Choices on Top of Choices:

A Case Illustrating the Dialectic Impact of User Technology Choice

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Abstract

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This dissertation is an instrumental case study of the dialectic impact of user technology choices on systems where users have high autonomy - more ability to choose technologies. The high autonomy context of the case study is humanitarian relief, specifically one humanitarian NGO, Local Hope. Local Hope users are like other users, choosing technologies based on many motivations, including choosing based on choices in their current environment. In dialectic impacts where users are choosing in reaction to their current environment, users' technology choices both are shaped by and shape their environment. I illustrate this by using prior theory including technological frames of reference (TFR) and sense-making. I call the combined theory perspective the high autonomy dialectic (HAD).

The new knowledge in this dissertation is that systems in high autonomy user environments may be seen as dialectic constructions of user choices. Users experience differences in technologies, which creates experiential gaps, which are overcome by tactics (user choices), which in turn create impacts. These impacts are dialectic because they both are shaped by and shape the system. The high-autonomy dialectic allows us to see how high-autonomy users' systems are both the outcome of user choices and the medium in which users choose. With users' technological environments becoming increasingly complex and autonomous, both at work and in our personal lives, a dialectic perspective on user choice promises to be an incremental but highly useful contribution to the scholarly conversation in human centered design and research.

Table of Contents

List of Figures

List of Tables

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Dedication

I dedicate this dissertation to my wife, Jennifer Jo Ann Crow. Her complete faith in me proves that the truth lies not in data, but in love.

Chapter 1: Introduction – The Story And Key Concepts

In this dissertation, I use the term "dialectic" to mean the successive impact interacting user choices have on their system. Not all user choices will be dialectic impacts. As a case study, this dissertation does not attempt to investigate user choices which fall outside the scope of my dialectic perspective on Local Hope. Users may choose different technologies in reaction to existing choices and in the Local Hope case those interacting choices declared by users in the data are the subject of study. Those declared, interactive users' choices may create incongruent uses of technologies as users employ technologies that do not line up (systemic misalignments), and these misalignments may in turn indicate dialectic impacts where the user choice changes the system, and may precipitate user choices further changing the system.

The point is not to understand Local Hope more deeply, although some increased organizational understanding is inevitable. The point is to share new knowledge about the phenomenon of the dialectic impact of user technology choice in high autonomy user environments. This compounding impact of user choice is successive and evolutionary. Users choose in reaction to existing choices (are shaped by the environment). Those choices change their system (shape the environment), and thus provide the potential for yet different choices. In this way, user choices can be seen as dialectic and Local Hope serves as a case study in this dialectic view. As technologies become more sophisticated and users' choices greater, we are more obviously creating systems not just out of different technologies, or even out of different user choices among technologies, but out of user choices that influence each other. This is especially true in systems where users have more autonomy to choose technologies. With the autonomy to choose and more technologies to choose from, users can choose technologies and thus are both shaped by and shape their user environment. This dialectic nature of users' technology choices both reacting to and changing users' environment is explored in detail in this dissertation through the Local Hope case.

TFRs and sense-making are both well-established frameworks with a distinguished record of published work. That combined focus creates the need to define a number of terms in this dissertation. In this

dissertation, systems where users have more autonomy are called *high-autonomy user environments,* the extent to which users can make their own technology choices is referred to as *autonomy*, misaligned user choices are called *systemic misalignments* and the compounding, dialectic impact users' technology choices make on their system is seen through the new perspective built on prior published work called the *high autonomy dialectic* (or HAD).

Since Human Centered Design (HCD) focuses on understanding and narrowing the distance between what is designed and what is desired, researching the dialectic impact of user choices promises insight into users' experiences, particularly in environments where users have greater ability to choose technologies.

To that end, this dissertation 1) Examines a high-autonomy user environment (Local Hope) that experiences the dialectic impacts of user choice, 2) Presents an account of dialectic impacts that arise at Local Hope, and in so doing 3) Illustrates a way (the high-autonomy dialectic – or HAD) to more deeply understand these dialectic impacts to create insight for human centered design.

To accomplish those three items, I conducted structured surveys with 24 Local Hope humanitarian relief professionals as representatives of high-autonomy users. I then applied iterative analysis procedures guided by three research questions:

1. What about high autonomy environments helps to generate user technology choices?
2. What types of user technology choices might misalign in high-autonomy user environments?
3. What kinds of dialectic impacts can we see resulting from user technology choices in a high autonomy environment (like Local Hope)?

Key findings include that 1) High-autonomy user environments can enable user choices by fostering choice and resource variability, 2) User technologies may misalign consistent with user choice and variable resources, and 3) misaligned choices generate dialectic impacts.

With these three findings, I articulate a place for this knowledge in HCD theory. To do so, I borrow and combine elements from a number of existing theories. In the end, this dissertation contributes to the ongoing scholarly conversation in HCD which seeks to understand humans' rapidly changing technological experiences and thus narrow the gap between what is designed for and desired by people.

[BEGINNING OF FORMAL TEXT]

This is a story of an under-examined reality in user experience – users' choosing technologies and the dialectic impact of their combined choices. It is a story told from my personal experience, with qualitative data, and enhanced by prior theory. The moral of the story is that autonomy matters to human centered design. It matters because users who can will exercise autonomy to choose technologies, and through those choices users impact each other and their systems in important ways. Technology choice matters to users, to successful design for users, and to human center design (HCD) scholars and researchers trying to understand users. More specifically, this story is not about all users choosing technologies but about those users with high levels of autonomy.

To illustrate this, I use a case study to explore an example that is both simple and sophisticated. The case is simple as it is a single humanitarian non-governmental organization (NGO) at a specific point in time. It is sophisticated because that NGO, which I will call Local Hope, dealt with issues of personal choice, culture and policy in the impacts of high user autonomy (I am required by the University of Washington Human Subjects office to use a fictional name for the organization – Local Hope). Also, the characters in the story (the users in the Local Hope case) are not one dimensional. Local Hope users experience interactions among their organization, their roles, and the tasks they must perform all while making technology choices. Their experience is an example of how users' autonomy impacts users and their system.

The case of Local Hope illustrates the larger story of this dissertation. That larger story seeks to add to the scholarly conversation of human centered design (HCD). In terms of the HCD scholarly conversation, seeing user experience through users' technology choices and the combined impact of users' choices on their systems promises richer, deeper understanding into user experience. This dissertation examines these impacts of choices by building on other researchers' work to improve the HCD scholarly conversation. This will be increasingly important to HCD as users in many environments increasingly acquire and assert the power to choose among various technologies for various tasks. As HCD continues to evolve and investigates these empowered users, we must continue to develop better ways to investigate these high autonomy user environments. These ways to investigate users should

reflect the reality of user technology choices and the combined impact of those choices on the overall system. This dissertation suggests one way to do that.

Systems design practice similarly benefits from this dissertation because this dissertation affords a better way to see and organize user experience in high autonomy environments. Many HCD researchers and practitioners have traditionally investigated user experience to improve the design of more immediately visual user experiences such as computer desktop choice, website layouts, how users prefer to organize their files or where users look on the screen. While certainly useful, these approaches do not properly fit the focus of this dissertation. Rather, this dissertation focuses on and proceeds from different traditions in HCD and related disciplines including more organizational and systemic perspectives. In working from those systemic perspectives this dissertation's focus provides HCD another way to organize data about, and begin to design for, environments where users choose not within a single technology, but among various technologies. More importantly, it provides a way to think about the impacts those combined choices may have on a system.

Using the Local Hope case and prior theory, this dissertation provides a way to gain both additional HCD insight and design utility from a high autonomy environment like Local Hope. To illustrate this larger HCD story I unpacked the case of Local Hope user experiences. In so doing, I found that prior work did not fully fit the story of technology choices in this case. Often, this lack of fit seemed to trace back at least in part to a perspective on systems not completely consistent with the Local Hope case. That prior work is examined in detail in the Literature Review chapter, but includes important and accomplished work such as scenario-based design technique (Go & Carroll, 2004, Gruen, Rauch, Redpath, & Ruettinger, 2002), contextual design (Beyer & Holtzblatt, 1998; K. Holtzblatt & Beyer, 1999; K. a. B. Holtzblatt, K., 1996), naturalistic decision-making (Klein, 1993; Klein, Calderwood, & MacGregor, 1989; Klein, Kaempf, Wolf, Thorsden, & Miller, 1997), technological frames of reference (W. Orlikowski, 1992, 1993; Wanda Orlikowski, 1993; W. Orlikowski & Robey, 1991; Yates & Orlikowski, 1992), and sense-making (Dervin, 1992, 1998, 2000). These views rest at least in part on an assumption that systems are stable, or can be designed to be stable. This aligns with what has been called the Fixed Point Theorem (Paul, 1993).

Fixed Point Theorem is the idea that users will agree on what a technology means, when to use it, and which technology to use and thus the system has a stable end point.

Interestingly, even though designers (including myself) rarely think of ourselves as creating systems that meet this fixed perspective, users often experience it differently than we do. This is an example of the power of HCD as a discipline devoted to iteratively narrowing the gap between what is designed and what is desired. While we do not intend to design fixed systems, system owners may implement them that way or users may experience them that way, and thus users may make choices in reaction to the environment they experience instead of the one we sought to design. This is an excellent example of a distance between what is designed and what is desired. Local Hope users choosing in reaction to current choices demonstrates this. From an HCD research perspective, seeing systems from a fixed perspective assumes lower user autonomy. For some user environments, like many law enforcement or military systems, this lack of user choice is real. In others, like Local Hope, users can exercise autonomy.

Local Hope is an example of one of those user environments with more autonomy and prior research did not place enough agency for technology choice in the Local Hope users themselves to sufficiently explain this case. Thus, while many prior researchers contributed formative, even critical, ideas to the formation of this dissertation, none of that prior work alone quite fit the Local Hope case. Instead I combined facets of prior literature to generate a different perspective I call the High Autonomy Dialectic (HAD).

This perspective, the HAD, allows HCD researchers to see environments like Local Hope in a way consistent with most designers' beliefs that systems must flexibly and progressively adjust as users make choices. As the literature review will detail, a number of HCD researchers have explored this concept of understanding user choice to improve experience and design. However, none of that prior work provided a way to fully account for the kinds and impacts of user choice I investigated at Local Hope. That said, many prior researchers in HCD and information systems contributed important intellectual elements, and this dissertation brings those elements together in a new way to generate new knowledge about user technology choices in high autonomy environments. In so examining the Local

Hope case, we will see how Local Hope users' stories can increase our understanding of how users impact themselves and their system through choice. This understanding can in turn generate new knowledge and also practical systems design options otherwise not evident.

Telling this dissertation's story of user choice required three basic elements: personal experience, scholarly theory, and this dissertation's data. I organize this dissertation roughly along the same lines as those three sources: experience, theory and data. In this first chapter, I introduce the dissertation's focus on users' technology choices and my experiences which led me to that focus. In the second chapter, I describe the theoretical literature from the humanitarian, human centered design, and information systems disciplines I used in this study. In the third chapter, I explore how I built my understanding of the humanitarian context and Local Hope and address the research questions. I then discuss the methods and data I use to illustrate the impacts of users' technology choices. In the fourth chapter, I show impacts at Local Hope. In the fifth chapter, I discuss the impacts and their contribution to HCD. Finally, in Chapter 6, I conclude with considerations on how HCD can benefit by understanding users' technology choices differently through the perspective used in this case.

Perhaps the most important thing to keep in mind as you read this dissertation and the Local Hope case is that the moral of the story is not fixed. The moral is in motion. Local Hope's story illustrates how users' exercise of autonomy is not linear or stable. It does not have that kind of beginning and end. Local Hope users' technology choices interact in a dynamic and unpredictable. The impact of the users' choices is profound and compounding. Choices beget new environments, which beget still new choices.

In terms of users' technology choices impacting the system, the moral is that autonomy matters. More specifically, it matters because user technology choice provides HCD a fruitful way to understand how users create rich, complex systems as constructions of technology choices. This focus on user technology choice fits current trends in people's technology use. People are choosing various technologies in their daily lives, at work and personally. People will use Skype for far away relatives and IM for people they see every day; a BlackBerry for work and an iPhone personally; they will text their closest friends, but call their grandparents, post photos from a family outing on Facebook or Instagram but email a specific holiday greeting to a select few. As users' ability to make technology choices

increases, it is important for both HCD researchers and designers to include user technology choice in their analysis or risk missing a fundamental element of user experience.

That brings me to four key concepts which require definition and explanation: autonomy, roles versus tasks, systemic misalignments, and the high autonomy dialectic. Next, I introduce and define these four key concepts.

1.1 Key Concepts

Four key concepts are critical to a understanding user technology choices in high autonomy user environment with this dissertation: *user autonomy, role versus task, systemic misalignment,* and *high autonomy dialectic*. These important concepts are used throughout this dissertation and defined below.

1.1.1 Autonomy

Autonomy is a broad concept and could be understood in many ways. In this dissertation, user autonomy, or more simply autonomy, is not an abstract quality of human freedom. Autonomy for this dissertation is seen in user behavior. It is specific and empirical. Specifically, it is seen in user technology choice. Empirically, autonomy is observed through users' making choices to use, or not use, certain technologies. Thus autonomy in this dissertation is a demonstrated technology choice linked to the tasks users perform. For this dissertation, autonomy means people chose a specific technology to do a specific task.

Low Autonomy Defined

Of course, in some environments, like the examples I have seen while working with governments, users simply have little or no autonomy to choose technologies for the tasks they must perform. In these low autonomy environments the work context is often static, the workflow predictable, and the technologies used are tightly controlled. The autonomy is low. In low autonomy environments user choices are often restricted at least in part due to concerns over system security.

For example, in my consulting and technology design work police officers in the field often attempt to use their personal mobile devices to access information services outside IT policy, and the devices and

services officers chose differed as well. Some would use an iPhone, others a Blackberry, and others an Android. Some officers would access city resources, others a private vendor, and others still a combination of both. In many cases, unlike in humanitarian relief, the officers' IT departments would shut down their access, effectively removing those "renegade" devices from the system, and reducing the officers' technology choices. These actions reducing user's choices are motivated by security and accountability issues. Still, just as in the humanitarian environments, many users strongly felt users needed autonomy to choose technologies to get their work done.

The difference in these comparatively low-autonomy government environments was not just that users have less autonomy to make technology choices. Consistent with this dissertation's focus on the dialectic impacts of users' technology choices, a lack of choices also drastically reduces the compounding impact of user choice on the system.

High Autonomy Defined

In higher autonomy environments like Local Hope, the work can be unpredictable, even chaotic, and users choose technologies often as they see fit. In many high-autonomy environments, including Local Hope, user autonomy is not uniform. Different users have different levels of autonomy. Thus, user autonomy rests on a continuum. The more choice users have in the technologies they use, the higher their autonomy.

In places like Local Hope, the story of user autonomy is particularly rich because humanitarian NGOs like Local Hope have cultures of independence, of action-orientation, and of trusting the person on-site to get the job done. Adherence to IT policy is not valued as highly in humanitarian relief as accomplishing the objective – completing the task. Some users, often field-based workers, benefit from this culture by exercising great autonomy in technology choices.

Despite the general culture of high user autonomy, other Local Hope users are still constrained. For example, IT staff at Local Hope's global headquarters are similar to other IT staffs, bound to policies and state that others should be too. Together, the combined technology choices of these different people, in environments with different levels of autonomy, in different roles undertaking different (or shared) tasks,

create a living, breathing illustration of user autonomy and the profound, dialectic impacts those choices make.

1.1.2 Roles Versus Tasks

This brings us to the second and third key concepts, roles and tasks. These two concepts are distinct. The interaction between the two is important for this dissertation. In this dissertation, *roles* are not the work people do, but the name given to the collection of responsibilities users are expected to carry out. These roles are not the actual work, but the job title and cultural expectations around the title. Local Hope users in the data identified themselves as belonging to one of five professional roles: food security, program management, logistics, communications and donor relations.

The reason role is interesting in terms of this case of user autonomy is that despite a common job title and a shared set of cultural expectations, not all users in the same role exercised autonomy in the same way. Users in the same role made different technology choices even for the same (or shared) task. Users express many reasons for these differences in technology choices in the data and this will be explored in the section detailing data analysis.

Unlike role, task is the actual work users do. More specifically, it is the actions they perform to accomplish the expectations of their role. Consistent with the humanitarian culture, at Local Hope the emphasis is on getting work done – doing tasks. Over time, with iterative analysis, it became clear to me that high user autonomy for tasks was significant in understanding how users' technology choices impacted each other and their system. Technology choices were seen in the data through the tasks users performed more so than the role. The interaction between role and task is that users in the same role sometimes chose different technologies to do the same tasks. Initially, this interaction was difficult to articulate. The next concept helps to organize these different choices and the interactions between roles and tasks.

1.1.3 Systemic Misalignments

In this dissertation, systemic misalignment means instances where users' technology choices do not agree. These different choices help to create a system made of user choices. Misaligned choices set

the stage for dialectic impacts on the system. In this way, systemic misalignments are useful in showing and studying user technology choice because they indicate the possible presence of a dialectic impact in a high autonomy user environment.

To illustrate my definition of systemic misalignments as misaligned user choices, I use an example from Local Hope (explored in more detail in the findings chapter). In this Local Hope example, users shared work in a collaborative task with some Local Hope users choosing Skype to complete the task, and others choosing a web-based tool called Mayetic. These users were not operating in isolation, but literally building ideas together, ideas critical to the success of Local Hope. These two choices misaligned, with some Local Hope users trying to build the ideas through one technology and others through a different technology. Due to misaligned user choices, the work, and the system built of user choices to support that work, was now split between these two technologies. In this Mayetic/Skype example, and since Local Hope is a high autonomy environment, the stage is now set for users to choose Skype, Mayetic, or create a dialectic impact by choosing yet a different technology altogether. In this example, we can see how users' misaligned technology choices have systemic consequences with the potential for dialectic impacts.

At Local Hope, these four key concepts (user autonomy, role, task, and systemic misalignment) combined in the data to tell an illustrative story of how user technology choices matters to HCD as a source of intellectual insight and a lever for design utility. That story shows how users misaligned in their technology choices across roles and tasks, often creating different kinds of systemic misalignments, and then dialectic impacts. This idea of dialectic impacts is defined more fully next.

1.1.1 The High Autonomy Dialectic

The compounding impact of user choice is successive and evolutionary. Users choose. Those choices change their system, and provide the potential for yet different choices. In making choices in reaction to their current environment users both shape and are shaped by their environment. If a Local Hope user is dissatisfied with current choices and chooses a different technology in reaction to the unsatisfactory one, that choice is both shaped by (motivated by current choices) and shapes (adds more choices) the system. This fits Giddens (Giddens, 1976) conception of dialectic thinking as applied to user

environments through Orlikoswki (W. Orlikowski, 1992, 1993). This impact of users' choices both being shaped and shaping their environment is what is meant by "dialectic impact" in this dissertation.

The term "dialectic" is used in different intellectual disciplines. In our discipline and those closely related to HCD, dialectical thinking has been used successfully to study users' technology experiences. Most important to this dissertation is the work of Orlikowski (W. Orlikowski, 1992, 1993; Wanda Orlikowski, 1993; W. Orlikowski & Robey, 1991; Yates & Orlikowski, 1992). This dissertation uses "dialectic" similarly to how it was used by Orlikowski, to describe people impacting their environment by understanding technology differently. While Orlikowski originally uses "dialectic" exclusively within her Technological Frame of Reference (TFR), this dissertation extends that use by melding it with Dervin's sense-making (Dervin, 1992, 1998, 2000). Even though this dissertation extends the reach of dialectic thinking with sense-making, my specific use is still rooted in Orlikowski's original use – the successive impact seen when people differentially experience technology. Both TFR and sense-making will be detailed in the literature review.

Through this prior work on technological frames of reference, this dissertation also uses the thinking of the sociologist Giddens, and builds on Orlikowski's use of Giddens' structurational thinking in information systems research. Unlike pure technological frames research, the high autonomy dialectic does not assume a distinct technology or technologies, does not assume a stable systems environment, or proceed from a role-based definitional outlook. As a result, the high autonomy dialectic made up of work from Orlikowski, Giddens and Dervin accommodates the instability and user choice inherent in many high-autonomy user environments such as Local Hope. The new perspective comes from combining the proven power of iterative human centered design with Orlikowski's use of structuration and dialectic thinking and the decision-focused analytical power of sense-making to identify and understand the impact of user choices - which evolve and adapt quickly in high-autonomy user environments.

In combining TFR and sense-making, this dissertation extends the use of the dialectic concept into the framework called the high autonomy dialectic (HAD). The HAD is an intellectual framework for understanding how systems in high autonomy user environments are dialectic constructions of user choices. High-autonomy users shape their systems in that the choices they make may or may not align,

and the resulting misalignments greatly influence continued user choices. The HAD allows us, through the combined power of prior theory, to discern and analyze different user choices and begin to see the dialectic impacts of those choices.

The difference between this dissertation and previous work is that the differential experience in this dissertation is not what users think of a technology, but which technology users actually choose to use. Users at Local Hope make successive technology choices based on the new system environment which they helped to create through their own choices. The high autonomy dialectic (HAD) enables us to analyze users and to pursue insight from these user experiences based not on categorical or definitional assumptions, but on specific, empirical user choices framed in prior theory. As a result, the HAD offered in this dissertation is a new perspective, built on previous work, which can help both tell the story of these kinds of users and generate insight from that story.

At this point, it is important to avoid confusion in the difference between a systemic misalignment and a dialectic impact. A systemic misalignment is a difference in user choices. A dialectic impact is a new option introduced into the system by a new user choice. As seen in the above Skype/Mayetic systemic misalignment, users choosing different technologies, particularly for shared tasks, may create a systemic misalignment. If users then choose a new, different technology altogether in reaction to the previous choice, that new choice is a dialectic impact. It impacts the system. It is a new choice in a system constructed of user choices, and other users may or may not make the same choice. This provides the potential for yet another systemic misalignment depending on whether other users choose similarly. In this way you can see the dialectic nature of the impacts made possible by users choosing in a high autonomy environment like Local Hope. Choices beget the possibility of still more choices. New choices happen on top of old choices.

It is important to note that the HAD is not an all-inclusive perspective encompassing the total of high-autonomy user experience. Not all user choices will create systemic misalignments nor are all choices necessarily dialectic impacts. It is entirely possible, for example, that a user will choose a new technology based on the fact her friend recommended she try it. In this recommendation example the user choice was not made in reaction to existing choices in the environment. The user was motivated

differently. While the recommendation choice may impact the environment, it is not dialectic. It is not demonstrably chosen in reaction to existing choices. It falls outside the scope of study for this dissertation and the HAD. The Local Hope case analysis that follows focuses on those choices that are dialectic in that users report choosing in reaction to existing options, thus both being changed by and changing their environment.

In this way, users are both subject to and generate high-autonomy user environments. The high-autonomy dialectic (HAD) focuses on demonstrated empirical user choices, not on job or role-based user perceptions on a single technology. It also accommodates the diverse technological truth of high-autonomy user environments; many users choosing many technologies, all reacting to and impacting their system. By drawing on the power of combined prior theory, these individual choices power the HAD and the HAD offers a perspective through which to see and find value in high-autonomy user environments as those environments evolve.

To find that value, the HAD encompasses a wide variety of potential user choices among multiple technologies and provides a way to compare those choices. These comparisons in turn could build an understanding of how differences in those choices impact users and their environment. By incorporating the power of the sense-making moment from Dervin, the HAD does not presuppose a need to focus on any one user group or tool, but enables the consideration and illustration of users' choices, impact on their own environments, and subsequent users' choices. Through the Local Hope case, I use the HAD to focus on high-autonomy user experiences and account for the empirical realities of user technology choices and their impacts.

In the next section, I work from the foundation of these key concepts (user autonomy, role versus task, systemic misalignment, and high autonomy dialectic) to introduce each of the elements that combine to reveal this dissertation's story: my experience, existing theory, and data from Local Hope.

Chapter 2: Literature Review

In this chapter, I will examine the intellectual traditions upon which this dissertation is built and from which it grows. Due to the fact that user technology choices in high-autonomy user environments and humanitarian relief are both areas with little existing research literature (S. Lappenbusch, 2006; Steve Lappenbusch & Kemp, 2006), this dissertation draws from information systems, technical communication, human centered design and the humanitarian sector itself. I will begin by examining how my research fits into the publications and applied work of the humanitarian sector. Next, I will situate my research within both the intellectual traditions and emerging systems focus of technical communication and human centered design. Then, I will describe how previous work in information systems research influenced the thinking and design of this dissertation. Finally, I will discuss in detail two important intellectual building blocks for this dissertation: technological frames of reference (TFR) and sense-making.

Users can make many kinds of choices. However, a comprehensive study seeking to identify and analyze all possible types of user choices is beyond the scope and resources of this (or any other) dissertation. An achievable dissertation required a focused goal of studying a particular kind of user choice. Thus, this study did not seek to study, for example, various choices users could make in an interface (Galliers, Sutcliffe, & Minocha, 1999), choices between design options for the same communication technology (Fields, Paterno, Santoro, & Tahmassebi, 1999), choices made in reaction to end user errors (Sutcliffe & Rugg, 1998), choices between different workflows (Kock Jr & McQueen, 1996; Kock, 2001, 2003), how users choose to define a technology (W. Orlikowski, 1992, 1993; Wanda Orlikowski, 1993; W. Orlikowski & Robey, 1991; Yates & Orlikowski, 1992), or the differences in user choices seen as holistic decisions (Klein, 1993; Klein, Calderwood, & MacGregor, 1989; Klein, Kaempf, Wolf, Thorsden, & Miller, 1997).

Instead, this study focused on creating a deeper understanding of which technologies users choose and the dialectic impact of those choices. More specifically, I focus on users' technology choices in high-autonomy environments, illustrating this focus with the case of one humanitarian NGO. Since I use a humanitarian NGO as the subject organization, I will begin my review of the literature with the humanitarian sector.

Chapter 2:

2.1 The Humanitarian Sector

Humanitarian systems are motivated by many emergent and unpredictable issues: the end of the Cold War, increasing numbers of regional conflicts, failed states such as Somalia, crises in stable states such as Katrina, emergent health crises, increased economic globalization, increased internal displacement due to civil wars and drastically increased computing power in the hands of individual users (IAWG, 2005; Lindenberg & Bryant, 2001; Maiers et al., 2005).

Amidst all these changes, humanitarian NGOs have sought improvements to their systems. Knowing their deployments have not always lived up to expectations, NGOs are diligently working to improve their responses to humanitarian emergencies, and for the most part they are succeeding. Like many other needs of these organizations, their systems needs have changed significantly. However, their information and communication systems, to a large extent, have not (Lindenberg & Bryant, 2001; Maiers, Reynolds, & Haselkorn, 2005). In attempting to update their systems, NGOs often have sought to increase technological sophistication, as opposed to designing for greater effectiveness. The report I co-wrote resulting from the previously described humanitarian systems workshop in Kenya suggests similar issues of IT-centric thinking.

In that report, one idea that stuck with me was the organizing principle of *planners versus searchers*, an idea popularized by Easterly (Easterly, 2006). Planners create broad agendas that seek to address policy issues. Searchers seek to identify practical needs and satisfy those needs as creatively as possible. Planners versus searchers as a concept still proceeds from the existing, age-old IT dichotomy of centralized versus localized IT systems. In this view, all organizations have tension over centralized versus localized IT, and while the of concept planner versus searcher allows for the easy grouping of people, it did not enable me to think more deeply about the nature of user technology choices.

To increase humanitarian NGO effectiveness and broaden knowledge of their own profession in the face of these challenges, a consortium of the seven largest humanitarian NGOs banded together to create a consortium called the Interagency Working Group (IWG). The seven IWG members are the International

Rescue Committee, Mercy Corps, CARE, World Vision, Catholic Relief Services, Save the Children US, and Oxfam GB. To prevent repeats of the kinds of difficulties illustrated by the Local Hope example, the IWG is undertaking a collaborative capacity building project across relief and development processes of common interest. In early 2004, the IWG performed an internal assessment of member NGOs' capacities. The assessment illustrated four major capacity gaps, one of which was the productive use of technology (Braun, 2004).

To prepare this assessment, referred to as the Currion report (after the lead investigator), consultants gathered data from key personnel at all seven IWG offices and performed fieldwork in both Pakistan (a sudden onset emergency - earthquake) and the Sudan (a slow onset emergency – starvation and displacement due to civil war). Significant findings in the report included repeated failures by IWG NGOs to manage systems strategically, barriers between technical and non-technical staff, a lack of designing systems for response (instead of assuming everyday systems can be "turned up" when an emergency occurs), and, particularly critical to this dissertation, a lack of understanding of the roots of the system's problems. The report addresses this lack of understanding of the roots of the problems when it states,

"The primary finding of this assessment is that there are no technology problems, only organizational problems that prevent technology [from] being used effectively and efficiently. By this, I mean that existing technology has the capabilities that we need to deal with the issues raised by Local Hope participants during the assessment. The factors limiting the application of that technology are all related to organizational structures, policies, and capacities." (Currion, 2006)

The most salient idea in the Currion report for this dissertation is the concept of *organizational distance*. Organizational distance is put forth by Currion as one of the reasons for technology failure. He defines it as how far apart various job roles are in their understanding of the purpose of the work and even of the organization itself. People in different roles see things differently, and Currion offers organizational distance as a concept to describe those differences and explain systems difficulties. One of the most important uses of this idea for this dissertation is that it provides a way to frame the tension between the field and headquarters perspectives. In the report, Currion demonstrates that there is a rough but discernible organizational distance between not just people in different roles or places, but between

people in a field role versus a headquarters role. This field/headquarters tension seen through the concept of organizational distance was further demonstrated by the discussion of numerous humanitarian users, including some from Local Hope, at the summit where this report was first published to the humanitarian community.

In the discussions prompted by the Currion report at the 2007 summit, humanitarian practitioners, researchers and policy makers sought to first define organizational distance for their own use. Suggestions ranged from simple geography or job context (office versus refugee camp), to then encompass different job roles (such as donor relations or communications) and even differences in culture (North American versus East African). Another important distinction echoed by participants from the Currion report is that organizational distance could also be understood across roles and even across NGOs as the tension between all those in the field and all those at headquarters. By the end of the summit, most participants agreed that organizational distance could be a combination of all these issues.

Organizational distance is a useful concept which helped to produce ideas at the summit. However, I left the summit thinking that we had discussed organizational distance as a demographic concept describing the differences in people and places where technology use occurred, rather than attempting to describe the actual differences in technology use as explained to me by field users the year before in Kenya or by some of the summit participants.

This focus on organizational, not technological, issues describes the gap in common systems understanding between those in the field and those at headquarters by saying there was too much, “organizational distance between headquarters, country offices, and field offices.” (Currion, 2006) While providing a way to describe user groups, Currion did not use organizational distance to understand user choice. However, organizational distance can be used to more deeply understand the issues of user groups and their technology choices. To do so, I use organizational distance later in my analysis to see the context of high autonomy users’ choices.

In addition to organizational distance, the Currion report identifies failures the humanitarian sector does not want to repeat. Three major humanitarian NGO initiatives seek to prevent the kinds of failures

illustrated by the Currion report. Those three additional initiatives are: NetHope, the Emergency Capacity Building initiative (ECB) – especially the fourth ECB thread focused on technological systems (ECB4), and the East-African Interagency Working Group (IAWG).

Originally an informal gathering of the senior technology officers in larger NGOs, NetHope has become an official, formal organization run by its member agencies (NetHope, 2005). Its mission is to encourage communication of best practices in systems design and deployment for disaster response and recovery, humanitarian aid, and conservation work. NetHope continues its forum for knowledge sharing but also undertakes projects such as testing and managing technologies for relief organizations.

The 2004 IWG assessment illustrated many positive outcomes (rapid fundraising, adoption of international standards), but there were four major capacity gaps found (Braun, 2004). Those gaps are currently being addressed in the next major effort by the IWG, the Emergency Capacity Building (ECB) initiative. Emergency Capacity Building initiative Four (ECB4) aims to improve humanitarian systems. Through ECB4, the IWG's focuses on how technology can be successfully deployed.

The third humanitarian initiative helping to place this dissertation in the context of humanitarian efforts is the East-African Interagency Working Group (IAWG). The IAWG was a regional cooperative similar to the IWG. The IAWG formed in order to continue discussion and cooperation following a United Nations sponsored regional meeting in East Africa in June, 2002 (IAWG, 2005). It focused on the unusual or unique issues faced by relief operators in the East African region, a region of traditionally high relief demand and difficulty. It was composed of four sub-groups: training, logistics, emergency management, and information technology. The focus of the IT sub-group was to coordinate and test potential solutions to problems identified with and by "on-the-ground" humanitarian systems users. The NSF-sponsored workshop in Kenya in June, 2006 detailed earlier focused on this goal.

The various foci of the above initiatives on human, not simply technological, difficulties relates to that, "organizational distance between headquarters, country offices, and field offices." (Currion, 2006) Any or all of the sector-wide initiatives described above possess the potential to better understand user technology choices in humanitarian systems. Accomplishing that understanding, however, requires

understanding the power of user choice. Understanding user technology choices requires not just awareness of organizational tension, but of the impact of actual differences in user technology choices in and on high-autonomy user environments.

Taking users' technology choices into account necessitates more than simply acknowledging the existence of user choice, as the Currion report implicitly did. It requires a deeper understanding of how and when those choices are made. Gaining insight from users' technology choices requires a way to document, examine and more deeply understand those choices and their dialectic impacts.

To build to a foundation for creating that insight, the next sections of this literature review details literature from technical communication, human centered design, and information systems. Each of these disciplines provided crucial intellectual building blocks which informed this dissertation's contribution to the scholarly conversation.

2.2 Human Centered Design

Though growing from efforts in multiple disciplines, this dissertation is human centered design research. My own intellectual traditions incorporate both human centered design and more traditional, rhetorical technical communication. In this section I explain the respective contributions of both the HCD and rhetorical traditions to the conceptualization of this research.

2.2.1 Technical Communication

Technical communication (TC) has grown rapidly out of its textual roots to include increasingly dynamic technologies (Killingsworth, 1999; Staples, 1999). There has also been recent interest in how to design communication tools and systems for technical information within fields similar to my research context such as disaster response and mitigation (Jederberg, 2005). A larger body of more recent empirical TC research seeks to understand how narrowing the distance between what is designed and what is desired is impacted by the participants' ability to effectively communicate (Mirel & Johnson, 2006) and share knowledge (Winsor, 2001 Dayton, 2006; Kock, 2001, 2003).

Yet, while that empirical work represents growing foci in technical communication research, it only continues a pre-existing expansion of more traditionally rhetorical TC scholarship. This expansion increasingly focused less on a single reader and a single text and instead on communities of readers and texts (Coney, 1988; Fish, 1989; Miller, 1979), and further on towards systemic views in published TC work (Haselkorn, 2003; Heracleous & Barrett, 2001; Hughes, 2002; Kock, 2003; Steve Lappenbusch & Turns, 2005; Winsor, 2001; Zachry, 2001).

This expansion stems from an important intellectual lineage that can be traced from current foci on systemic communication issues and collaboration technologies back to traditional, rhetorically based technical communication scholarship focused on readers, authors, and texts. The intellectual legacy of earlier, more traditionally rhetorical TC work can be found in this dissertation. In the following passages, I trace this lineage in more detail.

First, there is the thinking of Carolyn Miller (Miller, 1979). Miller specifically wrote to describe the work of science and scientific, fact-based work such as engineering. For Miller, "science is, above all, a communal enterprise," founded on people securing, "the widest agreement with other people." (ibid. page 124) The intent of the community is to expand understanding through consensus agreement. Reaching a consensus across a community is inherently a persuasive, or rhetorical, activity. As a result Miller states that, "Science is, through and through, a rhetorical endeavor." Thus, not only does Miller expertly assert that communication is, even amongst logical and scientific people in a fact-driven environment, necessarily rhetorical, she also provides a basis from which to understand a group of professional and technical personnel as a communication group or community. As a result, this dissertation, focusing as it does on different groups of humanitarian professionals communicating in a fact-driven environment, owes a debt to Miller's influential framing of the rhetorical nature of communication between people in fact-driven work.

The second traditional, rhetorical TC concept to which this dissertation owes an intellectual debt is that of the implied author (Coney, 1988). Coney describes the rhetorical concept of the implied author as the abstract concept which separates the real author from the text, and the real reader from the real author. This is relevant to contemporary technological systems because for users in such a system to work

coherently, they must participate in the creation of an implied author within the discourse of the system so that they can sensibly share their work with each other. In large systems, Coney states users, "must speak as one if they are to speak at all, and the achieved resolution is expressed by and is the expression of, an implied author."(ibid. pg. 163) This "speaking as one" presages this dissertation investigating aligned or misaligned users technological choices in shared systems.

Yet, Coney's implied author itself implies a systemic discourse community required for the implied author to function. Other rhetorical scholars have explored this systemic discourse community. Stanley Fish explains it effectively (Fish, 1989) as interpretive communities. Fish, knowingly or not, uses what two technical communication scholars, Freed and Broadhead (Freed & Broadhead, 1987), describe as "sacred texts" and amplifies the concept by instilling it with an agency for gathering new adherents to that sacred text – membership in an interpretive discourse community.

For Fish, "interpretive communities are no more than sets of institutional practices [sacred texts]; and while those practices are continually being transformed by the very work that they do, the transformed practice identifies itself and tells its story in relation to general purposes and goals that have survived and form the basis of a continuity." (ibid. pg. 153) The way those practices tell their stories in an intelligible way throughout larger systemic discourse communities are through Coney's implied author function. Taken together, these traditional TC concepts provide both a visible progression towards a more systemic and less directly textual research and an intellectual basis in traditional TC for this dissertation. Many others have pursued work in this more systemic, less textual, and more empirical direction through the field of human centered design.

2.2.2 Human Centered Design

Human centered design (HCD) has a history and a pedigree of investigating technology users and of creating tools and concepts to serve and research them. Fundamentally, HCD seeks to understand and narrow the gap between what is designed and what is desired when people use technologies. Increasingly, our discipline is embracing or inventing new fields of inquiry, and this dissertation continues the incremental theoretical expansion of our scholarly conversation.

While the boundaries of human centered design are dynamic, the published work of many scholars and practitioners suggests or directly claims that its intellectual lineage can be traced back at least in part to (Gould & Lewis, 1985). In their important article, they detailed research based on a large survey of systems designers and programmers. Gould and Lewis outline three basic principles of human centered design: 1) early and continued focus on users, 2) empirical measurement, and 3) iterative design.

Gould and Lewis assert that while these three principles seem obvious, they are rarely implemented properly. Gould and Lewis foreshadow Davenport's, Kock's and Paul's work later in this literature review by writing, "In answer to our question about key steps in the development *process*, some people wrote *goals* [emphasis in original] for a system… What is needed is a process to ensure meeting these goals." (ibid., pg. 302) Much research has been done in human centered design that helps in understanding this process perspective as it may pertain particularly to this dissertation, specifically in regards to user autonomy. In human centered design research which informed this dissertation, I have categorized them as scenario-based and contextual deign, error investigations, user flexibility in high-stress environments, and decision-making.

Scenario-based & Contextual Inquiry

An often-cited and well-known piece of research on scenario-based design is (Go & Carroll, 2004). Go and Carroll seek to, "build a common language in software design," by using scenarios at different levels of user experience (moment to moment, day in the life, year in the life). Similarly, (Gruen, Rauch, Redpath, & Ruettinger, 2002) seek to show user experience through what they call "stories." These, "stories capture the characteristics of the design space and audience that designers and engineers need to understand." (ibid, pg. 503) Notice the use of the more passive term "audience" as opposed to the more active term "user." Even so, Gruen et al encourage the storyboarding and full illustration of user experience, and these stories are thus essentially well-illustrated scenarios. As a result, though Gruen et al provide a potentially effective procedure to follow for scenario-based design, their research suffers from a general assumption of a fixed-state system. Unfortunately, various researchers profiled in detail in the next section have called into serious question the veracity or utility of thinking in terms of a fixed-state, particularly for users in high autonomy environments.

Perhaps the most widely known of all user-center design methods that takes a story or scenario as its central principle, and one that merits individual mention, is contextual design (Beyer & Holtzblatt, 1998; K. Holtzblatt & Beyer, 1999; K. a. B. Holtzblatt, K., 1996). Like the previous methods of scenarios and stories, Beyer and Holtzblatt encourage the early focus on users, empirical data, and iterative design distinctive of human centered design. Importantly for this dissertation, Holtzblatt et al show that focusing on users' technology use at the task level produces considerable insight into the user experience.

However, for all the actionable detail and insight contextual design provides, and despite the distinct improvement it could and in many cases has made in systems design, it did not work for this dissertation. First, it requires direct contact with users in their environment to record data, which due to the dispersed and difficult global reality of Local Hope was just not possible for this study. Second, while they assert the need to re-analyze users as systems change in order to update our understanding, the stated purpose of contextual inquiry is not to discern the systemic compounding impacts of users' choices but to more fully describe and understand the users' experiences as they are impacted. Thus, while proven and powerful, contextual inquiry did not fit this dissertation's need to both begin to understand what motivates misaligned user technology choices and to describe the dialectic impacts those choices can make. Similarly, I examined a body of work focused on users in high-stress environments.

Flexibility & High-stress Environments

Woods examines work in high-stress environments, especially work that is in high-stress environments where quick decisions are needed and thus necessarily requires creative latitude for individual workers (Nemeth, Cook, & Woods, 2004; Watts, Woods, & Patterson, 1996; David D. Woods, 1993; D.D. Woods & Shattuck, 2000). Most importantly, it has proven useful in understanding and designing for high stress use contexts like cockpits. The lack of fit for this dissertation and the work of Woods is that the technologies in these use contexts are generally static.

Thus, while Woods' body of work provides useful insights for designers, it has limitations for applicability to user technology choice in high-autonomy user environments. The pilot and co-pilot, for example, do not introduce new technologies in mid-flight for communicating to the navigator or the control tower which in turn cause difficulties in their communication during approach and landing. Instead, Woods'

work focuses on how users adapt and make cognitive adjustments to their interpretation of those technologies they cannot change.

Errors and Taxonomies

As Woods focused on making cognitive adjustments to static technologies, others focused on the inevitable errors users would make in doing so. For many years human centered design researchers have examined systems through the lens of user errors and generating conceptual taxonomies in which those errors are committed (Norman, 1989; Palanque, Koornneef, Johnson, Szwillus, & Wright, 2004 Hollnagel, 1993 Galliers et al., 1999). Unfortunately, the central assumption of all these studies, as illustrated by their use of the term "error," is that there is an ideal or reliable end-state or "to-be" system that can be achieved or should at least be strived towards. To be error-free, or to create a taxonomy that enables error-free work, presupposes a stable ideal state users should operate in or work towards that can be eventually matched by an ideal design. The perfect user environment in which users perform no system-corrupting errors. This conceptual center just does not hold in high-autonomy user environments where users can constantly choose new technologies. This characterization of user choices as decisions led to an examination of Klein's decision-making work as a potential framework.

Decision-making

Klein and his colleagues (Klein, 1993; Klein, Calderwood, & MacGregor, 1989; Klein, Kaempf, Wolf, Thorsden, & Miller, 1997) research users in terms of decision-making (what they term naturalistic decision-making). Further, they suggest representing decision-making as situational awareness, which can then inform the design or redesign of systems. Situational awareness could be described as a person's holistic understanding of a situation and the judgments for action flowing from that understanding. For Klein et al, naturalistic decision-making is not simply choices amongst options but judgment of the holistic environment and situational awareness.

Klein et al describe an orientation to user data and debut a modeling representation for that data called the Critical Decision Method (CDM), derived from Flanagan's Critical Incident Technique (Flanagan, 1954). Unlike Flanagan, however, Klein et al do not seek to identify factors for later classical experimentation in order to optimize the assignment of job roles and work, but instead to model

decisions of high-pressure users and incorporate those models into efforts aimed at deriving training requirements, evaluating systems and developing case-based or expert knowledge systems. In addition, Klein et al aim to refute claims that decision-making in high-pressure time critical contexts is an exercise in considering optimal choices. Instead, they assert that experts do not consider single options serially or several options concurrently, but instead create, "decisions for which action alternatives are directly derived from recognition of critical information and prior knowledge." (Ibid., page 463)

Advocates of Klein's decision-centric perspective state that not paying attention to the decision needs of users perpetuates at least one of two classic errors in HCI design: technology-centrism and data-centrism. Technology-centrism is indicated by users and designers falling back on the newest or most sophisticated technology to solve problems. Data-centrism is thinking that cramming more or the most current data into a system or interface will solve design problems. Both approaches subvert a human centered paradigm by putting the capacities of a technology or the availability of data, and not people, at the center of design. While Klein et al forthrightly admit that there is significantly more to human centered design than decision requirements, they do assert that using decision needs in design can significantly increase the success of system design.

While I agree with Klein's assertion about the utility of CDM, Klein et al's focus on human centered design from a decision-making perspective does not focus on the dialectic impacts of user technology choices but on how users decide. It also contains a critical weakness specific to this dissertation. Human centered design from the perspective of CDM abstracts users' concrete, real-world technology use so far out of focus that it cannot be seen in the final CDM analysis. Naturalistic decision-making, while a very powerful lens, does not sufficiently focus on technology use and choice to be the theoretical framework for this dissertation. Users in this dissertation chose and used specific tools and those choices aligned or misaligned to motivate yet different user technology choices. This dialectic represents more than the sum of their naturalistic decisions, and users and their technology choices will continue to evolve beyond the boundaries of any one user's situational awareness.

While these prior works did not fit this dissertation's focus fully, many of these researchers did show that HCD is increasingly recognizing the power and importance of user autonomy. Many users want

autonomy. When they get it, they will exercise it. The presence of such large and influential bodies of work shows that is worth studying. This increasing focus on the system, and not only on users, shows where the literature review began to move into the information systems space.

Intellectual Overlap Between Human Centered Design and Information Systems

One of the most relevant thinkers working between the conceptual boundaries of information systems, human centered design and traditional technical communication is Ned Kock. Kock, who comes from an information systems background, masterfully traces the origins of process thinking and research from Frederick Taylor forward to present day, and moves forward through technical communication into human centered design. A quick summary of the history Kock offers will help to put his work in proper context.

Kock starts with Frederick Taylor's time and motion studies revolutionizing manufacturing. As indicated by Kock, Frederick Taylor and his principles of scientific management (Taylor, 1911) still seem to describe much current knowledge work infrastructure as understood by many in the information systems community. He moves forward to William Deming and Joseph Juran and their total quality management (TQM), which still focused on refining worker tasks in support of maximally efficient manufacturing (Ahire, Landoros, & Golhar, 1995; Taviera, James, Karsh, & Sanfort, 2003). From total quality management Kock comes closer to the present with business process re-engineering (BPR). BPR asserted that TQM did not deal well with the accelerated rate of change. However, Kock points out that at the operational level, where work gets done, BPR still dealt in workflows, which are Tayloresque in their sequential nature and operate from a firm assumption of a defined division of labor. This segmented, siloed infrastructure for work may persist even in systems for high-autonomy, emergent work such as humanitarian relief – work which is fundamentally different from manufacturing in that it requires ideas to be shared and grown amongst workers and consists of unpredictable, emergent tasks or use contexts, not a concrete sequence of discrete tasks completed in an optimal time in a stable, controllable environment.

As a result, Kock breaks from the mechanistic legacy of some information systems thinking and breaks into human centered design by articulating a lack of fit between current knowledge-intensive work, such

as humanitarian relief, and the latent tradition of efforts to redesign systems based on workflows (Kock Jr & McQueen, 1996; Kock, 2001, 2003). Kock diligently investigates this phenomenon of legacy mechanistic thinking in knowledge work systems creation.

In his investigations (Kock, 2001, 2003), Kock and his collaborators use an empirical study of process redesign to illustrate the differences and comparative advantages of standard workflows and what he terms "communication flows" which are meant to represent not the sequential hand-off of work but the movement of ideas around an organization. He seeks to better understand the flow of ideas between workers as opposed to the flow of work from one worker to another. He argues that even though workflows are essentially a mechanistic systems view traceable to Frederick Taylor, workflows have some use and even high utility in processes where material items are created or modified. Further, he states that in knowledge work a workflow is not bad or good, but simply inappropriate due to its assumption of necessarily chronological and sequential value creation by workers doing discrete tasks in regulated contexts.

In asserting the modeling and use of communication flows as the primary guiding model, Kock makes the claim that what is most important in knowledge work is not work, but knowledge. Specifically, at an operational level pertinent to this dissertation, how that knowledge is shared. He found that communication flows are not just the majority of the flows present in a process, but are the most critical to achieving the goals and successfully redesigning the system process (Kock Jr & McQueen, 1996). Thus, Kock illustrates how workflows are little more than Frederick Taylor's ideas repackaged, and as a result do not fit with the reality of knowledge work. Instead, it is the movement of ideas and their growth that matters most in knowledge work and the ability of workers to do so with some degree of freedom. This focus on communicating ideas and the freedom to do so illustrates one of the previously mentioned assumptions of this dissertation, that users need to share ideas and may exercise freedom to do so in ways that misalign.

Unfortunately, Kock's work does not enable a richer understanding of user technology choices in high-autonomy user environments. He does not focus on the dialectic impacts of user technology choice. Thus even while pointing out limitations of workflows in determining how ideas are moved around an

organization, Kock does not seek to provide an actionable alternative for researching user choices and the impacts of those choices. Additionally, like Klein's CDM, Kock's focus on the movement of ideas from one person to another ignores whether users' technology choices enable or impede that communication. These limitations, and the focus not on users' actual technological choices, is explored further in the next section.

2.3 Information Systems

The previous sections profiled TC and HCD research and those studies' conceptual contributions to this dissertation. I also examined how despite the utility of each body of work, none of them fully supported an investigation of user technology choices in high-autonomy user environments. In each example, I pointed out that most did not quite fit because of an assumed need or desire to design or investigate the ideal system state, the "to-be" system, or the focus on a single technology, or focusing on decisions as opposed to users' specific technology choices.

However, in high-autonomy user environments misaligned user's technology choices may make a stable system-state impossible. Seeking the ideal system state, or presupposing one as a foundation for research, did not fully support my investigation of user choice at Local Hope. We will see how Davenport calls the changing collections of users and technologies seen at Local Hope "information ecologies" (Davenport, 1997) and Paul calls them "living systems." (Paul, 1993) In either case, they seek to understand systems as combinations of users and technologies, and find ways to understand those systems as they necessarily adapt and change, something particularly true in high-autonomy user environments like Local Hope. In the next section, I examine important examples of this qualitative work in information systems.

2.3.1 Qualitative Work in Information Systems

Understanding people's choices in systems requires careful consideration of a key but often overlooked word in that phrase, "system." Understanding the difference between open and closed systems can help show why narrative and qualitative thinking can help develop new knowledge of users. (Bertalanffy, 1968) Open systems are systems which interact with their surroundings. As open systems interact with their

surroundings, entropy increases. In fact, it could be said that open systems import entropy through their interactions with other systems, which are essentially what the surroundings of an open system are – other open systems. Closed systems, on the other hand, are specifically engineered to squeeze entropy out of the system in order to maximize predictability.

This broad distinction could be seen as two different perspectives on how systems may operate – open systems corresponding to a view of systems as interactive and closed systems corresponding to a view of systems as aggregations of distinct, knowable parts. Seeing open systems may require a new or different way of looking at the system as a whole.

Bertalanffy presciently explores at length this need to see systems anew, their inherent complexity in modern life, and their impact on our thinking. (Bertalanffy, 1968) He writes that modern systems complexity as it has been conceptualized, "requires a basic reorientation in scientific thought." (ibid. pages 4-5) He explicitly states this reorientation is not a matter of thinking of new and bigger technologies. Further, he states that developing new technologies might be less important than creating other categories of thought which could help us deal intellectually with the complexities of the interdependent systems which result from all of our technologies. According to Bertalanffy, a system should be thought of in terms of these new categories of thought, from a new conceptual orientation, different from mechanistic thinking. He asserts that only through new categories of thought can we intellectually explore and empirically understand systemic complexity such as user technology choices in high-autonomy user environments. This new way of looking need not be revolutionary, but could be incremental and based on prior work. In fact, the work examined in this section shows the scholarly conversation doing that reorientation. No person can do it alone, but as part of an ongoing intellectual community this dissertation provides an incremental extension based on prior successes.

In the case of Local Hope, when seeing systems conceptually as Bertalanffy suggests, understanding a system with high user autonomy requires creating new knowledge of the generative power of user technology choices. As discussed previously, high-autonomy user environments such as humanitarian relief generate highly emergent and dynamic systems that reflect the choices of users. New obstacles and the user choices made to face them literally appear hour by hour, or even one moment to the next.

These high-autonomy user environments might even be described as organic in the breadth and depth of their emergent, continually changing nature. Building on that past work allows us these systems to be understood as dialectic constructions of user technology choices.

An example of information systems work that is conceptually related to this dissertation, but ultimately did not fit it, is the growing body of work on Dynamic Adaptive Systems (DAS). In DAS, the focus is on how to design systems, largely software, which can adapt to user preferences, the environment, or ideally both. In other words, the focus is on making the tool more adaptable, rather than on the adaptiveness of the people using it. As a result, much of the prior literature on DAS comes from the requirements engineering field. (Berry, Cheng & Zhiang, 2005; Qureshi et al, 2010) Interesting work like that of Berry illustrates this focus on the adaptivity of the tool but not the choice and dialectic impact of the human user choosing it. In DAS, he says, the goal is to create a tool that can, "adapt to unanticipated domain changes on the fly without human intervention." (ibid., 6). While such a tool would be highly useful, it does not fit the focus of this dissertation as the Local Hope case. This dissertation focuses on the dialectic impact of users adapting by choosing different technologies, not on the technology's ability to adapt. Even if the technology adapted to the user choice, the user choice could still motivate a dialectic impact on the high-autonomy user environment. Indeed, it is possible to imagine how an adaptive tool would even further motivate systemic misalignments and dialectic impacts as individual user's tools could adapt to individual users to such a degree that the even users choosing the same technology for the same task become misaligned as their respective tools adapt further and further from each other. However, I did find an expanding body of information systems research seeking to understand systems with a focus beneficial to this dissertation, such as that by Davenport (Davenport, 1997).

Tom Davenport is a prominent information systems thinker. Amplifying Bertalanffy's earlier thoughts, Davenport refers to more mechanistic views as "machine engineering." (Davenport, 1997) Davenport presents a compelling argument about how destructive to effective knowledge work a past and largely present focus on machine engineering and the stable system state has been. He uses database management systems to illustrate his point.

A database management system could be thought of as the ultimate in a “machine engineering” system. These systems rely on, indeed are constructed with, discrete, steady, predictable data. Though potentially holding terabytes of data accessible in real-time, these systems militate against emergent, creative value generated by interpersonal collaboration. Any inputted ideas must be fractured into isolable components, and any “ideas” accessed from it must be a logically reconstructed series of these discrete components. While not useless, Davenport asserts these machine engineering systems require a perspective on systems which suggests sequential, componentized work, a stable, desired end-state to design towards. Yet as Kock, Bertalanffy and now Davenport (Davenport, 1997) have shown, seeking a stable end-state is not the appropriate perspective for systems with high user autonomy.

Davenport regards these machine engineering views as examples of failures in current information systems thinking. Echoing Bertalanffy’s view of qualitative information, Davenport calls on practitioners to embrace and act from the understanding that, “the same attributes that make computer-based information easy to load into the computer, and easy to manage once there, make it less valuable to humans.” (ibid. page 2) What people want and use best in understanding the needs and goals of their work is not steady-state, discrete, quantifiable, and atomic pieces of decontextualized data, but stories with meaning and purpose. Davenport asserts this difference is the distinction between, “simple ‘state data’ and information that adds value to human users.” (Ibid., page 27). The story adds the value, and stories require communication and collaboration through an open system, subject to change. In other words, Davenport agrees with Bertalanffy and Kock, only he looks at it from a different point of view and presages the utility of focusing on users’ making choices.

To provide systems of value to people and organizations, systems which will help to construct meaningful knowledge instead of only reconstructing mindless query responses, Davenport provides a high-level four part framework for creating what he terms information ecologies.

First, Davenport asserts that all of the disparate communication channels and information sources be integrated, and that integration be done through person to person interaction, not some enormous database-driven application which by its very machine nature will require the human elements (what Davenport considers the most important part of a system – the story) to be broken into quantifiable data

pieces and destroyed, or simply ignored. This emphasis on person-to-person interaction, on imbuing user experience with meaning through a story, foreshadows the new conceptual lens used to gain insight into user technology choices in this dissertation.

Second, an information ecology outlook requires admitting that the environment containing the system and its users will change, a tenet particularly relevant to high-autonomy user environments and user technology choices. Similarly, Davenport urges recognition that information ecologies must be designed for growth and change, while striking the right balance between lasting structures and flexible adjustment. This balance generally aligns with the social dialectic brought into information systems by Orlikowski (Yates, & Orlikowski, 2002). This also echoes what Ray Paul has termed the Fixed Point Theorem (Paul, 1993). Both of those ideas seek to understand systemic and organizational aspects of technologies and not user choice, but contribute directly to the need for a new category of thought to understand high autonomy user environments where users can choose.

Third, Davenport states information ecology systems and their designers and advocates must push for description and observation, not only prescription. This supports my choice of a qualitative methods approach and follows logically from the second attribute that the environments of systems will change. This agrees with the systems perspective held by those seeking actionable methodologies to research and build a successful knowledge work infrastructure (G. H. Galal, 2001a; G. H. Galal & Paul, 1999).

Fourth, Davenport advocates paying attention to how people communicate within these systems, and not on only whether data is valid or well-formed or whether applications have features which could increase efficiency. This is extremely pertinent to this dissertation, which focuses on people with significant autonomy seeking ways to communicate and collaborate through technology choices.

This recognition of the importance of communication to overall systems success aligns with Clemons et al's research on process re-engineering risks and how the most pertinent of those risks for contemporary technology-rich organizations emanate from the interactions of people in the system (Clemons, Thatcher, & Row, 1995). If users feel threatened or undervalued by a new or redesigned system, they employ their political power to ensure its failure, often by making choices contrary to the new system. This

political power of knowledge workers is considerable when it comes to success in high-autonomy user environments.

To realize information ecologies and not alienate their people, organizations must undertake their systems as processes in creative human activity, Davenport asserts. This includes identifying what information processes there are in an organization and the various stages of the processes. Davenport sees, “emphasizing both measurability and improvement, which matches the ecological emphasis on description and observation.” (Davenport, 1997).

While Davenport’s four part focus on integration, description, user changes, and story were useful, for this research Davenport did not offer a way to examine and glean insight from the individual user choices he advocates are important. What Davenport did offer was the emphasis that systems must be redesigned with human creativity in mind, from the admission that people will cause things to change. His four part framework states that people create and re-create systems by using their human creativity and a way to understand this dynamic creativity should encompass the reality that people’s choices change their systems.

A useful amplification of Davenport’s evolving systems principle is Ray Paul’s Fixed Point Theorem (Paul, 1993). Paul implies, echoing Bertalanffy and Davenport that systems can be thought of as living entities which inevitably change. The idea that human systems can be conceived of and successfully represented as static entities with a reliable end-state to be designed to, like machines, is, to Paul, false and misleading – particularly in high-autonomy environments. In short, Paul asserts, the modern human system is changing too fast, as users themselves change it, to think exclusively in terms of strict, stable traditionally mechanistic criteria. Paul strongly agrees with Bertalanffy that we should focus on understanding user-generated changes in the system.

Paul also points out that prototyping, and iterative systems design work in general, can be done from a fixed-point perspective. Systems engineers should not design and redesign over and over again to "get it right" but to make sure they are keeping up with the changing realities, and the users operating in and creating those changing realities. Paul rejects that there is a static end state that can be reached and

satisfy all concerned. This mistaken perspective on modern systems leads to the dangerous notion that, "systems are built for one (hypothetical) point in time, whereas the system must work over some time continuum." (Ibid., page 251) It is a mistaken notion that there exists a fixed point in time when everyone involved in the system knows what they want and agrees with everyone else. It also abstracts the system outside the influence of the users that work in and recreate it with each new choice.

As described by Paul, people inevitably change and react to change in systems. People are part of their systems. Indeed, as previous researchers asserted in one form or another, people are the main engine of systemic evolution (Bertalanffy, 1968; Davenport, 1997; G. H. Galal, 2001a, 2001b; G.H. Galal & Paul, 1998; G. H. Galal & Paul, 1999; Kock, 2001, 2003; Paul, 1993). These information systems thinkers see importance not only in information or in systems, but in the indispensable and powerful role of users as perpetual systems designers. To empirically understand this setting of dynamic systems the previous thinkers started a scholarly conversation where modern systems could be investigated as an evolving information ecology of creative human work augmented by technologies which are chosen by people to facilitate their activity. Investigating and gleaning insight from user technology choices in systems such as these extends this conversation. The specific intellectual building blocks I use to create the high-autonomy dialectic (HAD) from this scholarly conversation are explored next.

2.3.2 Technological Frames of Reference: The First Component of the High-Autonomy Dialectic

Technological frames of reference (TFR) provide a powerful way to understand users' perspectives on a technology. Unfortunately, as a framework it focuses on the differences in how users define a single technology or at most a tightly integrated, centrally designed technological system (such as an Enterprise Resource Planning system –"ERP"). In addition, even though TFR has a rich and successful intellectual history accompanied by an impressive record in peer-reviewed research, that research history is of inquiries in stable, comparatively predictable user contexts where technology use across time was more stable and user choice more constrained (Davidson, 2002, 2006; Davidson & Pai, 2004; Lin & Cornford, 2000; Lin & Silva, 2005; McGovern & Hicks, 2004; McLoughlin, Badham, & Couchman, 2000; Ovaska, Rossi, & Smolander, 2005; Robey & Sahay, 1996; Yoshioka, Yates, & Orlikowski, 2002).

High autonomy user environments like Local Hope are often neither stable nor predictable. As a result, the framework necessary to better understand users in these environments could not make that presupposition.

TFR is based on work in organizational systems failure and change management by Wanda Orlikowski (W. Orlikowski, 1992, 1993; Wanda Orlikowski, 1993; W. Orlikowski & Robey, 1991; Yates & Orlikowski, 1992). The framework has been used extensively to investigate the organizational impacts of technology on users. The most often cited and analytically used work in the literature is a study by Orlikowski and Debra Gash which reported on their investigation of how Lotus Notes users' different technological frames of reference led to problems in design, implementation, and use in a large international consulting firm (Wanda Orlikowski & Gash, 1994).

To build the TFR framework used in that Lotus Notes investigation, Orlikowski and Daniel Robey (W. Orlikowski & Robey, 1991) had earlier sought a way to reconcile various empirical research traditions in order to more fully examine the organizational consequences of technology. They asserted that, "in the case of information technology, systems developers and users may exert considerable influence over the nature of information technology. Users often continually shape and reshape applications, so that technology ceases to be a fixed tangible constraint." (Ibid. page 41) Specifically, Orlikowski and Robey construct a theoretical framework designed to investigate and further an understanding of how technology is partially a dynamic social phenomenon based on both material and social dimensions. To do so, they borrow Giddens' structuration theory (Giddens, 1976, 1979, 1984). It is their successful use of Giddens' structuration theory that this dissertation draws from heavily.

Structuration Theory Introduces Dialectical Thinking

Structuration theory seeks to end the ongoing intellectual dispute between subjective social scientists (who maintain that human behavior constructs social reality) and objective social scientists (who maintain that social facts that exist apart from human behavior constitute social reality). To bridge this divide, structuration theory fuses the core principles of both subjective and objective social science. Structuration theory dialectically states that people actively shape their social world (subjectivist) just as their social world shapes them (objectivist). People generate structures as they live their lives, and in

turn their lives are guided, shaped, and constrained by those institutional structures. Humans' subsequent behavior can in turn modify those constraints, creating an ongoing dialectic. Orlikowski and Robey borrow structuration theory's dialectical thinking and apply it to information systems (Wanda Orlikowski, 1993; Yates & Orlikowski, 1992).

Orlikowski then began to deepen her thinking about how structuration theory could apply to systems in organizations (W. Orlikowski, 1992). Specifically, she uses her preliminary analysis of interview data of Lotus Notes users in a large consulting firm (also used in the subsequent 1994 article with Gash) to show that, "technology is physically constructed by actors working in a given social context, and technology is socially constructed by actors through the different meanings they attach to it and the various features they emphasize and use." (ibid. 406). This specific mention of users assigning meaning to the technology further contributes to the full formation of TFR, which relies heavily on users' different roles as sources of technological frames. That focus on the meaning users construct is also what differentiates TFR's use of structuration from this dissertation. TFR focuses on the construction of meaning. This dissertation focuses on the impact of actual technology choice and use, not the meaning assigned abstractly by those users.

Attempting to use technological frames to get underneath the behavior of users, Orlikowski investigated the impact of the implementation of computer-assisted software engineering (CASE) tools in two large firms (W. Orlikowski, 1993). The overall analytical framework was her dialectic structuration theory. Orlikowski found that different groups shared common reactions to the CASE tools. The common denominator she uncovered amongst members of a group that shared a reaction was their job role.

In Orlikowski's next publications, she (Wanda Orlikowski, 1993; Wanda Orlikowski & Gash, 1994) describes how technological frames can, "shape the way information technology is designed and used in organizations." (ibid, page 4). She states further that users, "try to understand a technology [note the singular] in terms of their existing technological frames, often augmenting these frames to accommodate special aspects of the technology. If the technology is sufficiently different, however, these existing frames may be inappropriate, and individuals will need to significantly modify their technological frames in order to understand or interact effectively with the new technology [as opposed to choosing a new

one].” (ibid, page 4). Again, note the singular and the focus on the introduction and definition of a single technology as opposed to focusing on how users choose multiple technologies and explicitly use them, rather than define them. Also, the last phrase in the above quote regarding the need to modify technological frames suggests Orlikowski’s own insight about the potential limitations of technological frames. This insight presages Orlikowski and Gash’s assertion that incongruency between different technological frames in an organization cause difficulties in systems design, deployment and use. With this final step from vague conceptual viewpoint to empirical lens on the social and material dimensions of systems, TFR was ready to be fully assembled and put to use as a theoretical framework.

This was done in their 1994 article (Wanda Orlikowski & Gash, 1994), and this article has precipitated a large body of work by others, including this dissertation in part. As shown below, however, TFR work has been done in comparatively stable, low autonomy work environments. Due to the radically different nature of higher autonomy environments, this work was useful, but limited. Table 1 provides an overview of this previous TFR research.

Table 1. Previous Technological Frames of Reference (TFR) Research

Author(s)	Research Focus
(Davidson, 2006)	TFR theoretical expansion. How can we enable inter-organizational or even interdisciplinary comparisons?
(Robey & Sahay, 1996)	Government. What are the differences in implementation and organizational consequences when introducing identical technologies in different organizations?
(McGovern & Hicks, 2004)	Manufacturing. How do technological frames of reference operate in small firms? Do they operate differently than in large firms?
(Ovaska et al., 2005)	Telecommunications. Technological frames of reference during creation of IT product (software) not just in implementation and use.
(McLoughlin et al., 2000)	Manufacturing. What motivates the political processes of IT implementation?
(Yoshioka et al., 2002)	Manufacturing. How do the assumptions and expectations of users shape systems use over time?
(Davidson, 2002)	Insurance. How TFR can aid in requirements definition and understanding how frames are created and maintained while doing so.
(Lin & Silva, 2005)	Banking. How can technological frames of reference of other groups be consciously influenced or modified by a different group?

Orlikowski admits that her work falls short in these kinds of high autonomy contexts because, "Empirical research is needed to determine the forces motivating the conception, development, *and use of technologies* with different degrees of interpretive flexibility and to assess their integration with social practices and organizational forms." [emphasis added] (Wanda Orlikowski, 1993). Understanding how these forces work is critical to high-autonomy user environments which necessarily involve the use of many technologies, by different users, even at the same time.

For example, one user group may experience an emergent need while the other does not, but those users still need to accomplish a common task. In other words, in high-autonomy user environments

different users may not only have different technological frames of reference on a technology, but different technological frames of reference for the many different technologies they choose to use, even for a common task. With my need to accommodate multiple use choices on multiple technologies and to understand how those different uses align or misalign in systems, TFR ceased to be enough to guide this study theoretically on its own.

While TFR did not fully fit this dissertation, important intellectual elements of technological frames of reference enabled my understanding of user technology choice. The most useful idea was Orlikowski's use of Giddens' structuration theory as a way to see how people both react to and help to define their environment as users. This concept was critical to my understanding of how user technology choices interact to dialectically impact their system. Orlikowski's conceptualization into information systems of Gidden's idea that people both shape and are shaped by social facts is directly tied to my understanding of choices on top of choices.

What I needed was a way to expand this theoretical power of TFR to fit contexts where people chose a wide variety of technologies and sought to make sense of their systems even as they experienced emergent contexts that required one user choice on top of another. Just as importantly, I needed some way to incorporate the full range of technologies users chose, instead of, as Orlikowski repeatedly asserted, "a technology."

2.3.3 Sense-Making: The Second Component of the High-Autonomy Dialectic

Sense-making provided the necessary additional theoretical component for investigating users' choices in high-autonomy user environments. Dervin (Dervin, 1992, 1998, 2000) is generally regarded as the founder of sense-making. Sense-making is a way to understand human systems as efforts to make sense of discontinuities or gaps in our understanding of our own experience (Dervin, 1992). As Dervin states, "discontinuity is an assumed constant of… human nature." (Ibid. pg. 62) Simply put, the core of sense-making is that there is always a gap between people and their experience. Making sense of their experience requires using "tactics" to define and bridge that gap. Thus sense-making assumes a discontinuity, or many discontinuities, between people and their experience. What we do to alleviate that discontinuity, to bridge that gap with tactics, is sense-making.

In essence, Dervin asserts that people create their own meaning. Or, as Dervin put it, "the order that humans live within cannot be seen as given. It is made." (Ibid, pg 63) Dervin's assertion theoretically aligns with Coney's implied author (people generating shared meaning in discourse) and Fish's discourse communities from rhetorical technical communication. Sense-making also aligns theoretically with structuration theory as used by Orlikowski since the structures people use to create their systems from technologies are both created by and reinforced by people. They are not a given. They are made, and thus can be remade with different choices.

Dervin also agrees with Orlikowski and Giddens by stating that when it comes to users' actions in a system, "which tactic is used has consequences for the kind of idea created; the kind of idea created has implications for which tactic is used." (Ibid. pg 65). That moment when an idea is created or a tactic is used is the sense-making moment and as Dervin describes above, it is dialectic.

If we understand "tactic" to mean the choice of a technology to accomplish a task in a system, then we see how sense-making moments occurring within technological frames might together amount to shared systems used to define and bridge users' gaps as they try to makes sense of the systems in which they operate. This coupling of sense-making with technological frames of reference enables us to see user choices as dynamic and cutting across, instead of anchored to, technologies.

Consequently, the activities of gap defining and gap bridging are critical to the high autonomy dialectic. Gap-defining is the activity by which people identify barriers or blockages (Dervin's "discontinuities"). At Local Hope this will be seen as technologies that users do not prefer or cannot make work. Gap-bridging is the act of choosing a tactic to overcome that barrier and move forward. At Local Hope, this will be seen as users choosing different technologies to bridge that gap.

This gap-defining and gap-bridging is neither capricious nor fully scripted. Rather, as Dervin states, "an individual who defines self as facing a gap of a particular kind may use … tactics of a certain kind. In a different moment… he or she may use a different tactic. The point is that by focusing on gap-defining and gap-bridging we allow to emerge for examination human flexibilities and rigidities… amenable to systematic analysis." (Ibid. pg. 66). In terms relevant to the high autonomy dialectic, gap-defining and

gap bridging show how users choose to use certain technologies to accomplish certain tasks (their "tactics"), and that as different users choose different technologies we see dialectic impacts "amenable to systematic analysis" as made visible by the structuration theory imported into our discipline by TFR.

Thus, we can use sense-making to organize what would otherwise be a plethora of variable technological frames of reference, sense-making tactics and user choices into a theoretically sound framework - the high autonomy dialectic. High-autonomy users' evolving needs and the choices they make to accommodate those needs can now be theoretically understood through a new perspective grounded in user experience and founded on prior theory.

As a continuation of scholarly work from Bertalanffy to Davenport, and on to Dervin and Orlikowski, the theoretical building blocks of technological frames of reference and sense-making allow us to introduce order to the systematic analysis of individual choices by many people of many different technologies. Continuing that scholarly conversation also enable me to investigate the dialectic impact of those choices in high autonomy user environments. Seeing users' behavior partially as identifying and bridging gaps allows us to build a theoretical framework whereby what would otherwise be an unwieldy multiplicity of disconnected, disorderly technological frames and technology choices, are instead a systematically researchable experience. The literature upon which I based my systematic analysis of the Local Hope case is detailed in the next section.

2.4 Literature Review Summary

I have explored three main areas in this literature review. First, I examined the literature in the high-autonomy user environment for this dissertation, humanitarian relief, in order to situate this research within that domain. Second, I detailed the intellectual debt this dissertation owes to prior thinking from information systems, technical communication and human centered design, especially in terms of understanding human systems as those systems become more technologically diverse and the users within them more autonomous. Third, I examined in detail the two main theoretical bases of the high-autonomy dialectic (technological frames of reference and sense-making) and how each of those theoretical frameworks offered critical components.

I then described the high autonomy dialectic as an incremental evolution of thinking proceeding from these important previous works.

Chapter 3: Exploring the High Autonomy Dialectic - Methods, The Local Hope Case and Data Analysis

In this chapter I will recount my engagement with humanitarian users, especially those from Local Hope, detail the Local Hope dataset and explain how I analyzed data to generate findings. In detailing the methods I used, I will begin by explaining my crucial formative experiences with various kinds of users. I will then state the guiding research questions, discuss data collection, articulate my possible biases and explain the analysis procedures. In keeping with the traditions of qualitative research, an explanation of my analysis procedures includes describing the initial lack of fit of my original theoretical framework (technological frames of reference) and the resulting shift in my analytical path.

Chapter 3:

3.1 Research Focus and Questions

The research questions below are the foci of this study. To review, these questions benefited from preliminary work at the East African Inter-Agency Working Group workshop in Nairobi, Kenya in June, 2006, participation in an international summit of humanitarian NGOs in May, 2007, and subsequent informal conversations with relief practitioners from major humanitarian NGOs. In addition to providing important relationships that resulted in access to Local Hope and Local Hope employees, this persistent observation allowed me to build an intuitive understanding of how various members of the humanitarian community think of themselves and of their colleagues. The questions also indirectly benefit from years of consulting work with thousands of users who perform their daily work in high (and low) autonomy environments.

My three guiding research questions were:

1. What about high autonomy environments helps to generate user technology choices?
2. What types of user technology choices might misalign in high-autonomy user environments?
3. What kinds of dialectic impacts can we see resulting from user technology choices in a high autonomy environment (like Local Hope)?

The research questions for this study are rooted in the emergent nature of the qualitative research paradigm – which encourages systematic, iterative data exploration. An assumption of this research is that as user technology choices increase the potential for dialectic impacts from those user choices also increases. High-autonomy user environments, like Local Hope, have a high potential for dialectic impact.

This dissertation analyzes the dialectic impacts found at Local Hope as a case study in the dialectic impacts of high autonomy users' technology choices. The case findings seek only to illustrate these dialectic impacts and to begin to understand what contributes to their creation.

3.2 Methodological Literature

This dissertation is a case study which employed a qualitative approach. This section will explore the literature which informs that approach. A study employing a qualitative methodology seeks deep insight into a narrow slice of user experience. This study approached creating research knowledge consistent with Lincoln and Guba's work (Lincoln & Guba, 1994). Guest, Bunce and Johnson illustrate the particular qualitative data collection strategy I employed (Guest, Bunce, & Johnson, 2006), and Corbin and Strauss frame the practical issues in how the data is organized and analyzed (Corbin & Strauss, 1990; Strauss & Corbin, 1998). First, however, I will examine the literature informing my construction of this dissertation as a case study.

3.2.1 This Dissertation as a Case Study, But Not on Local Hope

This dissertation is a case study. It is a case study of a single humanitarian NGO and a phenomenon within that organization that is not easily divorced from the organization itself. The case study literature on which I relied most heavily was that of Yin (Yin, 1981) and Stake (Stake, 1978, 1995). As Yin states, a case study, "attempts to examine a contemporary phenomenon in its real-life context, especially when the boundaries between the context and the phenomenon are not clearly evident." (Yin, 1981) As discussed earlier and as will be illustrated in subsequent chapters, the dialectical impact of users' technology choices on their systems is an example of a phenomenon that cannot be meaningfully divorced from its context. Understanding how users' technological choices impact their context and thus

influence subsequent user choices in that context is an example of a phenomenon (choices) and context (impact of those choices) being necessarily studied together.

Further, Yin presages the analytical arch of this dissertation by stating that, “case studies may often begin with little conceptual framework, [but] the narrative must nevertheless be organized around specific propositions, questions or activities, with flexibility provided for modifying these topics as analysis progresses.” (ibid., pg. 60). As stated earlier, this dissertation’s case study of Local Hope attempted a number of times to use different frameworks (e.g. CDM, TFR and sense-making), only to organize itself not around completed prior frameworks but around central questions as suggested by Yin. The key, Yin states, to creating understanding is to retain a focus on what the case study is about. Finding meaning in the case requires a continued focus on the purpose of the case.

The purpose of this case study of Local Hope is to begin to understand the nature of the dialectic impacts of high autonomy users’ technology choices. At this point, Stake’s well-cited work on case study research asks researchers to consider why we would bother telling the story at all. In Stake’s words, cases must be such that, “we seek to understand them. We would like to hear their stories.” (Stake, 1995, pg. 1) As significant amounts of HCD work focused on user experience and choice suggests, many people would like to hear the story of users’ dialectic impact on their system, and Local Hope is an example.

Stake takes this one step further by stating that not only must the case be interesting and a story people want to hear, but we must know our own purpose in telling it. Specifically, do we want to learn and communicate a deeper understanding of the case subject itself, or do we want to tell the story in order to grow and share our understanding of some phenomenon (as Yin called it)? Stake names these two kinds of case studies. Those case studies told to share a deeper understanding of the subject of the case he calls intrinsic case studies. Case studies told to increase our understanding of the issues in the case, not the case subject itself, he calls instrumental case studies.

Together, Yin and Stake’s work provides a strong foundation to know what kind of story I am telling, and why I am telling it. From Yin, I was able to understand that not only may case studies lack an *a priori*

framework, but that case studies are the best fit for a phenomenon like user technology choice in high autonomy environments where the phenomenon of interest and its context are not easily divisible. Yin also agreed with Stake in saying a critical task in case study work is to maintain a focus on the purpose of the case.

From Stake, I was also able to articulate not just the case study purpose, but what my purpose was in telling the story. This dissertation is an instrumental case study of the dialectic impact of user technology choices, with Local Hope as the subject. The point is not to understand Local Hope more deeply, although some increased understanding is inevitable. The point is to observe, investigate and report on the phenomenon of the dialectic impact of user technology choices. The purpose of the case study is to grow our understanding of the dialectic impact of user choice in high autonomy environments. As an instrumental case, the purpose of telling that story of increased understanding is not to teach HCD about Local Hope, but to further the HCD conversation about the impact of user choices and their utility in both research and systems design.

3.2.2 Qualitative Methods In This Study

In high-autonomy user environments such as Local Hope researchers face difficult challenges in the form of ethical constraints and viable controls (Hutchings, 2002; Stallings, 2002). In these high-autonomy user environments, research can become problematic and difficult to maintain (S. Lappenbusch, 2006). High-autonomy user environments not only consist of what Albers calls a complex context, but as mentioned previously, those systems contain high levels of human interaction and interdependence between many user groups, many of whom have very different perspectives, objectives and resources. Systems with so much interdependence and complex interactivity will eventually experience unexpected and unpredictable results (Albers, 1999; Perrow, 1999). In addition to interactive complexity, high-autonomy user environments such as Local Hope also necessarily evolve as Bertalanffy, Davenport and Paul all illustrated.

As a result, my methodological approach required a focus not on discrete events and components, but on processes and the human perspectives which compose and guide those processes (G.H. Galal & Paul, 1998). I needed methodological leverage to reveal subtle and dynamic human processes and

perspectives at play in high-autonomy user environments. This dissertation required a methodological focus which tolerated the fruitful idiosyncrasies of various choices and how those choices interrelated.

To support those requirements, this research employed a qualitative research methodology. The strengths of this approach were the consideration of human subtlety, a contextually focused depth of analysis, an iterative approach fitting the evolving nature of high-autonomy user environments and a narrative result more immediately identifiable to many practitioners in the knowledge domain of study (G. H. Galal, 2001a, 2001b; G.H. Galal & Paul, 1998; G. H. Galal & Paul, 1999; Paul, 1993).

3.2.3 Trustworthiness for This Study

Coarsely, this dissertation seeks descriptive human depth. Thus, for this dissertation the findings are intended to provide applicable, actionable knowledge about the dialectic impacts of user choices in high-autonomy user environments. Lincoln and Guba examined how knowledge generated by qualitative methods is about analytic depth and useful descriptiveness drawn from a purposive sample and achieved through neutral analysis.

This study provides that depth and descriptiveness while satisfying accepted peer-reviewed criteria for trustworthiness. Those criteria come from a widely accepted standard for establishing trustworthiness explicated by Lincoln and Guba: credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985).

Credibility

Three activities increase credibility: prolonged engagement (sufficient time to detect the researcher's personal biases and potential distortions in viewing the subjects' data), persistent observation (continued focus on those issues most likely to be relevant to the research questions), and triangulation (multiple sources, methods or researchers) (Lincoln & Guba, 1985; Patton, 2002).

To address prolonged engagement (sufficient time to detect the researcher's personal biases and potential distortions in the subjects' data), I attended an ECB4 conference immersing myself in the culture of relief NGOs in April, 2006. I spent another week in Kenya in June, 2006 with key members of NGOs, beneficiary country governments, and third party partners. I also participated in a humanitarian

service science seminar in October, 2007 funded by the National Science Foundation. I also, between August, 2006 and May 2007, assisted the CTO and a program manager at the International Rescue Committee (IRC) as they planned for and implemented a new SharePoint intranet for the entire, global IRC operation. Finally, I spent over six years in the private sector consulting with professionals in various systems environments on their technology use.

All of these activities are in addition to speaking and working with humanitarian workers in the course of data collection and analysis. To satisfy persistent observation, I engaged the research questions vigorously for the length of the study, approximately five years from conception to completion. To satisfy triangulation, I collected and analyzed data from a large number of different humanitarian job roles.

Transferability

This dissertation seeks to provide enough thick description (Geertz, 1973; Silker & Gurak, 1996) and deep analysis of different user groups' the high autonomy dialectic to provide other professionals the ability to consider whether the findings may transfer to a context which interests them.

This research sought transferability through the inclusion of data from many different kinds of users including: IT staff, program managers, communications and marketing, finance, and field staff. Table 4 in the Methods chapter breaks down this variety of humanitarian job roles within the data set.

Dependability

To satisfy this criterion, this study employed an audit trail of all decisions made during data collection and analysis. This audit trail was kept so as to make transparent the process by which findings were reached. Indeed, periodic reviews of this audit trail were the source of my iterative literature reviews and the reflections leading to the creation of the new theoretical framework debuted in this research, the HAD.

Confirmability

This is the concept assessing the neutrality of a researcher and the conclusions. This study is neutral. Prior to and during analysis, I explicated my biases and assumptions. I employed procedures to make the data analysis transparent by logging biases and analysis decisions in an audit document for periodic researcher review over time.

This iterative use of the audit document also supported the purpose of this research - to provide a rich enough description of high-autonomy humanitarian systems users' dialectic impacts. As such the confirmability affords a decision about the transferability of this research to other high-autonomy environments, particularly humanitarian NGO systems contexts. That is a decision which can, ultimately, only be made by the research reader.

3.2.4 Purposive Sampling – Where The Data Came From

My data collection mechanism was purposive sampling restricted by the make-up of the humanitarian NGOs staff and their willingness to volunteer for the study. Since this leaves the amount of data to be collected potentially open-ended, a guideline would be helpful in assessing what makes for sufficient amounts of data for useful analysis. Doing so in turn requires a way to know ahead of time how much data will be needed to reach theoretical saturation, the point at which no new understanding will be reached on the research questions by gathering additional data from participants.

To determine this point of saturation, I relied heavily on previous work from health sciences researchers who also used interviews as their sole data source (Guest, Bunce, & Johnson, 2006). In planning their own research, Guest, Bunce and Johnson found no concrete guideline for theoretical saturation, even after an exhaustive search of seven scientific journal databases and twenty four research methods textbooks, to help them determine the point of theoretical saturation. As a result, they used their own study of West African sex workers as a meta-study in how quickly saturation is reached in research with purposive sampling and participant interviews, such as this research.

Simply put, they found that, "data saturation had for the most part occurred by the time we had analyzed twelve interviews." (Ibid. page 296) To reach this conclusion, Guest, Bunce and Johnson looked at how quickly the total number of codes were created and how quickly the highest frequency codes stabilized in their application across participants' interviews. By the twelfth interview, they had created 92% of the total number of codes. The remaining 8% included only variations on existing thematic codes and occurred progressively less frequently after the twelfth interview.

In order to determine which of the codes were most important across participants, they analyzed which codes occurred most frequently across all their participants. After twelve interviews, they found that, of these high frequency codes, 94% had been identified after only six interviews and 97% had been identified after twelve interviews. Summed up, after twelve interviews Guest, Bunce, and Johnson had created 97% of their most frequently used codes - and 92% of their entire codebook. Thus, I am confident that my participant data set of 24 structured surveys was defensible as a sufficient data set for this research.

3.2.5 Iterative Data Analysis

The iterative data analysis procedures employed in this research followed previously published data coding procedures (Corbin & Strauss, 1990; Strauss & Corbin, 1998). This overall procedure followed the iterative steps of open, axial and selective coding of the data.

Open coding involves first reading the data as a whole to increase familiarity and stimulate thematic consideration. Open coding then involves seeking categories across the entire data set. These categories could be actions, opinions, beliefs or some combination of those three things. The research questions generally guide the type of categories one would seek. As such, in this dissertation, difficulties faced by the users in their high-autonomy user environments guided the categorical associations.

The second step in the coding process is axial coding which involves discerning connections between the categories revealed during open coding. The utility of these connections is best revealed during the third step. The third step, selective coding, is the articulation of the nature of the connections discerned in axial coding. If the nature of the connections does not produce a sufficient understanding relevant to the research questions or focus, then the researcher can begin either axial or open coding over again, informed by the knowledge of the previously discovered connections. This is the earlier stated iterative nature of the analysis.

3.3 Engaging Humanitarian Environments and Users

The conceptualization and focus of this dissertation, and my intellectual development in creating it, evolved over years of experience working with and studying organizations including but not limited to Local Hope. My personal experiences included:

- A 2006 National Science Foundation-funded workshop on humanitarian technology adoption in Kenya
- A 2007 international summit of humanitarian NGOs
- Working with one of the five largest global humanitarian NGOs to plan a SharePoint portal implementation
- Six years of professional consulting and technology design experience with government agencies providing a useful counterpoint experience in low-autonomy environments

Each of these experiences and how they were critical to the formation of the study focus and underlying ideas used to derive insight from the Local Hope case are detailed below.

3.3.1 National Science Foundation Humanitarian Technology Workshop

In June, 2006, I co-wrote a successful grant for a National Science Foundation workshop for humanitarian practitioners and researchers. This event was held near Nairobi, Kenya, and explored ways to research and improve the use of technology in humanitarian work. The most valuable contribution to this dissertation came from discussing technology use with workshop participants including many from Local Hope. Due to the workshop placement in the field in East Africa, the workshop participants were overly represented by users working in the field. These were professionals with strong ideas on why they did or did not use technologies available to them. They worked in difficult, even perilous environments. They wanted the right tool at the right time. Indeed, the funded purpose of the workshop was to generate new thinking on how to more effectively use and implement technologies in the humanitarian sector.

After talking with practitioners in Kenya, some of whom had been in the humanitarian field for decades, it was clear that their view was that humanitarian systems success ultimately relied on the ability of the user in the field to flexibly and progressively adjust technology use in order to accomplish practical tasks. Though I did not articulate it this way at the time, these field users expressed a strong desire to exercise user autonomy.

There were competing views from some of the more senior NGO staff, who expressed disappointment in the repeated under-utilization of costly technologies. This view was an important one in the workshop, as the purpose was to improve the use of technology in humanitarian work and these users represented important parts of those humanitarian organizations. However, these views were largely sidelined in the workshop, presumably due to the predominant field user representation and the immediacy of the context in East Africa. My later experiences in the humanitarian sector and as a technology designer brought these headquarters perspectives back to the fore for me.

3.3.2 International Humanitarian NGO Summit

About one year after the workshop with field users in Kenya, I participated in an international summit of humanitarian NGOs in May, 2007 in Seattle attended by dozens of humanitarian professionals, including both field and headquarters personnel from Local Hope. It became clear to me that in humanitarian work action was of primary cultural importance to both field and headquarters users. Those who choose to act, to roll up their sleeves and solve a problem, are the right kind of people for humanitarian work. Most in the humanitarian sector seemed to agree that they had to trust the person doing the work in the field. Often, unless brought back consciously by a headquarters user, the conversations drifted to issues of field technology use. In describing what they did in terms of technology to leverage their local knowledge, users talked about choosing this or that technology over others. This general discussion of choosing one technology over helped me realize user technology choice may be a fruitful focal point.

This pushed me to examine prior literature and previous work to find what others had researched and written about users' technology choices. My search reviewed concepts such as distributed cognition, critical decision-making, and technological frames of reference, and the work done from those theoretical perspectives. As I was researching the literature, I worked on another humanitarian project which

helped me see how technology choices may dynamically impact a system. It also gave me a much better appreciation for and understanding of technology choice from the headquarters perspective.

3.3.3 Global SharePoint Implementation

In addition to the extensive time spent with users representing the field in humanitarian work, I also spent approximately four months working with a humanitarian headquarters user group in New York City as they chose technologies. After meeting the CIO of the International Rescue Committee (IRC) at the 2007 summit, I assisted in preparing the IRC for a global roll-out of a new SharePoint portal system. The IRC wanted quicker and more comprehensive information sharing worldwide. This was also the stated goal of Local Hope headquarters and senior staff as will be seen in section 3.4.

My purpose in volunteering was to engage humanitarian technology users more deeply and directly to see how or if humanitarian work could illustrate my emerging focus on users' technological choices. My first-hand experience with headquarters users provided useful insight into the experiences of headquarters users in humanitarian relief. It also gave me valuable balance in my perspective on the needs of a user group which until that point I had experienced mostly as the "other" both in the field in Africa and largely, but less so, at the 2007 summit. The value of this balance is unpacked in section 3.5 where I articulate my biases, but generally it is that headquarters sought creative choices also and was no less committed to the humanitarian mission than those in the field.

While working with headquarters users, I witnessed mixed results on the global SharePoint project. Some users chose SharePoint. Others did not. Some used it sparingly, or for purposes other than those intended when the system was implemented by the headquarters users I was working with. In seeing things from a strategic perspective at headquarters, it became clear that users were choosing to use SharePoint in different ways. Some used SharePoint as a repository, others as a collaboration tool, and others still as a way to placate headquarters or other colleagues by posting work there as asked. Each use seemed to track to a task, for example collaborating through SharePoint as opposed to collaborating via email. The task was collaboration, but different users chose to use different technologies to collaborate. The concepts I found in the literature did not seem to fully account for the fundamental differences I witnessed in users' technology choices. The concepts treated users' systems

statically or focused on issues other than the impact users choosing specific technologies had on each other.

Thus, even for users who would not normally be understood as being organizationally distant or would be seen in prior literature as needing to make similar decisions in similar contexts (field operators in the same country, for example) I saw differences in individual IRC user technology choice. As I worked with headquarters users to make sense of how different users chose to use SharePoint it became clear that not only were there differences in who used SharePoint, but that their choice to use SharePoint had what at this point I thought of as systemic importance. Their technology choices impacted others, and even the entire system. These impacts became evident. Finally, when users talked about their use of SharePoint they consistently referenced other technology choices, so the system experienced by users was not only SharePoint but also email, the phone, and so on.

I also witnessed differences in not only job title and geographic places of technology use, but in the tasks for which users chose technologies. The recurring issue was choice and not simply job title, place, or how they defined the technology. They needed to do the work, and exercised the autonomy they had to choose technologies to do their work their way. Many IRC users said they needed more flexibility in gathering and sharing information to get their jobs done and could not be tied to the SharePoint option (or any one option). This was especially true when many IRC users said that single SharePoint option ran counter to the impoverished technology choices or time-critical settings experienced in humanitarian field work.

Other users, such as those at the New York headquarters or the main program offices in national capitals, said that standardization in information collection and communication made it easier to complete their work. These divergent viewpoints tended to track towards whether or not users operated in higher or lower autonomy environments, more in the field or more in a headquarters setting.

These experiences with humanitarian technology users, both with users in the field and as a headquarters user, allowed me to internalize the culture of humanitarian users like those at Local Hope. Those experiences also allowed me to appreciate the nature of their work and the choices they face, and

when combined with my professional experience in the next section, to begin to articulate an important backdrop to the focus on user technology choice – high or low autonomy environments. This understanding of the humanitarian domain, the articulation of higher or lower autonomy, and the view of a field/headquarters user group division carried over to my work with Local Hope. While these previous experiences provided the potential for a number of biases in my analysis of the Local Hope participant data (which are articulated in section 3.6), I firmly believe the insights I was able to derive from studying Local Hope would not have been possible without my diverse and first-hand prior experiences. The reason these prior experiences were so important is that, like users in other domains, humanitarian users operate in environments particular to their work. My prior first-hand experience with that work, both from a field and headquarters perspective, allowed me to come to the Local Hope analysis with a deeper understanding. I also had the benefit of having worked hard to frame and understand humanitarian users' choices. Combining this basic understanding of the world Local Hope users faced with a diligent search in prior theory amplified the utility of the Local Hope analysis. There is one more experience, however, that proved important to my work on Local Hope.

3.3.4 Professional Consulting & Technology Design

My final experience motivating this dissertation's story about user autonomy is my engagement and observation of users with low autonomy. For over six years I have consulted with and designed technology for users in diverse government agencies. Very few of these government users have the high-autonomy environment that humanitarian users do. Like humanitarian NGOs, however, most of these government agencies have personnel in various roles and locations, including both office users and agents in the field who often face difficulties similar to humanitarian users.

Most importantly for this dissertation, users in these government agencies with a strong desire for autonomy in technology choice often contrast with their humanitarian counterparts. The government users are far less frequently able to make their own technology choices. Users and managers in many of these government agencies seek to reduce user autonomy. While the government users' work is topically different from humanitarian work, for example hunting fugitive sex offenders instead of delivering sorghum to starving orphans, the concept of user choice was still critical. In these government

agencies, many users often expressed strong desire for exercising autonomy, for making technology choices. They just didn't get to.

3.4 Local Hope as a User Environment with High Autonomy and User Technology Choices

Local Hope is one of the largest humanitarian NGOs in the world, with decades of experience around the world in program areas as diverse as education, civil infrastructure, emergency relief, and medical assistance. It has operations on every continent except Antarctica and more than one humanitarian program area on each continent. It has an annual budget in the $100s of millions and employs thousands of people worldwide. Its workers have won grants, stayed in combat zones when the military fled, healed sick orphans, rolled out massive IT projects, seen refugees die with their world on their backs after a forced march from their homes, lobbied world leaders on behalf of the powerless, balanced daunting budgets, and dealt with the work realities all those activities create when happening simultaneously, sometimes in a cubicle in an American office building, sometimes in a tent in the Sudanese desert, and sometimes out of the back of truck in a war zone with artillery shells exploding nearby.

Those complicated humanitarian work realities are time-critical and incredibly emergent. User autonomy allows Local Hope users to adapt, to adjust, and to decide for themselves what technologies they need to use to overcome obstacles that could never be foreseen or planned for ahead of time. Summit participants in Seattle, those earlier in Kenya, users at the IRC, and finally those in this case of Local Hope, all described the benefits of user technology choice. Generally, Local Hope echoed that their world was changing and so autonomy was necessary.

Like many organizations, Local Hope systems have been impacted by various changes large and small including rapidly advancing handheld computing power (e.g. cell phones or PDAs) and changing geo-political global conditions (e.g. the break-up of the Soviet Union and increased economic globalization) which create events and user environments that Local Hope and its systems were not originally built to accommodate (e.g. failed states such as Somalia). To adjust successfully, Local Hope continued its

tradition of trusting the person on the ground by allowing humanitarian users to avail themselves of whatever technologies will work in the moment, resulting in users making their own technology choices. Because of all this, Local Hope is a fruitful test bed for investigating the dialectic impact of user technology choices in a high-autonomy user environment.

3.4.1 Local Hope And User Choices

In my time with Local Hope, I learned that Local Hope is like other humanitarian NGOs I'd experienced. Simply put, doers run the show. Those who seek humanitarian work strongly identify with this overtly action-oriented profession. Local Hope employees, both field and headquarters alike, share this action-oriented work ethic. Around the world at Local Hope, high-autonomy allowed for users closest to their work to choose their own tools to accomplish their tasks. The next few paragraphs summarize approximately a year of Local Hope's experience.

In response to repeated demands for more information sharing and communication capacity from the field and office workers alike, Local Hope implemented a centralized global information and communication system. Everyone at Local Hope was excited by the new system. Headquarters eagerly anticipated centralized reporting. Donor relations could not wait for real-time updates from the field. Field staff could finally quickly share critical detailed information with colleagues which would be archived for later use.

Six months into the implementation none of those goals had been realized. Management found reporting to be difficult because the portal sites were not consistently utilized as management had intended, and thus data was unreliable or difficult to obtain. Donor relations got infrequent and decreasing activity updates because they sought automatic alerts from portal sites that seemed, to donor relations, to be so convenient and sensible. Field staff with limited connectivity continued to send one-off emails or text messages from the field to some but not all donor relations staff rather than post content on portals.

Field staff found sharing information with colleagues through the centralized system far more cumbersome and less timely than a simple phone call to a colleague at the moment of need. The more

experienced analysts and program managers in headquarters knew they were getting incomplete or incoherent data, and so would simply resort to calling aid workers in the field to get refinements or updates in an ad hoc fashion as they always had. In return, the program managers would scrub and enter in Excel spreadsheets the data they gleaned from the field, which often did not make it back into the central system and occasionally contradicted the information posted directly by field staff. The expensive information and communication technology, in other words, was failing. With such tremendous initial buy-in, no one could figure out how this failure was growing so rapidly.

Local Hope senior management commissioned a survey of users around the world and called a conference of their IT, management, country directors and experienced field staff. After some intense discussions, one of the senior field staff, who had seen her share of inter-cultural disagreements, suggested people were talking past each other. They were not arguing over the new system, but over their choices in the system. The system was composed of not just the new technologies Local Hope rolled out, but older technologies users did not stop choosing and also technologies no one had officially considered one way or the other. The system was, in the terms of this dissertation, composed of the choices users made.

This realization of multiple tasks, roles and choices sparked debate over the new system's purpose, about what the system was, was for, and had been from the beginning. Quickly, they realized not only that different departments and different people at Local Hope all had different ideas about what the system was and was for; but also that they all made different choices in composing their different systems. Suddenly talking of saving "the system" seemed to make less sense than figuring out what the different user choices were in Local Hope that made up and impacted their system. Thus at Local Hope new sources of emergent complexity arose because users possessed the autonomy to choose their own technologies. Those choices often did not align. Those misalignments impacted their system dialectically.

Local Hope participants, scattered around the world, often use technology as they see fit and as need arises in their work. There is interaction between tasks and roles in the organization over technology choices. Different users choose different technologies for tasks, regardless of their role, or even despite

a similar role. This often fosters systemic misalignments which illustrate the dialectic impact of users' technology choices. Table 2 provides an overview of these roles, their tasks and the user-chosen technologies examined in the Local Hope structured surveys (and as stated by the participants).

Table 2. Relevant Categories at Local Hope

Job Roles	Tasks	Technologies
Food Security Program Management Logistics Donor Relations Communications	Document Development Collaboration Scheduling	Groove Skype Mayetic Village Phone Email Microsoft Excel

3.4.2 Users and Roles

As Table 2 shows, five distinct Local Hope job roles participated in this case study. These roles were stated by participants. Of the roles shown, some (e.g. donor relations) seem particularly "HQ-centric", bound to be performed in a stable office setting. However, the tasks performed in these seemingly stable roles interact with other roles and technology choices that are not as stable – such as food security or field relief workers. Also, despite their apparent office-centric nature, many of these users expressed a need for, and an agreement with the history of, high user autonomy at Local Hope.

3.4.3 Tasks Performed

Local Hope users, like their humanitarian counterparts around the world, performed many different tasks. Field operators in particular often faced demands that required new and different approaches to work. The tasks shown in Table 2 were the foci of Local Hope's strategic planning in this case: calendaring, collaboration, and document development. During iterative analysis, different tasks were revealed and are described in Table 4.

3.4.4 Technologies Chosen

Local Hope's high-autonomy user environment displayed an array of technologies chosen by users. These include technologies chosen and deployed by IT and technologies chosen by users unbeknownst or without the sanction of Local Hope IT.

There were six technologies chosen by Local Hope users and studied in this dissertation on the Local Hope case. Those six were: Email, Excel, Groove, Mayetic Village, Phone and Skype. Groove is a shared workspace that allows people to collaborate on documents offline and synchronize changes in a peer-to-peer network. Skype is a software service that enables the use of the internet to make inexpensive phone calls, have video conferences, exchange instant messages and even share files over the computer. Mayetic Village (referred to as "MV" or "CWS" by many at Local Hope) is a web-based collaboration space accessed via the open web on a browser. Phone, while seemingly obvious, could include either a landline desk phone or a satellite phone in the field depending on the user. Email is client-side email, accessed via an application on a computer or alternatively browser based email. The variability in dependable connectivity (high at headquarters, very low in the field) is what makes email much like the phone, a seemingly stable and known technology, but one that differs based on the user choice.

As with the users, the list of technologies in this Local Hope study is not comprehensive. Local Hope users have many more technologies at their disposal than those shown in Table 2 (e.g. fax). A study with a different context than the global planning for communication and collaboration would likely find other technologies widespread at Local Hope (or any other high-autonomy user environment). The technologies shown above were those focused on by Local Hope during the Local Hope implementation and investigated in this dissertation.

3.4.5 Combining Roles, Tasks, and Technologies to Study Local Hope as a Case of the Dialectic Impact of User Technology Choice

As previously described, systemic misalignments are essentially incompatibilities resulting from users choosing different technologies. With the various lists of user groups, tasks and technologies in Table 3, one can see how users' choices may or may not align. Local Hope's users' different technology choices

combined to create systemic misalignments. Local Hope's systemic misalignments guide the identification of dialectic impacts. These misalignments can indicate dialectical impacts of users' technology choices on their systems and provide the potential for highly useful insight for HCD.

3.5 Bias Articulation

A qualitative researcher seeking to create new knowledge must remain neutral, open to whatever the data reveals during analysis, even (or perhaps especially) if those revelations run counter to the researcher's own preconceptions. To that end, I articulate three biases below which had the potential to affect my analysis of participant data. All of these articulated biases result from my extensive engagement with humanitarian users as described in section 3.3. Those biases are an affinity for field users, first-hand experience working with headquarters users, and deep prior experience with humanitarian users.

Articulating my bias regarding field users is simple. I like field users. Throughout my time working with and even as part of humanitarian organizations including Local Hope, I have admired the personal commitment and ingenuity of field users. More generally, I have a personal affinity for taking action in the moment, for what I think of as intuitive, creative, gut-level decisions. However, what I learned in my time working with headquarters during the Share Point implementation is that creative decisions are not limited to adventurous, immediate contexts like the field. Humanitarian users in an office are no less committed to the humanitarian mission simply because they are in an office. As a result, while I acknowledge my personal affinity for field users, I have experienced the headquarters perspective first hand. I worked with headquarters users as they sought creative choices to difficult technology problems. I'm confident this tempered my bias towards field users. The reason for my confidence is that I am able to see and show important headquarters choices at Local Hope and to demonstrate in subsequent chapters that Local Hope headquarters users made an important choice with a dialectic impact, just as the field did. Were I overly biased towards the field, teasing this choice out of the Local Hope headquarters users' participant data and seeing its dialectic impact may not have been possible.

Instead, were my bias towards field users unchecked, I may have only seen creative, impactful choices coming from field users.

In terms of my biases for or against the headquarters user group perspective, there were two instances where previous first-hand work as a member of a headquarters team rolling out Share Point impacted my view of Local Hope. First, as my work on Local Hope began to reveal to me that I could see Local Hope's system as constructed of user choices, it was a perspective very much like a headquarters perspective I was seeing it from. Analyzing the Local Hope data after data collection was complete, thus in retrospect, felt very similar to the strategic level perspective we used to understand Share Point users during the global implementation at the IRC. Thus, while I had to constantly patrol against my bias towards the field users, I did record an instance of the headquarters perspective greatly influencing my characterization of Local Hope.

The second instance of headquarters bias in my work on Local Hope resulted from changes in my professional work outside the dissertation. As the analysis was ongoing, I took a job designing and implementing technologies for large organizations, many of which were similar to Local Hope with variations on field/headquarters user group divisions. As the designer responsible for creating technologies rolled out to users across a vast organization, I not only appreciated but assumed the responsibility to make choices in my designs that may or may not have aligned with what field users of my designs sought. This first-hand experience conferred a possible bias for headquarters users when they sought strategic level solutions like Mayetic.

An additional, overall bias possible in my work with the Local Hope participant data is the bias of privileging what I saw at Local Hope only in terms of what I saw in my previous work in East Africa and at the IRC. My prior engagement with humanitarian users was critical to forming the ideas in this dissertation, but it is always tempting to see things in terms of the past and this is a threat to neutrality. This possible bias could be summed up as perhaps I saw the field/headquarters user group division and the multiply chosen technologies I did at Local Hope only because I saw it first at the IRC or amongst users at the workshop in Africa. While this possible bias is impossible to ignore, I feel confident it did not overtake my analysis of Local Hope participant data. The reason for my confidence is that the

technology choices of Local Hope participants are demonstrated in the data, not inferred. Local Hope users reported making the choices they did and often clearly stated the difficulties they faced.

3.6 Data Collection – Gathering Data From Different Kinds of Local Hope Users

At the time of data collection for the structured survey, Local Hope had a large number of high-autonomy users around the globe and was creating a new strategic plan for a global communication system. The data used in this study were structured surveys of humanitarian professionals at Local Hope experiencing that new strategic plan. The questions consisted of 30 scripted questions (in Appendix A) asking about participants' current on-the-job systems use in humanitarian work. To maintain the confidentiality of both the participants and Local Hope, the participants will be numbered (P3, P4, P5, Pn…). In this dataset, the 24 Local Hope users showed how they spanned many job roles, performed many different tasks and in so doing chose many different technologies. They were a diverse group. And yet, the common thread running through their data was that their technology choices were important. Their technology choices made an impact.

My data collection mechanism was purposive sampling as detailed in the literature review, restricted by the make-up of Local Hope's staff and their willingness to volunteer for the study. Responses were collected via email. The email response type was necessary due to the nature of humanitarian work. Local Hope employees in the field often face extreme time constraints, greatly limited technology infrastructure and unreliable Internet or even phone access in remote and distressed locations. The email response type allowed for those in regional or far-flung field offices to respond offline and send the response quickly during the few moments they had connectivity or time to respond. In using the Local Hope data to illustrate the larger story of the importance of users' technology choices, I did not need to focus on how to theoretically illustrate users' ability to choose, because they demonstrated their choices in the data.

As I collected data, Local Hope was implementing a new global communication system for its humanitarian workers – similar to the IRC project I had volunteered for two years prior. In preparation

for the new system, much as I had experienced at the IRC with its Share Point project, Local Hope sought to understand what users chose to use now, and why, for communication and collaboration tasks. These responses represented the data for this dissertation.

These structured surveys, done while Local Hope prepared for and began to roll out the new system, display the way different users at Local Hope chose to use or not use different technologies for certain tasks. As will be seen, headquarters often sought information in a way that was incompatible with how the field chose to send it. Managers sought financial data from the field and faced similar problems. The field found new technologies cumbersome and often simply instituted a workaround like a phone call directly to a colleague, thus eliminating any chance of allowing others to learn from the question and the answer. All of these examples draw from real life work of Local Hope participants exercising autonomy.

To dig deeper into autonomy at Local Hope, I used proven iterative data analysis procedures. I followed the iterative steps of open, axial and selective coding of the data (Strauss & Corbin, 1998). With each successive iteration, themes emerged and frameworks (like those discussed above) were tried and failed until my prolonged engagement with the data clarified the case's story of the dialectic impacts of user choice. All responses not submitted as Microsoft Word documents were pasted verbatim from the email responses into Microsoft Word documents. These documents were then imported into Atlas ti version 5.0 for coding and analysis.

Just as my personal experience brought user technology choice to my attention one project at a time and prior literature suggested the importance of autonomy, each iteration of the analysis of Local Hope data further illustrated the importance of user's technological choices. Iterative analysis of the Local Hope data confirmed my personal experience that users' technology choices promised a way to increase our understanding of how high autonomy users impact their environment.

3.6.1 Revisiting Data from Prior Engagements To Help Frame Local Hope

The historical data acquired over the course of my engagement experiences with humanitarian users can best be thought of as the experiential foundation on which the guiding research questions were formed, the structured survey questions written, and the initial analysis undertaken. Over the course of

the years I spent with humanitarian users I met at the East Africa workshop, the summit and during the Share Point implementation at the IRC, I experienced a great deal and also collected notes and correspondence during those experiences.

While this information was not part of the formal, human subjects sanctioned data set and so could not be used in the analysis detailed in section 3.7, the ideas and work recounted in these documents were invaluable in generating insight from Local Hope. These documents include data such as emails with field and headquarters users at multiple NGOs including Local Hope about their technology use and work challenges, internal memos from both Local Hope and IRC headquarters users regarding strategic technology choices (Mayetic and Share Point, respectively), internal documents from IRC users during the Share Point project, and extensive notes taken during meetings at the East Africa workshop, the summit and at the IRC. This history of my personal engagement with humanitarian users set a strong foundation of prior experience from which I drew ideas and direction while constructing the formal data collection and analysis that was sanctioned by Human Subjects and is recounted beginning in section 3.7

3.6.2 Participants

Participants in this study were at least age 18 and had on-the-job experience at Local Hope. Some participants had experience in field operations, some in back-office work, and many in both. Participants were both male and female, and four nationalities from three continents were represented. The specific breakdown of those characteristics will not be reported in order to adhere to participant confidentiality as the combination of gender, job role and nationality could potentially reveal a participant's identity. Four participants did provide information for this study, including two follow up discussions and their structured survey responses. However, I was unable to secure a Human Subjects release from these four subjects due to their difficult work contexts and priorities. As a result, this data is not used in the iterative analysis of Local Hope, but is referenced in section 3.6.1 as background information useful in framing and understanding the Local Hope case.

3.6.3 Recruiting

Participant recruitment occurred via email with the consent of Local Hope leaders. The process complied with University of Washington Human Subjects requirements. Those individuals who chose to participate included field personnel, program officers with field experience, senior managers, and finance headquarters personnel amongst others.

3.6.4 Informed Consent

Participants in this study were briefed on confidentiality, risks, and their rights as research participants prior to their involvement in the research. Consent was obtained from the participants in compliance with University of Washington Human Subjects requirements, with only consenting participants included in the data set. All participants' involvement is confidential. All links between the participants' identities and their data has been eliminated in this dissertation.

The recruitment procedure had little chance of being perceived as coercive since I had little or no power over the participants, participation in the study was completely voluntary, Local Hope leaders were not told which Local Hope employees participated, participation or nonparticipation in the study did not harm participants' work status in any way, and the identity and responses of study participants is confidential.

3.7 Analysis of Local Hope Participant Data

This section will detail the analysis of the 24 Local Hope user interviews. User technology choices are basic choices on how users will interact with each other. Users choosing technologies for certain tasks are observable or reportable. Identifying user technology choice reported by users in the structured surveys does not require nuanced interpretation, though subsequently discerning the dialectic impacts of user technology choices does require more nuanced thinking and this is where prior work served as a critical guide.

After an iterative analysis process originally focusing on technological frames of reference, focusing instead on users' technology choices in the data analysis fit the user experience emerging from the data. In addition, after years of persistent observation with humanitarian organizations and other high-autonomy user environments, focusing on technology choices also fit my gut sense of how humanitarian

users think of themselves: global, distributed, with a useful, if complicating, independent streak. As a result, the analysis reveals a story about high autonomy users choosing technologies, and thus impacting their own system dialectically. I discuss the analytical steps I undertook to reveal that story next.

3.7.1 Initial Analysis – Open Coding

As discussed in the methodological section of the literature review, the process of open, axial, and selective coding used in this dissertation is a proven and useful process in empirical user research. My initial open coding activity consisted of reading all 24 Local Hope responses closely and noting concepts in the data of interest to the research questions. Consistent with published procedures, this thorough reading of the structured survey data ensured familiarity and more importantly allowed initial impressions to emerge. After this whole reading, open coding continued by employing Atlas ti qualitative analysis software to automatically code for keywords specifically asked after in the structured survey. These keywords included technologies noted in the initial reading such as "Excel" or "email" and tasks such as "document development," "calendaring," "scheduling," and "collaboration." These keywords drew from the questions, which in turn relied on Local Hope's organizational systems priorities. The categories from this preliminary data analysis resulted in Table 2. At this point, I was still using technological frames of reference (TFR) as my framework.

Table 3. Relevant Categories Found in Local Hope Data – Preliminary TFR Analysis

Job Roles	Tasks	Technologies

Food Security Program Management Logistics Donor Relations Communications	Document Development Collaboration Scheduling	Groove Skype Mayetic Village Phone Email

After the creation of the categories in Table 3 each auto-coded segment was manually reviewed to remove any extraneous coding (e.g. coding of the question text itself). The resulting data set was then analyzed for co-occurrence of keywords based on stated job roles to see how each job role thought of which technology to do which task. This mapping of job role to task fit my initial theoretical framework of technological frames of reference. Technological frames of reference, with their specific focus on job role, had been successful in previous similar research such as (H. Chen & Lynch, 1992) and as seen in Table 1.

The first variation from technological frames of reference was that instead of aligning with only job role, participants' views of technologies and their choices of which to technology to use aligned with the job context – literally their geographic location. Thus, during the second round of coding, an important modification to a category was revealed, the specific job context (field or headquarters).

As previously discussed, there is often in humanitarian work, and was at Local Hope, a general division between field and headquarters in their understanding of how to get work done. In this dissertation, "field" describes all those workers in a remote setting while "headquarters" describes those in the more stable environment of the headquarters office. The breakdown of field and headquarters users is profiled in Table 4.

Table 4. Participants By Job Role and Job Context

Field Staff	Headquarters Staff

7 Participants, 4 job roles (food security, program management, logistics, communications)	17 Participants, 4 job roles (finance, program management, donor relations, communications)

So, to this point in the analysis, open coding revealed some general, abstracted differences in Local Hope users. I then created more formal categories for the data, as illustrated in Table 5. Next I sought to understand how the categories related to each other.

Table 5. Final Data Categories Used in Analysis

Job Roles	Tasks	Technologies	Job Context
Food Security Program Management Logistics Donor Relations Communications	Document Development Sharing Ideas Sharing Data	Groove Skype Mayetic Village Phone Email	Field Headquarters

3.7.2

3.7.3 Initial Analysis – Axial Coding

At this point, axial coding had begun. To recall, in axial coding the analyst seeks to find connections between the categories that have grown from the open coding. At this point in the preliminary analysis, connections were sought between the categories of users' roles, tasks, technologies and job context (field or headquarters) as seen in Table 5. Users' definitions of the technologies, their technological frames of reference, should have aligned between the categories above according to job role. Those in

the job role of communications, for example, should have aligned in their estimation of a technology. Except they did not align.

As might now be expected, this earliest axial coding proceeding from technological frames of reference did not fully account for the story the case data was telling. Specifically, axial coding revealed code categories that did not fit the assumptions implicit in technological frames of reference. No coherent analytical result could be found in the data to support the TFR assumption that users' views and use of technology could be understood and analyzed in terms of job role. People in the same job role thought of the same technology differently, and even chose different technologies for the same task despite the shared job role.

Recall that humanitarian NGOs are a good example of a high-autonomy user environment because of the culture of improvisation and adaptation. In seeking an abstract and definitional concept for users' experiences, TFR had denied the participants and their data the power to illustrate a core component of who they were and how they worked – their power to do what it takes to get the job done. The power to choose.

3.7.4 Moving Past the Initial Analysis

To reiterate, the story TFR allowed me to tell did not fit the experiences participants were articulating in responses. My personal experience had taught me that humanitarian users in the field were a particular breed of user. They not only prided themselves on improvising, adapting and overcoming in the moment, but felt they were very much expected to. I could not see the participants' technological experiences as they were expressing them in the data without taking choice into account.

This realization pulled me along a path away from technological frames of reference's definitional concept towards something else, something I could not immediately articulate with the literature or find a sufficient framework to fully capture. As a result, the journey discussed above in detail and in the literature review came not only from categorical inconsistency during axial coding, or my persistent observation of the humanitarian sector, but from both the analysis and previous research.

From the initial axial analysis, I could see Local Hope users were missing each other in their technology choices. Some even said as much directly in the data as will be shown later. This is when, in the analysis, the combined theoretical and analytical power of TFR *and* sense-making, and in keeping with best practices of iterative qualitative data analysis, I circled back and worked the data again.

This is when sense-making became of analytical, in addition to theoretical, utility. When I understood users' choices as sense-making tactics the analytical importance of choices to telling the story of Local Hope became clear. That is what was missing in the analysis, and missing in the story I was trying to tell with that analysis –the inability to find sufficient connections amongst certain categories during preliminary analysis, and the subsequent revelation enabled by including sense-making theory that technology choice was critical in users' construction of their systems.

3.7.5 Achieving Selective Coding With User Technology Choice

After stalling as described above, I revisited the basic categories which had emerged as a result of the open, and axial coding in the preliminary work: user roles, tasks, technologies, and job context. Adhering to the iterative data analysis procedures, I returned to open coding using the combined power of technological frames of references and sense-making as a way to focus on technology choice as a an additional coding category. With users' technological choices as a focus, I was able to proceed to discerning relationships between categories. This was the beginning of selective coding.

To recall, in selective coding the structural relationships between the categories found in axial coding are explored. The perspective of users' technological choices motivated an understanding of structural relationships between the categories, specifically of how user technology choices dialectically impact Local Hope's high-autonomy user environment.

Field and headquarters users independently chose to combine multiple technologies in different ways. Users' choices can be described as Dervin's sense-making "tactics." Indeed, incorporating Dervin's sense-making allowed me to focus on exploring the structural nature of the relationships by providing an organizing principle for the users' technological choices across job roles and contexts. This organizing principle, also influenced by the foundation of technical communication and the structuration theory

introduced by Orlikowski, allowed for the articulation of the high-autonomy dialectic as a way to understand the issues exemplified in the Local Hope case.

This is the point in my analysis that I began to explore how users in high-autonomy environments are just not as cut and dried as their job roles would suggest. There was much more in terms of the dynamicity and exercise of human will as a story in the data. Using the high-autonomy dialectic constructed of this prior theory, I unpack the Local Hope case and tell that part of the story in the next chapter.

Chapter 4: Dialectic Impacts in a High Autonomy User Environment - Local Hope Findings

This chapter illustrates and makes concrete the core claim of new knowledge in this dissertation. That claim is that systems in high autonomy user environments can be seen as constructions of the dialectic impacts of user choices, and that the high autonomy dialectic (HAD) can assist HCD in identifying those impacts. This core knowledge claim is important because as user choices increase in our everyday world the ability of HCD to understand how users' choices impact systems is increasingly important.

I illustrate the core claim through three insights: 1) three facets of a high autonomy environment motivating user choice, 2) three examples of the kinds of misaligned choices that may occur, and 3) specific impacts illustrating how systems can be seen as dialectic constructions of user choices. To illustrate these findings, I use Local Hope participant data and the HAD composed of ideas from prior theory examined in the literature review: TFRs by Orlikowski, sense-making by Dervin and the dialectic thinking of Giddens structuration theory as introduced by Orlikowski.

I present the findings incrementally and according to the guiding research questions. To review, the three guiding questions were:

1. What about high autonomy environments helps to generate user technology choices?
2. What types of user technology choices might misalign in high-autonomy user environments?
3. What kinds of dialectic impacts can we see resulting from user technology choices in a high autonomy environment (like Local Hope)?

The first question guiding the analysis in this case study focuses on the nature of a high autonomy environment, of which Local Hope is an example. Showing how participants experienced their environment sets the stage for answering the next two questions, which deal with user choices in that environment. Answering the second question illustrates systemic misalignments as defined in chapter 1. Finally, the third question focuses on dialectic impacts as illustrated by the Local Hope case. It is in examining the second and particularly the third question that the claim of this dissertation (that high autonomy systems can be seen as dialectic constructions of user choices) is made concrete. In addition,

answering the third question provides a transition to discussing how the findings offer insight for human centered design.

Chapter 4:

4.1 What about high autonomy environments helps to generate user technology choices?

The answers to this question set the stage for understanding the dialectic impact of user choices by situating users' choices in their high autonomy environment. This section is not an attempt to list all the relevant characteristics of high autonomy user environments. This section focuses on facets of a high autonomy user environment as demonstrated in the Local Hope case.

I observed three facets that seemed to encourage user choice: 1) variability in resources for users in the same organization or even users working on the same task together, 2) users experiencing different levels of empowerment in technology choice, and 3) the formation of user groups with different levels of empowerment and resources, consistent with Currion's concept of "organizational distance" as described in the literature review. At Local Hope, this is seen through headquarters and field users – with some users in tents in the Sudan or the Horn of Africa and others in air-conditioned office high rises in Belgium or the United States.

Together, the three facets of resource variability, user empowerment and organizational distance begin to illustrate how a high-autonomy environment could enable users to exercise autonomy.

4.1.1 Resource Variability

In this section we see how resource variability motivates user choice, with Local Hope as an example of a high autonomy user environment. With users in some of the most technologically difficult places on Earth, not all Local Hope users have their high autonomy environments created equally in terms resource variability. An excerpt from Participant 2 gives a succinct example of this at Local Hope.

"I'm making the job up as I go along, and having to ask other M&E officers, 'Have you done this? What [technology] works for you?' We couldn't use MV [Mayetic] in Africa – too slow."

Participant 2 - Field

For Participant 2, the reality of her experience is that there is work to do, and the resource assigned to do that work is not keeping up. Another important part of Participant 2's excerpt above is where he or she describes asking other field users, "What technology works for you?" This question is important to note in terms of resource variability. It shows how variability in resource access is not the same as resource utility. She asks what *works* - not what is available. Participant 2 knows resources in the environment vary in their usefulness and the "too slow" comment indicates she has no time to waste on less useful choices. Participant 8 echoes the same sentiment about resource variability and also echoes Participant 2's focus on a specific technology choice.

"In Eritrea… MV [Mayetic Village] was too slow."
Participant 8 - Field

Participant 8 wastes no words in describing why he does not use Mayetic in the field. The resource was there, but too slow for him in the field (Eritrea is a nation in the Horn of Africa). He had work to do, and the tool could not effectively help him do it. It is important to note that he situates his statement not on the technological capabilities of the tool, but on the use of it in the field. He does not say the technology is too slow generally, but too slow "in Eritrea." Thus, the resource varied in utility, just as for Participant 2 above.

The next user below describes resource variability differently.

"As an organization, there is no consensus on where we are going to collaborate. Some use Groove, some use MV [Mayetic]. There's ad hoc networking groups sharing information via email, chats, or on Skype. There's a diversity of forums because [some] people are comfortable, [more] adept, at one or [the] other, or don't have access to a resource."
Participant 22 - HQ

Participant 22, from headquarters, describes how users choose technology to share ideas or information. Participant 22 tells us that some users simply do not have access to a resource. Resources vary not just in how well they perform, as when Participants 2 and 8 described Mayetic working too slowly for field workers in Africa, but in whether a user can get to the technology at all. Here we see a user stating that

in her high autonomy user environment some users have access to technologies that others do not. While Local Hope is an extreme case of resource variability since users working from the back of a jeep in a Tanzanian refugee camp and users in an American high rise in a climate controlled cubicle will have variable levels of resources, the stark differences at Local Hope only help to make the point about resource variability. Resource variability exists, and makes an impact on user choice. The words of Local Hope Participants 2, 8 and 22 help illustrate this.

This resource variability encourages user choice by providing users different choices to make. Also, as Participant 2 foreshadowed by discussing how she makes her job up as she goes along, high autonomy user environments like Local Hope are focused on empowering people and thus being user-driven in terms of technology. This facet of user empowerment is explored next.

4.1.2 Variable Empowerment

The previous section described how by providing resource variability, high autonomy environments encourage user choice. This section shows that different users in that environment may feel more or less empowered to make those choices. Local Hope does seek empowered users, but just as not all users had equal resource availability, not all users feel equally empowered to choose.

Thus this section illustrates how empowering people in order to get work done is both true and not as simple as that. In this way, the Local Hope case both reinforces my previous humanitarian experiences and describes user technology choices in a high autonomy environment. For example, recall Participant 2.

"I'm making the job up as I go along, and having to ask other M&E officers, 'Have you done this?..."

Participant 2 - Field

Participant 2 reminds us that working in a high-autonomy user environment enables user choice and can empower users to make those choices. But just as technological resources varied, so did empowerment.

"Even with Groove the versioning problems weren't solved. We use Skype for phone and chat, but not for file transfer as IT told us not to."

Participant 5 – HQ

Participant 5 shows variable empowerment by beginning to contrast field users versus headquarters users. Participant 2, in the field, stated that she needs to choose. Here, Participant 5, at headquarters, states he or she is not going to use a technology because HQ IT said not to. Just as previous participants described how technology resources vary in both access and utility, we see here that users in a high autonomy environment may vary in terms of how empowered they feel to choose from among those variable resources.

4.1.3 Formation of User Groups With Shared Organizational Distance

The previous two sections discussed how Local Hope showed resource variability and different levels of empowerment. This section describes how different levels of resources and empowerment can generate different user groups in high autonomy user environments. These groups form consistent with the concept of organizational distance used by Currion to explain that, "the factors limiting the application of that technology are all related to organizational structures, policies, and capacities." (Currion, 2006) In other words, technologies don't misalign, people's choices of them do. And in the analysis the choices that misaligned did so in terms organizational distance between field and headquarters.

This organizational distance is similar to that seen previously in the Currion report and witnessed by me at the 2007 summit of humanitarian users. However, there is a point at which Currion's assertion of organizational distance breaks down for me. This is because Currion sees the tension between the organizationally distant groups as a cause of unproductive systems. From a dialectic perspective, however, the tension between these two groups, while real and impactful, does not make them opposites and is not necessarily destructive or negative. Rather, over the long term it could be seen as a productive and healthy influence on the Local Hope system as users are shaped by and re-shape their system together in search of a system that fits their collective needs. We will see examples of this tension playing out between from Local Hope participants in subsequent excerpts and I will revisit this idea in the discussion section 5.2.2 once the dialectic impacts are detailed.

In the rest of this section, I detail the formation of user groups with shared organizational distance – with differences in choices situated in variable resources and empowerment. Two Local Hope users begin to

illustrate this way of organizing people's choices along the lines of organizational distance and also support my contention above that the tension between the field and headquarters does not make them opposite.

"It's not a technology problem."
Participant 14 – Field

"It's a people problem, not a technology problem."
Participant 16 – HQ

Participants 14 and 16 are both answering a question asking what technologies they think can improve collaboration. Interestingly, one is from the headquarters group and the other from the field. Both seem to sense the reality of group formation along the lines of shared organizational distance when they state technology is not the problem (the "problem" being the poor nature of collaboration through technology). However, both participants only suggest this awareness. Their colleague, Participant 5, is more direct.

"Local Hope is field-driven. What happens is that lots of decisions are made [about technology] in the field without headquarters knowing what is going on. And lots of decisions are made at headquarters without the field knowing what's going on."
Participant 5 – HQ

Participant 5 describes how user choice at Local Hope is an experience in field versus headquarters. Participant 5 states that technology choice is driven by the field, but then immediately describes that headquarters users are driving their own uses of technology. Participant 5 describes user choice grouped by Local Hope's organizational distance where users with variable resources and empowerment make different choices. Further, Participant 5 describes how users choose similarly based on similar experiences of organizational distance between field and headquarters.

Participant 9 provides an additional, more technology choice-specific consideration in this field versus headquarters distinction.

"With Groove, I can see every file on Groove. I can see who put it there, the date, the latest version. It is for working on documents with team members not in HQ."
Participant 9 - Field

Participant 9 expands the general notion offered by Participant 5 of different groups (field and headquarters) choosing differently and drills down to a specific technology choice, Groove. He explains how in his experience Groove is, "for working on documents with team members not in HQ." In other words, Groove is a user technology choice that belongs to the field. This specific level of technology choice shows different technologies may be chosen and used by different groups along the lines of organizational distance. This moves us from different user groups choosing differently and brings us back to the idea of systemic misalignments explained in Chapter 1 – user technology choices that do not line up.

To set the stage for those misalignments as seen in the Local Hope case, in this section we saw three facets of a high autonomy user environment influencing user choices: resource variability, variability in how empowered users feel, and the formation of user groups along the lines of organizational distance. Ultimately, as different users make different choices, and those choices misalign, there are impacts to the system. Those impacts involve others in the high autonomy user environment. The next section shows the misalignments that lead to those impacts.

4.2 What types of user technology choices might misalign in high-autonomy user environments?

In the last section, the three environmental facets of variable resources, variable empowerment and user groups forming along the lines of organizational distance situated user choices in their environment. This case study, however, focuses not on the environment but on the impact of users' misaligned technology choices. Thus, the next step is to see which if any of those user technology choices misalign. This section builds on the previous environmental facets to illustrate the types of systemic misalignments found in that environment.

To recall, the six technologies chosen by Local Hope users in this case were: Email, Excel, Groove, Mayetic Village (referred to as "web-based," "CWS," or "MV" by Local Hope users), Phone and Skype. Just as with the three environmental facets the misalignments are not meant to be a complete inventory,

but those demonstrable in the Local Hope data. I focus on three different kinds of systemic misalignments: for the tasks of sharing ideas, sharing data and document development.

4.2.1 Misaligned Technology Choices for Sharing Ideas

There are two misaligned technology choices exhibited by high autonomy users seeking to work with others: choices for sharing ideas and choices for sharing data. The distinction between sharing ideas (e.g. extracting lessons learned from experience) and sharing data (recorded shipments, headcount, budgets) is the difference between Local Hope users building an idea together versus simply transmitting information. In the context of the Local Hope data, these sharing activities were referred to generally as "collaboration" and included shared tasks such as tracking and improving project status, recalling assigned roles and responsibilities, and creating and monitoring budgets together. The participant excerpts from Local Hope employees below are emblematic of the systemic misalignment in sharing ideas.

"I have not heard of it [Mayetic]."

Participant 4 – Field

Participant 4, who works in the field in Asia, is answering a question about her use of Mayetic. She states she is ignorant of a major technology choice (Mayetic), even though it was assigned and deployed by Local Hope headquarters as the default choice for idea sharing organization-wide. Her comment makes it clear that it made so little impact on her as a field user that she appears to have completely forgotten about it when choosing technologies. Next, Participants 27 and 21 amplify Participant 4's technology choice away from Mayetic Village (a.k.a. "web-based" or "CWS") in the field.

"I don't like the web-based because it is too slow."
Participant 27 – Field

"CWS [Mayetic] is not the world's easiest tool. Tends to be slow sometimes. I think in the field that the technology used in the field was HQ-driven. We just did things by phone and email."

Participant 21 – Field

Participant 27 echoes the complaint voiced by Participant 5 earlier, that Mayetic is too slow for the field. She wants to share ideas at the same speed as her work, and clearly her work goes faster than Mayetic. Participant 21 also describes his choice not to use Mayetic similarly, due to Mayetic's slowness,

Alternatively, the Local Hope users below illustrate the headquarters perspective on this idea sharing misalignment.

"For the DAP project [a collaborative project involving American and European headquarters and field personnel], we used the CWS [Mayetic]."

Participant 20 – HQ

"I use Mayetic. It doesn't suck up resources. There are glitches, but it is more stable. It takes my computer longer to boot up with Groove."

Participant 19 - HQ

Here Participants 19 and 20 present different and misaligned choices from their field counterparts. Participant 20 describes a large project involving ideas moving across countries and continents, and cutting across field and headquarters users. In her experience the project, driven by headquarters, worked through Mayetic. Participant 19 not only chooses Mayetic, but describes why she does not choose what her counterparts in the field choose, Groove, providing a succinct statement of the systemic misalignment in idea sharing and hearkening back to previous statements about variable resources and empowerment. Empowerment also emerges as important to the next misalignment, sharing data.

Before exploring that next misalignment, note how for this misalignment and those that follow prior theory (TFR, sense-making and dialectic thinking) helps to articulate the observed user experience. The existing user experience is understood via Orlikowski's use of technological frames of reference (TFRs). Local Hope users' TFRs are not the same and involve multiple technologies. Users' experience and definition of technology do not line up. This creates a gap. The gap, a concept borrowed directly from Dervin's sense-making, makes it difficult for users to use the technology to make sense of their experience. This gap is overcome via another sense-making concept, the tactic. The tactic is users

choosing a different technology. Thus leveraging prior theory to frame user experiences we see that systemic misalignments can be seen coming into being from misaligned TFRs across multiple technologies, and those misalignments further articulated via sense-making's concepts of gaps and tactics. Users execute a tactic to bridge the gap, making a new technology choice to make sense of their experience. For the misalignment in this section about sharing ideas, users greatly differed on their definitions and use of Mayetic. That gap was bridged by field users by employing the tactic, making the choice, to use Groove instead of Mayetic.

For each misaligned technology choice in sections 4.2.1, 4.2.2 and 4.2.3 I trace the use of prior theory as above to make visible how prior theory is used to construct an understanding of the systemic misalignments at Local Hope. For easy reference, I will refer to this use of prior theory as the "TFR/Gap/Tactic" sequence. .At this point, where I am only documenting the misalignments, dialectic thinking is not yet applied. That thinking will be applied in section 4.3 when I examine impacts.

4.2.2 Misaligned Technology Choices for Sharing Data

True to the environmental facets of resource variability and empowerment, we also see differences in user group formation and user group choice in sharing data. To make matters more interesting in terms of systemic misalignments, Microsoft Excel entered the picture as a data sharing user choice on its own. It was not articulated in the original questions, but users repeatedly reported choosing it, or not, to share data. As before, the excerpts below will contrast field and headquarters choices. The field users are shown first.

"If I use Excel, I do something fancy, it stops cooperating."
Participant 21 – Field

"An elaborate Excel spreadsheet for relief distribution tracking in Lebanon became unwieldy and massive. The print out was 40 pages. Trying to figure out a way to translate [it] into something more useful."
Participant 25 – Field

"I send [email] it to people. Figure out who to send it to, give feedback, and get back by this particular date. People know in the [email] group exactly what they are expected to do."

Participant 2 – Field

These high autonomy field users find Excel cumbersome, if not simply unworkable as a data sharing technology choice. Participant 21 expresses frustration at Excel's inability to handle the demands of the work ("stops cooperating"). Participant 25 provides a concrete example of exactly what that inability looks like for users in the field (in Lebanon). All three participants simply choose otherwise, with Participant 2 explicitly stating they often prefer email.

Contrast these typical Local Hope field user Excel choices with the data sharing choices expressed by their Local Hope headquarters colleagues.

"Typically we use an Excel spreadsheet."

Participant 20 – HQ

"If we are working together, I'll insert a question on the Excel spreadsheet."

Participant 13 – HQ

"Workplan and tracking tool in Excel which is a Gant Chart. Clarity on roles & responsibilities and deadlines is the most important consideration."

Participant 15 – HQ

Participant 20 positions Excel as the default data sharing choice, as implied by his use of the word, "typically." Participant 13 takes it even further, explaining how Excel enables him to share data, and even to ask questions of colleagues using it. Contrast this use of Excel with field Participants 21 and 25 rejecting Excel because they experienced it as too "fancy" for the field and could not "figure it out." Perhaps one of the things they could not figure out was Participant 13 inserting questions into Excel sheets. Finally, Participant 15's description of Excel as a superior way to share data and even clarify "roles and responsibilities" around that data directly contradicts Participant 2 in the field.

As shown, field participants did not choose Excel to share data, and certainly not to discuss it, but just sent an email or called. Yet Participant 15, working in a glass and steel headquarters office in Brussels, talks of embedding all that within an Excel Gantt chart. It is hard to imagine how the field participants would describe that complicated Excel tool as anything other than "massive," "unwieldy," or "fancy."

Participant 21, another field user, begins to articulate his fuller experience of systemic misalignments and dialectic impacts.

"I worked on a big proposal in 2002 on the Collaborative Workspace [Mayetic]. I thought it was great. I thought CWS was the next big thing. I tended to think in the field that the technology used in the field was HQ-driven, so I waited for people at HQ to say 'Hey, use this.' [In the field] We just did things by email and phone."

Participant 21 - Field

Participant 21 explains how in the field he would react to, perhaps hope for, headquarters offering technologies to use, but at the same time admits that he would choose as his colleagues in the field did and use email and the phone because those worked for him while the headquarters choices did not. Even as Participant 21 implies a general desire to align technology choices ("thought it was great…CWS was the next big thing…") his statement agrees with previous field participants describing how they would choose technologies to get the work done regardless of headquarters' choices. Overall, Participant 21 describes a system composed of choices made by both headquarters and the field, where those choices may misalign.

Mapped to the "TFR/Gap/Tactic" use of prior theory as done in 4.2.1 for the Mayetic versus Groove misalignment, for this misalignment in data sharing we see something quite similar. Users had different notions of a data sharing technology (Excel or Mayetic), and these different TFRs on multiple technologies show themselves as a gap for field users. Field users execute a sense-making tactic to bridge that gap by choosing (or perhaps more accurately re-choosing) to use phone and email for data sharing. Thus, with prior theory we can frame how this systemic misalignment in data sharing came to be. Next, I will illustrate another prominent systemic misalignment, technology choices for document development.

4.2.3 Misaligned Technology Choices for Document Development

In previous sections we have seen high-autonomy users at Local Hope choose differently and generate systemic misalignments even for interdependent tasks like sharing ideas and data. Document development is another task that participants discussed specifically at Local Hope, and where choices misaligned. As a NGO, Local Hope often depends on document development literally for its continued existence. Poor documents informing donors or in competition for grants mean less money, a lower competitive profile, and a declining organization. Despite this critical importance, consider two Local Hope participants both of whom work in program development.

"For discussion in the document development process we use email."
Participant 6 - Field

Contrast that simple and declarative, "we use email," document development technology choice from Participant 6 with a Local Hope colleague with the same job function, but at headquarters.

"I use Mayetic… can start CWS [Mayetic Village] right away."
Participant 23 - HQ

Participant 22 states Mayetic twice, ignoring email as chosen by Participant 6. Participants 22 and 6 state misaligned technology choices for document development, even though they share the same Local Hope program development job role. Similarly, the following two participants both work in a Local Hope communications role, but express very different choices for the technologies they choose to use for document development.

"We use an email message [for proposals]."
Participant 17 – Field

Participant 17 states a simple declarative choice just as Participant 6 did. They develop documents via email. Participant 22 chooses differently.

"For proposals we usually use Excel."
Participant 22 – HQ

Participant 22 states the technology choice to drive proposals, perhaps the most important documents at Local Hope, is Excel. Note that these last statements are not about general document development, but about a proposal, which in many ways is the lifeblood of an organization like Local Hope that relies on proposals to fund its existence. Systemic misalignments in document development could both figuratively and even literally cost Local Hope if the documents fail to win donor and grant money. Interestingly, recall the misalignment in data sharing, where field users also rejected Excel while headquarters users chose it.

Finally, we see yet another Local Hope user who prefers not email or Excel for proposals, but Groove.

"[In Groove] There is an * [asterisk] if the document has changed since last I've seen it. Can put the cursor over the * to see who's been editing it. All the information is in your face without having to think about it much. It is mostly for working on documents with team members not in HQ. It has become our mini team S:drive - some people on our team don't have access to the S:drive."

Participant 9 - Field

The first thing to note in this rich excerpt is that Participant 9 situates his technology choice directly in one of the facets of the high autonomy environment mentioned earlier – resource variability. When Participant 9 states, "some people on our team don't have access to the S: [shared] drive," it is not just a description of a technology choice, but a statement describing the resource variability of the environment in which that choice is made.

Further, Participant 9's excerpt focusing on Groove as the technology choice for document development also begins to expand our notion of systemic misalignments. With Participants 17 and 6 choosing email, Participant 22 choosing Mayetic, and Participant 9 choosing Groove we see that systemic misalignments in a high autonomy user environment are not simply a matter of choosing either/or. Users are not choosing one technology versus another, or one technology instead of another, and leaving it at that. Instead, a larger array of user choices emerges and those arrays of choices can be seen to align or misalign. This larger, less dichotomous, more systemic nature of misalignments is further illustrated in the excerpts below.

Field Users

"Skype is one. Need something that doesn't need to be on the internet all the time. So Groove is really important. To upload every page every time in the field is icky."

Participant 27 - Field

"In Eritrea… MV [Mayetic Village] was too slow. Not enough people knew how to use it."

Participant 8 – Field

"With Groove, I can see every file on Groove. I can see who put it there, the date, the latest version. It is for working on documents with team members not in HQ."

Participant 9 – Field

Among the three field participants we see a choice for Groove and Skype and against Mayetic. These choices are consistent and one portion, the rejection of Mayetic in favor of other technologies, is consistent with previously seen field choices. In those previous choices, field users repeatedly chose not to use Mayetic and choose instead email and the phone. For these excerpts regarding document development we see users choosing not phone and email but Skype and Groove, but still rejecting Mayetic. Also, note the systemic misalignments are again not about either/or. Choices happen *in addition to* or *on top of* other choices. Field users choose from amongst different technologies, but these document development choices still do not align with headquarters users like those below.

Headquarters Users

"For proposal development, very much so by email. So if there are questions, there would be a series of questions to the field… usually all by email."

Participant 10 – HQ

"90% of the time it is through Mayetic Village."

Participant 22 - HQ

"Even with Groove the versioning problems weren't solved. We use Skype for phone and chat, but not for [document sharing] as IT told us not to."

Participant 5 – HQ

Field users' consistent technology choice of Groove for document development stands in stark contrast to how headquarters users describe their document development technology choices. In the last three excerpts, we see systemic misalignments with field users across document development.

As before in 4.2.1 and 4.2.2, the "TFR/Gap/Tactic" sequence traces and allows us to articulate this document development misalignment. Similar to previous misalignments, the technologies are Mayetic and Groove. Users demonstrated different notions of Mayetic as a document development technology. These different TFRs created a gap, again for field users who executed a tactic to bridge that gap by choosing to use Groove instead. These varied systemic misalignments in document development and idea and data sharing are important. Recall, however, that systemic misalignments are not dialectic impacts, and that seeing and beginning to understand the nature of dialectic impacts in a high autonomy environment is the ultimate purpose of this case study. To recall from Chapter 1, dialectic impacts emerge from systemic misalignments. Thus, while this section has organized systemic misalignments in a "stand-alone" fashion in order to illustrate them, this case showed dialectic impacts can be successive or evolutionary. For all of the misalignments detailed above, the user choices motivate impacts. It is in the next section that I examine the choices as impacts and use structurational thinking from Orlikowski's use of Giddens' prior theory to show how those impacts are dialectic.

4.3 What kinds of dialectic impacts can we see resulting from misaligned user technology choices in a high autonomy environment (like Local Hope)?

This section describes dialectic impacts motivated by the three previously described systemic misalignments – idea sharing, data sharing and document development. I describe each choice as an impact. It impacts, changes, the system. Prior work from Orlikowski's use of structuration theory combined with TFR and sense-making allows us to see that not only is the user choice an impact, but a dialectic impact since users choices do not replace other choices, but happen on top of and interact with other choices.

The dialectic impacts are visible in the Local Hope case. To preview across the Local Hope case, first, Local Hope headquarters IT chooses Mayetic in reaction to users' demands for better collaboration worldwide. Second, as an alternative to Mayetic, some Local Hope field users choose Skype and Groove. This choice moves across many Local Hope users, both field and headquarters, as users accustomed to using only email, Excel and the phone, and disappointed with Mayetic, choose Skype and Groove. With these, we see two dialectic impacts at Local Hope: the choice to introduce and use (or not use) Mayetic and the successive choice to Skype and Groove. The next sections unpack these impacts as dialectic.

4.3.1 The First Dialectic Impact - Users Choose Mayetic Village

The choice to use Mayetic was made prior to data collection and after the recognition by Local Hope headquarters of what this case calls existing systemic misalignments. Local Hope users reportedly demonstrated different notions and different uses, and thus chose different technologies to accomplish those shared tasks. To bridge all the gaps for all Local Hope users at once, Local Hope HQ attempted a tactic of choosing a viable alternative for all Local Hope users, one that could be controlled by Local Hope IT at headquarters. Thus, the systemic misalignment generated by Local Hope users' variable choices for Excel, Email, or the phone motivated a new choice, Mayetic.

Recall that Mayetic is a web-based collaboration tool Local Hope headquarters users chose in response to user needs for better global collaboration. Local Hope headquarters sought to move all Local Hope users onto it. In the data, it is clear not all user choices aligned prior to Mayetic's introduction. In keeping with a high autonomy user environment, different Local Hope users chose to use Mayetic differently if at all. A number of Local Hope users state in the data their choice to use "phone or email" instead of Mayetic. This choice of Mayetic, made in reaction to existing choices, was the first dialectic impact observable in the data.

To begin to illustrate this dialectic impact, some of the participant quotes offered earlier pertaining to the choice of Mayetic are gathered in Table 6 for easier comparison.

Table 6. Examples of Mayetic Dialectic Impact

Field Staff	Headquarters Staff
P4 “I have not heard of it [Mayetic].”	P22 “90% of the time it is through Mayetic Village.”
P22 “CWS [Mayetic] is not the world’s easiest tool. Tends to be slow sometimes. I think in the field that the technology used in the field was HQ-driven. We just did things by phone and email.”	P20 “For the DAP project [a collaborative project between American and European headquarter offices], we used the CWS [Mayetic].”
P2 “We couldn’t use MV [Mayetic] in Africa – too slow.”	P15 “Workplan and tracking tool in Excel which is a Gant Chart. Clarity on roles & responsibilities and deadlines is the most important consideration.”
P6 “For discussion in the document development process we use email.”	P4, “For proposals we usually use Excel.”

The different user choices indicated in Table 6 can also be seen graphically in Figure 4.1.

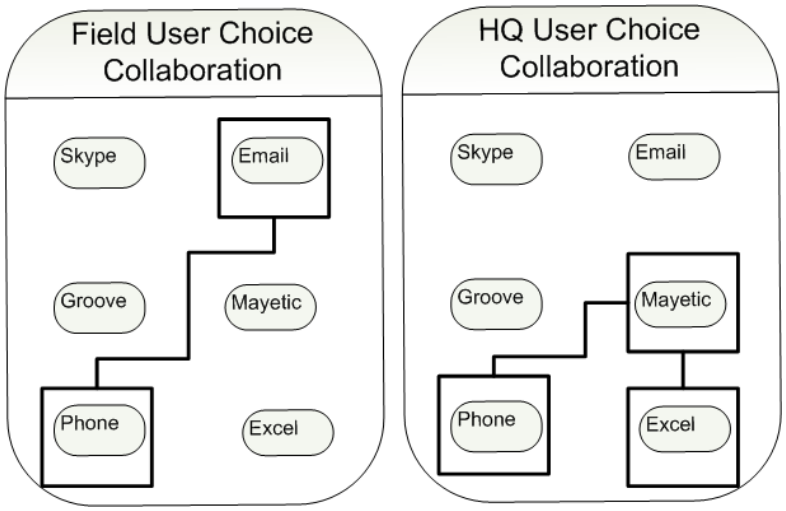

Figure 4.1 –Dialectic Impact of Headquarters Choosing Mayetic

As Figure 4.1 illustrates, headquarters users chose to use Mayetic and field users did not. This choice for Mayetic in reaction to existing choices was the first dialectic impact. Local Hope users reacted to myriad existing choices (shaped by the environment) and then chose Mayetic (shaped the environment). It provided both a new user choice and a new potential for misaligned choice if users chose something besides Mayetic. And some users did choose something else. Borrowing from Orlikowski's use of structuration, the dialectic nature of the impact becomes clear.

Recall that Orlikowski used Giddens' structuration theory as a way to see how people both react to and define their environment as users. Orlikowski's conceptualization of Gidden's dialectical thinking into information systems shows that people both shape and are shaped by their technology environment. This thinking applied to the first Local Hope impact demonstrates that impact's dialectical nature. Local Hope users at headquarters chose a technology, Mayetic. The HQ users who chose and introduced Mayetic shaped their environment, but in turn are shaped by it as other Local Hope users do not choose Mayetic, but instead react to the changed environment the Mayetic choice created by choosing yet a different technology.

By further examining it through the use of the thinking detailed in the literature review: TFR, sense-making and structuration, the differences in users' understanding of the existing environment is understood via TFR's use of technological frames of reference. Local Hope users' TFRs do not line up, across multiple technologies, creating a gap. The sense-making gap concept shows users technological frames of reference on various technologies misaligning. This gap is overcome with a sense-making tactic when users choose a different technology - Mayetic. The dialectic in structurational thinking adds to this previously demonstrated sequence of prior theory. The impact of the choice is seen as a dialectic impact since users both shape and are shaped by their environment. They shape it by their choice, which is a dialectic impact because it then shapes them when other users choose a different, second technology in order to bridge their gap with the first technology. With this, we see the full sequence of how prior theory is used to construct the high autonomy dialectic (HAD. Users dissatisfied with Mayetic chose a new, different technology altogether, Skype and Groove. This second dialectic impact – users choosing Skype and Groove - is detailed in the next section.

4.3.2 The Second Dialectic Impact – Users Choose Skype and Groove

Not long before I collected data from the 24 Local Hope participants, Skype and Groove were introduced without the sanction of Local Hope IT as an alternative to Mayetic through the choices of field users. In the previous section 4.2.2. on systemic misalignments in document development, field users reported choosing Skype and Groove for shared tasks previously handled by email and Mayetic. Thus, once the field chose Skype and Groove, field staff and headquarters staff consistently differed in their choices. This is the second dialectic impact, the choice of Skype and Groove by field users.

This impact was not without tension, as some of the participants illustrated earlier in their excerpts. Participant 13 thinks he has the answer to this tension.

"If we can get everyone on Skype, we can do it that way. Skype is instant. When a response comes in, I am notified. Seems a lot easier and quicker. No sifting through emails. I don't use Outlook. There is an enhanced version at HQ that's better, but we don't have that… With Skype, we can call computer to computer. It is a great way to get questions answered, and it is not a long-distance phone call."

Participant 13 – Field

Participant 13 expresses a perhaps natural and common reaction to the proliferation of technologies resulting from user choice. Enforce a single way of doing things – limit choices. Participant 13 thinks everyone should use what he himself finds useful. As seen previously with the first dialectic impact, artificially limiting user choice not only constrains users ability to do what they know is necessary to succeed, it drastically limits insight that could be used to design more responsive and effective systems. This restrictive view diminishes the importance of users. It also, as shown by the first dialectic impact above, will not likely work as users in high autonomy environments will choose in reaction to existing options they do not prefer.

Additionally, recalling Paul and Davenport from the literature review, this tendency to fight user choice is destined to fail – particularly in high autonomy user environments. The first dialectic impact (headquarters users choosing Mayetic and attempting to enforce it as the default worldwide) shows concretely how this approach simply did not work at Local Hope. Ironically, Participant 13 can compare Skype to Mayetic (or email or anything else) only because his counterparts in the field chose something

in reaction to the "approved" choice of Mayetic. Enforcing a single choice did not work for Mayetic, it is hard to imagine how it would work for Skype or Groove in a high autonomy environment.

The workability of the suggestion aside, Participant 13's excerpt is particularly helpful in illustrating this second dialectic impact. In the above excerpt Participant 13 addresses most of the issues raised so far: resource variability, variably empowered users, systemic misalignments between user choices, and the description of a dialectic impact unfolding. Resource variability is shown in the, "we don't have that," and, "not a long-distance phone call," comments. Variably empowered users is addressed in the "we can call computer to computer," and, "great way to get answers," in that users need not depend on HQ IT. Also, Participant 13's statement pointedly focuses on the systemic misalignments already documented between headquarters and the field. Finally, dialectic impacts are addressed in the opening line, "If we can get everyone on Skype…" This statement can only be uttered by Participant 13 because user choices for Skype and Groove have dialectically impacted the system. The system is different than it was before only because users chose Mayetic in reaction to their environment, and then chose Skype in reaction to Mayetic.

Table 7 below organizes additional participant excerpts from Local Hope representing how the field and headquarters users chose Skype and Groove in reaction to existing technologies.

Table 7. Examples Skype and Groove Dialectic Impact

Field Staff	Headquarters Staff
P27, "Skype is one. Need something that doesn't need to be on the internet all the time. So Groove is really important. To upload every page every time in the field is icky."	P4, "For proposal development, very much so by email. So if there are questions, there would be a series of questions to the field… usually all by email."
P13 "With Groove, I can see every file on Groove. I can see who put it there, the date, the latest version. It is for working on documents with team members not in HQ."	P5 "Even with Groove the versioning problems weren't solved. We may use Skype for phone and chat, but not for file transfer [document sharing] as IT told us not to."

P27 “I don’t like the web-based [Mayetic] because it is too slow.”	P19 “I use Mayetic. It doesn’t suck up resources. There are glitches, but it is more stable. It takes my computer longer to boot up with Groove.”

The dialectic nature of the impact of users choosing Skype and Groove can be seen in participant data. For example, had the field users not independently chosen Skype and Groove it is hard to imagine the following excerpt from Participant 14, who articulates a gut-level understanding of this second dialectic impact of users choosing Skype and Groove at Local Hope.

“I use MV, but with people at HQ for internal matters. I use Groove with the field [as] there is better connectivity. HQ uses MV but HQ IT is seen as less friendly to Groove. One of the biggest challenges is dealing with both headquarters and the field.”

Participant 14 – Field

Participant 14 describes the concrete results of this second dialectic impact. She chooses Skype and Groove over (and in reaction to) Mayetic but admits this creates “challenges” in reconciling the misalignments between field and headquarters. The field chose to use Skype and Groove and not the previously aligned email and Excel or Mayetic as chosen by headquarters users. As a result, this dialectic impact lands on Participant 14’s desk (if she has one in the field) in the form of increased choice, and in Participant 14’s words, “challenges.” This is another example of one user group’s choice dialectically impacting the system. Participant 14 states, consistent with previous data that, “I use Groove with the field,” and in the same breath states that, “HQ uses MV,” and ends it by saying that dealing with both is, “one of the biggest challenges.” That challenge is the systemic misalignments motivated by the dialectic impacts of headquarters choosing MV, the field choosing Skype and Groove, and participant 14 experiencing both while working in the field - in a hot, dusty refugee camp teeming with desperate people in a drought stricken African nation teetering on failed-state status. Figure 4.2 illustrates all this.

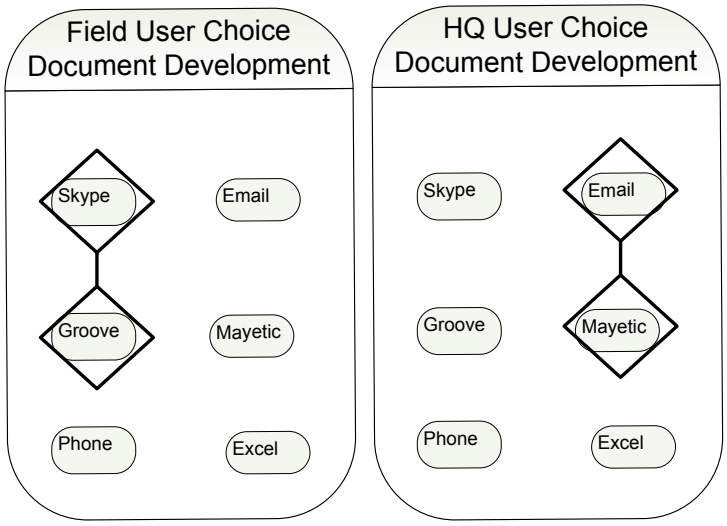

Figure 4.2 –Dialectic Impact of the Field Choosing Skype & Groove

It is important to emphasize that as seen through the combination of prior theory that is the HAD, user choices do not replace each other. One choice does not overwrite the other. Users experience differences in technologies, which creates gaps, which are overcome by tactics (choices), which in turn create impacts. These impacts are dialectic because they both are shaped by and shape the system. And in high autonomy environments like Local Hope, dialectic impacts persist because choices may proliferate. Users' choices impacted Local Hope, and as a result the system itself changed. Now, users choosing technologies are able to choose differently than before. The users choosing Skype and Groove made a second dialectic impact just as the users who chose Mayetic made the first dialectic impact. User choices both shape and are shaped by their environment. The impacts are evolutionary and successive. They build on each other, just as Gidden's dialectic thinking described.

User choices impact the system by changing the environment, one choice did not replace the other, but happened on top of other choices. And as Figures 4.1 and 4.2 illustrate, these dialectic impacts are not distinct and separate, but co-occurring and perhaps even overlapping. Dialectic impacts can be thought of as combining in a high autonomy environment. This potential for dialectic combinations is discussed in the next chapter.

4.4 Findings Summary

The findings included showing what about high-autonomy user environments may contribute to user choice, examples of systemic misalignments found in a high-autonomy user environment, and examples of the dialectic impacts misaligned user choices can create. Each of these findings was offered through the lens of prior theory combined to demonstrate the high autonomy dialectic (HAD). The high autonomy dialectic, constructed of and extending prior theory, allows us to see and analyze the data in order to see and examine these dialectic impacts.

After providing the three example facets of the high autonomy user environment seen in the Local Hope data, I detailed two successive dialectic impacts: the choice to introduce Mayetic and the choice to introduce Skype and Groove. These two impacts are dialectic as they both shape and are shaped by the Local Hope user environment. Thus, looking at the case of Local Hope through the HAD we see profound impacts motivated by user choices. User choices propelled changes in their environment, with user choices occurring on top of other user choices.

Chapter 5: Discussing Choices on Top of Choices

2. Provide further abstraction about how dialectic is not just a succession of changes

a. Describe the tension of local versus global organizational perspective

b. Better articulate the "archeology idea" of using the dialectic approach to dig up and see the users creating systems

c. Better articulate the assertion that by tracing back through people's choices, designers can use this information and perspective to do a better job.

As seen in Chapter 4, a system like Local Hope can be understood as dialectically composed of user choices. Users choosing different technologies, particularly for shared tasks, can generate a systemic misalignment. If users in that system, experiencing that misalignment choose a different technology that new choice can be a dialectic impact. The new choice impacts the system. It is dialectic because it was both motivated by previous choices and in a high autonomy environment other users may or may not make the same choice – or choose a wholly different technology. The choice both shapes and is shaped by the environment. Combining prior theory into the HAD allows us to intellectually organize these choices as dialectical and frames those data for analysis and insight.

Discussing the Local Hope findings of systemic misalignments and dialectic impacts brings us back to the brainstorming session called by Local Hope management to discern and correct the failure of the new global collaboration and communication technology rollout. You may recall that it was the senior field manager who had seen her share of inter-cultural disagreements who suggested that Local Hope was arguing over different perspectives on systems. Her description of it as cultural miscommunication makes sense considering she views things from her experience as an international humanitarian relief expert.

In HCD, however, we see things differently. Our charge is to understand, advocate, and insist on design for or even by users; to narrow the distance between what is designed and what is desired through the careful, empirical, observation and analysis of users. The high autonomy dialectic (HAD), built from TFR, sense-making and dialectic thinking allows us to see and analyze the empirical data of user choice

underneath these systems changes. The high autonomy dialectic allows us to see a high autonomy user environment, like Local Hope, as a system dialectically constructed of user choices. It also allows us to interpret those empirical findings in human centered design terms to influence systems design in favor of users.

To discuss the findings of the previous chapter, the next two sections do two things. The first section, 5.1, discusses how the HAD helped to illustrate the impacts of user choice in Chapter 4. The second section, 5.2, demonstrates using the HAD, this time on yet another dialectic impact from Local Hope.

Chapter 5:

5.1 Illustrating Dialectic Impacts at Local Hope With The HAD

Local Hope is a case study revealing how user choices are part of, and impact, the larger system. The case illustrates how Local Hope is a dialectic construction of user choices. We see a system that is composed of user choices in a high autonomy environment with variable resources, levels of empowerment and user groups, and we see examples of the dialectic impact of user choices. We see how insight can emerge from focusing on users' technology choices in high autonomy environments like Local Hope. We see how systemic misalignments occur for sharing data and even sharing ideas occur. These different technology choices when taken together begin to paint a picture of systemic misalignments indicating an emergent and living system of user choices. Reviewing Tables 6 and 7 illustrating user choices helps to illustrate this.

From this view, the HAD helps to illustrate the power of user choice, and suggests the potential of harnessing that user power for better HCD research and practice. Users profoundly impacted their system by choosing. Whether that user power is illustrated by users in tents in Africa or by headquarters users in climate controlled offices, HCD can leverage our expertise and help to improve users' experiences in these dialectically impacted systems if we view systems as dialectic constructions of user choices.

The systemic misalignments between all these user choices becomes impossible to ignore. It becomes, as Participants 14 and 16 both independently described it, "a problem," and that "problem" illustrates the

dialectic impact of user choices. Users constructed a system out of their choices, and the system was not meeting their needs at a global level. In an environment now changed by the two previous dialectic impacts, Local Hope senior management makes a technology choice of a sweeping nature, announcing an initiative for a total global systems redesign.

Organizing and viewing Local Hope participants' data through the HAD we see systemic misalignments grow and proliferate across Local Hope as result of user choice, even for a critical shared activity for people within the same organization; even the same job role. We begin to see the depth of systemic misalignments in high-autonomy user environments. Even for critical, shared activities such as proposal writing, Local Hope users made choices which generated misalignments that reverberated literally around the world. Local Hope's emergent, living system of high autonomy users both changed and was changed with each user choice. The sections below discuss these impacts as identified in Chapter 4.

5.1.1 Illustrating The Personal Depth and Importance of Choice Through the HAD

If we understand user group formation in a high autonomy user environment through the HAD we can see how systemic misalignments can be situated through variable resources, variable empowerment, and organizational distance (all facets of prior theory). These organizationally distant user groups forming along the lines of resources and empowerment are relevant to understanding the dialectic impact of user choices because they illustrate how users see themselves, and not just their choices, aligning in a high autonomy user environment.

By understanding that users combine into groups, that those user groups make choices which impact their environment, and that those choices may be attributable to differences in resources and empowerment, we are better able to use the high autonomy dialectic to inform research and design. Seeing the issue as not just providing a choice everyone can agree on but instead as identifying and providing a way to address underlying differences which motivate user choices could lead to narrowing the distance between what is designed and desired in a high autonomy user environment.

For example, previous excerpts in Table 6 begin to illustrate and humanize the personal depth and investment users have in choosing technologies. In making up the job as she goes along, Participant 2

provides an initial glimpse into why users will make choices even knowing those choices may complicate things. She was making up the job as she went along and needed to exercise the same level of choice in technology as she did in the job she was making up. Additional excerpts show that user choices amongst available resources are important in a high-autonomy user environment. These Local Hope users also begin to describe resource variability as a natural part of their high-autonomy work. Thus, in high-autonomy user environments people may make their jobs up as they go along and users need a corresponding ability to choose technologies from available resources. Those resources may vary, both in terms of their utility and their accessibility, as represented by Local Hope. In these environments, the HAD helps to identify the personal depth and importance users place on the technologies they choose, and helps to organize and analyze the data.

5.1.2 Illustrating The Mayetic Impact Through the HAD

The first impact in Chapter 4 links together the environmental facets of resource variability, the formation of user groups along the lines of organizational distance and a misalignment in idea sharing. Participants 4, 5, 21 and 27 from the field explicitly reject Mayetic as a poor idea sharing choice. Participants 19 and 20 from headquarters, on the other hand, choose Mayetic and even state why headquarters may reject Groove – the field's choice for idea sharing. In the case of both groups they state reasons of resource variability consistent with the resources in their experience of organizational distance. Headquarters users declare directly that they choose Mayetic, even while their field counterparts openly reject it. Participant 19 even insinuates some frustration ("doesn't suck up resources" and "more stable") with his field counterparts' technology choice in proactively stating why Mayetic is preferable to Groove. Also, for a project involving many different users from both the field and headquarters offices (the DAP project), Participant 20 states the project was run on Mayetic – a technology choice repeatedly rejected by field users. One wonders how the field personnel experienced the DAP project on Mayetic.

Thus we have a situation where not only are users grouped by organizational distance, but those groups are choosing different technologies to perform a critical task in their high autonomy environment – idea

sharing. Some users even consciously recognize this fact, but still choose as they see fit. This is consistent with the facet of empowerment described earlier.

In addition to Mayetic, users chose differently when it came to Excel as well. Participant 21 explains how Excel is a poor choice for him. Participant 25 goes further still in explaining how Excel literally does not work in the field. Her description of an "unwieldy and massive" thing she still has not been able to "figure out" becomes even more damning when you consider the context of use in the field. Imagine her sitting in a modular surplus military shelter in the 110 degree Lebanese desert, in a combat zone, "trying to figure out a way to translate [Excel] into something useful," and you quickly realize why the field user group rejects Excel and just does what various field participants state - just email information back and forth. In her experience as a field user, Participant 2 she states that with a simple email, "people know…exactly what they are expected to do." Contrast that with Participants 21 and 25 describing Excel as a "massive," "unwieldy," and "fancy" thing that stops cooperating while they stand in a makeshift shelter 50 feet from an open pit toilet, surrounded by 10,000 civil war refugees seeking a way to feed their children.

5.1.3 Illustrating The Skype & Groove Impact Through the HAD

The excerpt from Participant 21 on idea sharing helps to build an understanding of this impact. Participant 21 describes experiencing HQ rolling out technology that does not work for the field. He states he (and he includes his field colleagues by saying "we") chose differently than the HQ deployed options like Mayetic. Here we not only have a field user giving a reason to choose differently, but a user stating he (and implied in his "we") and other field counterparts chose differently – and stating the other choices made. Using the HAD we can see the statements of these Local Hope field users indicating a systemic misalignment in technology choices used to share ideas.

They are conscious of that misalignment with their headquarters counterparts, but do not seem worried about it, as indicated by Participant 21's final sentence ("We just did things by phone…"). Participant 21 amplified the systemic misalignment for us by explicitly stating that technology choices tend to be pushed to the field, but the field continues to choose technologies they believe fit better, recalling Participant 2's "making the job up as I go along" excerpt.

Together, user technology choices between Mayetic and Groove for idea sharing and between Excel and email and the phone for data sharing illustrate two systemic misalignments. Recall, however, that just as this case study is not only on the facets of a high autonomy environment, it is also not only about misaligned technology choices. It is about the eventual dialectic impacts of those misaligned user choices on the system. Using the HAD to see the impacts of misaligned user choices means using Gidden's and Orlikowski's dialectical thinking incorporated into the HAD to see a fuller picture. From the dialectic perspective of the HAD, impacts will not stop so long as users choose. User choices motivate impacts which are evolutionary and successive. Each choice may motivate a slightly, or very, different user environment from the original user environment that existed prior to the dialectic impact. The next section discusses using this dialectic view through the HAD.

5.2 Using the HAD to Understand Dialectic Impacts

This capability of the HAD to help us see and analyze the dialect impact of user choices is important, and a logical extension of previous research. Recall that Orlikowski admits her work falls short in high autonomy contexts because, "Empirical research is needed to determine the forces motivating the conception, development, *and use of technologies* with different degrees of interpretive flexibility and to *assess their integration with social practices and organizational forms*." [emphasis added] (Wanda Orlikowski, 1993). By combining her work with that of Dervin to form the HAD, this dissertation begins to examine how the choice of technologies both impacts and is impacted by social practices and organizational forms.

If we look at the Local Hope user experiences through the intellectual composition of the HAD, we can see how Local Hope users experience an existing system state and that their opinions of those technologies can be described as technological frames of reference (TFR). Then, across many tasks and technologies at Local Hope, this initial state can be thought of as an (unworkable) proliferation of TFRs. Next, we see users experiencing a difficulty in the use of those various technologies, and sense-making allows us to see these difficulties as discontinuities, as sense-making gaps. Sense-making provides an organizing principle for the subsequent choices that users make to overcome their

discontinuities – the tactic. These tactics are the new choices users make when faced with their difficulties, and they choose many different technologies used in a variety of different ways. To accommodate this, the HAD combines TFR and sense-making to provide the intellectual foundation to see users experiencing technologies differently and choosing other technologies in reaction to their different discontinuities. Finally, as we see that users' choices are made not *instead of* but *on top of* or *in addition to* previous choices, it is the dialectical thinking from TFR and ultimately from Giddens that allows us to understand how these compounding user choices are dialectic. They are successive and evolutionary. Users' choices have been made in reaction to an environment, but an environment which their choices thus impact and thus change. An example of applying the HAD to an overall group of user choices is detailed in the next section.

5.2.1 A Third Potential Dialectic Impact - Illustrating A System Redesign as a Dialectic Impact with the HAD

Field and headquarters users choosing differently add up to a system where different users are literally working in different systems composed of different choices. As Mayetic was chosen by headquarters users, field users did not choose Mayetic. This choice impacted the system. Eventually field users' chose Skype and Groove instead, generating a previously unseen systemic misalignment between Mayetic and Skype and Groove users. Excel, email and phone choices impacted Local Hope similarly.

As described previously, all the misaligned choices and impacts proved too much for Local Hope's users, IT staff and management. Management launched an initiative to undertake a global system redesign of how Local Hope staff shared data and ideas. The global redesign initiative could itself be seen as a dialectic impact as it was motivated by previous user choices and promises to be an important part of Local Hope's high autonomy user environment - which in turn promises to motivate further and different user choices. The reason it is not listed as one of the dialectic impacts identified as a finding in Chapter 4 is that Local Hope had not made any choices yet for the redesign as of data collection. Since no choices had occurred, no impact was demonstrated in the data. Instead, this section examines how to use the HAD composed of prior theory to unpack a fuller picture from user data and glean insight.

As shown in Chapter 4, user choices dialectically impacted the Local Hope system. The simple figures below are the graphical representation of the "TFR/Gap/Tactic/Impact" prior theory used to create the HAD and unpack findings. Understanding where user choices such as those in section 4.2 are aligned or misaligned across a system can be seen through the comparison of user choices. The first two dialectic impacts from Chapter 4 (shown again for reference in Figures 5.1 and 5.2.) are combined graphically in Figure 5.3 below to illustrate multiple impacts generated by the successive user choices in this case.

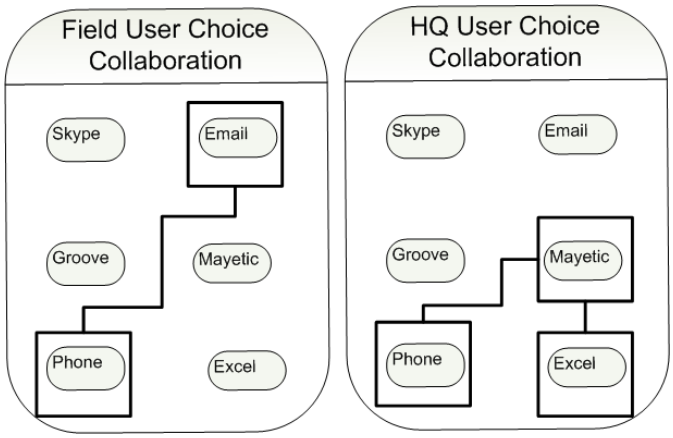

Figure 5.1 – Dialectic Impact #1: HQ Users Choosing Mayetic

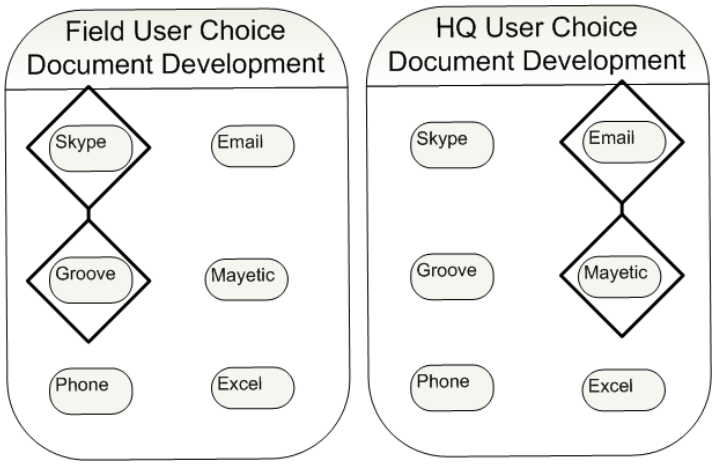

Figure 5.2 – Dialectic Impact #2: Field Users Choosing Skype and Groove

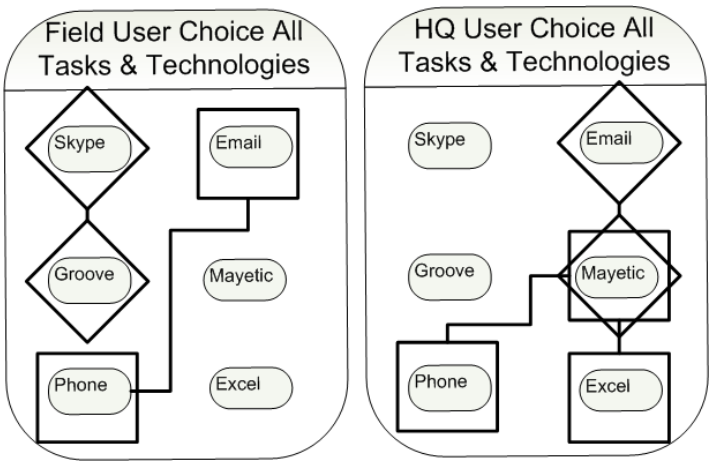

Figure 5.3 – Dialectic Impact #3: Combined Systemic Misalignments Motivating Global Systems Redesign

Figure 5.3 illustrates the combined dialectic impacts of headquarters and field choices. Field and headquarters users choosing differently add up to a system where different users are literally working in different systems composed of different choices. As Mayetic was chosen by headquarters users, field users did not choose Mayetic. This created yet another systemic misalignment. The dialectic impact occurs when field users' chose Skype and Groove instead of Mayetic, generating a new, dialectic impact between headquarters users choosing Mayetic and field users choosing Skype and Groove. The HAD shows how user choices both shape and are shaped by the system. Choices impact the system.

Specifically, this demonstration of combining user choices to illustrate the power of users to both choose in and thus change their environment draws directly from the structuration theory pioneered by Giddens and brought into user research by Orlikowski. These choices (users choosing Mayetic, other users then choosing Skype and Groove) were made both in reaction to and motivated by the new user reality their choices helped construct. The user choices themselves impacted and helped to make a new system in which users would make yet another choice – which could be yet another impact.

Without the HAD combining technological frames of reference, sense-making and dialectical thinking through which to see Local Hope users and their technology choices, one could simply say Mayetic failed field users. Or that Skype and Groove failed headquarters users. Or that users like Participant 14 are destined to suffer as users work outside the "approved" technology choices as suggested by

Participant 13. Instead, as part of the HCD scholarly conversation, this dissertation continues and extends the work on which it was built as it demonstrates these kinds of user choices are dialectic impacts. These successive, evolutionary, dialectic impacts result in a system composed of user choices which we can see through the HAD, as graphically represented in figure 5.3.

When seen in Figure 5.3, the successive and combined effect of the first two dialectic impacts is impossible to ignore, as Participants 14 and 16 from the field and headquarters told us when they both intuitively called it a problem. Local Hope users constructed systems out of choices, but they were different systems. And so Local Hope management launched an initiative to create yet another choice in the system. This third potential dialectic impact is not seen directly in Figure 5.3, but its basis is shown when seeing how field and headquarters users operate in two different systems composed of different user choices and knowing that Local Hope management began seeking a way to make sense of these different systems. This in turn motivated the third potential redesign dialectic impact. This further illustrates how the HAD can be thought of as an intellectual thread going from multiple technological frames of reference to sense-making moments and tactics, to dialectic impact as framed by structuration.

This global redesign itself promises to be a dialectic impact as it is a choice built on previous user choices. The redesign choice is both shaped by and shapes the system previously constructed by other user choices. It reinforces that the Local Hope system is a dialectic construction of user choices. Users made choices on top of choices, reacting to and impacting their system, and eventually the collective misalignments and resulting impacts are too much for the users too successfully navigate. The global redesign, the third dialectic impact, promises to be an important part of a Local Hope's high autonomy user environment. Technology choices will be introduced and change the system. This will in turn motivate further and different user choices. This reflects a growing reality not just at Local Hope, or in organizations similar to Local Hope. This reflects a larger shift in how users operate and their power to choose not just technologies but to choose variably and create systems from those choices.

5.2.1

5.2.2 HCD Archaeology – Seeing Dialectic Impacts As Layers

As with any idea, there is more than one way to see and explore the dialectic impact of user choices. In an effort to more fully articulate how dialectic impacts seen in the Local Hope data are not simply a succession of choices, I will employ a metaphor from a different field which, like HCD, often reconstructs people's experiences based on traces they leave behind – archaeology.

In figure 5.4 below, I recount the choices identified as impactful in Chapter 4 and made by both field and headquarters user groups as visual layers, as choices on top of choices. If the Local Hope system which users experience is understood as the whole triangle, you can see how users both are shaped by and shape their system with each choice. It is not simply about one choice after another successively, which would construct not a triangle but a straight line. Rather, each choice is shaped by the environment before it, choices rest on and are shaped by previous choices and each choice thus dialectically shapes the system. This dialectic impact of choice can be seen by the changing of the triangle with each successive choice. Choices are not simply happening one after the other, but impacting the system dialectically – shaping and being shaped. The triangle is a base on which a new choice is made, and that choice expands the triangle, it impacts the system. If we trace back we can see a reconstruction of users' choices.

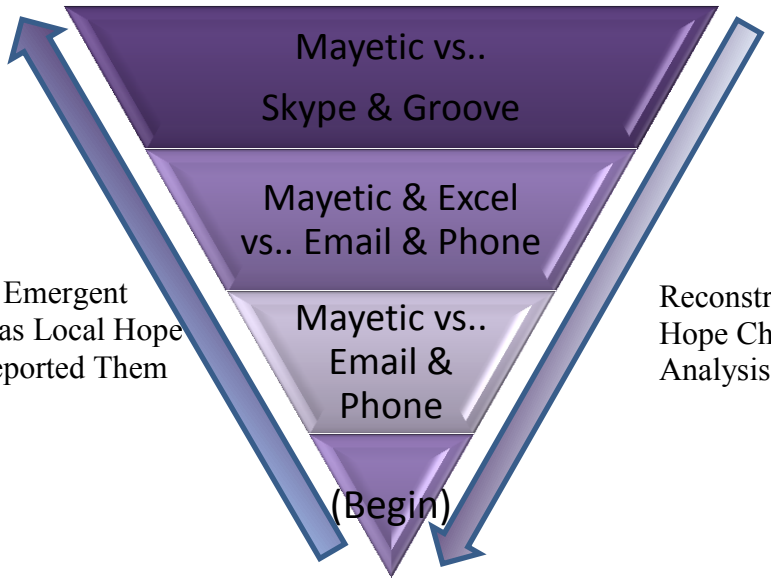

Figure 5.4 – Seeing Local Hope Choices and Dialectic Impacts as Layers

If I extrapolate the use of this representation of the HAD where we are tracing choices on top of choices, I assert that "digging down" into users choices could provide useful insight for HCD practice. For example, to understand how investigative field users and their colleagues both at headquarters and in other field roles have constructed a system, we could start with their current choices, and trace back down. In this thought experiment, these users have constructed their system out of four technology choices, A, B, C and D. All the choices are there in the system. Tracing down to understand which user or user group made each choice (shaping) and in reaction to what choice in their current environment (shaped by) provides the opportunity to elicit and understand users' desires and demands of technology when they made the choice, and to see how the whole system was impacted, re-shaped, by that choice. In this way, the HAD suggests a way to not simply list out the successive choices of users, but to structure and analyze the dialectic impacts of those choices on the system in which they occur. It allows a better framing of why users choices as they did, or did not, and a way to see how their choices may have impacted the system in which they all reside. Additionally, I can imagine using this same approach over time if the designer or researcher has time to patiently collect data on choices as they unfold in an organization.

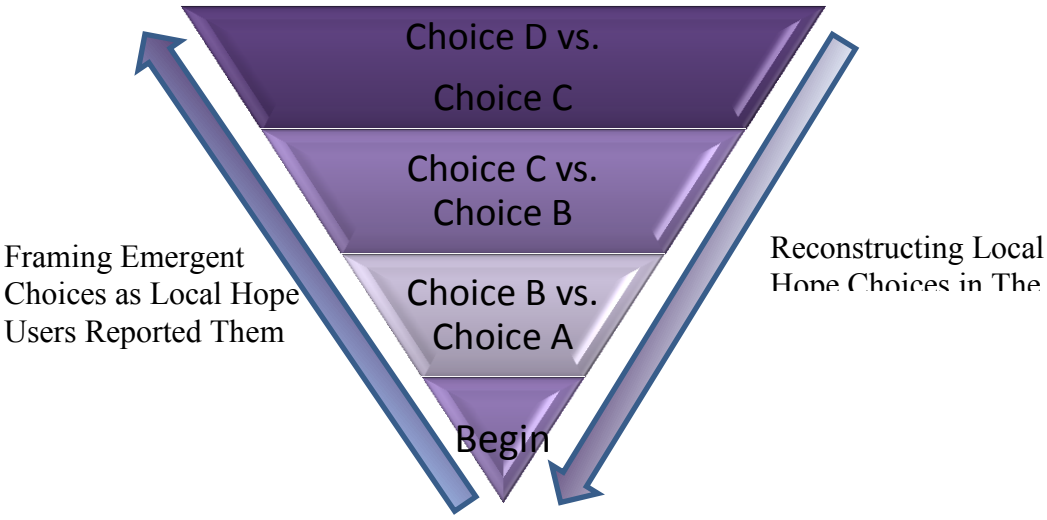

Figure 5.5 – Seeing Dialectic Impacts as HCD Archeology

This representation of choices and dialectic impacts also recalls an assertion I made earlier in section 4.3.1 regarding the tension between the field and headquarters users groups. I stated that some may assume that this tension is negative or destructive, but the tension could also be seen as users' collectively exercising their autonomy to create a more functional system based on their choices. In a high autonomy environment, such as Local Hope, tensions between user groups may be inevitable. In such environments, using a dialectic perspective to understand the choices different users or groups are making and the possible impacts of those choices on the larger system of which they are a part could lead us to seeing that tensions between users groups (like field/headquarters) may indicate a healthy system attempting to be as useful as possible to all of its users. Using tensions and choices to see systems and users in this way suggests expanding on the HAD to include many of the prior works cited including the dialectic thinking of Orlikowski, the individual sense-making actions of Dervin, the ecological emphasis of Davenport, Galal and Paul, the iterative and empirical focus of Gould and Lewis, and Bertalanffy's expression of open systems, motivated by his work as a biologist.

With multiple ways to see and manipulate users' data as they construct systems dialectically out of their choices, the dialectic perspective suggests a useful way to investigate a burgeoning reality for most users in most environments – their ability to choose. Some considerations of what that may mean for the future are in the next and final chapter.

Chapter 6: A Dialectic Future in Human Centered Design

High-autonomy user environments pose fascinating and critically important user research questions. Considering the urgency, scope and importance of many of these high-autonomy user environments (e.g. humanitarian relief, disaster planning and recovery, technological implants for the disabled), or the widespread nature of other high-autonomy environments (e.g. smartphones, your car, your house) the need for ways to empirically investigate and understanding these human systems grows with each passing day.

As a user research community, we hold expertise that could directly benefit the quickly growing number of users with the power to choose, including those who seek to help the least fortunate even as their technological options explode. For example, the exponential increase in internet-enabled cell phone adoption in the developing world leads to interesting research questions about how local residents, emerging businesses and humanitarian relief workers' technology choices do or do not align and what that means about the systems they are constructing together out of their choices.

This research points to a possible path for future researchers in this area and many others. The high-autonomy dialectic could provide a way to understand how systemic misalignments between two or more user groups who share a common goal motivate yet different user choices, which in turn dialectically impact the shared system. Whatever the specific topic, our professional community can do research that answers interesting intellectual questions, impacts daily practice, and makes a substantive positive difference.

The previous literature in technical communication, information systems, and human centered design provided strong building blocks for this new perspective. Leveraging the insight of these previous works, the high autonomy dialectic is a nimble, theoretically vigorous framework based on widely used prior theory which can help HCD investigate and better understand the impact of user technology choices in high-autonomy user environments. The high-autonomy dialectic allows us to see how high-autonomy

users motivate dialectic impacts through choice. From this perspective, the system is both the outcome of user choices and the medium by which users reshape those practices through their choices.

Allowing a researcher to specifically focus on and thus better understand and generate insight into the dialectic impacts of user technology choices can enable a deeper, more systemic understanding of how users create change by choosing in environments like Local Hope. As shown, this meant leveraging the intellectual power of traditional, rhetorical technical communication, the expanding systems-level thinking occurring in human centered design and the more organic, qualitative perspectives from information systems. Combining this proven prior thinking in a new way generated the high autonomy dialectic – an agile perspective with which to investigate the potential impacts of user choice.

Going forward, seeing things through the high autonomy dialectic allows for various research avenues. For example, now that this dissertation has begun to articulate the nature of dialectic impacts of user choice, research could be done to better understand the differences in the dialectic potential of high and low user autonomy environments. In these environments with different degrees of user autonomy, how are impacts more or less severe, or perhaps just different? These high and low autonomy environments could exist within the same organization. With the foundation laid by this dissertation, it is possible future research could attempt to build to a more sophisticated and nuanced understanding of how degrees of user autonomy motivate different degrees or kinds of dialectic impacts.

In addition to exploring dialectic impacts within the context of an organization, it is possible to imagine using the high autonomy dialectic to examine issues such as identity in the digital age. For example, imagine researching if dialectic impacts extend beyond the system itself and to the users' own identities. In this way, users' different technology choices interact with users' desire to construct identity differently. Users make choices as to how they construct their identities online (do they use Foursquare or not, friend co-workers on Facebook or not), and those choices in turn not only impact whether users are able to work together as in Local Hope, but the nature of how they represent their identity (identities?) online – or even understand their own identities. Seeing users' technology choices through the high autonomy dialectic allows for these questions to be formed and answers to be pursued.

The high autonomy dialectic allows us to understand how user choice dialectically impacts the huge array of personal technology choices, particularly as more and more of our technology is subject to personal choice and could be said to occur in a high autonomy environment. Though this dissertation focused on more traditional technologies, the high autonomy dialectic promises a way to empirically study the quickly emerging realities of less obvious, but increasingly widespread, technologies. These technologies may redefine the very notion of a user environment. That new user environment will increasingly exist in the context of user choice.

A simple example is my own running routine. For exercise, I run around the track at the Nike World Headquarters campus at least 3 days a week. Recently, I came upon Nike employees testing running shoes that synchronize with your iPod or iPhone to tailor your running music experience. These shoes are not an anomaly, but a single example of a burgeoning user reality. There is also apparel that adjusts to ambient and body temperature (on the market in Japan), individually RFID smart-tagged products which create a running total on your shopping cart LCD display which then automatically checks you out with your credit card as you walk out the store (being tested at Wal-Mart) and follow you out to the parking lot to interface with your car's GPS system (e.g. On Star) and report to data aggregators the kind of car you drive and the kinds of groceries you buy. There are also heads-up and hands-off retinal projection displays for technical maintenance personnel (in use at Boeing), voice-activated system interfaces in cars (widespread in many models), or even mobile apps that "intelligently" know what we have in common with others in our personal system and automatically shares music, suggests a concert to attend, a restaurant to eat at, or negotiates new times to meet for band practice (various mobile software and social media startups, such as Urban Airship, currently market such technologies).

Finally, to take systems as dialectic constructions of users' choices to an extreme, imagine robotic human prosthetics which run their own software, adapt to individual human nervous systems, interface directly with a PC, Mac or smartphone, and even enable wireless remote control of those prosthetics when physically disconnected from the person. The prosthetic could be sitting on a shelf across the room, or in a room across the planet, and be operated by the prosthetic owner/user via the computing device. The computing device is attached via a USB port or Bluetooth connection interfacing with the

person's nerves in the limb stump. The person simply thinks to operate the prosthetic, as if it were attached to him. The prosthetic portion implanted in the user translates the nerve impulses and sends a Wi-Fi signal over the Internet to the prosthetic. The prosthetic, disconnected from the user's body, moves – wherever it is in the world.

These prosthetics are currently being tested by DARPA on returning military veterans who have lost limbs. They work. What are the possible dialectic impacts of choosing commercial technologies to replace your body parts which you can operate remotely from anywhere the world? How might those choices dialectically create systems out of user choices? How prepared are we to imagine how that could change the realities of user experience? How prepared are we to research and lead the design of those experiences?

For example, imagine combining the Nike shoe and remote prosthetic realities above with the data-mining capabilities of current internet commerce to create a scenario which shows the dialectic impact of user choice in unpredictable ways and which will likely come true soon. First, you configure your Facebook profile to automatically purchase MP3 files from iTunes based on your Facebook friends' preferences. If enough of your Facebook friends like a song, iTunes buys it for you. You simply set your purchasing preferences ahead of time and the system does the rest. In this dialectic scenario, you have severe hearing loss and have a hearing prosthetic surgically connected to your auditory nerve, similar to the limbs described above. iTunes synchronizes the music to your iPhone. That music is transmitted wirelessly to and stored directly on your robotic prosthetic ear. When you play that music on your prosthetic ear you will bypass your damaged hearing – the robotic device interfacing directly with your nervous system. Facebook and iTunes will be wired literally into your mind. The wisdom of your crowd will be in your mind. How will that in turn change the choices you have available to you, or the choices you make? What kind of systems will users dialectically construct in such an environment? How will they experience those systems their choices help to construct?

Whether that scenario disturbs or excites you, these are all existing or quickly emerging technologies. Different people will choose differently how, or if, to use these technologies, and as a consequence redefine our human experience as a vast dialectic construction of user choices. Like never before in

human history, our worlds will be the technologies we choose and the technologies we choose will be our worlds. Or even our bodies.

The high autonomy dialectic used in this dissertation is another example of our ability as a discipline to constantly evolve as an intellectual community, to keep up as we constantly incorporate new ideas and focus on people. In this regard, the utility of investigating exploding user technology choices is exciting. Understanding user choice is perhaps the single most important purpose of human centered design. Our lives are not subject to an IT policy. Our field is embracing this emerging human reality. In doing so, we may struggle intellectually, as I did in this case, but we have the scholarly history and focus to continue to succeed.

As we continue our scholarly conversation in this direction, a dominant metaphor of the last few decades - of humans interacting with computers (HCI) - will fall short more and more. As stated by many previous researchers discussed in this dissertation, and as this dissertation emphasized, we are not simply interacting with computers. We are not even only interacting with each other through computers. We are designing entire systems of personal experience through choices made to meet our human needs – even including technologies that may be worn on or literally be part of our bodies. Through choice, we are creating overlapping and dialectic systems of human experience through which we construct the meaning of so much of our lives. The high autonomy dialectic can provide a framework to begin to understand how user choices interact, and how user choices dialectically construct our personal systems.

References

Ahire, S., Landoros, R., & Golhar, D. (1995). Total Quality Management: A literature review and research agenda. *Production and Operations Management, 4*(3), 277-306.

Albers, M. J. (1999). Information design considerations for improving situation awareness in complex problem-solving. In *Proceedings of the 17th annual international conference on Computer documentation* (pp. 154-158). New Orleans, Louisiana, United States: ACM Press.

Bertalanffy, L. v. (1968). *General System Theory: Foundations, Development, Applications*. New York: George Braziller, Inc.

Berry, D. , Cheng, B. C. , & Zhang, J. . (2005). The four levels of requirements engineering for and in dynamic adaptive systems. *REFSQ 05 Proceedings of the 11th International Workshop on Requirements Engineering Foundation for Software Quality* (pp. 95-100).

Beyer, H., & Holtzblatt, K. (1998). *Contextual Design: Defining Customer-Centered Systems*. San Francisco, CA: Morgan Kaufmann.

Braun, S. (2004). *Report on Emergency Capacity*. East Chatham, NY: Interagency Working Group.

Chen, H., & Lynch, K. J. (1992). Automatic Construction of Networks of Concepts Characterizing a Document Database. *IEEE Transaction on Systems, Man and Cybernetsystems, 22*(5), 885-902.

Chen, H., Schroeder, J., Hauck, R. V., Ridgeway, L., Atabakhsh, H., Gupta, H., et al. (2002). COPLINK Connect: information and knowledge management for law enforcement. *Decision Support Systems, 34*, 271-285.

Chung, W., Chen, H., Chaboya, L. G., O'Toole, C. D., & Atabakhsh, H. (2004). Evaluating event visualization: a usability study of COPLINK spatio-temporal visualizer. *International Journal of Human-Computer Studies*, 1-31.

Clemons, E. K., Thatcher, M. E., & Row, M. C. (1995). Identifying sources of reengineering failures: A study of the behavioral factors contributing to reengineering risks. *Journal of Management Information Systems, 12*(2), 9.

Coney, M. (1988). The Implied Author In Technical Discourse. *Journal of Advanced Composition, V*, 163-172.

Corbin, J., & Strauss, A. (1990). Grounded Theory Research: Procedures, Canons and Evaluative Criteria. *Qualitative Sociology, 13*(1), 3-21.

Currion, P. (2006). Emergency Capacity Building Project Information Technology and Requirements: Global Assessment Report: Interagency Working Group.

Curtis, P., Heiserman, T., Jobusch, D., Notess, M., & Webb, J. (1999, May 15-20). *Customer-Focused Design Data in a Large, Multi-Site Organization.* Paper presented at the CHI '99, Pittsburgh, PA.

Davenport, T. (1997). *Information Ecology*. London: Oxford University Press.

Davidson, E. (2002). Technology Frames and Framing: A Socio-Cognitive Investigation of Requirements Determination. *MIS QUarterly, 26*(4), 329-358.

Davidson, E. (2006). A Technological Frames Perspective on Information Technology and Organizational Change. *Journal of Applied Behavioral Science, 42*(1), 23-39.

Davidson, E., & Pai, D. (2004). Making sense of technology frames: Promise, progress and potential. In B. Kaplan, D. Treux, D. Wastell, T. Wood-Harpe & J. DeGross (Eds.), *Relevant theory and informed practice: Looking forward from a 20 year perspective on IS research* (pp. 445-473). Boston: Kluwer.

Dayton, D. (2006). A Hybrid Analytical Framework to Guide Studies of Innovative IT Adoption by Work Groups. *Technical Communication Quarterly, 15*(3), 355.

Dervin, B. (1992). From the mind's eye of the user: The sense-making qualitative-quantitative methodology. In J. D. Glazier & R. R. Powell (Eds.), *Qualitative research in information management* (pp. 61-84). Englewood Cliffs, CO: Libraries Unlimited.

Dervin, B. (1998) "Sense-making theory and practice: an overview of user interests in knowledge seeking and use", *Journal of Knowledge Management*, Vol. 2 Iss: 2, pp.36 - 46.

Dervin, B. (2000). Chaos, Order and Sense Making: A proposed theory of information design. In Robert E. Jackson (Ed.), *Information Design* (pp. 39-57). Boston, MA: MIT Press.

Easterly, W. (2006) The White Man's Burden: Why the West's Efforts to Aid the Rest Have Done So Much Ill and So Little Good. New York, NY. Penguin Press.

Fields, R., Paterno, F., Santoro, C., & Tahmassebi, S. (1999). Comparing Design Options for Allocating Communication Media in Cooperative Safety-Critical Contexts: A method and a Case Study. *ACM Trans. Comput.-Hum. Interact., 6*(4), 370-398.

Fish, S. (1989). Doing What Comes Naturally: Change, Rhetoric and the Practice of Theory in Literary and Legal Studies. Durham, NC: Duke University Press.

Flanagan, J. (1954). The Critical Incident Technique. *Psychological Bulletin, 51*(4), 327-355.

Freed, R., & Broadhead, G. (1987). Discourse Communities, Sacred Texts, and Institutional Norms. *College Composition and Communication, 38*(2), 155-165.

Galal, G. H. (2001a). *Architectural Modelling to Understand System Evolution*: Department of Computing, Communications Technology and Mathematsystems

London Metropolitan University.

Galal, G. H. (2001b). From contexts to constructs: the use of grounded theory in operationalising contingent process models. *European Journal of Information Systems, 10*, 2–14.

Galal, G. H., & Paul, R. J. (1998, August 14-16). *From the Prescriptive to the Analytic: A New Direction for Information Systems Engineering Methodology.* Paper presented at the Association for Information Systems Americas Conference, Baltimore, Maryland.

Galal, G. H., & Paul, R. J. (1999). A Qualitative Scenario Approach to Managing Evolving Requirements. *Requirements Engineering, 4*, 92-102.

Galliers, J., Sutcliffe, A., & Minocha, S. (1999). An impact analysis method for safety-critical user interface design. *ACM Trans. Comput.-Hum. Interact., 6*(4), 341-369.

Geertz, C. (1973). The interpretation of cultures: selected essays. New York,: Basic Books.

Giddens, A. (1976). *New Rules of Sociological Method*. New York, NY: Basic Books.

Giddens, A. (1979). Central Problems in Social Theory: Action, Structure and Contradiction in Social Analysis. Berkeley, CA: University of California Press.

Giddens, A. (1984). *The Constitution of Society: Outline of the Theory of Structure*. Berkeley, CA: University of California Press.

Go, K., & Carroll, J. (2004). The blind men and the elephant: views of scenario-based system design. *interactions, 11*(6), 44-53.

Gould, J., & Lewis, C. (1985). Designing for usability: key principles and what designers think. *Communications of the ACM, 28*(3), 300-311.

Gruen, D., Rauch, T., Redpath, S., & Ruettinger, S. (2002). The Use of Stories in User Experience Design. *International Journal of Human-Computer Interaction, 14*(3&4), 503-534.

Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? An experiment with data saturation and variability. *Field Methods, 18*(1), 59-82.

Hammer, V. (2003). *IT design criteria for damage reduction.* Paper presented at the Information Assurance, 2003. IWIAS 2003. Proceedings. First IEEE International Workshop on.

Haselkorn, M., Sauer, G., Turns, J., Illman, D., Tsutsui, M., Plumb, C., Williams, T., Kolko, B., Spyridakis, J. (2003). Expanding The Scope of Technical Communication: Examples from the Department of Technical Communication at the University of Washington. *Technical Communication, 50*(2), 174-191.

Hauck, R. V. (1999). COPLINK: Exploring Usability of a Multimedia Application for Law Enforcement: University of Arizona.

Hauck, R. V., Atabakhsh, H., Ongvasith, P., Gupta, H., & Chen, H. (2002). Using Coplink to Analyze Criminal-Justice Data. *IEEE Computer Magazine,* 2-9.

Hauck, R. V., Chau, M., & Chen, H. (2002). COPLINK:Arming Law Enforcement with New Knowledge Management Technologies. In W. M. a. A. Elmagarmid (Ed.), *Advances in Digital Government: Technology, Human Factors and Policy*: Kluwer Publishers.

Hauck, R. V., & Weisband, S. (2002). When a better interface and easy navigation aren't enough: Examining the information architecture in a law enforcement agency. *Journal of the American Society for Information Science and Technology, 53*(10), 846.

Heracleous, L., & Barrett, M. (2001). Organizational change as discourse: Communcative actions and deep structures in the context of information technology implementation. *Academy of Management Journal, 44*, 755-758.

Hollnagel, E. (1993). *Human Reliability Analysis - Context and Control*. New York, NY: Academic Press, Inc.

Holtzblatt, K., & Beyer, K. (1999). *Contextual Design: Using Customer Work Models to Drive Systems Design.* Paper presented at the Conference on Human Factors in Computing Systems, Vancouver, British Columbia, Canada.

Holtzblatt, K. a. B., K. (1996). Contextual Design: Principles and Practice. In J. R. Dennis Wixon (Ed.), *Field methods casebook for software design*. New York: Wiley Computer.

Hughes, M. (2002). Moving from Information Transfer to Knowledge Creation: A New Value Proposition for Technical Communicators. *Technical Communication, 49*(3), 275-286.

Hutchings, P. (Ed.). (2002). *Ethsystems of Inquiry: Issues in the Scholarship of Teaching and Learning*: The Carnegie Foundation for the Advancement of Teaching.

IAWG. (2005). Interagency Working Group: Disaster Preparedness for Central & East Africa. Retrieved April 18, 2006

Iivari, N., & Abrahamsson, P. (2002). *The interaction between organizational sub-cultures and user-centered design - - A case study of an implementation effort.* Paper presented at the 35th Annual Hawaii International Conference on Systems Science, Hilo, HI.

Jederberg, W. (2005). Issues with the Integration of Technical Information in Planning for and Responding to Nontraditional Disasters. *Journal of Toxicology and Environmental Health Part A, 68*(11-12), 877-888.

Kaangas, E., & Kinnunen, T. (2005). Applying user-centered design to mobile application development. *Communications of the ACM, 48*(7).

Killingsworth, M. J. (1999). Technical communication in the 21st century: Where are we going? *Technical Communication Quarterly, 8*(2), 165.

Klein, G. (1993). A Recognition-Primed Decision (RPD) Model of Rapid Decision Making. In G. Klein, J. Orasanu, R. Calderwood & C. Zsambok (Eds.), *Decision Making in Action: Models and Methods*. Norwood, NJ: Ablex.

Klein, G., Calderwood, R., & MacGregor, D. (1989). Critical Decision Method for Eliciting Knowledge. *IEEE Transactions on Systems, Man and Cybernetsystems, 19*(3), 462-472.

Klein, G., Kaempf, G. L., Wolf, S., Thorsden, M., & Miller, T. (1997). Applying decision requirements to user-centered design. *International Journal of Human-Computer Studies, 46*(1), 1-15.

Kock Jr, N. F., & McQueen, R. J. (1996). Product flow, breadth and complexity of business processes An empirical study of 15 business processes in three organizations. *Business Process Re-Engineering & Management Journal, 2*(2), 8.

Kock, N. (2001). Changing the Focus of Business Process Redesign From Activity Flows to Information Flows: A Defense Acquisition Application. *Acquisition Review Quarterly, 8*(2), 93.

Kock, N. (2003). Communication-Focused Business Process Redesign: Assessing a Communication Flow Optimization Model Through an Action Research Study at a Defense Contractor. *IEEE Transaction on Professional Communication, 46*(1), 35-54.

Lappenbusch, S. (2006, October 23-25). *Research Methods for Humanitarian Relief Communication Systems.* Paper presented at the International Professional Communication Conference, Saratoga Springs, NY.

Lappenbusch, S., & Kemp, R. (2006, November 3-8). *Investigating the boundaries and substance of humanitarian actors' information environments.* Paper presented at the American Society for Information Science and Technology, Austin, TX.

Lappenbusch, S., & Turns, J. (2005, July 10-13, 2005). *Finding their place in TC: using a community of practice model to research emerging TC professionals.* Paper presented at the IEEE Conference on Professional Communication, Limerick, Ireland.

Lin, A., & Cornford, T. (2000). *Framing implementation management.* Paper presented at the 21st International Conference on Information Systems, Atlanta, GA.

Lin, A., & Silva, L. (2005). The social and political construction of technological frames. *European Journal of Information Systems, 14*, 49-59.

Lincoln, Y., & Guba, E. (1985). *Naturalistic Inquiry*. Beverly Hills: Sage.

Lincoln, Y., & Guba, E. (1994). Competing Paradigms in Qualitative Research. In N. Denzin & Y. Lincoln (Eds.), *Handbook of Qualitative Research* (pp. 105-117). Thousand Oaks, CA: Sage.

Lindenberg, M., & Bryant, C. (2001). *Going Global: Transforming Relief and Development NGOs*: Kumarian Press.

Maiers, C., Reynolds, M., & Haselkorn, M. (2005, July 10-13). *Challenges to Effective Information and Communication Systems in Humanitarian Relief Organizations.* Paper presented at the IEEE Conference on Professional Communication, Limerick, Ireland.

McGovern, T., & Hicks, C. (2004). How political processes shaped the IT adoption by a small make-to-order company: A case study in the insulated wire and cable industry. *Information and Management, 42*, 243-257.

McLoughlin, I., Badham, R., & Couchman, P. (2000). Re-thinking a-political process in technological change: Socio-technical configurations and frames. *Technology Analysis & Strategic Management, 12*, 17-37.

Miller, C. (1979). A Humanistic Rationale for Technical Writing. *College English, 40*(6), 610-617.

Mirel, B., & Johnson, N. (2006). Social Determinants of Preparing a Cyber-Infrastructure Innovation for Diffusion. *Technical Communication Quarterly, 15*(3), 329.

NCIRC, N. C. I. R. C.-. (2006). *State and Regional Intelligence Fusion Centers*. Retrieved 12/18/2008

Nemeth, C. P., Cook, R. I., & Woods, D. D. (2004). The Messy Details: Insights From the Study of Technical Work in Healthcare. *Systems, Man and Cybernetsystems, Part A, IEEE Transactions on, 34*(6), 689-692.

NetHope. (2005). *What Is NetHope?* Retrieved April 19, 2006, from http://www.nethope.dreamhosters.com/about.html

Norman, D. A. (1989, June 28-29). *The problem with automation: inappropriate feedback and interaction, not over-automation.* Paper presented at the Human Factors in Hazardous Situtations, London.

Olluson, T., Soronen, H., & Vaanen, K. (2008). *User needs and design guidelines for mobile services for sharing life memories.* Paper presented at the human-computer interaction with modible devices, Amsterdam.

Orlikowski, W. (1992). The Duality of Technology: Rethinking The Concept of Technology in Organizations. *Organization Science, 3*(3), 398-427.

Orlikowski, W. (1993). CASE tools as organizational change - investigating incremental and radical changes in systems development. *MIS Quarterly, 17*(3), 309-340.

Orlikowski, W. (1993). Learning from notes: Organizational issues in groupware implementation. *Information Society, 9*(3), 237.

Orlikowski, W., & Gash, D. (1994). Technological Frames: Making Sense of Information Technology in Organizations. *ACM Transactions on Information Systems, 12*(2), 174-207.

Orlikowski, W., & Robey, D. (1991). Information technology and the structuring of organizations. *Information Systems Research, 2*(2), 143-169.

Ovaska, P., Rossi, M., & Smolander, K. (2005). Filtering, negotiating, and shifting in the understanding of information systems requirements. *Scandinavian Journal of Information Systems, 17*, 31-66.

Palanque, P., Koornneef, F., Johnson, C., Szwillus, G., & Wright, P. (2004). *Safety-critical interaction: usability in incidents and accidents.* Paper presented at the CHI '04 extended abstracts on Human factors in computing systems, Vienna, Austria.

Patton, M. Q. (2002). Qualitative Interviewing. In *Qualitative Research & Evaluation Methods* (pp. 340-418). Thousand Oaks, CA: Sage.

Paul, R. (1993, March 29-30). *Dead Paradigms for Living Systems.* Paper presented at the The First European Conference on Information Systems, Henley on Thames, UK.

Perrow, C. (1999). *Normal accidents : living with high-risk technologies* (2nd ed.). Princeton, N.J. :: Princeton University Press,.

Robey, D., & Sahay, S. (1996). Transforming Work Through Information Technology: A Comparative Case Study of Geographic Information Systems in County Government. *Information Systems Research, 7*(1), 93-110.

Qureshi, N. , Perini, A. , Ernst, N. , & Mylopoulos, J. . (2010). Towards a Continuous Requirements Engineering Framework for Self-Adaptive Systems. *1st International Workshop on requirementsruntime*.

Sade, S., & Battarbee, K. (2000). *Bridge for Buttons: A GUI design methodology applied in non-GUI consumer product design.* Paper presented at the Designing Interactive Systems, Brooklyn, NY.

Shaw, N., Lee-Partridge, J., & Ang, J. (1997). *Understanding end-user computing through technological frames.* Paper presented at the 18th International Conference on Information Systems, Atlanta, GA.

Silker, C. M., & Gurak, L. J. (1996). Technical communication in cyberspace: Report of a qualitative study. *Technical Communication, 43*(4).

Stake, R. (1995). *The Art of Case Study Research*. Thousand Oaks, CA: Sage Publications.

Stake, R, (1978). The Case Study Method in Social Inquiry. *Educational Researcher.* Vol. 7, No. 2 (Feb., 1978), pp. 5-8

Stallings, R. (Ed.). (2002). *Methods of Disaster Research*: International Research Committee on Disasters.

Staples, K. (1999). Technical communication from 1950-1998: Where are we now? *Technical Communication Quarterly, 8*(2), 153-165.

Strauss, A., & Corbin, J. (1998). *Bassystems of Qualitative Research* (2 ed.). Thousand Oaks, CA: Sage.

Sutcliffe, A., & Rugg, G. (1998). A Taxonomy of Error Types for Failure Analysis and Risk Assessment. *International Journal of Human-Computer Interaction, 10*(4), 381-405.

Suthers, D. D., Hundhausen, C. D., & Girardeau, L. E. (2003). Comparing the roles of representations in face-to-face and online computer supported collaborative learning. *Computers & Education, 41*, 335–351.

Taviera, A., James, C., Karsh, B., & Sanfort, F. (2003). Quality management and the work environment: and empirical investigation in a public sector organization. *Applied Ergonomsystems, 34*(4), 281-291.

Taylor, F. (1911). *The Principles of Scientific Management*. New York: Harper & Brothers.

Tu, C.-H. (2002). The relationship between social presence and online privacy. *Internet and Higher Education, 5*(4), 293-318.

Vicente, K. J. (2000). HCI in the global knowledge-based economy: designing to support worker adaptation. *ACM Trans. Comput.-Hum. Interact., 7*(2), 263-280.

Watts, J. C., Woods, D. D., & Patterson, E. S. (1996). *Functionally distributed coordination during anomaly response in space shuttle mission control.* Paper presented at the Human Interaction with Complex Systems, 1996. HSYSTEMS '96. Proceedings., Third Annual Symposium on.

Wei, C. Y., Evans, M. B., Eliot, M., Barrick, J., Maust, B., & Spyridakis, J. H. (2005). Influencing web-browsing behavior with intriguing and informative hyperlink wording. *Journal of Information Science, 31*(5), 433-445.

Winsor, D. (2001). Learning to do knowledge work in systems of distributed cognition. *Journal of Business and Technical Communication, 15*(1), 5-29.

Woods, D. D. (1993). The price of flexibility. In *Proceedings of the 1st international conference on Intelligent user interfaces* (pp. 19-25). Orlando, Florida, United States: ACM Press.

Woods, D. D., & Shattuck, L. G. (2000). Distant Supervision-Local Action Given the Potential for Surprise. *Cognition, Technology & Work, 2*(4), 242 - 245.

Yates, J., & Orlikowski, W. J. (1992). Genres of Organizational Communication: A Structurational Approach to Studying Communication and Media. *Academy of Management. The Academy of Management Review, 17*(2), 299.

Yin, R.K., (1981). The Case Study Crisis: Some Answers. *Adminstrative Science Quarterly.* 26(1), 58-65.

Yoshioka, T., Yates, J., & Orlikowski, W. (2002). *Community-based interpretive schemes: Exploring the use of cyber meetings within a global organization.* Paper presented at the 35th Annual Hawaii International Conference on Systems Science, Hilo, HI.

Zachry, M., Cook, K.C., Faber, B., Clark, D. (2001). *The changing face of technical communication: new directions for the field in a new millennium.* Paper presented at the. International Conference on Computer documentation, Santa Fe, NM.

Appendix A

Structured Survey Questions

1. [Local Hope] has an increasingly dispersed virtual headquarters, in addition to having staff in the field. Describe your needs to collaborate with others across distances in relation to the type of work you need to get done.
2. How many groups or projects do you participate in at the same time?
3. What tool(s) do you use or have you used for collaboration? (Skype, ReadyTalk, Mayetic Village, Groove, chat)
4. How do you decide what to use? (When do you use email as opposed to CWS or chat? How do you decide when to use MV as opposed to Groove?)
5. If you didn't use MV, why didn't you use it?
6. What are your biggest frustrations on collaboration?
7. What currently works well?
8. How important is it for you to have an intuitive tool? (On a scale of 1-6 with 1 being Extremely Important and 1 being "Not at all Important)
9. How much time are you willing to spend learning to use a new collaborative tool?
10. How often do you collaborate on a document or set of documents with staff spread across geographic boundaries?
11. With how many people do you usually collaborate on such documents?
12. Describe the process of developing a document as a group.
13. What tools do you use to track the development of the documents?
14. How do you keep track of revisions in a document? How do you know what the latest version is?
15. When collaborating on a document with a group, how do you notify others that it has been revised and hand off responsibility to the next editor?
16. When the document is complete, what happens to it?
17. What are the biggest obstacles to efficient development of shared documents?
18. How do the groups you belong to currently handle discussions?
19. What obstacles hamper the management of tasks in/across a group?
20. Does your group integrate discussion into the document development process? How?
21. How would centralized discussions be helpful?
22. What types of calendaring would facilitate collaboration with others?
23. What system do you currently use for calendaring?
24. What challenges do you encounter with calendaring?
25. How often would you access a project calendar?
26. If you had access to one, why didn't you use it? Comfort level? Training?
27. How often would you access a calendar that tracked the travel of other MC staff?
28. Whose travel would you envision being posted in it?

29. How likely would you be to add your own scheduled travel to it? (on a scale of 1-6 with 1 being “Very Likely” and 6 being “Never.”)
30. What other comments would you like to make?