

# MASTER'S THESIS

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Towards a framework for interaction designers  
in rural villages in developing countries

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## INTRODUCTION

As computer technology improves and becomes cheaper, the prospective user base of computer technology also increases. For a couple decades, the field of HCI has concerned itself with how to design user-centered artifacts and interfaces. However, this “user” has often come to imply users not vastly different from the designers themselves. There is a rich history of attempts and methodologies derived in the field of HCI which aim to bridge cultural gaps and reconcile designers’ and users’ models of problem spaces [53]. Unfortunately, an exhaustive review of these methodologies, theoretical frameworks, design principles and optimal design qualities will expose a recurring theme that HCI practitioners are operating within an exclusive user base and environment. HCI has of course been concerned with computer-users which have, up until the last decade, included only the upper 20% of the world’s population. Additionally, the environment which these users operate within can be classified as ‘modern’, urban or industrial societies. This also neglects a large user base. In Zambia (and most countries in sub-Saharan Africa) over 50% of its citizens reside in rural villages [36]. The situation is rapidly changing. Technology is getting cheaper and computers are extending beyond the desktop and into the world of everyday activity—no longer must HCI only consider interaction with a set-top computer. As a result, it is vital for HCI practitioners to begin understanding how we can operate beyond the classical environments and populations. What methods can be adapted for this area? Will current methods and theoretical frameworks be suitable? What qualities should design artifacts and interfaces exhibit in rural villages?

In this paper I seek to answer these questions by looking at the evolution of HCI methods since 1980, what attempts HCI has made in this field previously, cultural and environmental considerations in a typical African villages (specifically in Zambia), and a brief overview of ICT successes and failures in lesser-developed countries. From this in-depth analysis, I propose a synthesized theoretical framework to help inform HCI/d based on understanding design in terms of meaning rather than use, converting Activity Theory into practice in the field, and reconciling HCI’s tendency towards modernization with traditional practice and village culture. Additionally, I will describe the shortcomings of current HCI methodologies and illustrate how some might need to be adapted. I then look at how the design process might be carried out in a Zambian village—one that will be focused intensely on participatory techniques and deeper ethnographic investigation. Third, through brief analysis of successful ICT projects coupled with research into Zambian village communities, I put forth design qualities and implications which may help guide HCI/d. Last, I conclude with a reflection on my own process in this project and problems I faced, how it could be done better in future work, and what must be done to validate my proposals.

## BACKGROUND

### Rural Villages

My area of interest in this paper is rural villages in general because they share many common characteristics. They are predominantly agriculturally-based, subsistent communities often isolated from urban areas. From a higher level, African villages have been described as having high levels of poverty and illiteracy, having poor top-down policies, being immature states (from a political standpoint) and consisting of a broad range of diverse cultural groups [10]. In this paper I specifically look at the Tonga tribe in the Gwembe region of Southern Zambia. I will not give an intensive ethnographic description of this group but specific cultural considerations as I discuss how HCI can be applied in this region. I use this as a particular example that can be abstracted to rural villages in lesser-developed countries (LDCs) in general. What is important here is simply to understand how the notion of work, culture and social practice in rural villages is vastly different from the West. In the West, HCI is often interested in work performed in an office setting or a corporate environment. In Zambian villages work is predominantly centered on subsistence farming. Culture and social practice also vary greatly. Where appropriate I will illustrate some of these characteristics to provide a foundation for understanding how HCI might need to be adapted to account for these differences.

### HCI Environment

The environment that interaction designers operate within is vastly different from a typical rural environment. The trend in HCI is geared around more culturally-sensitive practice that puts more focus on human activity than ever before. However, today, many of these new approaches are still only being applied to the same environment. For example in one of the most recent HCI books *Beyond the Desktop Metaphor*, the authors in that compilation discuss cutting-edge HCID philosophies that seek to challenge the entire paradigm that the field has operated under for decades [34]. While many of the chapters in this book lend themselves well for application in rural villages, “work” and “environment” are very clearly intended to only apply for appropriation in a Western setting.

This is not necessarily a criticism of HCI but simply a description of the environment its inhabit. For the most part this is understandable since the cost of technology has created an exclusionary situation that has resulted in designers working only with users that can afford it—the West, or ‘modern’ areas. However, it is important for the field to acknowledge that the ‘H’ and the ‘C’ of HCI are changing. A market that once excluded the developing world is now seeing more opportunities for development. A recent analysis showed that the combined economies of the developing world comes close to equaling that of 6 of the combined economies of the G8 nations [51]. While economics is just one way to analyze this situation, it does illustrate a growing user base that HCI must be aware of—in other words, the ‘H’ is changing. Of course the ‘C’ changes even more rapidly with a doubling of computing power in less than every 18 months. More importantly than simply processing power is how the nature of the ‘C’ is evolving. McCullough brilliantly illustrates the need for expanding HCI outside of the notion of desktops and into the environment [43]. More explicitly, viewing the ‘C’ only in terms of devices that communicate through text is restricting and unrepresentative of the way humans communicate in the real world. Humans use modes such as proxemics, haptics, oculesics, numbers, colors, olfactory, etc. to communicate information [67]. More pervasive computing—with its encompassment of modes such as these—will be (and already is) the next major trend for HCI. Dourish summarizes the combination of the new ‘H’ and ‘C’ by writing that “the massive increase in computational power and the expanding context in which we put that context to use—both suggest that we need a new way of interacting with computers” [21]. Of course I do not presume he was referring directly of the developing world, but he gives a starting point for understanding why and how HCI can operate in this new environment. In conclusion, the rapid evolution of HCI continually forces designers to modify and adapt methodologies. My argument is that the area in most need and of greatest importance to HCI should be rural villages in the developing world.

## Gap

While C.K. Prahalad presents a compelling reason to believe there is a market in the developing world, this does not exactly explain *how* HCI should go about understanding the nature of the gap that exists between typical designers and the developing world. Nor, does he explain *why* designers should care. Firstly, on the surface it would appear there is no pretense for understanding this since HCI essentially has no record of operating in these areas. However, there begins in the 1980s documentation of many failed ICT projects in Africa. Hutteman and Musana describe barriers in the creation of rural libraries in Uganda in the early 80s [32]. The ignorance of local languages and the illiteracy of the potential users created these barriers. Additionally, the authors describe problems with the communication of information between sender and receiver. This relationship can be reformatted into problems between designer and user today. Aboyade also describes similar communication problems in his description of information systems in Nigeria in the 80s [1]. Many of the problems illustrated in the documentation of early ICT projects in Africa all lack the general framework that HCI works within. That is not to say that the problems listed are not valid but simply that they need to be framed within the methods and theories in order for HCI to use these past failures as a starting point for this new wave of HCI.

Secondly, there are the obvious moral imperatives for doing work in developing countries but I do not take that stance in this paper. My goal is to view this area simply as one that HCI is largely overlooking. HCI should be concerned with this area because there is an increasing number of ICT projects being undertaken in the developing world both by the state but more importantly by private companies (I say ‘more importantly’ because this is most likely the avenue designers would take in this area). In Africa specifically there are more efforts being taken to provide technological infrastructure. The African Bureau of the United Nations pledged \$6 million to improve Internet connectivity continent-wide in 2001 while Columbia Technology has undertaken a \$1.6 billion project to create a fiber optic loop around the continent [37]. On March 28<sup>th</sup>, 2007, the Zambian government created a new policy that “concentrates on using information and communication technologies (ICT) to popularise telemedicine and disperse information for farmers” [2]. The aforementioned projects have been widely criticized for not focusing enough on the private sector, however. Fortunately, there is a growing interest from high-tech companies in the developing world. In 2001, Sun Microsystems, AOL Time-Warner, and HP all pledged \$10 million for information systems in Sub-Saharan Africa [37]. Intel and Microsoft are currently collaborating on how their technology and design can work in Indian villages [28]. This increase in participation from private high-tech companies—which employ the use of interaction designers—necessitates a parallel trend in the academic field to better prepare its followers.

In this section I have shown that ICT projects have been undertaken since the 1980s which provides a starting place for understanding the nature of the problem. While I have only provided a few examples for an overview, I will provide more detailed descriptions of how HCI will operate in rural villages later. I also gave evidence that HCI’s entry into this area is not unfounded. Rather, it is necessitated by the recurring problems of ICT projects in this region and the growing interest on the part of government and private companies to enter this market.

## Overview of Paper

To this point I have defended my call for why HCI should enter this domain so I will spend the duration of the paper discussing how HCI should go about this process. While I have shown there is some literature with which to draw some design implications from, there is very little framed in terms of HCI with which to begin. As a result, I will illustrate how HCI can be modified and adapted for application in the rural villages of the developing world. The purpose of this paper is to elucidate some considerations for interaction designers in order to formulate a preliminary framework for practicing design in this area. My framework is not prescriptive nor is it rigid. The two major problems I see when attempting to place HCI in a new field are 1) to explain how design can and should be undertaken and 2) to provide a vocabulary with

which to analyze, judge, and critique design and design artifacts. My goal is to provide principles to bear in mind while designing and heuristics with which to measure designs in order to accomplish these goals.

The core of my paper is divided into three parts: perspective, practice and principles. First I will discuss the designer's perspective in terms of how a designer should mentally approach or prepare for work in this area. Here, I simply provide mislead ideologies that need to be corrected. Second, I will outline some methods and theories I find appropriate for this area of inquiry. I will discuss how these practices should be conceptualized or adapted for the village on give a specific example of how this could be undertaken in Zambia specifically (by drawing on specific characteristics of Zambian villages). Third, in the principles section, I will describe qualities designers should strive for in their designs. These will not necessarily serve as a checklist but a way for designers to visualize what is possible. I will then conclude my paper by giving a meta-perspective on my project in terms of why I chose to approach this problem the way I did, obstacles I faced and what I see is the future of this project.

## PERSPECTIVE

Here I will introduce ideas and cognitive approaches designers must embody when designing in a rural area. This isn't necessarily theoretical though it will be based on some theory. I outline some necessary change in perspective not only in ways to conceptualize designing in the village but to elicit certain practices that are insufficient for this setting.

### **Against technology-centric approaches**

Designers must see context independent of technology. It is tempting to see technology as a panacea for the developing world but it is often not the case. Even if we don't believe this, often, designers still design using existing technology and the solutions may not fit. Essentially, designers must assume nothing. Anything is possible. While this perspective is an axiom of user-centered design, it is still often overlooked in rural villages. There are two common ways that this happens. First, designers often attempt to fit developed-country solutions to developing-country conditions [65]. Second, designers and developers may make deliberate attempts at understanding the context and potential users but in the end, the results are more or less unimaginative because throughout the duration of the research phase, there is an underlying assumption that the computer will be the solution.

It is understandable why designers may believe technology can simply be "fitted" to other environments. In Africa, often leaders get education outside of the country and attempt to fit what they have learned in their home country [67]. Unfortunately, this does not typically ensure success in a vastly different environment. This is not to imply that technology should simply be disregarded but that sometimes it may need to be to be rethought. For example, throughout the United States and Canada, there is centralized education and as a result many learning technologies are centralized. Computers are not typically thought to be spread amongst the citizens. This paradigm can lead to problems even within these countries as this centralized model does not work well on Indian reservations. The Denendeh tribe in Canada "will always learn best on the land" rather than through centralized schools which are difficult for Dene to attend [64]. Designers must not only look beyond technology itself but view technology in terms of how it fits within the context since designers may often carry deeply-held, subconscious assumptions as to what and how technology should work.

Moreover, utilizing highly context- and culturally-sensitive research methods when looking to implement ICTs can become greatly hindered when the designer constrains his or her thinking within a predefined technology. In a Tanzanian project, the developers spent months understanding their users, drawing rich insights [56]. Unfortunately these insights were either overlooked or wrongly misapplied in implementation because the resulting design was centered on a communal computer lab. While the content was highly customized, the usage of a computer shows a general

predilection for using computers. This might be the right choice in some scenarios but often it constrains the design process. McCullough provides many examples of how design can take many modes of input and manipulation into account besides simply using text [43]. Ansu-Kyeremeh imagines that ideographs and drumbeats could be utilized for communication [4]. While he is not speaking of design in particular, one could imagine how these could be utilized in HCID. These are just a few examples of how design can embody different interfaces, modes of input and communication.

The most negative outcome of focusing design on the assumption of technology is that it does not lend itself well to the target users. It is clear that in the United States for instance that our method of work lends itself well to the desktop interface and necessitates artifacts like laptop computers or PDAs. However, this is simply not the case in rural areas. While there is a rapidly growing demand for wireless phones in rural Africa [41], they are still not widely adopted in terms of all villagers in general. Aboyade illustrates the problem of technology-fitting in terms of the barriers of a rural library in Nigeria. In this case the information services were all conveyed through text but the rural population is widely illiterate [1]. In conclusion, as HCI looks at this area we must be aware of the predispositions that lead us to assume a technology or interface can be fitted for rural use.

## Modernity in the village

Another common perspective that can easily cloud designer's judgment pertains to how to perceive the "gap" that exists between rural villages and the urban setting with which designers are accustomed. This is clearly a large gap but what is important specifically for interaction designers are the notions of development and modernity. Both of these are highly complex and well-discussed areas but I will just briefly convey how they might factor into an interaction designer's perspective in the village.

### Modernity

A recurring theme that exists in ICT projects is the notion of *getting villagers on board*, or accelerating the "inclusion of isolated—particularly rural—populations into the mainstream of society" [33]. This takes form when designers seek to create mainstream mental models in their users [24, 64]. In this case, designers appear to take the position that there exists a universal mental model that can be achieved. However, projects undertaken in tribal reservations in North America exposed the opposite. In fact, there can be more than one mental model for using technology—no single one is correct.

There are even deeper implications when designer view this gap as a divide between "haves and have-nots" as occurred in the development of an interface for Indian villagers unfamiliar with computers [14]. The danger in this mentality is that it again constrains and skews the designer's imagination. Viewing villagers as "have-nots" simply creates a design situation that forces the designer to help the villager achieve what he or she has. This is wrongheaded as it ignores the potential users' own practices, work, lifestyle, etc. The Digital Divide undoubtedly exists, but designers must understand that poverty itself is a matter of relative comparison [1].

This gap is probably nowhere more prevalent than it is between rural Zambian villages and outside developers. There are deeply held traditions and cultural practices but there often exists the desire to "modernize." Gould outlines this conflict as being between traditional and modern practices [26]. In projects in the 1970s this conflict was mediated by the usage of cooperatives. In these situations, designated villagers could serve as a link between the village and the "modern" Zambia which existed in the larger towns [26]. This conflict exists in any society (e.g. conservative Republicans and liberal Democrats) but for designers working in the village it is a significant obstacle in perception. Furthermore, modernity itself has been cited as a large reason for poverty in Zambian villages [18]. Designers have to overcome the

presumption that they can *modernize* villages rather than assist in creating culturally- or context-centered artifacts or systems.

### Development and gifts

The literature on development is extensive but carrying from the discussion on modernizing villages, designers must also embody the perception of creating rather than aiding. I am not implying that designers should not feel *helpful*, but rather think of design as what it is intended to be—creation—rather than charity. There are a few reasons why seeing design in the developing world as charity is problematic. First, the charity relationship is problematic. From an economic perspective, development from outsiders often creates a situation where receiving areas are reliant on it and cannot innovate beyond what is given [12]. From a more anthropological standpoint, development gifts create indebtedness on the part of the receiver, creating a conflict in reciprocity [60]. Designers should move away from designing as a gift and think more in terms of the success of design being contingent on the involvement of the users themselves [1]. In this way, the designer can help the users by helping them take control over their own situation. In essence, the designer empowers rather than donates.

### From usage to meaning

HCI began in the early 80s more focused on the computer and less on the human because the technology was highly restrictive. As a result many human factors were more focused on the computer as an activity itself. Early human factors included human response time, nature of errors, and time to learn; and central HCI topics included programming, database access and editing [3]. These topics and factors are all valid but they are essentially centered on the computer as an activity itself since designers were often greatly restricted by the capabilities of the computer technology [45]. Accordingly, design methodologies sought to measure these factors using models such as GOMS which are fundamentally methods for measuring design [13]. Even today there are counterproductive calls for better ways to better quantify the “right design” [54]. With these perspectives, HCI has predominantly favored analyzing design in terms of usability. Usability allows designers to measure design by setting standards to measure the effectiveness of an interface’s design. However, these methods are inadequate for determining *good* design before something has been created. As a result, designers need a better perspective in order to design from the ground-up in a village setting—where no such digital artifacts exist that can be measured initially. Fortunately, there is a growing trend towards viewing artifacts through their meaning rather than their use.

HCI has recently spawned new ways of conceptualizing design through meaning rather than simply usability. The most notable example of this is the aptly-titled *The Semantic Turn* by Klaus Krippendorf. This seminal work illustrates how design can move away from simply the usability of its created artifacts and more into the meaning of them in use [38]. The power of this “turn” was explained 50 years ago in the study of a case where steel axes were introduced to the Yir Yorant tribe in Australia in the 1930s [57]. Briefly, in this case Dutch explorers disseminated steel axes to replace the tribe’s stone axes. From the perspective of usability, the steel axe had distinct and undeniable advantage over the stone ones. They were easier to make, more durable and more effective in use. However, this perspective overlooked the meaning placed on the stone axes. They played a unique role in the social hierarchy. Culture and daily activity was centered on the stone axe. As a result, the implementation of steel axes had disastrous societal effects on the tribe. This situation is not all too different from what designers in the developing world might face. The gaps described in previous sections renders previous usability methods inadequate. They can be of use once something has been created and implemented to provide insights for improvement. However, for HCI design from the stage of creation, understanding artifacts by their semantics rather than simply usability will help provide a deeper perspective for which designers can understand previous and potential designs.

## PRACTICE

In this section I will go through specific theoretical frameworks and methods in HCI to articulate how designers can take this perspective and adapt their methods of practice. I will organize each subsection into the discussion on the particular topic then a conceptual exemplar for how that method/theory might be carried out in practice.

### Mental Models

One of the most important gaps interaction designers will have to reconcile when designing for different village cultures is the mental models of potential users. HCI was founded on cognitive psychology for the sake of trying to understand how users process information. Again, this approach was taken solely with the computer being the means of information conveyance and the human as the receiver. While I take the stance that theoretical approaches for HCI in the village will be more anthropological than psychological (as will be shown in later sections), there is still a need to understand the appropriateness of HCI theories that can analyze users' mental models since design will inherently involve cognitive activity. In this section I will discuss the issues concerning Distributed Cognition and Yoked-State Space.

#### Distributed Cognition

As the computer has extended, models such as Distributed Cognition have extended beyond just the use of computers by isolated individuals and into understanding human information processing as a larger process—taking place amongst collaborating users, larger units of analysis and through the use of tools [50]. In other words, the Distributed Cognition theoretical framework develops an understanding of mental models not just in individual users using a specific device but as a shared mental model extending beyond one activity and between many people. However, while there does exist an anthropological approach to this approach [50], applying Distributed Cognition in the village is problematic for two reasons. First, there is an assumption that this approach can be applied because it allows the observers to “enter the cognitive domain” [50]. Put simply, I find this to be unlikely in a scenario where the observer does not have a good foundation for understanding the user's intentions in the first place. While there has been a broad range of applications of this framework from manual activities to distributed technology-related processes, these observations are conducted within the comfort space of the observer. Second, Distributed Cognition positions its observations within a “system goal” [46]. While I do not contend this position, it may not be helpful when designing artifacts and systems that may not be highly complex from an information-processing standpoint. As I stated earlier, most applications of Distributed Cognition involve systems of information processing across many conceptual levels and between many individuals. Activity in a village setting may not necessarily embody these characteristics. This is not to say that activity does not involve shared and distributed cognition but the focus of analysis is constrained when the common artifacts used are not information-based. There appears to be too large a gap between user and observer/designer's mental models to use as a core method of analysis. As a result, Distributed Cognition could be a highly useful theoretical framework but it will be more useful after more ethnographic analysis is conducted to bridge this gap.

#### Yoked-State Space

One method that has a more direct influence on analyzing a design situation is the Yoked State-Space hypothesis because it seeks to model how a user maps a physical device to a mental representation of the action [48]. This hypothesis maintains that users construct a goal space and a device space, then map the two together [49]. The *goal space* represents what in the real-world can be manipulated with the device whereas the *device space* represents the possible states of the device itself [49]. The goal for interaction designers then is to discern the best fit for an artifact with the actions it seeks to augment or replace. Paul Dourish extends this idea more specifically for interaction through the term “coupling” whereby the user constructs meaning in the usage of artifacts by “assembl[ing] a set of abstract computational representations into a tool, and then act[ing] through that tool to achieve some end result” [21]. Krippendorff writes of

this coupling of humans and machines as a central feature of interfaces in terms of “dynamics” [38]. In effect, the Yoked State Space can be extended beyond just reconciling the gap between a goal space and a device space to include how the user constructs meaning and intentionality through using the tool or artifact. Both of these methods pertain to connecting users’ mental models to the intended use of the artifact. As a result, the implications for interaction designers is that there needs to be specific consideration for how to design artifacts, systems or tools that best represent themselves in terms of how the user would expect to use them.

### Conceptual Exemplar

For the most part, the theoretical models and frameworks concerning human cognition will be the most problematic to apply in the village. While an argument can be made that all human brains work the same, it is presumptuous to claim that mental models themselves are universal. Methods and frameworks such as Distributed Cognition or the Yoked State Space Hypothesis are inherently founded upon some common ground between the designer/observer and the user. While both of these methods seem to acknowledge the importance of context and culture on human cognition, nonetheless, neither seems to appropriately account for this largely influential factor. In fact, mental models and the theories that attempt to explain them may best be applied after other preliminary studies have been conducted in the village. In other words, it is vital that the observer gain a cultural foundation before attempting to make claims about mental models.

The following reasons explain why mental model theories and framework are not the best-suited for applying HCI/d in rural villages:

1. Distributed Cognition can be ‘done’ because observers can enter the cognitive domain of the user [50]. However, this appears unlikely in a village where a designer has absolutely no context for understanding “why things are the way they are.” Language, communication, activities are all large barriers to understanding mental models in a village setting.
2. Distributed Cognition is highly focused on information processing but this activity does not occur on the scale that designers are accustomed to.
3. Distributed Cognition looks at “system goals” more than individual consciousness [46]. This is not inherently problematic but creates a difficult design situation in the village when there is no preexisting information system.
4. Coupling and the Yoked State Hypothesis can both be highly effective methods of inquiry but require a more complete understanding of culture in order to derive the necessary components of intention, goals, and meaning.

In conclusion, I have highlighted these methods of inquiry and observation because they can be effective for conducting HCI in the village. However, they require ethnographic research to be conducted effectively. They also may become more appropriate “after the fact”—meaning, their focus on information processing and system goals is more feasible once an information and communication technology (ICT) has been designed and implemented. In other words, they could prove useful in modifying and improving systems and tools. In the next section I will discuss how ethnography can provide this understanding of user culture and activity, necessary for more cognitive approaches.

## Ethnography

Ethnographic approaches to design will prove to be the most useful tool for interaction in the village. As shown in the previous section, there exists a large barrier between the average designer and the average villager in the form of cultural differences. These barriers render many common approaches to HCI (such as Distributed Cognition) futile. As a result, a focus on gaining a deeper understanding of village cultures and work practice will provide the designer with a better foundation to engage in further HCI methods of observation and inquiry.

### Discussion

Ethnographic approaches have gained a significant foothold in the discourse of HCI so it is unnecessary to summarize them all here. There are many appropriations of and theoretical frameworks with similarities to ethnography in design such as Ethnomethodology (see [53] for a brief description) and Activity Theory (see next section), respectively. However, here I am interested in ethnography in terms of its capacity to inform the design of systems and tools by engaging the designer in observation of the users' work practices and social organization (such as [31, 58]). I will highlight some issues concerning practicing ethnography in the village that will be important to the designer.

First, it is essential that designers understand that ethnography does *not* necessarily “unlock” the right answer [20]. A common misconception for designers is to believe that ethnographic methods will create implications for design—specifically laid out considerations or factors that should be accounted for in the design. However, often ethnography can reveal that an intervention may not be appropriate at all [20]. It is important that designers in a rural village setting understand this notion. As mentioned earlier there is a danger in assuming the implementation of a specific technology because it can inhibit creative solutions. Additionally, there is a danger in assuming that an intervention is inevitable in design.

On the other hand, when using ethnographic approaches in design, there will be a significant difference between its application in design than in its application in its roots of anthropology and sociology. The designer, while he or she needs to be concerned with applying it to gain a deeper second-order understanding of a particular user group [38], must also not allow that to prevent action from taking place. The main cause of this mindset stems from the negative connotation placed on creating a “disruption” to the studied culture or work practice [27]. However, designers should not necessarily see these disruptions as negative since the field of design inherently prepares designers to mitigate these disruptions and ensure that they occur as appropriately and beneficially as possible. In fact, ethnography in design should be seen as a way of “inquir[ing] what people are willing to abandon, where openings for newness exist, and which resistances need to be overcome and how” [38].

Last, in the setting of rural villages, it might be that designers are simply not equipped to practice ethnography in this setting. Rapid ethnography within one's own cultural domain is possible but most training for interaction designers cannot prepare them for the deep analysis and understanding that is necessary in the village. Approaches such as Technomethodology may afford the designer a means for understanding the organization of work but will most likely fall short of giving accurate portrayals of the organization of social action and interaction (as described in [11]). This does not mean that designers cannot apply ethnography in the village but there is a strong possibility that without extensive training in ethnography, meaningful insights or implications for design can be rare or misguided. As a result, I see designers as needing not only to understand ethnographic methods but to be able to communicate with true ethnographers or to extract insights from ethnographic literature concerning the setting in which the designer works.

### Conceptual Exemplar

There are two examples of how the above two points reveal themselves. First, in the development of a rural computer lab in Tanzania, developers actually documented a rather thorough ethnographic investigation in order to discover insights

for how to develop technology appropriately [56]. However, the solution—a computer lab aimed at women and children—was rather unimaginative. Ethnographic investigation no doubt guided the process but was not effectively applied because the developers did not draw strong connections between the research and the design. The product seems to fall in a category that would place it as being culturally-sensitive but not disruptive enough to produce significant change.

The second example shows why designers may not be equipped to “handle” the rural village. In many Zambian villages, gift remittance between relatives (especially those that have left the village) is extremely common [17]. However, if this activity were studied by a designer—with the aforementioned goal to understand how activity takes place within a given context—the design implications might very well fall short of what is actually occurring on a social level. Based on a designer’s typical level of ethnographic investigation, in this example gift remittance may be seen simply as a way for relatives to maintain ties with their home village or to provide support after they leave. However as Cliggett describes, this activity is actually an one that has become a way for modern Zambian villagers to cope with the variability of modernity (fluctuating local economy, inflation, etc.) [17]. A Zambian villager may leave his/her village to seek opportunity in town, only to fall on hard times later when the local economy collapses. As a result, they often use gift remittance to their home village to “hedge their bets” [17] against impending economic crises. The point here is to illustrate how “designerly” appropriations of ethnography may not give the most accurate representation. Since designers usually conduct ethnography within a certain comfort zone, this factor is negligible. However, in the village, where cultural differences are vast, ethnography is much more important, and all the more difficult to conduct.

## Activity Theory

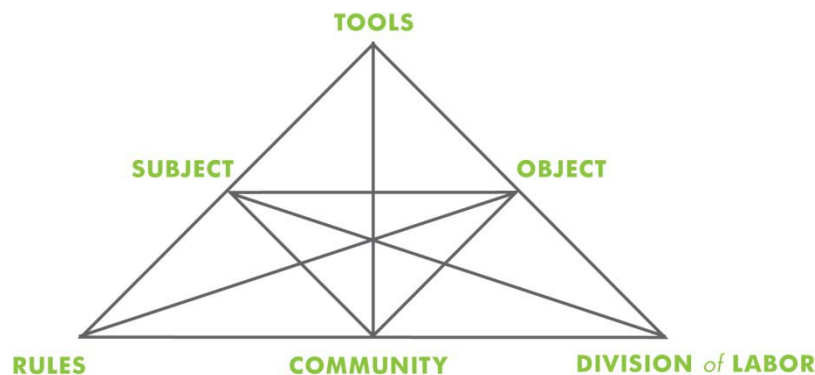
It should be clear at this point that designing in a village setting requires that the designer develop a richer understanding of the culture and social practices and organization before attempting to draw insights for design interventions. Cognitive approaches do not afford the designer enough of an analytical framework to accomplish this and typical ethnographic methods either fall short or are too complex for designers to undertake. As a result there needs to be a theoretical framework that can help resolve this paradox. The increasingly popular Activity Theory framework has commonalities to ethnographic approaches yet it affords the designer a means for extracting useful insights for design.

### Discussion

In short, Activity Theory separates itself from other HCI theories in its focus on human activity as a shared practice and how practice itself may change over time [8]. The defining characteristic of this approach is that it puts activity and humans in context by seeking to understand how human activity is affected through the use of tools, is changed by these tools, and how activity can change the use of these tools themselves [8, 35, 39, 46]. This theory is well-documented within the field of HCI and its application and meaning is often convoluted. Kuutti has noted one significant clarification in that the term “activity” is a bit misleading. Rather than being a blanket term to apply to an activity as action, instead activity applies to “a form of doing directed to ‘an object’ and activities are distinguished from each other according to their objects” [39]. To confuse this notion even more, the object itself may actually be an action [25, 35]. Kapteinin and Nardi describe a case in a biotechnology firm where the act of “cell selection” became the object of inquiry as it could be acted upon by various different parties [35]. This leads to another aspect of Activity Theory which is that it does not separate the object (which for the sake of confusion will refer simply to a physical object) from the intentions of the user. This means that any single object can be conceptualized differently for every person whom draws different goals from it [35]. This aspect is vital to Activity Theory and is one of the most important distinctions for interaction designers in rural villages. This is because understanding existing tools beyond simply usage gives the designer a better idea for how activity is not only organized but given meaning—thus, resulting in a more accurate description of the observed culture.

Again, Activity Theory has become well-documented and applied in the field of HCI. An overview of the literature yields two broad focuses. One is a focus on the object and its construction of meaning through use (especially over time), which is framed within Cultural-Historical Activity Theory [40]. The second focus is on the process of designing the object or the act of observing activity with the goal of designing something. This focus puts emphasis on how the designer must use Activity Theory to gain a second-order understanding of the design situation in order to bridge the gap between how the designer perceives an activity or design space, and how the potential user conceptualizes it [22]. These two focuses are not at odds, but rather work together to provide a systemic overview of Activity Theory. I will discuss the first focus more later on, but here I will give a brief overview of how Activity Theory can directly influence interaction design in a rural village setting.

The most effective way for understanding Activity Theory in terms of a framework is through Engeström's oft-cited triangle model (figure 1).



**Figure 1:** Activity Theory Framework, adapted from [23]

Briefly, this diagram illustrates the hierarchy of human activity in terms of interaction between subject, object and community. The interaction between these three components are mediated by tools, rules and division of labor [35]. This framework is useful for analysis in the developing world because it reduces the assumptions made by the observer or designer. More importantly it solve a significant problem facing designers in the developing which is that there is a gap in the starting groundwork for understanding the user. Activity Theory helps to bridge this gap. For example, if designers were seeking to design something for rural villagers that would aid them in harvesting crops more effectively and efficiently, this would be difficult since this activity is poorly understood. Village cultures will most likely involve rules, divisions of labor and tools much different than the native culture of the designer (most likely an industrialized environment). As a result, the activity, intentions behind sub-activities, the cultural norms, etc., all obstruct the designer's understanding of how to analyze the situation. By using this framework the designer can begin to place subjects, objects and communities, then analyze how their interactions are mediated. In this case the designer will achieve a more holistic, systemic view of harvesting activity which will lead to more meaningful insights for design opportunities later.

### Conceptual Exemplar

The two distinct advantages for using Activity Theory in Zambian villages are that it helps frame the design situation more appropriately and that it retains focus on activities and mediators as they occur and interact. The first advantage is

important because there is typically no pretense for digital technology in the village to use as a starting point for analysis. Secondly, as mentioned previously, the culture and traditions in village societies is often vastly different. The second advantage will result in the designer being able to design technology that will integrate into the local tradition rather than become exclusive activities in themselves.

While there will need to be real application of Activity Theory in a village setting to understand how it can be effectively utilized, conceptually it appears appropriate. What seems to be different is the way it will be applied in the village. For instance, looking again at figure 1, the subjects, objects and communities will undoubtedly look different from what the designer is accustomed to but this difference does not have great implications from a design standpoint. Rather, the important differences will be in how these are mediated through tools, rules and division of labor. The latter two make up the cultural gap I have written about thus far. I will not speak on it here because it requires much more ethnographic investigation. For the sake of simplicity, tools will be discussed here.

In villages most mediating tools will take physical forms such as farming and building tools. In contrast, Activity Theory is usually applied in a setting where the tools are digital to begin with. As a result, the designer almost has an easier task at hand. In the village it is much more difficult to envision design opportunities because physical tools are the basis of analysis. However, using this framework to analyze interaction with these tools could aid the designer in generating insights into how these physical tools might be modified digitally rather than simply being disregarded as rudimentary. Conceptually, Activity Theory is appropriate for analyzing village activities and generating design insights. The core differences in its application will only revolve around the difference in the nature of the factors being analyzed (e.g. harvesting tools vs. PDAs). In conclusion, Activity Theory can be an effective means for designers to deconstruct the design space meaningfully and creatively.

## Evolutionary Design

The previous three subsections concern the first phase of design—the act of research and analysis. The next two subsections will discuss two imperative areas specific to the act of designing itself in the developing world. ICT projects have often suffered from the act of developers creating something then leaving the project. Problems frequently arise because there is little attention paid to how design must change and adapt over time. Suchman, Trigg and Blomberg explain this perspective as shifting from viewing design as a singular event into a focus on “ongoing practices of assembly, demonstration, and performance” [61]. In this section I will discuss two evolutionary design philosophies relevant to HCI/d in the developing world.

### Discussion

#### *Design Claims*

The foundation for design has to be made at a specific moment in time. This means that the basis for design often inherently assumes static conditions. For instance, if a designer uses Activity Theory to inform his/her design; the basis for any insights derived from this will be constrained to the specific points in time of the investigation. This conundrum can lead to designs that may seem right on paper but do not work according to plan. This can often happen because the situation the designer thinks he/she is designing for initially will have changed when the time comes for implementation [42]. While this situation is obviously unavoidable, designers can better accommodate this perpetual change by frequently revisiting the preliminary claims and assumptions that were made in the beginning of the design process [62]. This will accomplish two goals. First, it will minimize the possibilities of creating false assumptions in the first place. Revisiting them as the design process unfolds will expose faulty bases. Second, as the design process unfolds, so does the design space. For instance, the users themselves might change their practices or new insights might change the way the design space is framed. Yrjö Engeström proposes the process of *coconfiguration*, whereby the designer maintains an ongoing relationship with the users in order to better respond to changes in the design space [22]. In any case,

reexamining design claims throughout the design process will result in more appropriate design interventions. This next subsection will discuss how designers must conceptualize the evolution of the design space *after* implementation.

### *Technological Drift and Instrumental Genesis*

Technological drift occurs when a technology moves away from its original intent. It is a problem that often plagues ICT projects in rural Africa [16]. Users either “tinker with the system” and improvise with it or they discover unforeseen features and exploit them [16]. While this “drift” has been discussed as problematic in the development literature, it is an understood phenomenon in the HCI community. The notion of how users and their activities change after a design intervention is made was briefly introduced in the discussion of Activity Theory. More specifically this notion is well-documented in terms of Cultural-Historical Activity Theory which, at its core, allows designers to better analyze a design situation by looking at how user activities are mediated by the artifacts they use [40]. Tied very closely to this theoretical framework is the notion of *instrumental genesis* (in this case the “instrument” refers to the design intervention). This concept refers to “the evolution of artifacts as the user's activity unfolds, and the building of utilization schemes, both of which participate in the emergence and development of an instrument” [7]. *Instrumental genesis* broadens the design process from isolating the intervention temporally and understanding how the use of a digital artifact may change over time. More importantly it empowers the designer to see how the activities, which are mediated by the artifact, change over time through its use. The result is a more inclusive design approach.

### Conceptual Exemplar

As mentioned previously, designing ICTs in the village often differs from designing in industrialized settings. In short, it occurs more distinctly and temporally isolated. For example, cell phones are frequently being iterated upon with new versions constantly coming to market. The nature of the market creates a highly reactive and predictive design situation. In the village however, design interventions are not guaranteed to take place. If they do, the artifact or system is rarely iterated upon. While there are many contributing factors to this that are outside the scope of interaction design, reexamining design claims and understanding instrumental genesis can mitigate the potential hazards from designing in such an isolated manner. However, the main question facing designers is how to ensure these perspectives are accounted for in rural villages. The answer is again nothing new but rarely practiced well in the developing world—*participatory design*.

Participatory design has been well-documented in the West but there have been few attempts at defining techniques for the developing world. It can help create more bottom-up, culturally-sensitive change [44]. However, it would be misguided to assume that all participatory design techniques will be the same in every situation because there are varying cultural, environmental, political, etc. factors in each situation. Different approaches will be necessary for each situations [52]. User and stakeholder participation in the village is even more crucial from an evolutionary perspective because there is an even greater gap between how the designer may envision the future of a design intervention and how the user would. As a result, designers need to develop an ongoing dialog with users in the village from the inception of the design process. However, they should not be treated as a focus group or consultants but as designers themselves. The reason for this is that they will most likely be in a better position to assist the designers in foreseeing how an intervention may change the local activities and traditions; thus, they can equip the designer to better react to change.

### Systemic Design

In addition to broadening the design perspective temporally and evolutionarily, the designers in the developing world will need to develop better understandings of the systemic, encompassing nature of design. Again, this is not a new perspective, having gained much interest in the fields of ubiquitous and pervasive computing. However, this perspective is rarely taken in the developing world. As mentioned previously, successful design in the developing world will have to truly move beyond the desktop and into the environment. Paradigms borrowed from the western notion of information

technology will often not adapt well in this setting. As a result, the designer will need a more effective means for framing the design situation to allow for more effective insights. In this subsection I will briefly describe two systemic design philosophies relevant to HCI/d in the developing world.

## Discussion

### *Interaction ecologies*

This term, coined by Malcolm McCullough, describes how digital artifacts can have diverse purposes but work together to create a systemic ecology of interactions [43] (this is also very similar to Krippendorff's notion of an "ecology of artifacts" [38]). This perspective shifts focus from artifacts as isolated tools to a more systemic view of how they integrate with a diverse array of daily activities users can undertake. The danger of concentrating on isolated activities is that a designer can easily optimize one part but disoptimize the whole [43]. Revisiting the example of the Yir Yorán tribe described by Sharp, the missionaries essentially optimized the act of chopping and harvesting by replacing stone axes with steel replacements but ended up disoptimizing the social hierarchy. In a village setting, designers should remain cognizant of "systemic flows" [43] of the users' activities and interactions to develop a better core understanding of how design will affect the larger system.

### *Embodiment*

Another key systemic perspective is described by Dourish as *embodiment* [21]. This perspective creates a truly systemic situation by bringing design out into the environment and away from the isolated, independent artifacts. This was touched on briefly in the discussion of changing the "technology-centered" perspective. As a practice, designers working in rural villages might focus more on design environments than the individual artifact. For example, multiple artifacts can be embedded in the environment to create a macro-interface that manages the interaction with a diverse group of artifacts. Bannon describes this as a Computationally-Enhanced Environment [5]. Designing for embodiment seeks to keep the users engaged with their own goals and activities rather than instituting new ones. The goal is that the design interventions will work more pervasively and effectively for the user rather than forcing the user to adapt to the artifact or system.

## Conceptual Exemplar

Understanding design systemically can open the designer up to generating designs that involve the usage of technology not initially obvious. The challenge is to think outside of the WIMP paradigm, especially in the West where that is the dominating standard. However, in the village, there is a blank slate for designers to develop designs that may not work simply as independent artifacts for specific individuals or a single artifact to be used by many (e.g. kiosk). Instead, designs can be pervasive, encompassing a broad array of tasks. The designer can design environmentally, outside of simply the interface and within space itself [21, 43, 66]. For example, a designer might embed sensors in farming tools and design an interface that tracks their usage and records relevant information to help the user make better judgments about their harvest—in essence a means of managing the ecology of these artifacts. Systemic design in the village creates a more seamless transition for the user as the intervention is not self-serving but rather operating throughout and within the broad range of activities that occur in rural villages.

## PRINCIPLES

I began by illustrating the perspective interaction must embody in the village setting, and then I gave an overview of methodologies and theoretical frameworks of HCI that can provide the backbone for practicing HCI/d in the developing world. However this can only bring interaction designers so far because there is no real precedent for HCI/d in this context. While there has been a plethora of ICT projects undertaken in LDCs, there is little documentation of the design process or methodologies in any of them [63]. As a result, in order to initiate the domain of HCI in LDCs, designers first need heuristics to measure these past projects and judge current initiatives. Additionally, designers need a way to frame these design situations. I have already described perspectives, but there is a more specific need for *what* to look for in the village. To accomplish this, I propose a few core principles that can provide a better vocabulary for analyzing, practicing and discussing interaction design in the developing world.

This section is the result of a combination of the HCI perspectives and practices I've mentioned up until this point, and common themes among ICT successes in villages and ICT research conducted in rural African settings from the 1980s onward. For the most part, the first three principles loosely lead into one another. A design should be transparent which can then lead to the ability for adaptation on the part of the user which eventually increases the sustainability of the ICT. The last two are social focuses for design. At first glance they may seem obvious but they are not readily apparent in the design of many digital artifacts in the West. Culturally-centered aspects illustrate how well an intervention can reduce its disruption on users and work more seamlessly within existing activities. Communally-centered aspects are highly catered to the developing world because for the most part, this is a population that is not predominantly individualistic. Additionally, much research has shown that when people in the village do become successful, they leave it behind—worsening the condition of the village. In summary, these five principles will provide a well-grounded starting point for interaction design in the rural developing context.

### Transparency

This principle has two parts: conceptual and technical. The conceptual factor relates to how well the users' mental models map onto the artifact or system. The technical is more literal as it describes how well the inner-working of the constructed system is understood by the user.

#### Conceptual

*Is the value of the design obvious? Can the user understand how it helps her/his to achieve goals?*

As the discussion on Yoked-State Hypothesis, Coupling and Mental Models alluded to; designs should provide little confusion over how they help to accomplish what they are intended to do. This does not mean that designs should not have the capacity to be reformatted or improved upon by the user. Rather, for instance, if a design project is undertaken with participation from potential users, the resulting product should mirror their understanding of the problem. This is a principle of interaction design in general but it takes on a slightly different form in the developing world context. The main reason for this is that achieving a second-order understanding between an urban designer and a rural villager is more difficult to elicit. This is often taken for granted in typical HCI practice because there is often much less dispute over how artifacts and systems are understood on a basic level. Even something as common to Westerners as a WIMP interface is most likely not conceptualized similarly in a village setting. As a result, the purpose of this question is to force the designer to deconstruct design on even the simplest level in order to better conceptualize it as the user would.

## Technical

*Can users develop an understanding of how the artifact or system works?*

This principle is slightly out of the realm of interaction design (though well within the realm of HCI) but it should be a consideration in design. Even if a design is well-mapped conceptually, it does little good if the user does not understand how it works. This is often not a consideration in HCI because the user does not need to understand how an artifact works. In the village however, there is less consistent intervention on behalf of the designer so the user will often assume the role of the designer. As a result, the user should know how an artifact or system works in order to improve upon it. The repercussion of not providing technical transparency is greater than often expected. If something is designed for a particular village, it might then become relied upon. However, if there is some breakdown and the user cannot fix it, the village will be in a worse state than before the design intervention. Something that had become relied upon has been stripped, forcing the users to adapt once again. However, empowering users to be able to fix something is not the only thing technical transparency provides. More importantly, transparency creates adaptive capacity so that it can be improved and innovated upon, as covered in the next principle.

## Adaptive Capacity

This principle is intricately tied to the notion of evolutionary design but it is also supported by the research already conducted in the area of developing ICTs in rural Africa. The term itself is derived from biology but in this case I draw on environmental management (see [29]). In this area it refers to using environmental management and policy-making to make ecological systems more adaptable to change. In the field there have been numerous successes in techniques that give people more ability to innovate themselves rather than being mandated by policies [47]. From these techniques I derived two components that can make adaptive capacity a possible quality of information artifacts and systems: customization and innovation.

## Customization

*Can the design be modified or extended for new activities?*

By being able to answer this question, the designer can turn a previously negative outcome of “technological drift” into a quality that designs actually promote. Designs must be customizable because of the nature of design in the developing world. In most cases, the designer will have to leave the design project after implementation. This fact results in a difficulty to engage in evolutionary design because the designer and user will not often be able to maintain interaction and collaboration over the duration of the life of artifacts and systems. The alternate scenario is that the designer may be able to revisit the area, albeit with long gaps in between. To account for this gap or exit, designs should facilitate customization by the user [38]. This customization does not necessarily have to be foreseen or directly accounted for in the design. Rather, the designer should seek to remove as many restrictions on his/her product as possible. This will allow for shift in use. More importantly it will create more ownership and buy-in on part of the user.

## Innovation

*Does the design facilitate and inspire innovation?*

From a policy-level, creating ICTs in LDCs that support innovation by the user for the user’s needs is vital [6, 55]. However, innovation does not have to be mandated by government policy. Rather, it can be a quality of the design interventions themselves. For many similar reasons to the discussion on *customization*, designs should allow for innovation because often there cannot be consistent intervention by the original designer. More importantly innovation is vital in the developing world because there is a greater need to foster self-empowerment. By instilling innovation-inspiring qualities into design, the designer is empowering the user to become a designer his/herself rather than creating a less-desirable **donor**→**recipient** relationship. More importantly, by fostering innovation, and allowing for customization, the design becomes more sustainable.

## Sustainability

The principle of sustainability is arguably the most important because every other principle relies on it. However, it can also be facilitated through acknowledgement of the other principles. Sustainability has three components: stakeholder buy-in, environmental, and financial. Yet, in terms of interaction design, this principle is difficult to assess. It is better measured or predicted by other fields. I only address it here because of its importance.

### Stakeholder buy-in

This can partially be accounted for through the actual design process. If the process is largely participatory, the design is almost assured of having buy-in. This can also be a property to strive for within the design itself. Designers can design in a way that promotes engagement and active use. For example, if one is designing a better way to diagnose medical problems, there will be a better chance for buy-in if it can be used by more than just the nurses. The system can take on many different forms for different users so that a broader range of people buy in to the design. Additionally, the designer's should not exclude users. Obviously, designers would not do this intentionally, but the inherent nature of a design often does. A common example is video games. They are not designed deliberately to exclude women but the very nature of their content is often unattractive to women. Designers must be aware of these cultural factors to avoid alienation users and prohibiting buy-in.

### Environmental

This is quite out of the scope of interaction design but it must not be ignored because environmental sustainability is greatly magnified on a village level. One of the greatest challenges that will face interaction designers in the developing world is how to create something that uses electricity in an area that often does not have access to electricity. There is plenty of opportunity for creative innovation from other fields but interaction designers might attempt to accommodate this burden in the design itself. The One Laptop Per Child project (OLPC, [olpc.org](http://olpc.org)) originally created a laptop that included a hand crank for recharging. How the design intervention interacts with the environment and not just the people should be a primary concern.

### Financial

This is clearly the principle most outside the scope of HCI. Nonetheless, financial sustainability is a frequent cause for failure even in the most impressive attempts. Designers must avoid implementing anything that requires much outside input. Since this is often not possible, designers might seek to design in a way that allows for money to be made in some way. If a design intervention can somehow at least fund itself, this is the easiest way to sustain an ICT.

## Culturally-Centered

Culture is difficult to define in terms of how to design for so this principle is subdivided into activity, social, and cognition. What is common among these is that by centering design on them, the designer may create something new but not something that negatively disrupts the status quo. To be culturally-centered does not mean design cannot be disruptive but that if it is, it must be done appropriately.

### Activity-centered

*Does it enhance current, beneficial practices?*

Many problems that plagued rural libraries in Nigeria and Dene schools in rural Canada resulted from how they overthrew current practices in favor of activities that were vastly different from what the users knew [1, 24, 64]. Designers should avoid creating new activities in themselves. For the most part this is unavoidable because the inherent nature of design is one of creation but village cultures are often very deeply entrenched and often vastly different from that of the designer. As a result, designers can bridge this gap by focusing on existing activities more than attempting to

create new ones. Theoretical frameworks such as Activity Theory can elicit ways of designing around the activities themselves. The goal is that design will enhance current activities rather than detract from them.

*Does it alleviate some current burden?*

If a design can be judged as enhancing existing practices then it must also alleviate some burden. While this is an obvious question for most interaction designers, it is not often answered “yes” in the West. One could argue that many new digital artifacts do not necessarily alleviate burdens. While this model may work in a more capitalist, market-driven environment, it is a poor fit in rural, subsistence-based villages. In this environment, the designer must be focused on designing something helpful.

### **Socially-centered**

*Does it work within current socio-cultural models?*

The larger perspective of the structure of villages is one of decentralization. Within Zambian villages there are central headmen [59]. However, between villages there is not a centralized structure. ICT projects often fail because they do not take this into account. Cooperatives in Northern Zambia were often difficult to implement because they forced more centralized structure on decentralized, disconnected villages [26]. The implementation of centralized multi-purpose community centers (MRCC) [19] leave out many villagers that are not geographically close enough to them. It is imperative that designers understand the socio-cultural models before implementation because it can prevent future problems of unforeseen causes.

*Does it “break” those rules appropriately?*

As is often mentioned with design principles, one needs to learn them to know when to break them. A similar perspective is taken in this principle. Just because social norms exist does not mean that they have to persist. Designers must be aware of the norms not only to better understand how their designs might have a larger effect but also to make more informed judgments as to when the norms might best be broken. The successful Grameen Bank initiative goes against the male-dominated social paradigm by empowering women [30] (it should also be noted that the bank mirrors the hierarchical structure of Bangladeshi villages). Similarly development programs in rural Zambia succeed more if they utilize women which also goes against the patriarchal structure of Zambian villages [15]. This question is very difficult for designers to answer quantitatively yet forcing the question to be asked will improve the designer’s overall understanding of the “whys” of culture rather than simply “what is the users’ culture?”

### **Cognitively-centered**

*Does the ICT work within ways the user can understand (e.g. symbols vs. written text)?*

This question is related to conceptual transparency but differs in that it is focused more on methods of information processing. Again revisiting cases of rural libraries in Nigeria and Uganda, they also were difficult to implement because the information was given in English—a language that most villagers do not read [1, 32]. The goal here is not necessarily to get villagers to learn the method of communicating in designed interfaces but to truly center this means of communicating on what makes sense to the user. In other words, libraries and western-based schools do not necessarily fail in the village because the user do not read English, but rather, reading English is not the preferred method of communication. Almost anyone can learn to read but this does not mean they should. Asking this question will force designers to be more creative—by exploring other means for communicating their design. For example, Ansu-Kyeremeh has explored the possibility of using ideographs and native drumbeats as information representation because these are commonly used in many African tribes [4].

*Does it make sense logically in the way the user conceptualizes information?*

Following the last question, the designer should also ensure that information is delivered in a way that makes sense to the user. This is also a question that needs to be asked more in interaction design in general but is even more of a consideration in the village. For instance, in the West, even though lists and drop-downs are not how humans necessarily cognitively organize information, convention at least makes this method possible. These conventions are not common in the village. Once designers have a better cultural understanding of their users, then they should use cognitive methodologies to better understand how the users conceptualize information. For example, Ansu-Kyeremeh has also proposed that information could be delivered more in terms of icons because this is more in line with symbolic methods of representation used in African villages.

## Community-Centered

*Does the design promote independence or isolation?*

A persistent struggle for Zambian villages which seek progress occurs between the inherent nature of technology and affluence to promote independence and the structure of the village which promotes community [59]. For design to be community-centered, careful consideration needs to go into the isolative effects of the intervention. These considerations are actually no different than in an industrialized setting as mp3 players and cell phones are progressively creating more isolation between people. However, the impact is much greater in a village setting as villages are more dependent on the collective success of their people. If interaction design promotes independence and isolation, this can create a worse condition for the village by fragmenting the community.

*Does the design promote the construction of communities of practice?*

While this may not necessarily be a vital requirement, it is largely inspired by the notion that within these close-knit rural village communities, more communities of practice [9] can be established which might strengthen villages. Individually, villagers and villages are relatively powerless because they do not center around specializations [59]. However, if people and communities can be established through knowledge and work, stronger communities will result as Brown and Duguid have shown [9]. The hope is that if design interventions can essentially make stronger sub-communities, then the larger network of villages might become more empowered.

I have proposed 5 core principles I find vital as a starting point for interaction design in rural villages:

1. Transparency
  - Conceptual
  - Technical
2. Adaptive Capacity
  - Customization
  - Innovation
3. Sustainability
  - Stakeholder buy-in
  - Environmental
  - Financial
4. Culturally-Centered
  - Activity-Centered
  - Socially-Centered
  - Cognitively-Centered
5. Community-Centered

However, I do not see these as being universal nor eternal. My hope is that they can provide a starting point for interaction design to develop a better vocabulary for discussing ICT projects and development so the field can improve and learn from a design standpoint. However, I have only provided a conceptual representation for how design should unfold in the village. I hope that such a framework can be improved upon and tested through application in the field.

## PROJECT SYNOPSIS

In this section I will provide a meta-perspective on my project. I will include hurdles and reasons for my approach.

### Obstacles

The first major obstacle in this project was that I expected to find a lot written about design in the developing world already. Almost every project has been done in some form or another so I assumed this to be true with this project. While I did find many ICT projects that were doing what I envisioned to be carried out with a framework I am proposing, none of these projects provided much—if any—documentation about the design process. Not having this body of work to begin with made my project initially difficult to frame from a research standpoint. I had a large body of work that essentially provided documentation on project successes and failures but not academic writings on the design of any of them. Eventually, I reframed my project into an attempt to provide a framework for appropriating HCI in the developing world whereas initially I had the notion I would be *creating* a new field. While this may eventually become a new field, I examined numerous HCI methodologies in order to see how they would conceptually work in this area. My initial predisposition was that none would work but I came to find that many of them would simply have to be adapted. There are many aspects of villages that current HCI methodologies are ill-equipped to handle but I still used them to derive practical design principles. This obstacle was overcome by reframing my project.

Throughout this process, it was extremely difficult to sift through and coherently synthesize academic literature from other fields. I drew heavily on the fields of anthropological, sociological and policy for insight but there is much work that is difficult to draw on from the outside. For example, I initially wanted to provide better background on the culture of Zambian villages (especially my area of interest—the Tonga in the Gwembe Valley), however much of the writing was too dense for a non-anthropologist to extract anything meaningful. Design is truly multi-disciplinary and I find that this obstacle for my project will perpetually face design researchers. As a result, a project of this scope should definitely involve individuals from the appropriate fields.

Another obstacle related to using outside research was that it was difficult to decide how far to deconstruct the problem. There are issues with designing in the developing world that I did not explore in great detail such as political and environmental concerns. However, I tried to adhere to what I found to be the most relevant areas of interest but this does not imply that other areas are irrelevant. "Stopping" the project at any point never implies it is finished. This project can always afford to bring in more perspectives. On the other hand, understanding the scope of this project will best be determined when it is applied.

Lastly, designing is difficult to undertake remotely. I needed to 'place' myself in the design situation so the only means I had at my disposal was ethnographies of particular Zambian village cultures. This is not sufficient and could be potentially dangerous for future design work because for many reasons (including what was written in the last paragraph) written ethnographies will not give an accurate representation of the design space or the potential users. Originally, I had intended on designing something for the clinic in Nkandanzovu but halfway through the project I realized this would be presumptuous. I wanted to design something to test my framework but without undertaking a true design project in the area, the framework could not accurately be tested.

## Approach

While basing a practical framework only off of secondary research is obviously not sufficient, I found the process to be appropriate. I looked at a lot of outside research to help frame the problem, then looked at methods, theories and frameworks from within HCI. After examining those two large bodies of research, I looked more at Zambian villages specifically to try to conceptualize how these two bodies of research could join to create a framework for practicing interaction design in rural villages in developing countries.

As I mentioned above, I found that my original intention of trying to design something would be presumptuous. This project still greatly needs application but it must be done in practice. There is a great amount of documentation of ICT projects in the developing world but they do not provide analysis in terms of design. I could use my framework to analyze these cases, but that would only provide retroactive proof-of-concept rather than yielding insight into how well this framework can be used from the beginning of the design process.

## CONCLUSION

I began my project by exploring some of the earliest attempts at ICT projects in Africa in the 1980s. These projects illustrated many design considerations that were essentially before their time, as I saw many of the obstacles faced in ICT design consistently repeated in this area in projects over the last 10 years. I thoroughly examined the evolution of HCI methods beginning in the early 1980s and followed the field's focus from solely information-processing and cognition into its current trend towards situated action and semantics. I followed this by researching culture and tradition in African villages in order to analyze the appropriateness of methodologies and theoretical frameworks. Concurrently, throughout my research process I fleshed out simple concepts and specific design strategies for the developing world in an effort to articulate and realize my findings. In this process I found that my initial predisposition of the inadequacy of HCI methods not to be entirely true. Many methods will need to be adapted and re-evaluated in a village context while some may not be appropriate at all considering their concentration on technology itself.

However, my research and analysis shows that HCI can and will work in this setting through theoretical frameworks such as Activity Theory and grounding theories such as a focus more on semantic and cultural meanings placed on artifacts and away from simply usability engineering and task analysis. HCI/d must extend beyond the assumption of the desktop interface and small variances such as the OLPC and into human activity and culture. Design should consider transparency, sustainability, adaptive capacity, and cultural and community centeredness as guiding principles in the design process and desirable qualities of interaction design. These qualities and considerations can provide a rubric not only for future design work but towards an effort to create a better vocabulary with which to examine previous ICT projects.

While my framework has been constructed specifically with Zambia as my particular area of interest, I have drawn on not only areas outside of Zambia but design fields outside of HCI and broader research from anthropology, sociology and communications. My framework can be expanded beyond not only the specific region of Zambian villages but can inform HCI/d in general. The future for this body of work lies in the application of the framework. I have provided a conceptual model that needs to be validated and improved upon in practice. I have found an overall deficiency in literature discussing design in the developing world that needs to be expanded upon. As transnational corporations and high-tech industries seek to enter the market of LDC's it is imperative that HCI practitioners improve the field to ensure this movement advances as beneficially as possible. I do not assert that I have provided a flawless framework. Rather, I hope to have simply provided a starting point for how HCI can begin to expand beyond our traditional pretenses, environments and user bases.

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**Final Project Approval**

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Primary Advisor	_____	_____
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