existence. There may be a few of the ubiquitous duka shop stalls, but not an organized marketplace. Everyone in surrounding hamlets goes to a central village for market day.

**Security**

For the safety of nationals and NGO workers in some of the regions investigated, this paper uses names for cities, but not for towns or smaller population centers. Nor is any national named, except for individuals who were interviewed and gave explicit permission. Raw study data is available to qualified individuals upon request and a non-disclosure agreement.
How Mobile Phones Work In Africa

Mobile phones in the developing world differ from contemporary American consumers' experiences with mobile phones in some fundamental ways. This section is a primer on how phones work in Africa, from an end-user's point of view. It is considered “common knowledge” in Africa, but may not be familiar to western readers. This section is for background, and is not part of the research per-se.

Mobile phones in Africa are nearly all prepaid. According to the GSMA's *African Mobile Observatory 2011*, 96% of Africans use prepaid services (p9). A user purchases a handset for the full fair market value without signing any long-term contract or subsidy such as is common in the United States. All phones use GSM-based technology, similar to T-Mobile and AT&T.

A person may purchase a handset from a specific cellular carrier, but it is just as common for them to purchase an unlocked phone from a non-affiliated vendor. To use a specific handset with a particular cellular carrier, the user purchases a SIM card for a nominal fee (sometimes free, and always trivial). A SIM is a chip similar in size to a micro-SD card. It provides the unique ID and other information which allows a handset to operate on a specific network; the SIM may also provide other value-add functionality. The SIM is generally placed in a special slot inside the back of the phone underneath the battery. On some newer multiple-SIM phones, the second or third SIM may be inserted in slots similar to a micro-SD card.

Once a handset has a SIM for a specific vendor installed, it may access that mobile network. Prepaid credits, generally called *vouchers*, are used to place calls, text, or access the Internet. Vouchers take several physical forms, but by far the most common is the scratch-off card.
Adding credits to a handset is as simple as purchasing a voucher, scratching off the foil to reveal the unique voucher code, dialing a short number on the handset, and entering the code. Many preliterate and even pre-numerate (lacking basic math skills or the ability to tell prices in the marketplace) people have started using mobile phones. The voucher charging system has proven easy for even low-numerate people to learn. Notably, it is significantly easier than the similar voucher systems of prepaid plans in the United States.

Incoming calls are generally free. Calls between two phones on the same carrier are less expensive than calls between phones on rival networks. In the past, SMS texting has been cheaper than voice, although this is changing in some markets. All of these facts have important implications for African mobile use, elaborated on in later parts of this document.

Credits are transferable between handsets on the same provider network. This fungibility was quickly picked up on by informal businesses to transfer value over long distances (typically from a wage-earner in the city back to their family in a village).

Kenya's wildly successful MPESA (“M”obile + PESA, the Swahili for “money”) network and its newer copycats are an exploitation of the same basic principle. MPESA ties a financial account to a handset and allows easy transfer of funds between handsets. Funds may also be “cashed out” at numerous business locations. This has provided lower economic classes with practical and easy access to “banking” services for the first time. MPESA is significantly easier to use than its western counterparts.

Wireless Internet service is provided through 3G, similar to what is available in the United States, and through Edge, its slower predecessor, which is still widely deployed. 3G service is being rolled out
aggressively, as detailed below, but Edge is ubiquitous. In either case, a SIM and prepaid credits are still required, although the process for transforming voucher credit into “Internet credit” (which goes by various names) is not standardized. 3G dongles which plug into a USB port and visually appear similar to a thumb drive are also becoming a popular system for laptops and even desktop computers to get Internet service.

The main limiting factor in Internet performance is not 3G or even Edge, but rather the degree to which various networks have oversold their broadband capacity; this means that Internet speeds can vary significantly between various times of the day, being slow in the evenings but much faster in the early morning.

Study

The study conducted interviews and reviewed marketplace conditions in cities, towns, and villages in Tanzania, Kenya, and Uganda in East Africa, and Chad in Central Africa. An additional North African country was initially planned, but had to be canceled for security reasons.

Ubiquitous Features

The differences between East African countries are mostly a matter of degree, rather than of kind. Each of the countries is ahead in some areas and behind in others. Some significant differences in Chad will be pointed out where relevant. However, several features were universal throughout all of these countries, whether in urban environments or the most rural settings.
Advertising

In every country in Africa, advertising for mobile phone carriers is everywhere. From billboards in the capital cities, advertising the latest smartphones at the highest speeds, to local soccer team t-shirts in rural settings, the carriers are conducting massive marketing campaigns, competing for market share.

Most of the carriers have a simple bold color branding, and in some areas of East Africa, more than 50% of the buildings are painted in a carrier's color and feature a prominent logo. Buildings right next to each other often have competing carriers' branding. This is equally true in both rural and urban settings.

Because the industry is still dynamic, some vendors have changed names and branding repeatedly in quick succession, as corporations are bought out or consolidate. This has led to many buildings which are advertising the color scheme of brands which no longer exist.

Chad has significantly less advertising in general, but most of it is for mobile phones and follows a similar pattern.

Vouchers

The carriers make their money primarily off of sales of airtime, via vouchers. So they have well-developed networks of vendors selling vouchers. There is always a vendor available to sell additional airtime minutes anywhere in Africa, no matter how rural the setting.

Virtually every store sells airtime for one or more carriers, but it is also commonplace to see informal

In Uganda, one vendor said that he makes 200 UGX ($0.08 USD) of profit off of every 5000 UGX ($1.92 USD) of vouchers he sells.
street vendors doing a brisk business in vouchers.

Chad has logistical challenges in regular supply of ticket-vouchers, so it too has a well-developed network of vendors, but in rural settings they generally sell airtime by direct transfer of minutes from their account to the customer phone. Since it adds one more human into the process and increases the potential for miscommunication, this can be more accident-prone than using a scratch card.

“Beeping”

Incoming calls are free, so often someone who has little airtime credit, or is an employee of a business, or friends with someone wealthier, will “beep” them. This means they call and let the phone ring once, then hang up. The other person is supposed to immediately call them back, effectiveness reversing charges for the call. This is commonplace throughout the study area.

Notable Hardware

The following hardware is worthy of mention, and except where noted below, was common in nearly all geographic areas covered by this study:

Nokia 1280

The Nokia 1280 is the current version of what may be the most popular mobile phone on the planet. It is the archetype of the developing world feature phone. The 1280 is simple, cheap, and rugged. The
feature which the press talks about is its built-in LED flashlight, but in Africa all mobile phone screens are used for flashlights; it takes very little light to have a large impact on a truly dark trail when there is no light pollution from electricity.

The real reason that the 1280 is so wildly popular and omnipresent is that its battery lasts about a week and a half between recharges. Some people are fiercely loyal to it and Nokia because of this battery life, “Nokia really cares about village people. Their phones last a long time between charges.” The primary reason it is falling out of favor with consumers seems to be that it only supports a single SIM; Nokia has recently introduced dual-SIM models with the advertising slogan, “Dual SIMs. Loud!”.

**Huawei IDEOS U8150**

Huawei is a large Chinese electronics firm with close ties to the PLA. They have recently made major waves with the IDEOS brand of Android devices targeted specifically at the developing world.

In the first half of 2011, the IDEOS was the least expensive Android phone available, by a considerable margin, typically costing around $80 USD. IDEOS has poor battery life if used for continual 3G web browsing like a typical western smartphone, but lasts several days for voice use with occasional web browsing, a much more typical developing world scenario.
The IDEOS is small, rugged, and easily recharged by micro-USB. It is popular in every market where it is introduced.

Samsung, the dominant developing world smartphone vendor, has not taken the threat of IDEOS lightly. The Samsung Champ is not available in most Samsung stores, but is often available from street vendors for the same price as the IDEOS. However, the Champ runs a proprietary operating system, has a resistive touchscreen, and compares poorly to the IDEOS in applications, usability, and general user experience. The Champ feels like an intentionally crippled Microsoft Works, compared to IDEOS's powerful LibreOffice.

Huawei also has an IDEOS-branded Android tablet, but it is much less compelling, with cheaper hardware which isn't in the same league with competitors. It remains to be seen if its lower price will overcome the burden of its outclassed hardware.

**USB/SD SW Radio**

The short-wave transistor radio has been ubiquitous throughout the developing world for many years. During an extended village interview towards the end of the study, it was noticed that the radio loudly blaring was significantly different that many seen in earlier years. Instead of listening to the radio or a cassette tape, this radio had both USB and SD interfaces, and villagers were listening to music off

*Illustration 4: A typical USB/SD Shortwave Radio.*
of an SD card.

Subsequent study in the markets and followup emails confirm that in just the past year USB and SD audio has become a common feature of SW radios not only in all the countries of this study, but throughout the developing world. Similar models are available for $10 - $30 USD in India, Papua New Guinea, and even areas of war-torn North Africa.

While there are a plethora of brands and makes, they are generally identical in price, with a pricepoint at $15 - $25 USD for a cigar-box sized unit and at $30 - $50 USD for a “boom box” sized unit. The feature-set of the two sizes is identical; the perceived difference is that size equals loudness and hence a higher price.

Different brands offer identical hardware, suggesting that most of these ultimately are made by only a handful of manufacturers.

The decision to use USB vs SD media varies by which is less expensive in a given geography. SD seems to have a slight edge because they are already being used to store music for phones, while often there are no pre-existing USB devices in common use. One national reported that SD was better because the USB connectors break more often.

**Universal Battery Recharger**

How are mobile phones kept charged where there is no mains electrical service? In each village there will be a kiosk with a generator or solar power, which sells battery recharging to townspeople. It is not unusual to observe a young child run up to the kiosk with a small coin and a handset. This is just
regarded as another chore for the child to do for their parents. The cost of charging varies, but is generally inexpensive; it's uncommon for someone to not be able to afford to charge their phone, although if they are very poor they may leave it off much of the time to stretch out the time between charges.

However, that leaves the kiosks with the problem of charging the batteries of dozens of different phone models. The kiosks will commonly have a row of small plastic mouse-sized devices, plugged into power strips. These are ingenious universal battery chargers, and they are also common in middle-class homes and businesses if there is mains power, so that one battery may be charging while another is in use. The chargers are clear plastic with lots of flashing lights and are Christmas-tree obnoxious to western eyes. But in Africa, if the lights are flashing, it means that you're getting your money's worth from the charging kiosk.

**Digital Quran**

In malls catering to the wealthy, several digital study tools for the Quran were available. These devices were found in only two locations, both targeting an upper-class clientele. They are not commonplace...yet.

A netbook and a tablet were observed in one location and a netbook in the other. Neither was sold as a general-purpose device. The tablet was available for inspection; a full marketing description may be
found at http://www.islamicebook.com/. The hardware appeared to be fairly standard but the software was customized, along with packaging and marketing materials. The tablet cost 350,000 TZS ($227.86 USD; approximately the same as a similar general-purpose low-cost tablet would have in that geographic location).

The software provided the Arabic text, along with the meaning in several translations, concordances, dictionaries, and commentaries. Overall, the feature-set was similar to what would be found for other electronic religious books in a western setting.

The cover of the tablet was made of high-quality leather with beautiful embossing. It appears to be intended to convey the same cultural impression as sacred borders on hardcopy texts.

Many carriers offer holy texts of several major world religions automatically delivered daily by text message to feature phones for a nominal fee. While of low value for in-depth study, these brief blurbs appear to be particularly popular for the Quran, suggesting that this device may be poised to tap into an under-reached demographic.

**Tanzania**

The study obtained good coverage of various sizes of population centers in Tanzania. Two major cities were investigated, as were a leading central region town, and multiple villages and hamlets in the interior. The eastern-half of the country was well-covered, and some knowledge of conditions in the south were obtained through interviews, but no investigation was done of the far west portion of the
country. Anecdotal evidence suggests phone conditions there are similar to town and village conditions in the east.

Dar es Salaam

Reception was excellent. The city is well-covered by all major providers. 3G is in most areas and Edge was everywhere else.

Almost everyone has a mobile phone. It is unusual to encounter someone who doesn't have a phone. Employers expect job seekers and employees to have phones.

Most nationals have at least two SIMs. Reception is good in most of Dar, so this is for financial reasons rather than reception. In-network calls are less expensive than mixed-network calls. They make decisions on which network to use when placing outbound calls based upon the network of the destination phone number. Phones (predominantly counterfeits, but now a few name brand) with two SIMs are popular, while other people carry multiple phones; in some cases, this may be seen as a status symbol, but both phones are also actively used.

People change carriers because of pricing changes or perceived speed improvements. Providers will run sales and quickly gain a large customer base, which then slows down their network, so people switch. After a few months, enough people have left that performance has improved, and people start drifting back.

3G service from a number of different carriers is widespread and common throughout Dar.

Competition for 3G market-share is vigorous. Pricing is gradually becoming less expensive, but is still
higher than Kenya.

Samsung Android phones are available in Dar. The more sophisticated and knowledgeable value them, but many other people still view Blackberry as the prestige brand. Because of this, “fatberry” profile feature phones with keyboards are popular.

New IDEOS phones were not for sale in Dar Es Salaam at the time of the study, but shortly thereafter one of the team members reported that they are now available, heavily advertised, and proving popular.

3G USB dongles are starting to become popular.

The Wealthy

Each carrier’s high-end stores carry many different varieties of smartphones, including popular Android models. They are clearly popular among the upper class. The Galaxy Tab is 1,000,000 TZS ($651.04 USD), while an iPad is $950 USD and the MacBook Air is 2,718,000 TZS ($1769.53 USD). There is wide variation in smartphone price, but the majority tend to cluster around ~350,000 TZS ($227.86 USD).

Desktops, laptops, and netbooks from Compaq, Acer, and Dell are readily available in Game, a store similar to Wal-mart.

The Poor

The secondary market is smaller than Nairobi. All major brands are represented except IDEOS (but see note above). The Samsung Champ is 160,000 TZS ($104.17 USD). HTC is a particularly common brand. There are many knock-offs and counterfeits, but only a handful of TECNOs.
There are some phones available which appear to have come from US secondary markets, with US carriers' stickers still on them.

**Arusha**

Arusha is growing at a tremendous rate. Reception was excellent. The town was well-covered by all major providers. 3G was in most areas of town and Edge was everywhere else.

**The Wealthy**

Western tourism is the primary industry in Arusha. In addition to a street full of shops selling generic mobile phones and some basic smartphones, Arusha has a few shops that cater to the high-end. They had a selection of smartphones, but prices were quite high.

Wealthy shopkeepers purchase phones and other electronics on yearly international vacations. Female family members of shopkeepers had iPhones and other smartphones (in one case, an iPhone, a Samsung feature phone, and a Samsung smartphone, all with incoming text messages at the same time).
The Poor

Only about half of all church goers on Sunday morning own hardcopy Scriptures, but virtually all of them have mobile phones. Few have laptops, netbooks, or tablets, though.

As preparation for meeting with the team, Key Connection Ministries did a survey of 81 pastors in Arusha province. Both rural and urban pastors were included. While better educated than average (most respondents had some high-school education), they were lower-middle income economically.

All of the survey respondents owned a phone, although none currently owned a smartphone. Nearly half (44%) had phones capable of playing multimedia files, and most of these were well aware of how much memory their phones had and how to use them. Over half of all respondents planned to purchase a smartphone in the near future.

Non-3G wireless (WiMAX?) connectivity is available for residential use, and is inexpensive enough that even the under-employed with no regular source of income can afford a desktop computer Internet connect. It works good enough to stream radio stations from iTunes. Bandwidth is best at night and in

Survey of 81 pastors in Arusha province (both rural and urban). No pastors didn't own a mobile phone.

1) Do you have a smartphone?
   Yes: 0  No: 81  Don't Know: 0

2) If you do not have a smartphone, does your phone have the capability of loading and playing an audio file?
   Yes: 36  No: 44  Don't Know: 1

3) Would you be interested in listening to language development materials on your phone?
   Yes: 81  No: 0  Don't Know: 0

4) Do you know how to load an audio file on your phone and play it?
   Yes: 27  No: 9  Not Applicable: 45

5) Do you know the memory capacity of your phone?
   Yes: 17  No: 12  Don't Know: 9  Not Applicable: 45

6) Do you plan to buy a smartphone in the near future?
   Yes: 46  No: 0  Don't Know: 33  (SPF: I think 'Don't Know' should be 35.)

7) Comments?

81 respondents (100%) thought putting language development materials on mobile phones is a good program.

Source: Key Connections Ministries, used by permission.
the morning, and worst in the afternoon.

A SIP phone is provided as part of this residential wireless Internet service. It looks and functions similar to a wireless payphone for making local calls.

**Town**

Two of the survey team members live or have lived in this town. The team spent several days in it and was able to do both general surveys and visits to specific vendors.

Reception was excellent. The town was well-covered by all major providers. 3G was in most areas of town and Edge was everywhere else.

**The Wealthy**

All shops had counterfeit Blackberries, but freely admitted when questioned that they were fake. Most people purchasing them realize that they are phony, and are buying them as status symbols. No genuine Blackberries were observed at most stores.

The most expensive phones were Nokia smartphones: 6700C at 400,000 TZS ($260.42 USD), the E71 at 380,000 TZS ($247.40 USD), and the C3 at 200,000 TZS ($130.21 USD).

Both of the high-end mobile phone shops had genuine Blackberries: the 9700 at 780,000 TZS ($507.81 USD) and the Curve2 at 750,000 TZS ($488.28 USD). One of the shopkeepers knew nothing about IDEOS, Android, or Google phone, while the other knew all about them, was able to discuss them at length, and hasn't ordered any yet because customers aren't aware of them yet and still desire physical
keyboards. They frankly admitted when questioned that some of their high-end phones were stolen.

**The Poor**

The least expensive phones were clones at 30,000 TZS ($19.53 USD), but the most common low-cost phone was the Nokia 1280, at 37,000 TZS ($24.09 USD). Most popular models sold between 37,000 TZS ($24.09 USD) and 50,000 TZS ($32.55 USD).

Multi-SIM phones were abundant. No 3G phones were observed.

Mobile phone repair shops do a brisk business, mostly replacing cracked screens and re-soldering power connectors with broken leads.

**Villages**

Five villages were visited. In three, phone penetration was high; almost everyone on the street had visible phones, and children were observed casually taking phones to the charger. In two, phone penetration was about 50%. All villages had abundant places to charge phones and to purchase vouchers and accessories. Spare batteries and faceplate covers were popular accessories.

Only one village had a duka (small shop) selling new phones, and it had only been open for two weeks. It offered a few dozen typical counterfeit Nokias and a handful of genuine Nokias. The least expensive phones were a TECNO at 40,000 TZS ($26.04 USD) and a Nokia 1280 at 50,000 TZS ($32.55 USD) (which probably would have sold for 40,000 TZS ($26.04 USD) or less to a national).

The most expensive phone was a 70,000 TZS ($45.57 USD) Blackberry look-alike. Most phones had
dual SIMs, which were a major selling point. Most phones also had media player controls prominent. While some phones were marked on the outside as “3G”, none really appeared to support 3G and no real smartphones were observed.

Several other villages had small secondary markets consisting of a handful of used (& in some cases damaged) phones.

A mobile phone vendor goes from village to village, attending each's weekly market. This appears to be the primary means of phone penetration in this region. Several shopkeepers who didn't sell phones mentioned that people often go into the main regional town to purchase phones. This seems a smaller avenue, since it entails an inexpensive but all-day bus ride in poor conditions. However, a man was seen selling an apparently new phone to another man for a wad of cash in the middle of a crowd at one market; this appeared to be a pre-arranged transaction and may be a case of someone who is going to town anyways purchasing a phone to bring back to someone else.

A typical duka offering phone battery charging was 300 TZS ($0.20 USD) per charge. There are also a variety of creative businesses using it as a added bonus to draw in customers. At some roadside restaurants, customers can charge their phones as they eat lunch. Generally electricity is by local small-scale generator, although some solar panels were also in evidence.

In many (but not all) villages, there is a shop where ringtones, music, and videos can be purchased. This is often the only computer in the entire village, and it is generally a laptop or older desktop computer with a teenage boy running it. Most music is transferred by

A significant amount of DVD burning is also done. This poses a mystery which was not solved because a few people have personal TV's, powered by car batteries, but the team saw very few CD/DVD players; it's not clear what devices they are using the discs on.
bluetooth or SD card.

Reception in the villages was good. Edge was everywhere and a few had 3G. Most villages were well-covered by all major providers.

**Hamlets**

The many small hamlets with only a handful of mud huts are generally even poorer than the villages, and yet it is striking how much they resemble them in the area of mobile phones. Penetration is high and most families have at least one phone. Many families have multiple phones.

Reception is spotty. Almost every area in Tanzania visited had reception from one or more vendors, but there were many rural areas where an individual vendor would not have reception but a competitor would.

3G was rare, but all areas had Edge.

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After ½ day of hacking and hiking through dense jungle, we were accosted by an intoxicated man who lived with his entire extended family in a single hut. He decided to report the team to his “chief”. The matriarch was sent for and had the family phone in a medicine-bag-like pouch around her neck. A younger male actually dialed and the intoxicated man did the talking. Fortunately his village elder told him to stop being a nuisance. This shows several interesting things. Even in a quite rural setting:

- The family owned a feature phone.
- It was charged. There was no electricity anywhere nearby.
- It had airtime.
- They had integrated the phone into their culture sufficiently that it was their first choice instead of sending a runner.
- Drunk Guy used it often enough that the village elder was used to receiving inebriated calls from him.
Kenya

Nairobi

The capital of Kenya has all the amenities of a large western city, next to appalling squalor and poverty. Virtually everyone has a phone of some kind and reception is generally excellent.

The Wealthy and Middle Class

Nairobi has a number of modern shopping centers and malls, with numerous shops selling smartphones. Android, Apple, and Samsung are the status symbols. Nokia and Blackberry are present, but not highly sought after. Nakumatt, a chain similar to Wal-mart, sells a variety of feature and smartphones targeted at the emerging middle class.

Huawei is selling IDEOS Android smartphones as quickly as they can produce them. They are wildly popular in Nairobi, and even throughout the rest of the country. People that cannot afford $500 USD for a high-end smartphone are able to get essentially the same thing with similar quality for only about $80 USD.

IDES is already being used by NIST (Nairobi International School of Theology) to do educational development all the way from rural pastors up through masters-level coursework: “NIST/ILU has now laid out the technical infrastructure required to offer many of its programs online.” (NIST NEWS, Issue 9, 2011, p4) An in-depth interview was conducted with Dr. David Ngaruiya, who indicated they were very please with IDEOS. Their initial programs included the phone in the cost of tuition, but now they are seeing students apply who already own their own IDEOS.
The Poor

Nairobi’s city center has a large street devoted to shop after shop offering many different makes and models of inexpensive mobile phones. Most are priced between 2000 KES ($22.22 USD) to 6000 KES ($66.67 USD). The majority of the phones are blatant counterfeits, mostly of Nokia but also some of Samsung and Apple.

An Apple specialist examined several replica iPhone 3Gs. Visually they are superficially good matches, but they are light and made of low-quality plastic. The screens are resistive and require a stylus; screen resolution and contrast are both poor. The start screen graphically mimics iOS, but the cloning is quite shallow. It is unresponsive and rather than offering true applications, the built-in “apps” for Calendar, Photos, and Calculator appear to be an elaborate menu for what is essentially a feature phone. The fake iPhones are not 3G but do support two SIM cards. They cost between 5000 ($55.56 USD) and 7000 KES ($77.78 USD) at different street vendors.

Nearly all of the knock-off phones have at least two and in some cases three SIMs, which is better than most of the genuine phones they mimic.

Towns, Villages, and Hamlets

The study did not examine any towns, villages, or hamlets in Kenya. Anecdotally, voice and Edge reception is excellent throughout the country, while 3G service is available in most towns and at all new towers.
Uganda

Voice reception in southern Uganda is generally good. Edge is ubiquitous, but 3G is currently limited to a single carrier, MTN. 3G coverage in Kampala and Entebbe is good.

Kampala

Kampala is not as large or thoroughly modern as Nairobi, but is still relatively prosperous. It has less of Nairobi's stark wealth/poverty dichotomy. Most people have a phone and voice reception is generally good. Getting Internet access at all was significantly more difficult from a technical perspective than in Tanzania or Kenya, involving several service calls. Even after that was achieved, there were periods when Internet service was unavailable. When it worked, it worked well, but it frequently didn't work at all.

The Wealthy

There are a few high-end stores selling smartphones, primarily in the Kampala Rd./Bomba Rd. region. They have the most popular smartphone models, but not a good selection of less popular models. Prices are about a third higher than in Nairobi. Samsung and Apple are the prestige brands. IDEOS is available from several stores, at 365,000 UGX – 420,000 UGX ($139.95 USD - $161.04 USD), depending on the store. Samsung is selling the Champ for about the same price.

The Poor

Kampala's malls are not the completely western consumer malls of Nairobi, but rather developing world
hives of laissez faire commercial activity. Shops selling low-end feature phones abound. TECNO is
the dominant brand, but virtually identical phones spuriously branded with Nokia and Samsung logos
are also common. The models are the same ones available in Tanzania and Kenya. Counterfeit iPhones
are popular.

Even though virtually everyone has a mobile phone, payphones are also still popular in Uganda. The
typical unit is a mobile phone on a standard desktop handset chassis. As a rule, incoming mobile phone
calls are free, and so mobile phones are used by people who receive calls on their own phones but
cannot afford to keep outgoing minutes on their phones. A call on a payphone is 200 UGX ($0.08
USD) per minute. Carriers are starting to offer vouchers in denominations as small as 500 UGX ($0.19
USD) to make inroads on this business.

**Entebbe**

During colonial times, Entebbe was the capital of Uganda and it still has the principle international
airport and some major governmental compounds. However, it is much smaller than Kampala. There
are a few phone vendors in Entebbe, but most commercial business is conducted in Kampala, which is
only an hour away by the inexpensive public bus transport system. For mobile phone purposes, it may
be considered the same as Kampala.
**Towns, Villages, and Hamlets**

For security and financial reasons, the study did not directly gain experience with mobile phone and Internet conditions in regions north of Kampala. However, directed questioning during interviews yielded some information about conditions in the north.

Coverage is reported to be good. Most people have mobile phones. Edge network is available everywhere but is unreliable.

Uganda has had mobile phones since at least 1998, so voice communications is well-engrained in the culture. However, they have not kept pace with continuing trends such as SMS text messaging. SMS messaging is available, but has not predominated over voice in the same way it has in the past in Tanzania and Kenya.

**Chad**

Chad is completely landlocked. The Sahara Desert blankets northern Chad, while the south is savanna. Merging the two is a vast region featuring a mix of rock, sand, and thin soil. N'Djamena, the capital and major city, is in the west, and large refugee camps are in the east, near the border with Sudan. Chad has little economic activity, but significant amounts of foreign aid.

Chad has no 3G service. Areas which have mobile phone coverage have Edge, which works fairly well. The larger villages have coverage, and new towers are being put up all the time, especially around villages and on strategic routes between villages. These often coincide with the paving of roads by Chinese construction firms. There are still large areas, including significant villages and refugee
camps, which do not have mobile coverage.

**N'Djamena**

**The Wealthy**

Airtel and Tigo, the only two carriers in Chad, have busy customer service storefronts on opposite sides of Charles de Gaulle street, the primary commercial thoroughfare. They offer a bare handful of phones. No retail stores selling phones were observed anywhere.

There are two sources for phones. Occasionally shop owners will band together to have consumer goods such as radios and phones shipped in from Dubai; these handsets are predominantly feature phones. When Chadians make the Hajj, they return with suitcases stuffed with luxury items. Outside of the Airtel and Tigo offices are a few street vendors who have returned from Dubai or the Hajj with suitcases full of high-end phones. They offer a broad selection of phones, including a variety of smartphones. Smartphone brands include Apple and Samsung, but not IDEOS. Generally, there are only one or two of each type of phone. Prices are about double the western price.

**The Poor**

N'Djamena's main market doesn't have as many shops selling mobile phones as there are in Dar es Salaam or Nairobi, but there are enough that phones are readily available for anyone who wants one. Most shops have a few low-end Nokia feature phones and many knock-off counterfeits. Counterfeit Nokias, Samsungs, Blackberries, and iPhones were observed. A handful of shops offered some low-end Samsung Champ and Champ DUO semi-smartphones which appeared to be genuine.
A genuine Nokia 1280 was 13,000 XAF ($29.15 USD). Most phones ranged from 11,000 XAF ($24.66 USD) to 27,000 XAF ($60.54 USD). The Champ was 44,600 XAF ($100 USD).

**Towns, Villages, and Hamlets**

Towns in Chad are similar to larger villages in East Africa. If they have cellular service, the towns and larger villages have shops in the marketplaces which sell feature phones. People in smaller villages must travel to a nearby village with a larger market to purchase phones.

Basic Nokia models such as the 1280 are available for 15,000 XAF ($33.63 USD). So are many generic and counterfeit phones, for similar prices. About three-quarters of the phones are multimedia-capable. No smartphones of any kind are available.

Village elders brought in an AM/FM/SW radio/cassette player to listen to music. It has an integrated SD and USB player, and they were listening to MP3s from an SD card.

This led to a market trip specifically to research the radio SD/USB player. Many different shops which sell electronics carry them. There are many different brands, although they all appear to be from the same physical manufacturer. They come in two main sizes: cigar-box sized for ~6,700 XAF ($15.02 USD) and boom-box sized for ~13,000 ($29.15 USD). Larger size is directly equated to larger volume.

A Hairun HR-6990U cigar-box sized unit that was entirely typical was purchased.

In East Africa, it was clear that everyone involved understood that cheap dual-SIM phones were counterfeits. This doesn't extend to Central Africa. A well-educated (high school diploma) and relatively sophisticated white-collar national had a counterfeit dual-SIM Nokia. He thought it was real. When politely asked how you can tell, he replied, “You can tell because it says 'Nokia' right on it.” He clearly had no idea that his phone was not genuine. The storekeepers knew that the counterfeits were not real, but the average person did not.
Discussion

Behind the Scenes

Visits to local markets in the study area reveal a dizzying plethora of mobile handsets in a huge array of brands, shapes, colors, sizes, form-factors, and prices.

There are the “Name Brands” like Nokia and Samsung, and plenty of cheap counterfeits that are identical right down to the brand logos. Then there are knock-offs that look virtually identical, but have a very tiny change in the logo and name; these can be remarkably subtle, and sometimes to a westerner, humorous. Confusingly, there are also plenty of phones with name brand logos but with form factors that don't bare even a passing resemblance to anything that those companies have ever manufactured. Then there are huge numbers of phones which either have no branding, or bear a brand which is unheard of outside of that geographic area.

At first, this can be overwhelming. However, after looking at a number of them, and visiting multiple markets, it becomes increasingly clear that almost all of these non-name brand phones actually share a common provenance.

MediaTek, a huge Taiwanese electronics firm which is the world's largest manufacturer of mobile phone chipsets (Kwong, 2011), bares more responsibility for bringing mobile phones to the developing world than any other single company except perhaps Nokia. In 1997, Mediatek got its start as a spinoff producing chipsets for CD-ROM drives, but hopped on the mobile phone megatrend early (Wired News, 2003; Kwong, 2011).
MediaTek manufactures the chip at the heart of each feature phone. Their innovation was to provide the chip along with complete schematics and all necessary firmware software. Prior to this, it required a large corporation with significant resources to produce a mobile phone. Now a small firm with just a dozen employees can produce their own branded phone, simply by putting the chip in a case with appropriate number pad, LCD, and battery components. It revolutionized feature phones, allowed them to flood the developing world, and brought prices plummeting down (Kwong, 2011; Yang, 2009). For the last several years, MediaTek has shipped over half a billion mobile phone chipsets per year (Luk, 2011).

Taking the next step, many phones are produced by smaller firms, but the lion's share of the actual handset manufacturing is done by another Chinese firm, TECNO. They produce phones both in their own brand and white-box (without a brand, or with branding applied at the local level). The typical African market is the result of MediaTek and TECNO's dominance of the market. (Cighi, 2011) They have been successful at bringing mobile communications to the developing world masses, concretely increasing productivity and standard of living.

**Feature Phones vs Smartphones**

Feature phones are those phones which are “dumb”. They make calls and may have some canned built-in functionality such as an address book and calculator, but have limited storage and no ability to load new applications. They have small screens and no expandability. But they are very inexpensive. Most non-namebrand feature phones in Africa are built around the MediaTek MT62xx family of chips.

Semi-smartphones are not popular, but are a middle ground between feature phones and smartphones.
They usually have resistive touchscreens (which require a firm press or stylus) and often have some way of browsing the Internet. Their built-in applications are better than feature phones' included apps. But they have limited ability to add new applications. They are more expensive than feature phones, but substantially less expensive than smartphones, generally being well under $100 USD. Many semi-smartphones are built around the MediaTek MT6236 chipset (Mediatek, 2011), which is popular with copiers of high-end smartphones like the iPhone (Yang, 2011).

Smartphones have powerful out-of-the-box functionality, and the ability to download new applications which provide enormous flexibility. They are capable of accessing the Internet by Edge or 3/4G, and have capacitive touch screens and beautiful color browsers. They usually have some amount of expandability via SD cards. Smartphones play music, show movies, play games, check the weather, and occasionally are actually used for making voice phone calls.

By far, the most popular smartphone platform in the world is Android, with Blackberry running a distant and shrinking second; Apple's iPhone is third in US sales, but not actively marketed in the developing world. Samsung actively markets their smartphones to the upper class in the developing world.

Huawei, the huge Chinese electronics conglomerate with close ties to the PLA, has recently made waves with the IDEOS Android phone. It is a low-cost Android phone designed and marketed specifically for the developing world. The IDEOS broke new ground by costing $80 USD, by a large margin the least expensive Android phone at the time. The IDEOS is well built and quite functional. The battery life is short if used for extensive web browsing, but if used primarily for voice and text, it lasts for several days. It is popular wherever it is introduced.
Samsung's semi-smart Champ seems to be positioned as a response to the IDEOS because it is not generally found in Samsung's high-end stores, but frequently is available in street shops where the IDEOS is present, and usually for the same price. However, the two phones are not comparable either in hardware or software. The Champ is proprietary software and a resistive touchscreen, while the IDEOS runs standard Android with a capacitive touchscreen.

MediaTek's MT6573 platform is specifically designed to replicate with Android the success which MediaTek had with feature phones (MediaTek, 2011). It provides a tightly integrated chip along with everything necessary to turn out an inexpensive but competitive quality Android phone. MediaTek is under considerable financial pressure to expand this line of business rapidly (So, Asia Times Online, 2011), and it appears that low-cost Android phones are about to flood the African markets in late 2011 or early 2012. MediaTek is expecting to ship 10 million units in 2011 alone (So, TechNode, 2011). It will be interesting to see the price-point that they have success at; IDEOS sets an upper bound on practical pricing of $80 USD and feature phones are currently $20 - $60 USD.

**SIM Numbers Don't Tell the Entire Story (But It Doesn't Matter)**

The GSMA, which represents carriers, has a nifty counter on their homepage, which indicates there are over 5.3 billion GSM connections (ie SIMs)! Viewers can watch the number increase in real-time by about fifteen a second. (GSMA, 2011) Statistics on phone penetration are often based upon number of “subscriptions” (meaning SIMs) sold. By this measure, 75% of all humans now own mobile phones! However, this statistic is a bit misleading. It is predicated on the assumption that one SIM equals one

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1 November 30, 2011: Based on personal correspondence with Chris Vickio, this prediction is already coming true.
account equals one phone equals one person. This is not true anywhere in the study area. As Aker and Mbiti point out,

This does not mean that 376 million people have mobile phones in sub-Saharan Africa—some people may own several handsets or subscriber identity module (SIM) cards, suggesting that official figures might overestimate the number of actual users. On the other hand, sharing mobile phones is a common practice in Africa, so usership could be even higher than subscriber totals suggest. There is, in either case, no question that Africans are using mobile phones in high numbers. *(Africa Calling, 2010)*

IT News Africa adds,

There is a strong trend for Africa mobile subscribers to have multiple SIM cards and consequently the number of unique users of mobile services on the continent is smaller than the number of subscriptions. The number of unique users in Africa at end-2016 is forecasted to be 572.35 million. *(2011)*

GSMA’s *African Mobile Observatory 2011* estimates that 20-25% of SIMs are duplicates in Egypt and South Africa and comments, “It is believed that this percentage may be much higher in the less developed African nations.” *(2011, p13)* It also reveals that customer churn in 2010 was at 38% (p19), although their specific definition of “churn” is unclear in the context of multiple SIMs.

The team’s first assumption on encountering this phenomenon was the same as GSMA's and other western researchers: that multiple SIMs were desirable because of poor signal coverage. While this was occasionally true in rural areas, almost nobody questioned indicated this as a reason.
Three attributes contribute to the trend of individuals having multiple SIMs: In-network calls and texts are less expensive than calls between SIMs from different carriers. SIMs are inexpensive (generally less than $1 USD, and sometimes free during promotions). Phones are not generally locked to a single carrier, so the cost of change does not include purchasing a new phone.

So it is common for people to have multiple SIMs. Which SIM they use on a daily basis for receiving incoming calls is a complex decision based on factors such as the various carriers' perceived rates and reception quality, which SIM their friend uses, which SIM they happen to have credits on, which SIM they used last and is already in the phone, and any promotions carriers have.

When they wish to call a friend, they will insert the SIM for their friend's preferred carrier. If it doesn't go through, they will remove it and try again with their friend's number on another carrier. This reveals the principle downside of multiple SIMs: each SIM is a separate phone number, and so individuals rapidly accumulate a list of numbers at which they may be reached, depending on which SIM is in their phone at any particular time.

Illustration 7: Businesses frequently have multiple phone numbers on different carriers.

Africans seem to have accepted multiple numbers as a minor inconvenience worth the cost savings and
flexibility provided by using multiple SIMs. Many business signs will list multiple phone numbers, with the general understanding that if an inquirer doesn't get an answer on one number, they are just to call back on the other carrier's number.

In addition to this being readily observable all over the study area, the huge demand for dual-SIM (and even triple and quad-SIM) phones, which make managing this easier, is a strong indication that multiple SIMs are a common and daily fact of life (BlogyMate, 2011).

Western phone manufacturers have been slow to accept this trend, with Nokia and Samsung only recently introducing dual-SIM models. This has led to the counter-intuitive situation where many of the counterfeit phones are actually offering a significant feature that their genuine counterparts do not.

So SIM numbers significantly over-state the number of Africans with mobile phones. But it doesn't matter. The largest productivity and quality of life gains were achieved when the average family had at least one mobile phone, which has indisputably happened. That revolutionized Africa in ways that are still only beginning to be understood. Further gains were made when most adults had phones, which has happened in many areas, including virtually all urban environments. Additional gains, while important on an individual level, won't spark another huge productivity increase on a mass scale.

**Experimental Business Plans**

The strong competition between carriers, and between handset manufacturers, has led to a dynamic market where many companies feel free to experiment with alternate business plans. These trials are
quickly rolled out, their effectiveness evaluated, and expanded or discontinued as warranted. The basic prepaid unlocked formula appears firmly entrenched, but carriers are eager for anything that can get them more lock-in to combat the low customer loyalty. Some niche strategies observed were:

- A wide variety of various pricing strategies and cost points.

- Printing vouchers in very small denominations. This allows even the poorest of the poor to keep a smidgeon of airtime available for emergencies, and drives additional usage.

- Locked phones, offered for large (~50%) discounts off of the normal price. Locked phones are foreign to the typical African mobile phone experience and promotional materials do not make it clear that these phones are locked. At the same time, an African is significantly more likely than an American consumer to attempt to switch SIMs to another carrier. This will probably lead to poor customer satisfaction.

- Semi-locked dual-SIM phones, offered for somewhat low prices. These phones come with one SIM slot locked to the specific carrier while the other SIM slot may use any carrier. These may enjoy better success than the locked single SIM phones.

- Two SIM “husband & wife” bundles. Two SIMs are sold in the same bundle. Their phone numbers are one digit apart, and free calling is offered between the two (usually with restrictions such as time of day).

- Regional SIMs. At least one carrier is advertising SIMs that work across countries. Some of the advertising is unclear at best; these do not give local calling to another country. What they do is allow a single SIM to be used in multiple countries, at the same rate as a local SIM would
be charged. A SIM bought in Tanzania, for example, can be used in Kenya to make local Kenya calls at the same rate as a native Kenyan SIM. They can also be recharged with local vouchers. Incoming calls are received as normal, allowing someone to keep their phone-number while traveling.

• “Free” music. Some carriers are offering free streaming music over their phones. However, the fine print is such that this appears to be mainly an advertising ploy, since there are hidden fees and tight restrictions, which render it much less practical than alternatives.

• “Free” calling. A heavily advertised service being experimented with by several carriers, this allows free calling between phones on the same network. Generally there are various restrictions such as time of day. The goals are to grow market share and to encourage use during non-free times.

• First minute free. Incoming calls in Africa are generally completely free, which encourages phone adoption even among the poor who would otherwise leave the phone off except when it was needed. (See “Beeping”.) This is one reason consumers use multiple SIMs. Carriers are desperate to end this practice, but cannot because of consumer backlash. Several carriers are trying to move to “first minute free” without revealing the change. The consumer doesn't always realize that after the first minute, their phone is being charged for the incoming call.

• Postpaid plans for the middle class. These work similar to the US, but to offer that level of credit on a broad basis in Africa is considered novel.
Any sufficiently advanced technology...

Africans have adopted mobile phones rapidly, integrating them into their cultures and lives. It is the first consumer electronics that most of them have ever owned. In some cases, they are every bit as savvy as western consumers. In others, they have developed unusual understandings of how the technology works which are incorrect but reasonable within their worldviews.

An elder in one village with poor reception was able to explain that the “signal” comes from the towers, but wasn't clear what that really meant, even at a high level. In a case of sympathetic magic, he explained what to do if you need more signal:

Get a long pole. Put a white bowl on the end of it. It's got to be just the right white bowl; get a good one. Attach a long wire to the bowl. It doesn't have to connect to anything. Stick the pole straight up next to your hut and over the course of a few months, it will gradually lure the signal in so you can use it.

Sure enough, a number of huts in the village sported these poles. The elder was confident that it worked, but conceded that if you really needed a signal, you...
might have to run to one of the “phone trees” which had good reception, a kilometer outside of town.

As interesting as this is, it’s not clear that it has any practical impact on their adoption of the technology. After all, many Americans don't understand the difference between RAM and a hard drive, but use a computer daily in their work.

**SMS Texting**

In the past, African text messages have been less expensive than voice communications, in line with the actual comparative costs of the two services to the carriers, but in stark contrast to U.S. fee structures. In high and even mediocre literacy areas, this has lead to high messaging rates. In fact, it would not be inaccurate to describe the primary use of mobile phones in these areas to have been texting, with voice communications a secondary occasional activity.

In low-literacy areas, voice communications were much more prevalent, raising the general cost of phone usage for the very people who are least likely to be able to afford it. Even in some areas with low literacy, though, texting has been popular because of its relative cheapness. Different numeric codes were used to indicate different things. This allowed someone who is numerate but preliterate to benefit from SMS capabilities and prices.

However, in the past year or so, the price of voice calls in many areas has switched from per-minute to per-second and has dropped to the point where short calls are cheaper in many African locations than a text message. For example, factoring in all taxes, an SMS on Vodacom Tanzania costs 57.6 TZS ($0.0375 USD), which is as much as a 23 second phone call (Vodacom, 2011).
Africans are clearly aware of these price differentials and are adjusting their calling and texting patterns accordingly, leading to more brief and abrupt awkward phone calls which are quickly terminated by the originating party after only a sentence or two. In most African cultures, brevity may be considered rudeness, so this may be the beginnings of a significant cultural shift driven by technology and finance.

It should be noted that in much of the available literature, SMS is lumped in with “Voice” (generally when comparing voice with data), leading to statistics which may easily be misinterpreted to imply that SMS is a minute portion of actual usage.

**Nokia's Collapse**

While perhaps not strictly related to this study, it would be remiss not to mention an event which will have profound impact in the study area: the collapse of the largest branded mobile phone manufacturer.

Nokia was the first “name brand” manufacturer to embrace the developing world, and has long dominated it with massive market share. However, squeezed by MediaTek and TECHNO from the bottom and IDEOS on the upper side, and with an increasingly obsolescent Symbian platform, it has faced serious competitive pressure. Its board, unhappy with its eroding market share and failure to penetrate the US market, appointed former Microsoft VP Stephen Elop as CEO.

In a surprise move, Elop published a memo comparing Nokia (which sold a phone to one out of every fifteen humans on the planet in 2010; computed from information in Nokia, 2010) to a burning oil platform (Gustin, 2011), and announced discontinuation of its feature phone business and a major shift to the untested Microsoft Windows Phone 7 platform (Laul, 2011), which has no market share.
Nokia R&D has heavily invested skillsets in Symbian and MeeGo, and no experience developing for Windows Phone 7. Nokia will only actually ship its first Windows Phone 7 smartphone in late November 2011 with general availability sometime in 2012, effectively ceding the smartphone market to competitors for a year.

Both Nokia's stock price and its market share have gone into free-fall. On 9 February, 2011, before the “burning oil platform” memo, Nokia was trading at 11.73; five days later it had dropped to 8.84. By 25 November, 2011, Nokia was trading at 5.29, a drop of 55%. (Yahoo! Finance, 2011)

Already in mid-2011, during this study, it is clear that Nokia has peaked as a brand in the study area. Samsung and IDEOS completely dominate the high-end market. While Nokia still sells many 1280's and similar models, and is enjoying some success with new dual-SIM phones (ben-Aaron, 2011), nevertheless they are swamped by the MediaTek/TECNO steamroller on the low-end.

**Conclusions and Recommendations**

At the beginning of this study, the question was poised,

> At the real-world ground level, are mobile phones, tablets, and other Internet devices a viable tool for minority language development work in Africa? If so, what audio and textual formats are most practical? Specifically, ILAD has literacy and language development educational materials in both audio and digital textual formats. Is Africa ready for this type of material?

For audio materials in MP3 format, the answer throughout the study area is undoubtedly, “Yes.” For textual materials, the issue is more of a mixed bag.
Audio Materials

About two-thirds of all the phones observed during the study were capable of playing MP3 files. Music is a major selling point of newer phones. Virtually all phones purchased in the future will come with this ability as a basic feature which everyone assumes all phones provide.

And listening to music phones is popular. The Key Connections survey was of pastors, not young people, and yet almost half of respondents knew that their phones were capable of playing music. Three-quarters of respondents who knew that, knew how to use the feature, and well over half knew the capacity of their phones.

The USB/SD-capable SW radios were a serendipitous discovery. These devices have a similar form factor and capabilities to devices which have been successfully used in language development in the past. They lack solar panels or hand cranks for charging, and their search and navigation is limited to Next Track and Previous Track, but they have the following important advantages:

- These devices are already widely available. People already own them and clearly they are within the purchasing capability of many people in the developing world. The distribution channel is already established.

- People have already made the conscious choice to expend resources on purchasing and charging them. They have decided that they can keep them powered without specialized hardware.

- They are already integrated into their cultures. Gathering around the “radio” to listen as a group is a normal part of daily activity.
• Propagation of educational materials ceases to be an issue of distribution for development organizations and becomes a normal part of their culture. They are already used to getting materials to listen to from the village market on SD, or by trading with other people.

• It is far more efficient in cost, shipping, and effort, to distribute SD cards than entire electronic devices.

• It gets them away from “the westerner gave me this as aid” and into “I purchased this myself”. Materials are no longer treated as the “white man's message”, and more as their own. Control of educational materials are pried away from development organizations, and moved to the people themselves. They are encouraged to take ownership of the results.

Some organizations have long tied the gift of expensive audio devices to a DRM “lock in” so that they cannot be repurposed for listening to non-approved materials. These devices use standard MP3 format and standard SD or USB media storage, and do not support this neocolonial view. If the minority language materials cannot compete with entertainment, then they deserve to be replaced with something useful to villagers. For centuries, this has proven not to be the case, and this is a false fear.

**Textual Materials**

Everywhere in the study area was ready for audio-based minority language materials, but for textual format materials, there was significantly more variation. The tremendous popularity of IDEOS, combined with MediaTek's Android plans, show that Kenya is ready for digital text formats today, and Tanzania is likely to be within 1-2 years. NIST is already providing successful education programs in these formats today. Uganda may take a little while longer, but if MediaTek is successful, then it too
will be ready for digital text in the next few years, at least in the cities and towns. Landlocked Chad is more challenging: it may not be ready for quite some time.

**Formats: Download vs Stream**

In the West, many media distribution systems use streaming, where a constant stream of data flows from the servers to the media consumer’s computer, retrieving content on the fly as it is needed. Rights-holders often like this approach because they (generally mistakenly) believe it makes it more difficult for the end-user to save or redistribute content. However, redistribution and repeated study is typically the desired goal for minority language materials, so minimizing it is in direct opposition to the stated interests of literacy and development organizations.

Rights-holders also like the excellent usage tracking it allows. Being able to say, “X people read Y passage in the last month.” or “Z% of our users accessed the material this weekend between 9AM and 12N times.” is both a powerful head trip and the kind of information that grant reviewers and donors like. While the financial benefit from donors should not be dismissed, it comes at the cost of the end-user's privacy.

Regardless, streaming has significant practical issues in Africa. Architecturally, streaming is a horribly inefficient use of bandwidth. Even with caching, content which is repeatedly studied must frequently be downloaded multiple times. And caching defeats the perceived benefit to rights-holders.

Streaming requires an “always on” Internet connection. This study found that cities and towns were generally well-covered, but in the villages and other poor areas where there is the greatest need for minority language materials, Internet coverage can often be spotty. Even in areas with good coverage,
the common practice of overselling bandwidth means that actual performance varies significantly throughout the day. It generally is good enough for email or light web-browsing, but streaming could be quite frustrating.

Many interviewees were asked about how well streaming would work in the study area. All those asked were unanimous that streaming is completely unviable. Nobody was found who believed it could work at all.

Everyone cited the same problem: African users are extremely cost-conscious. Prepaid works well for them because they avoid commitments which require future financial expenditure on a hard-to-predict basis. Any system which requires continual data transmission from the Internet is a direct cost to them and will not be successful.

This means that any successful literacy program must use non-streaming media formats. For audio, MP3 is the obvious choice because all of the existing hardware already supports it and a distribution channel is already in place via the local markets. The organization of minority language materials in audio formats is a well-understood problem out of the scope of this study.

In the case of digital text, with the exception of one major vendor, everyone seems to be coalescing behind the open EPUB format for digital books. Indeed, the format is supported on nearly every platform capable of showing digital text materials. There are several general-purpose EPUB readers for the Android platform.

EPUB produces a close emulation on the phone, tablet, or computer, of a printed book. Unlike PDF, which strives to duplicate the exact page layout of a physical piece of paper, EPUB allows for intelligent
page flow based upon the resolution of the screen, while still preserving high fidelity to the original.

Since minority language materials have been produced in paper format for many centuries, EPUB seems a good fit.

The current EPUB reader software is excellent for reading a novel straight through, but is still in early generations. Today's popular readers have room for improvement in how they deal with textbooks and other minority language materials with long and highly organized text which the studier may want to flip back and forth through.

Preliminary experiments with large minority language documents reveals that even with early reader software, EPUB is viable. Simple changes in tables of content can make large documents significantly easier for a student to navigate. Large documents' tables of content should follow a two-level layout: Book name and chapter. Nothing else is needed, and in some readers more detailed navigation can cause otherwise useful user-interfaces to become so cluttered as to be unusable.

In some cases, instead of one large volume, it may be better to split minority language materials into two volumes, or even more. Many cultures from another major world religion are already predisposed to accepting multiple divisions. While current Android phones such as the IDEOS can load even massive volumes, never-the-less, smaller volumes are more practical, especially when jumping around and trying to locate specific materials.

**Video Materials**

Video minority language materials such as digitized films in heart languages were not within the original purview of this study. However, NIST has demonstrated that such materials are quite viable
anywhere that the IDEOS or other Android phones are available. Today, this includes Kenya and Tanzania. However, the same caveats apply as with textual materials, above.

Additionally, watching video draws down battery life much faster than EPUB reading. This is not a problem in cities and towns, but interviews reported that it is a concern in rural areas where recharging is available but may be expensive at the increased frequency needed for video.

**Next Steps**

This study found that East Africa and Chad are ready today for literacy and educational materials in MP3 audio format, and that some countries are ready for materials in EPUB format today, while other countries will require more time.

ILAD is in discussions to do a similar grass-roots intensive study in 2012 of a single West African country which has not been included in many existing studies and statistics. For example, it isn't included in GSMA's otherwise comprehensive *African Mobile Observatory 2011* (p4). This study will be the first of its kind, reaching all major areas of the country, but will require additional funding.

A return visit to East Africa to follow up is planned for 2013, funding permitting. Of particular interest is gathering additional data in western Tanzania and rural parts of Kenya. GSMA's *African Mobile Observatory 2011* indicates that it is common for people too poor to own mobile phones to have a SIM which they use in borrowed phones (p29); while we did not observe this, it makes sense and bears further investigation. We would like to visit other countries, as well, if security conditions permit.

We also have had discussions about performing a study in 2014 in Papua New Guinea, one of the most
logistically and linguistically challenging places on Earth. This will involve significantly higher expenses.

Additional work needs done to determine optimal recommendations for formatting large EPUB literacy documents. This is probably a suitable topic for a separate study.

**Appendix: Lessons Learned**

The following are some suggestions for future surveys, based upon experiences in this one.

**Note Taking**

Use a smartphone to take verbal notes. It was unacceptable to take written notes during many encounters. Shop owners frequently would not allow it. However, mobile phones are common enough that someone speaking into one is utterly banal. Future studies could simply speak notes in realtime into a note-taking application. This would increase accuracy of study encounters and make daily writeups more detailed.

Smartphone apps to measure broadband speed would also be useful, although speeds typically vary significantly at different times of the day.

**Taxis**

Throughout the study area, both long distance buses and city public transport bus-vans were inexpensive and for the most part safe, as long as western ideals of comfort and personal space were left behind. Taxis, however, were the single largest source of conflict with nationals, a major source of
stress and frustration, and a safety issue.

In many prime locations such as bus stations and shopping areas, there are taxi cartels which make negotiating for prices difficult. Fuel prices were a serious concern for national economies during the trip and taxi drivers were clearly feeling squeezed. They were often aggressive and in one case the team avoided physical violence between rival drivers only by leaving the area on foot posthaste.

Prices should always be negotiated before putting anything into the taxi. If a taxi was called, confirm that the taxi pulling up is actually the one originally called by hitting redial. If the taxi driver's phone doesn't ring, walk away.

No taxi driver will ever admit to not knowing where an address is. Westerners are always charged high prices, which makes a driver eager to get the job, and in a face-saving culture to admit to not knowing an address would be shameful. Yet in a large percentage of the team's rides, the taxi driver turned out to actually have at best only a vague idea of the area of town where an address might be.

This led to many occasions where they drove around for a while aimlessly while hoping someone would shout, “There it is.” Since the team had never been to most places, this didn't work. It put the team perennially behind schedule and of course, at the end of the ride, the driver always needed “a little extra” because it took twice as long as it should have. This led to stressful negotiations at the end of many rides as well as the beginning, and the team always seemed to pony up in order to leave a good impression.

Taxi drivers in many areas are used to being given the general area of town and a specific landmark. To the extent possible, have hardcopy printed maps and directions of every location. Even in some fairly
large towns, there are plenty of areas where conventional street addresses are, at best, an unfamiliar concept.

**Financial Accountability and Expenses**

The team is used to high financial accountability standards which require receipts for every single expenditure and actual expenses submitted for reimbursement. Typically, each team member would track their own receipts and submit their own paperwork. This works well in a single country where they are familiar with local customs, currency, and prices, and speak the language.

This system proved unwieldy when visiting so many countries in quick succession. Many expenses such as taxis were incurred jointly, leading to only a single receipt. Likewise, most waiters provided only a single receipt which had to be divided and paid for jointly. Numeracy was poor and errors on receipts were common; errors were just as often in the team's favor as the restaurant's. Housing was often shared. Also, team members were continually having to swap amongst themselves to come up with correct sized bills in the correct currency; exact change frequently was not available and westerners are always expected to eat the difference.

In the future, all team members should pool their funds and as long as daily expenditures stay at or below budget, no receipts should have to be divided out individually. This will save a lot of time and effort, especially for meals. Then, at the end, receipts can be submitted jointly and each member can take per-diem rates.
Batteries and Connectivity

Crossing borders was a stressful time for the team. The primary issue was not the border crossing paperwork, but rather that everyone in the team knew that a couple of kilometers across the border we would lose our wireless connections. Until the team had the opportunity to acquire SIMs in the local country, stress levels remained high.

Coming off of long (in two cases, 16 hour) bus trips, every battery in the team would be exhausted. If all contact information is in a smartphone or laptop with a dead battery, there is no way to determine where to overnight until mains power is located for recharging. All travel plans, hotels, contacts, etc. should be kept in hardcopy, such as an old-fashioned Daytimer. Paper doesn’t require batteries.

Downtime

The team hit the ground running. Several days downtime needs inserted at the beginning of the trip to allow members to get over jetlag.

This study covered a tremendous amount of ground in a short time. In addition to several air flights, most of the team did 4000km by bus and public transport. These rides are physically exhausting and it is aggressive to plan much on the same day as a long bus ride.

A day or two of downtime needs added every week just for rest. The trip was planned out with activities almost every day. By half-way through the trip, the team was physically exhausted and having a variety of Africa-related health issues. An unplanned four-day pause allowed some critical recovery time. The whole team functioned better after it.
**Luggage and Laundry**

The less luggage, the better. This is particularly important given the travel extremes. Each team member should have a single carry-on sized knapsack and a single suitcase.

With only a couple of changes of clothing and hot, humid climates, team members ended up doing laundry every other day. Doc Bronners is an excellent versatile travel soap. The expensive travel clothing sold at REI and similar stores proved significantly better at drying after hand-washing than did standard clothing. This was particularly important for under-garments.

Nothing should be taken on the trip that cannot be left behind. Each team member should be able to carry or drag their luggage at least a kilometer over a gravel road. Uphill. In the dark. On the edge of a cliff.

The team should carry a well-stocked first-aid kit, including malaria tests and treatment, oral rehydration solution (ORS) mix, Pepto-Bismol tablets, and Loperamide (Immodium AD), as well as bandages and antiseptic.

**Daily Write-Ups**

At the end of each day, the team wrote up results in emails which were sent back to an administrative assistant. This ensured that even if interim paper results were lost, the trip data would still be available. It also helped work through the day mentally and focus on what had really been learned and observed. This process, though, took significantly longer than anticipated each night. Additional time needs explicitly allowed in the schedule for this activity.
Group Composition

The ideal group has five roles:

**Leader** - Organizer, sponsor, and ICT4D expert.

**National regional expert** - This should be a national who is fluent in the major languages used in the area and that has experience in multiple countries along the route. The national is an invaluable team member who understands local customs and helps make everything run smoother. They are also more in-tune with safety-related issues than expatriates.

**Translator** - At least one additional translator. At various times, the team will split up and the national can't be everywhere. If several people can be asking questions at each market, it increases effectiveness.

**Logistics, finance, and transport** - Keeping track of where the team is staying, calling ahead, juggling currencies, and arranging transport is a full-time role.

**Intern** - This type of trip is an excellent way for a college student to pick up a lot of cross-cultural experience very quickly and to learn about the differences between regional countries and people-groups. One of the intern's responsibilities should be to keep track of luggage in chaotic environments when other team members are distracted.

Works Cited

*Note: The mobile phone megatrend has moved so quickly that statistics and information more than a*
year or two old are hopelessly obsolete and worthless for this study's purposes. Virtually everything of note on it is online.


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