

“I want to imagine how that place looks”: Designing Technologies to Support Connectivity Between Africans Living Abroad and Home

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ABSTRACT

Uneven access to Information and Communication Technologies (ICTs) in parts of the African continent make it challenging for some Africans who migrate to the U.S. to communicate with family members in their countries of origin. However, Internet access is becoming more widespread throughout the continent and this development presents an opportunity to explore how future interactive systems can support exchanges between families with members living in developed and less developed countries. To investigate these design possibilities we interviewed 27 African-born students, currently living in Virginia, U.S., and asked them how they used ICTs to connect with family members in their home countries. Our findings informed the development of a low-fidelity prototype that eight students lived with for four to five months. Findings from this deployment study motivate a discussion regarding features to include in interfaces designed to support transnational family communication. Features include personally meaningful imagery, country specific content, and the ability to monitor the weather and changing currency rates in migrants' countries of origin.

Author Keywords

HCI4D/ICTD; Family communication; research through design; interaction design; diaspora communities; transnational

ACM Classification Keywords

H5.m

INTRODUCTION

The benefits accompanying high-bandwidth Internet access and low cost phone calls are unevenly distributed across the globe. Consequently, communication remains challenging for some individuals living in developed countries who regularly communicate with family members living in less

developed countries [39]. Census data indicate there are 1.4 million foreign-born Africans residing in the U.S. in 2007 and that number is growing [33]. Some of these individuals come from rural parts of Africa where the infrastructures necessary to support video-mediated communication (VMC) are scarce and high costs make domestic Internet access unaffordable for many people living there, so they can not always use these ICTs to connect with family members in their countries of origin [26,35,39]. Existing VMC applications appear to be developed for families with access to high-speed and high-bandwidth Internet at home (e.g., [9,23,42]). Yet, the arrival of an undersea fiber optic cable to East Africa promises to bring a higher quality Internet experience to the continent [1]. This development suggests that more African migrants in the U.S. may be able to use applications like Skype and Google Talk to communicate with family members abroad. But the question of whether systems designed to connect African migrants in the U.S. with their family members living in their countries of origin countries should differ from existing ones remains unanswered.

To understand what future applications designed to support these exchanges might look like, we interviewed 27 African-born students attending colleges and universities in Virginia, U.S. We asked them how they used, or did not use, mobile phones and the Internet to connect with family members in their countries of origins. Participants' desires to “see” home and to monitor the time of day there, motivated a simple design concept that displays an image of each participant's home with a changing background to mimic the sky's natural progression from day to night.

We built a version of this concept and asked eight participants from our formative study to live with it for four to five months. Though simple and low-tech, our design concept evoked a rich set of interpretations from participants including wanting to use VMC to view the surroundings of one's home in addition to the interior, to monitor activities outside the home that contribute to family members' well-being such as the growth of crops and to use ICTs to expose Americans to the diversity of life within the African continent. Findings from this deployment also suggest interfaces designed to support communication

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between African transnationals and their family members abroad include factors that do not yet exist in current applications. Elements to include in future systems include personally meaningful imagery, country specific content, and the ability to monitor the weather and changing currency rates in migrants' countries of origin.

RELATED WORK AND MOTIVATION

ICTs and Family Communication

Communication between remote family members continues to attract research interest within HCI, CSCW, and related fields. Researchers working in this area tend to develop novel systems to support connectedness, or the positive emotional sense that comes with staying in touch with loved ones [8,23,41]. Increases in domestic Internet access and high-bandwidth connectivity provide families in developed countries with additional ways to communicate and have motivated research examining how they use commercial applications like Google Talk, Skype, and iChat to maintain connectedness with extended family members.

Notable instances of this research include Kirk, Sellen, and Cao's study of VMC in 12 homes in the U.K. Their findings reveal how these technologies make families "feel closer" to extended members, more so than phone and email alone [8]. Findings from other studies suggest that VMC technologies enable family members to immediately and virtually share routines, feel involved and for young children to interact with grandparents in ways that are difficult to achieve without video [2,23]. These studies examine families living in North America and in the U.K. who communicate with extended members living within North America and the U.K., where Internet access is widespread and easily accessible. Yet there are a growing number of people living in these regions who have family members residing in countries with under developed technological infrastructures and where uneven access to technology limits Internet use.

Prior work exploring family communication in this context include: Horst and Miller's work examining the integration of mobile phones in Jamaican transnational communication [20,21]; Burrell and Anderson's study of how Ghanaians living in London use ICTs [7]; Parreñas' exploration of how Filipino migrants achieve intimacy across great distances [26]; Wyche and Grinter's study of Kenyan migrants in Atlanta, Georgia, U.S. [39]; and Williams et al.'s investigation of transnational Thai retirees' ICT practices [37]. Findings from these studies reveal how high costs, lack of infrastructure and access to ICTs in migrants' home countries limit some forms of communication (e.g., regular phone calls, VMC, and digital photo exchange). We build on these studies by translating our empirical findings into design recommendations and a low-fidelity prototype we deployed to uncover additional ICT possibilities.

To date, prototype systems designed to support family connectedness do not account for individuals in the U.S. who communicate with family living in infrastructure poor settings so these recommendations are needed. Underlying the design of high-fidelity prototype systems, such as *The Family Window* [23], *Share Table* [42] and commercial applications (e.g., Skype) are assumptions that families and their extended members have high bandwidth Internet connectivity in their homes. This is not always the case [39]. Further, like Gaver, we recognize that ideas emerge slowly over time, so we deliberately created a simple low-tech artifact and asked participants to use it [12]. This decision allowed us to uncover new design opportunities prior to committing the time and resources to building a functional system.

Designing with the Diaspora and Migrant Communities

We are not the first researchers to study members of diaspora communities to shape future technology design. Foucault, Russell, and Bell argue that studying migrant communities is useful for understanding sites researchers can not access due to political instability, terrorism, or travel restrictions [11]. Before travelling to the People's Republic of China, Sudden Acute Respiratory Syndrome (SARS) broke out and they were forced to cancel their trip. In response to this challenge, they developed novel research methods and used them to collect data that might have been collected in China. Their creative approach includes interviewing exchange students from China living in Portland, OR. Building on this research, Best and his colleagues conducted a series of design exercises with members of the Liberian diaspora community in Atlanta, GA [5]. They used their findings to inform the interface for a kiosk system, called *MOSES*, that was later evaluated in Liberia [32].

Inspired by these projects we interviewed exchange students from Africa who were affiliated with area universities. Unlike these prior studies, we were less interested in how migrants could act as surrogates for users in developing countries. Instead, we wanted to understand migrants' unique experiences and how they used (or did not use) mobile phones and the Internet to maintain ties with family in African countries.

Human-Computer Interaction for Development (HCI4D)

Our work also broadens the scope of topics considered in HCI4D research, or studies that focus on understanding how to apply HCI principles to the design of technologies for developing regions (see [19] for overview). Prior projects tend to focus on developing mobile applications to address needs associated with economic development, such creating local livelihood activities. Notable examples include *Avaaj Otalo* [27], a mobile service for rural Indian farmers that provides interactive, on-demand access to appropriate and timely agricultural information and Gupta et al.'s mobile crowdsourcing platform developed to support income generation among rural Indians [18].

Our research did not take place in a developing country and we did not create mobile applications to support economic development. But our decision to design with and for African transnationals builds on prior HCI4D research by extending the community's focus to include ICT use within a transnational context, or imagining technology use beyond a single country or culture [34]. After all increased travel, communication, and migration generate an understanding of place and community that spans multiple cultural and geographic settings [3]. Yet, HCI researchers tend to focus on local place-based scenarios overlooking the ways users are connected across developed and developing regions.

We are not suggesting studies of diaspora communities can substitute for studies of cultures in a pure or home context. Instead, like other HCI scholars argue [22], we contend that studies like ours illuminate the fluidity of cultural, regional, and transnational boundaries, as well as the variability of what "home culture" can mean in daily life. We also hope our focus on Africans living in the U.S. pushes the HCI4D community to consider the ways ICT can support their role in the economic development of their home countries [15].

FORMATIVE STUDY: OUR APPROACH

An ethnographically informed approach lent itself to our goal of uncovering insights to inspire and motivate design concepts [29]. We started our project by conducting one-on-one, semi-structured interviews with 17 students and four small-group interviews that resulted in 10 additional participants. Interviews occurred over a four-month period in fall 2010 and primarily took place at the following campuses in southwest and central Virginia: Hollins University, Radford University, Virginia Commonwealth University, Virginia Tech, and Washington and Lee University. Each institution has an African or international student group. We used the Internet to find the leaders of these organizations, sent them email announcing our study, and arranged one-on-one or small group interviews with interested students. In addition to being an accessible group, we interviewed students because they shared an experience common to many Africans who come to the U.S., they come to the country to further their education [4,10].

Like other researchers studying transnational populations we struggled with finding an appropriate term to describe our participants, because no single term applied to all of them [7]. 'Immigrant' suggests their stay in the U.S. was permanent, yet more than half of those interviewed wanted to return home. The term 'ex-patriate' implies status and privilege, and perhaps could be used to describe one or two of the students interviewed. None were forced to leave their country of origin so 'refugee' or 'asylum-seeker' was inappropriate [4]. All participants were born in countries in Africa, so we use 'African-born' throughout the paper. We also use 'transnational' because of our interest in how technology links these individuals with their country of origin [31].

Students came from 12 countries in sub-Saharan Africa. Six from Kenya, four from Nigeria and Zambia, and others came from Botswana, Cameroon, Ethiopia, Ivory Coast, Malawi, South Africa, Tanzania, Uganda, and Zimbabwe. Nineteen were graduate students and the remaining eight were undergraduates. We interviewed slightly more men than women (15 men and 12 women) and nearly every participant was relatively new to the U.S. One student had lived in the country for four years and six had been in Virginia for three years. The majority of those interviewed had been in the country for two years or less at the time of our study. Slightly more than half of our participants came from rural, rather than urban regions, in their home countries. All reported communicating with home as frequently as possible; thus, providing us with the most opportunities to study phenomena central to our study: communication between individuals living in countries with different technology infrastructures.

Participants' family structures varied. Eight left husbands, wives and children in Africa and frequently used ICTs to communicate with them. Nine students currently lived with their nuclear families in the U.S. The rest identified as single and told us they frequently communicated with their parents, siblings, cousins, and friends in their homeland.

The heterogeneity within our sample in terms of language, history, and economic development among and within our participants' countries of origin was immense! Despite this diversity, a key attribute shared among all participants was that they regularly used ICT to communicate with friends and family members living in sub-Saharan African countries, where technology infrastructures are less developed than in the U.S.

We initially examined transnational communication from the perspectives of users living in a country with a well-developed technology infrastructure, rather than those living in countries a less developed infrastructures for two reasons. First, findings from Wyche and Grinter's prior research suggest African migrants often educate their family members living abroad about new ICTs [39]. Because this work suggested our participants were more familiar with ICTs than many of their family members, we reasoned they would be more comfortable interacting with a prototype device developed to help us envision what future interactive systems might look like. Second, we wanted to develop and deploy a digital artifact. Lack of consistent electricity in rural parts of Africa would make such a deployment challenging and outside the scope of this project [40].

Methods and Data Analysis

Interviews began with these questions, "Where is home?" and "How long have you lived in the U.S.?" We also asked students to describe daily life in their countries of origin. Then we asked them whom they most often communicated with and to tell us the steps involved in calling home.

Sessions lasted approximately an hour and interviewees were compensated \$20 for their time.

Interviews were transcribed and field notes were written following each session. After the first author analyzed the transcripts, and field notes she drew tentative conclusions they were discussed with the second author who is originally from South Africa, currently lives in the U.S and uses ICT to communicate with friends and family in her home country. Her feedback was incorporated into the analysis. Once this was completed, the authors reread the related literature and formulated theme statements, which then led to the development of the research findings that motivated our design concept.

DESIGN IMPLICATIONS FROM FORMATIVE STUDY

We first present findings relevant to designing interactive systems for individuals in the U.S. who communicate with friends and family living in countries with underdeveloped technology infrastructures. Broadly, our results revealed that mobile phones were the most common and preferred ICT our participants used to communicate with family members; a finding reported elsewhere [21,26,39]. However, participants wanted to *see*, not just *hear* about, what was happening at home. This finding inspired us to imagine a standalone device with a screen larger than one found on mobile phones.

Maintaining Ties with Home

All interviewees currently lived in the U.S., but none described this country as home. Instead, they told us the names of cities, towns, or the villages they were originally from. The village typically refers to the rural or peri-urban location where students grew up and is where many of their immediate and extended family members live. Half of our participants came from (or communicated with family members) in Komana, Botswana; Ziwa, Kenya; Mulange, Malawi; Jinja, Uganda; or Mikuni, Zambia. Even participants from their country's capitals (i.e., Nairobi or Harare) communicated with grandparents living in rural parts of their countries where Internet access is less common than in urban areas.

We asked students to tell us about these rural areas and they described them as close-knit communities comprised of small homes that were typically far from urban centers and

in some cases off their countries' electricity grids. Subsistence agriculture, or farmers focusing on growing enough food to feed their families, was a key activity in participants' villages.

Social scientists have long recognized the significance of the village in rural African life [14]. Young men and women are often the links between these sites and the outside world. A primary way African transnationals support development at home is by sending remittances to family members via money transfer services such as *Western Union* or *MoneyGram* [15]. Many students added that they wanted to preserve the option of returning to the village for retirement and, as is customary, for burial [4]. Five participants maintained homes in their villages and two recently purchased land there to build a home to live in when they return. When describing their homes, participants consistently expressed a desire to "see" their villages or cities because of the memories they elicited. Those from urban areas missed the tall skyscrapers and busy streets lacking in rural Virginia. This Ph.D. student's remark about his village home in Kenyan home resembled others we heard:

Most of the memories you have are in your brain and you want to imagine how that place looks—you think you may have forgotten some details and when you see home, you see like some chickens running or goats running all over. But you can't see that here . . .

We probed to further understand why seeing these details were important and two themes emerged following our data analysis: tracking changes and monitoring the landscape at home.

Tracking Changes at Home

Given the high costs of travelling between the U.S. and countries in Africa (approximately \$2,000 depending on the time of year and country), many participants told us they were unable to return home as often as desired. Most accepted that they would have to wait until they finished their degrees before seeing their family members. Those students who did return home commented on the changes observed in their countries following their absence. They attributed these changes to the rapid economic and infrastructural development taking place in the continent. As this young man from Cameroon told us:

I was gone for just over 18 months and when I went back a lot had changed. There was a new stadium in our town, you know because it is a developing country, things change fast.

In addition to noting new construction, participants who returned home described other developments. They remarked on how family members' appearances changed. Young siblings matured and parents looked older. Other changes included faster Internet speeds, improved roads, and the growing presence of iPhones in some of their countries' urban areas. In response to participants' desires

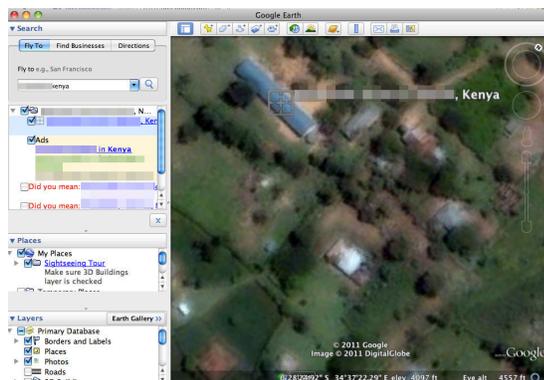


Figure 1: Google Earth's Aerial View of Participant's Village in Rural Kenya.

to see an image of their hometown, we made the straightforward decision to incorporate a picture of it into our design concept.

Monitoring The Landscape at Home

There were other aspects of domestic life participants, especially those from rural areas, wanted to track that were less tied to economic development or technological change and more connected to the natural environment surrounding their homes. Agriculture production forms the key economic activity in many of our participants' villages [17]. While living in the U.S. interviewees told us they became accustomed to shopping at grocery stores and big box retailers (e.g., *Target* and *Wal-Mart*). In contrast, their family members in rural Africa are less accustomed to shopping at western style stores; instead they grow most of the food they eat. Given the importance of farming in some participants' homes it was understandable that they wanted to monitor the landscape there. For example:

I tell them I want the photo of the garden, the farm, and I want to see how tall the crops are now and it kind of gives you that attachment and engagement.

Joseph, a doctoral student from Zambia continued to explain how monitoring the crops was one way of knowing about his family's well-being because it indicated they were producing enough food to sustain themselves. Other students told us how important it was to monitor maize and cattle production at home.

Five students used *Google Earth* (<http://www.google.com/earth/index.html>), a virtual globe, map, and geographical information program, to track changes and to observe their families' farms in Africa. The application uses images obtained from satellite imagery and aerial photography to map the earth. These participants told us, and in three instances showed us, their villages using the online application (Figure 1). Yet there were important aspects of village life they wanted to show us, but could not using Google Earth. Old, blurry, and aerial images made observing valuable information, such as the height of corn crops difficult for participants to determine. *Google Maps* (<http://maps.google.com/>), a web mapping service application, offers alternatives to the aerial view, such as Street View, or a panoramic view from various positions along streets in the world. Alas, this option appears unavailable for many of the remote parts of Africa where participants are from. This finding motivated a key component of our display, using a panoramic rather than an aerial view of participants' villages and hometowns.

Monitoring the Time of Day

We asked participants to walk us through the process of calling home. Nearly all told us they needed to determine the time of day in their countries prior to calling, a finding reported in prior research [8]. Depending on one's location in the U.S. and in Africa there can be up to a 10-hour time difference. Some students who recently moved to the U.S.

found keeping track of this difference challenging and developed strategies to assist them. A young woman from Zimbabwe wore two wrist watches to observe the time in Harare and in the U.S. Another participant from Botswana told us she knew to "add six hours" to the current time before calling her parents. Other participants looked online to determine the time, for example:

I go to the Internet and Google 'time in Nairobi,' and I'll be like in Nairobi right now it is 1 a.m. and this place is like 7 hours behind.

Even participants who were accustomed to the difference or as one told us, had it "programmed into her head" encountered challenges when determining the appropriate time to call home. This process became especially problematic during daylight saving time. For example:

For some people it takes awhile to figure out the time difference, and then when of course Americans go and change the clock! That is just so insane! What do you mean daylight savings? You can't just change the time!

This practice of temporarily advancing clocks forward an hour during the summertime and adjusting them backwards in autumn rarely occurs in African countries [28]. Consequently, timekeeping became more complicated for participants when the time in the U.S. changed and sometimes resulted in them calling home at inappropriate times.

Time difference plays an important role in communication between family members distributed across time zones and participants worked to avoid violating them. Nearly all of our participants told us they would only call home at late at night or early in the morning if it was an emergency. Similarly, if they received a phone call during an inappropriate time they assumed it would be regarding a crisis at home. This understanding, paired with participants' desires to see a picture of their home, motivated our decision to include a view of the sky changing during the day and a clock set to the time in their countries into our design concept.

DESIGN CONCEPT

Findings from our formative study motivated the development of a design concept that resembled an ambient display, or a device that communicates on the periphery of human perception, requiring minimal attention and cognitive load [24]. Because monitoring activities at home was often a non-critical, yet an important activity for our participants, an ambient display appropriately addressed the design opportunities uncovered in our formative study.

Design Decisions

Figure 2 shows our design concept, a screen with a changing image of participants' hometown accompanied by an analogue clock with their nation's flag on the face. The artifact was decidedly low-tech, inexpensive, and easy to produce. This decision allowed us to focus on participants'

interpretations of the technology so that we could uncover additional factors to include in future prototypes or incorporate into other platforms, such as mobile phones. We also wanted to work out the details of our design and how people would use it before committing time and resources to developing a robust version [12].

The central component of the display is a *Dynex 7"* Digital Picture Frame we purchased for \$35. We chose this model because it was inexpensive and we could program the frame to change pictures hourly. Uploaded onto the device were 24 frames depicting the location individuals described as home. We selected three images found online and asked participants to choose one that we then uploaded onto the picture frame (Figure 3).

Using *Adobe Photoshop*, we manipulated the background of the selected images to correspond with changes in the sky that take place during the day. In the morning the device displayed images of the sun rising and at night the sky behind the picture of participants' home was dark and filled with stars. The image of the sky changed every hour creating a time-lapse effect on the screen. Additional elements changed on the display, for example, a man riding a bicycle moved across the foreground of an image of a small Malawian town. Goats and chickens moved across three screens and birds flew in the sky on four displays.

Given the difficulty some participants had with keeping track of the time in their countries of origin, we incorporated an analogue clock set to the time there into our prototype. The images on the display corresponded with the time on the clock. This decision provided us with an opportunity to add another design element: the name of participants' towns and the flag from their home country. The clock and screen were housed in a case constructed out of black foam core board. We disguised the digital picture frame because we wanted participants to recognize the artifact as a unique device developed for them, rather than a re-appropriated frame.

DEPLOYMENT: OUR APPROACH

During the deployment we wanted our participants (rather than the designers) to interpret what our concept should be used for, so we used Sengers and Gaver's open to interpretation approach to guide our evaluation [30]. This strategy was appropriate because a goal of our research was to uncover design opportunities for future systems, rather than strictly evaluate the device in terms of usability, or what is broadly understood as "the use of the product (effectiveness, efficiency and satisfaction in a context of use)" [6]. The advantages of this method are that it encourages exploration as users engage in meaning making with deployed artifacts and allows researchers to uncover new topics for consideration without imposing their own views.

We gave the device to eight participants from our first study, explained that it depicted a changing image of their

home village or town, and asked them to live with it for four to five months. We also instructed them place the device in a location where they most often communicated with people from home. Six devices were put in participants' homes, apartments, or dorm rooms. The remaining were placed in participants work spaces.

Participants were interviewed twice after receiving the device. Eleven of the 16 interviews took place in participants' homes and each one lasted 15-30 minutes. We asked open-ended questions such as, "tell us about your experience" with the display, rather than focused questions that might reflect assumptions about how the devices should be used.

We complemented interviews with a survey sent via email at one and two-month intervals during the field study. The survey included open-ended questions such as: "What is one thing that surprised you about the device?", "Please recall the last time you called home" and "Have you talked to other people about the picture frame?" All participants responded to the survey.

The constant comparative method guided our data analysis [16]. When coding interview transcripts and survey answers, we looked for consistent themes related to participants' experiences with the artifact. Though simple, the digital picture frame seemed to work well in conveying an idea—showing a live view of their home town or village—that is not currently technically feasible, due to lack of infrastructure in some participants' home countries. What emerged from our second study was the following set of interpretations regarding the display.

FINDINGS AND DISCUSSION

Imagery and Imagination

Participants' reactions to our concept consistently centered on the display's image. This is unsurprising given the changing picture of participants' hometown was a central part of our artifact, but the stories the images prompted were unexpected. A 43-year-old man told us how entering his office and staring at the picture of his rural Zambian



Figure 2: Design Concept



Figure 3. Images Depicted on Deployed Displays.

village became a part of his daily routine:

Every morning I sit in that chair and I do some meditation looking at my life journey from that environment to where I am sitting here. For me that is a spiritual experience, it is a long journey to come from that far, that culture, that architecture there, that way of life, to something that is very different from the life I had as a child.

Two other participants similarly described how the image contrasted their current living situation in the U.S. They also told us how the images of their villages/hometowns prompted them to reflect on the differences in architecture, culture, and access to technology between the U.S. and in parts of Africa.

Five other students shared stories that also appeared to be evoked by the imagery on the display. Rather than reflecting on their life journey, they told us how the images prompted them to imagine or connect with the details of home. For example:

When I look at it before calling I know at this time they are eating or they are sleeping.

And

I am more connected to home because I know what they might be doing. At night mum is sitting in front of the TV and falls asleep after watching the news.

The time-lapse images of the sky changed hourly to mimic the natural progression of the sky from morning to night. Participants' reactions to this design decision suggest it was an effective way to help them track time differences. It also prompted five students to imagine home in ways they reported not doing prior to having the device and that differed from other artifacts that reminded them of home. For example, one individual compared the display with a wall hanging in his home depicting Kenya (Figure 4, left). Unlike the wall hanging, our digital concept was customized and as a result had personal meaning for him. He said, "Where else can I see those metal sheets, they remind me so much of home?" The non-digital artifact

reminded him of Kenya, but our display inspired him to conjure up details of his village, such as the sheet metal houses he described.

These findings echo those from other studies suggesting designers incorporate personally meaningful images into digital displays [13,38]. By evoking these reflections, our design concept provided more than functionality, or just informing users about the time in their countries of origin. It also appeared to provoke curiosity about what family members were doing at home, something a standard clock did not always inspire. Our findings also highlight opportunities for designers to imagine alternative ways to digitally communicate time. Rather than relying on numbers, designers may want to consider mimicking natural events such as the changing colors in the sky to communicate time on digital interfaces.

More broadly results from both studies suggest that future systems designed to support connectedness between extended family members allow them to view the surroundings of their home in addition to the interior. Systems like the Family Window [23] and the Share Table [42] focus on a home's interior. They appear to allow family members to view the living rooms or kitchens within each other's homes. However, many of our participants' understanding of home extended outside of its interior and into the land surrounding the physical structures (e.g., fields, gardens and animal enclosures). Future systems designed to support communication between extended family members could provide users with the option to see their home from multiple perspectives.

Future Iterations

Previously discussed findings suggest we keep elements such as a panoramic view of participants' hometowns and use the sky to communicate times of day. Here we describe additional interface details to include in future iterations of our design concept. We also highlight new activities future interactive systems designed to support long-distance caregiving could monitor.

Two participants wanted additional country specific features on the display. For example, an undergraduate who came to the U.S. from Zambia imagined future iterations showing a live image of his hometown and the “Freedom Statue,” a statue of a man breaking his chains that symbolizes Zambia's liberation from their former British rulers (Figure 4). This image reminded him of his country. Along these lines participants wanted up-to-date information about the exchange rates between their country's currency and the U.S. Dollar. We imagine future iterations will have graphs depicting fluctuating rates incorporated into the interface and exploring how technology can better facilitate sending money home.

A more common reaction was desiring more information regarding the weather in participants' hometowns. A limitation of our low-tech prototype was that it did not allow participants to see a live view of their hometowns or villages. The following quote was representative of others:

Rain comes at a particular time of the year, so that weather is a big part of the way of life there. If I could see it is raining, it would tell me a number of other stories, I can imagine what they are doing, looking for seeds and preparing the land.

Earlier in the paper we noted the importance of agricultural production among participants from rural parts of their countries. Given that drought and excessive rain affect soil conditions and determine the success (or failure) of crops it was understandable that participants were curious about this information. This finding suggests adding additional contextual elements to our concept, such visualizations of current and long-term weather forecasts and details regarding the height of specific crops.

Our findings also suggest new ways to imagine interactive systems developed to support long-distance caregiving. Prototype systems such as the *Digital Family Portrait* [25] and the *CareNet Display* [9] are examples of ambient displays designed to help the local members of an elder's care network provide this with day-to-day care. These



Figure 4. Artifact from Kenya (left) and “Freedom Statue” (right).

systems monitor events such as whether or not an older adult has taken medication, eaten meals, fallen, and so forth and appear to be grounded in western ideas about caregiving. As Internet access continues to become more affordable and widespread throughout Africa, designers should explore how systems can allow users to observe underexplored, yet equally important activities. For example, family members can send pictures and information regarding their crops, cattle, and goats, to family members living abroad to monitor their well-being. Such information is especially important for individuals with family members living in rural areas. More broadly our work reveals that caregiving extends beyond monitoring activities inside the home to factors outside the domestic environment and varies across cultures.

Educating Others about Life in Africa

A primary goal of our evaluation study was to find inspiration for future systems designed to support transnational communication between families with members living in the U.S. and in sub-Saharan Africa. Our open to interpretation evaluation allowed us to uncover new topics for consideration such as the potential role ICTs can play in educating Americans about life in Africa.

In our online survey and during interviews we asked participants to describe instances when visitors to their homes or workplaces encountered the artifact. The devices were placed in dorm rooms, houses, and in one case a retail store. Consequently, individuals other than our participants saw them. Seven participants shared stories about occasions when a stranger, friend or roommate, encountered the artifact. This quote was similar to others:

I explained it to my roommate and she would ask me about Harare and when she was going to sleep and I was going to sleep she would say ‘Guess what? At home they are waking up.

During our formative study participants repeatedly told us a challenge they encountered when coming to the U.S. was countering peoples' stereotypes about life in the African continent. Many pointed to the western media's tendency to report on disease, hunger, and war in Africa, instead of the continent's successes, as one reason these stereotypes exist. In contrast, our concept depicted a different kind of imagery and prompted discussions between our participants and their American co-workers and friends. The pictures uploaded onto the frames provided a glimpse of daily life in African towns and inspired questions about them.

This finding presents new opportunities for designers and researchers interested in cross-cultural communication. It suggests that in addition to supporting more effective collaboration among geographically distributed teams [36], there are other benefits of using ICTs to connect people living in different countries. VMC can potentially expose a western audience to the richness and diversity that defines daily life in African countries.

FUTURE RESEARCH AND CONCLUSIONS

We continue to iterate on our initial design concept based on findings from our deployment study and fieldwork conducted in Kenya. Communication is two-way process, but we only examined one end of these exchanges. We travelled to Kenya to study transnational exchanges from the perspectives of a subset of our participants' families. Preliminary findings have prompted us to imagine a solar-powered version of our design concept, because lack of electricity makes deploying our existing prototype challenging in some areas.

Further, we examined one kind of migrant in our research—Africans. Individuals coming to the U.S. from other countries such as Mexico or China may face challenges our participants did not encounter. Continuing to examine these computer-mediated transnational connections between the U.S. and other countries will likely point to more design opportunities, such as designing interface that support communication in multiple languages and that push the HCI community to broaden their understanding of caregiving, beyond monitoring a narrow set of health related activities.

In this paper, we studied how African students use ICTs to connect with people in their countries of origin from a design perspective. Findings from our formative study revealed the following: African migrants have a strong desire to see the landscape surrounding their homes and sometimes find it difficult to know the appropriate times to call. We used these findings to motivate simple design concept that participants interacted with for four to five months. In addition to highlighting design implications for future systems, this study also has broader implications for how the HCI community imagines future ambient displays and VMC technologies.

Our conclusions are twofold. First, studying how ICTs connect people in the developed and developing world is important if future systems are to account for the diversity of people taking advantage of VMC technologies. Second, when exploring a relatively new design space—communication between African migrants and family members living in infrastructure poor settings—developing low-fidelity prototypes that allow researchers/designers to understand the design space, before building a high-fidelity prototype are valuable.

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