Design, Appropriation, and Unanticipated Users: A Series of Studies to Address the Design, Implementation, and Use of Collaboration Technologies in Workplace Settings

by

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DEDICATION

Dedicated to my family, friends, and the shoulders of giants

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Getting a PhD can sometimes feel like an arduous process and there have been a small, but potent group of people who have made this possible. First, I would like to acknowledge my advisor, Stephanie Teasley, who called me on 2008 to tell me I had been accepted into the University of Michigan's School of Information and then became my advisor. Stephanie introduced me to CTools and a quick comment that she had made about staff using the system sent me on my 5-year path to try to understand why. Since then, she was always supportive to me and my research. In the same vein, I'd like to thank Steve Lonn from the USE Lab, who has helped review a sizeable portion of the work presented in various incarnations for conferences, and who has helped me on many occasions with various tasks such as running queries for me and assisting me with data management.

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CHAPTER 1. INTRODUCTION

1.1 APPROPRIATION AND UNINTENDED USERS IN DESIGN

Current design best practices in HCI (Human-Computer Interaction) place an emphasis on design techniques that first defines users and then addresses what the IT or system can do to fulfill that user's (or users') needs. As such, much of the HCI community has embraced 'User Experience' (UX) and a number of user-focused design methodologies such as Participatory Design and User-Centered-Design. As a result of the design process, the tools that are used in everyday life are designed according to designer's conceptions of who we are and what we, the users, need. As users, we encounter technology and incorporate it into our everyday practices, making sense of technology and what it does (or doesn't do) for us. Norman (1988) calls the former the *design model* and the latter the *user model*, pointing out that designers are responsible for creating objects in a way that users will understand, while users are responsible for interpretation.

At the foundation of this dissertation is the observation that even when using proven practices designed to understand users, this exercise creates idealized or conceptualized versions of users—users who may not ever interact with technology in exactly the way that designers hoped and that even the process of conceptualizing users is an inexact science that may lead to the inability to completely predict users. This observation arises from Computer Supported Cooperative Work (CSCW) and Information Systems (IS) literatures that also point to the difficulty of predicting needs in constantly shifting contexts, as well as the evolving and creative use of technology. Specifically, these literatures have used the term 'appropriation' as a general term for these issues.

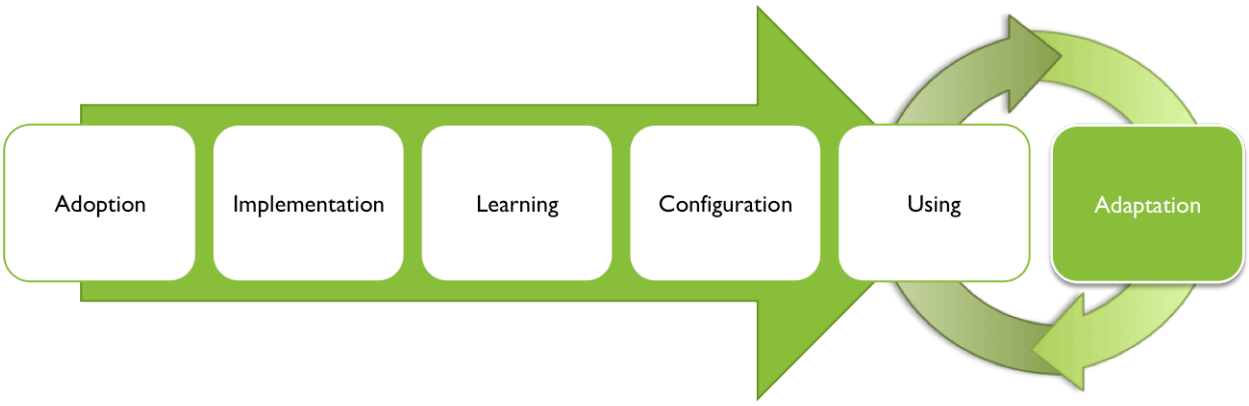


Figure 1. Conceptual model of appropriation process

The term appropriation has been used for over two decades as a blurry and sometimes inexact way characterizing both the process of using technology and the resulting use, which is both fluid and changing, while also likely to be unexpected in regards to the design intent. In pointing out the fuzzy nature of this concept, I point to Orlikowski, whose early work (e.g., 1992a & 1992b) described appropriation as 'unexpected use' (a result), but whose later work (2000) described appropriation as an organizational adaptation to emergent technological realities—adaptation of practices and structures. The CSCW special issue (2003) on evolving uses of groupware treats appropriation as end use, but as end use that evolves over time, as a result of organizational and technological changes and negotiations. Most recently, Draxler, Stevens, Stein, Boden, & Randall (2012) have described appropriation as a type of work, signifying the process of "searching, becoming aware, installing, configuring, and learning to use new tools" (pg. 2835) as well as "incorporating objects into one's life, including changes to the objects, caused by changing modes of using it" (pg. 2836). What remains, then, is a term that has come to connote the multitude of processes involved in incorporating technology into practice and structures—ranging from the decision to adopt a technology through its interpretation and, ultimately, its evolving end use (See Figure 1).

The appropriation of technology has been a concern for designers and researchers who have come to understand that technologies can be used differently across contexts. Further, technologies are not always used the way were intended by designers or researchers who want to understand how and why use changes over time. Perhaps the most influential of researchers of appropriation is Orlikowski (1991, 1992a, 1992b, 1993, 1996, 2000, 2002), who has studied appropriation to better understand how groups evolve their practices and structure themselves around changing use of technology. The result of this line of research is the observation that in adapting technology to emergent contexts, use is not static and may sometimes differ from design intent (Lamb & Kling, 2003; Draxler et al., 2012).

The existing research has enhanced our knowledge of technology use and come to understand that technologies are open to interpretation by users. Through the concept of *interpretive flexibility* (Pinch & Bijker, 1984), researchers and theorists suggest that when a design is flexible (or can be interpreted flexibly), it can be readily adapted—that is, appropriated (Orlikowski, 1992). Flexibility has been particularly important to a number of European researchers—e.g., Wulf, Pipek & Won (2008), Pipek, Won, Englert, & Wulf (2005), Stevens, Pipek, & Wulf (2010), and Draxler et al. (2012), whose work I describe later. These researchers have focused primarily on the design and implementation of tailorable/configurable/customizable systems that are adaptable to other contexts.

One consequence of interpretive flexibility is that end users may use technology in unexpected and/or evolving ways. I argue that these end users may not even be the audience of users that designers and implementers had intended, pointing to the extent to which design takes for granted that they can know the user. Users-whether from the target audience or not—interpret uses of a system or its application to everyday life in unpredictable ways. Another aspect of appropriation that is not often addressed is that all possible users, both those who are the intended audience and those that are unintended or unanticipated, have different ways of interpreting system use.

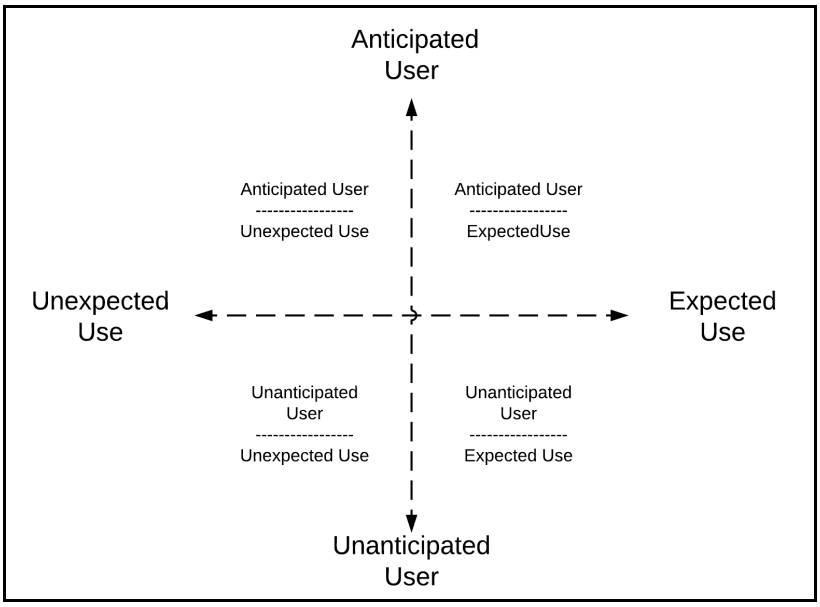


Figure 2. User/Use Technology Appropriation Matrix

If we combine these two aspects of appropriation—that end use *and* end users can differ from their designers' and implementers' intentions—we actually see a much richer and deeper sense of appropriation activities. In Figure 2, I present the continuum of anticipated versus unanticipated *users* and *uses* into a matrix that shows the ways that appropriation may manifest itself with regard to users and uses. Most of the literature on technology appropriation focuses on tools and systems that were implemented in the context that they were designed for and the users who were identified as target users. Thus, when using the matrix to evaluate the appropriation literature, the effort to understand appropriation has been aimed towards understanding the top of the matrix, where users are anticipated. To date, there is very little work that investigates issues specific to unintended users.

By virtue of the iterative design process and various user-centric methods, we can uncover various kinds of use through user studies. Unintended uses that are detected in user studies can be incorporated into future design iterations. However, given the silence on understanding how to involve unanticipated users into the design process, there is little that the literature can offer explicitly in regards to where to begin

and what to do. There are a number of potential reasons for this oversight, one being that unanticipated users might not be noticed or they may be perceived by designers and implementers as fringe members. Moreover, there is the question over whether unanticipated users should affect system-wide design. However, I make the claim that focusing on unintended users can be very informative, especially when those users exist in enough of a critical mass that studying them can be advantageous—particularly in collaborative where interaction between intended and unanticipated user groups can lead to the diffusion of kinds of system use.

1.2 PROBLEM STATEMENT

Design is based on asking what should be designed and for whom (Lewis & Rieman, 1994). All current HCI (human-computer interaction) and UX (user experience) design methodologies such as UCD and PD encourage deep understandings of users and their needs as hallmarks of design—doing so ensures that design products are both focused and useful for the groups of target users. However, as I have pointed out above, unintended use and unintended users may arise. Specifically, I investigate the use of a particular instance of a groupware toolkit, Project Sites, which is currently implemented at the University of Michigan. This toolkit, designed primarily for use by students and faculty, was also adopted by a significant number of other users, staff members, who were not anticipated to use the system. Their appropriation of the toolkit is important because site usage statistics suggest that staff are the second most prolific users of Project Sites, outnumbering faculty both in the number of users and number of sites created.

As a result of this early observation, I was motivated to ask a number of questions about users and the iterative design of system—questions that form the basis for this dissertation. The staff appropriation of the CTools platform is important both in the sense of the toolkit's iterative design, but also in pointing out what we can learn about these users to inform the design of the system and design theory when they are not overlooked in research and design. Unanticipated users, in general, provide an

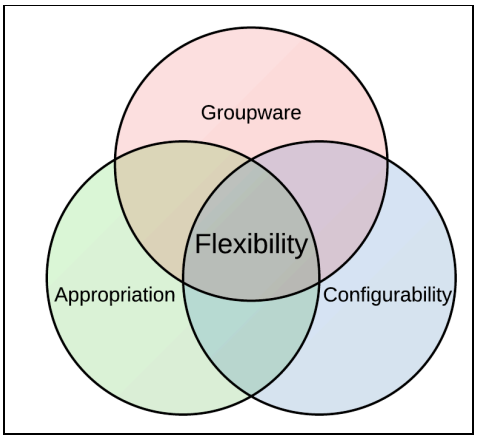


Figure 3. Conceptual Framework for Chapter 2

opportunity for expanding the appropriation literature and to further motivate the 'user experience' movement to pursue explicit methods of identifying these types of potential users, studying them, and thereby improving design our own practices.

In this dissertation, I examine both *how* and *why* groups of staff users appropriated Project Sites and describe how Project Sites is situated within the greater ecology of collaboration tools that these users incorporate into their everyday practices. I do so by conducting three studies, each with a specific kind of data that considered together provide a fuller representation of staff unanticipated adoption of this course-related toolkit. This dissertation is presented as follows:

- Chapter 2 reviews the relevant literatures, using the overlapping themes seen in Figure 3 to describe groupware and the kinds of people and tasks it seeks to support. Interestingly, groupware needs to be flexible in order for users to be able to adapt it to their evolving needs. As will be discussed in this chapter, Configurability/tailorability proves to be one of the most promising ways that groupware designers have explored to support these evolving user needs. Paradoxically, making systems flexible can also lead to a wider array of interpretations by end users, resulting in varied kinds of use and creating opportunities for unanticipated users. In this chapter, I highlight how groupware

might be appropriated while pointing out specifically how little attention we have given to users from anticipated audiences.

- Chapter 3 describes the research setting, the overarching research questions, and the general research agenda for all three studies. I describe staff at the University of Michigan who are using Project Sites, to accomplish non-academic work even though they were not an intended user group. The research questions introduced in this chapter are 1) Why did staff appropriate Project Sites? 2) How are staff members at the university using Project Sites, and 3) How does their use fit within the overarching ecology of work tools?

- Chapter 4 presents a quantitative study to address the first research question: Why did staff appropriate Project Sites? This study uses a survey to begin laying the foundation to understanding this user group by first describing users and then exploring how they perceive and value the system. This study finds that staff value the Project Sites toolkit as a space for sharing in a central location and for administrative activities.

- Chapter 5 addresses the question: How are staff using Project Sites? By using log data, I describe staff use of the Project Sites toolkit quantitatively, then compare this use to that of staff, faculty, and students The study confirms that staff use the system mostly for the tool that provides them the ability to share information as well as highlighting a few areas where staff use of Project Sites differs from students and faculty..

- Chapter 6 addresses both why and how staff appropriated Project Sites, but also frames these using qualitative methods (interviews) and an analytical framework that is based on the literature that examines information ecologies (Nardi & O'Day, 1999). I refer to staff as part of an ecosystem and situate their work within 'collaboration ecologies,' given the importance of collaboration in the work. Collaboration ecologies set a stage wherein CTools Project Sites is one technology

among a number of competing technologies that to support staff and their needs. Specifically, I note the important of the transition to Google as a comparative case study for understanding appropriation of tools as a target user versus being an unanticipated user.

- Chapter 7 concludes the dissertation, summarizing the findings of all three studies and drawing conclusions that can be generalized to IT design and implementation in terms of appropriation.

CHAPTER 2. LITERATURE REVIEW

INTRODUCTION

At some point during the implementation and use of a local learning management system (LMS), CTools, university staff became unintended users who adopted its Project Sites feature and appropriated it to fit their requirements within the wider organization—all despite the fact that the technology was not designed with their needs in mind. Even though the Information Technology Services (ITS) office knew that staff were using CTools Project Sites, there was little in-depth data about why staff adopted the system and how they were using it. There was not only a lack of understanding of staff use of Project Sites in practice but also no plans for iterative design work that could incorporate the needs of this user group into future versions of CTools. Thus, staff have adopted and appropriated a system that continues not to be supported with their needs in mind.

The particular reason why this adoption was of interest to me was because it pointed to a disconnect between design intent and actual end use. The system, primarily designed to support learners and instructors in their interactions with each other and with academic content at the University of Michigan, supports learning and research-related activities predominantly among faculty, students, and researchers. Learning cooperatively results in different requirements than working cooperatively—a difference that can be seen in the separation of the CSCL (Computer-Supported Cooperative Learning) and CSCW (Computer-Supported Cooperative Work) communities. The fact that staff widely adopted the Project Sites toolkit led to questions about its adoption and use within this group—why did they adopt it, how do they use

it in their everyday activities and develop practices around it, and what role does the toolkit play among other tools.

Draxler et al. (2012) describe appropriation as "an entangled, cooperative process of searching, becoming aware, installing, configuring, and learning to use new tools" and as "the social process of incorporating objects into one's life" (pg. 2835). Thus staff's appropriation of Project Sites was not only their adoption of the collaboration toolkit[1], but also the way they adapted it and incorporated it into their work lives. Staff's unanticipated adoption highlights gaps both in terms of (1) how we as technology researchers, designers, and implementers[2] bridge the gap between users' needs and the systems and tools we create and study, and (2) how we understand appropriation (users and use) and incorporate (or don't incorporate) what we learn into the iterative design cycle. The first gap is what Ackerman (2000) called to sociotechnical gap, which I describe in this chapter. The second gap is the one that this dissertation addresses.

The following sections frame my discussion about the appropriation of systems in general, and groupware in particular. First, I describe what appropriation is and how it highlights gaps in the design process. Next, I describe the design of groupware systems and how they attempt to fill the design gap for group collaboration by providing tools that support both collocated and distributed work among group members. In doing so, I present various frameworks that establish Project Sites as a groupware system.

Finally, I conclude with an assessment of how the discovery of unanticipated users might inform the way that we perceive the appropriation within the design/re-design process and how we iteratively implement design best practices, suggesting that current techniques are not necessarily as accurate at discovering and predicting possible

[1] I use the term 'toolkit' as a set of tools, not as a 'software toolkit'
[2] Here, I distinguish between designers (creators) and implementers (those who oversee its installation and maintenance) as two separate, but sometimes overlapping sets of actors

users as we think they are. I propose that there are two gaps in how to design in light of appropriation by unanticipated users: how to find these users and what to do once we identify them. This dissertation acknowledges the difficulty of the former, but is primarily concerned with the latter.

2.1 APPROPRIATION

As designers and researchers of collaborative systems, we hope that by designing and implementing a technology, we are going to improve the conditions of the context where it is deployed. From the designer's and implementer's point of view then the design is successful if the target audience uses the technology the way it was designed and benefits from that use. But, according to Orlikowski (2000), "When users choose to use a technology, they are also choosing how to interact with that technology. Thus they may, deliberately or inadvertently, use it in ways not anticipated by the developers" (p. 408). Orlikowski (1992a) distinguishes between design and use, acknowledging that the design and use of technology may not necessarily be in agreement. Appropriation is a term that has most commonly been used to refer to the way in which a technology is used, particularly in instances where it deviates from design intent, but also extends to include the ways in which users of technology enact practices and structure themselves around the introduction of new technologies and evolving contexts of technology use (Leonardi & Barley, 2010). As a result, appropriation has often been treated as an outcome or as a an observed behavior (e.g., unintended use, adapting, hacking, etc.).

While appropriation has evolved to encompass evolving technology use (see the CSCW Special Issue on Evolving Use of Groupware, 2003), the act of appropriation is not only related to the end use of a technology. In the process of adopting a technology, users often adapt either the technology or their work (or both) (Muller, 2000; Dourish, 2001; Muller, Millen, & Feinberg, 2009). Appropriation, therefore, is also the process of adaptation that results in end use. This view suggests not only that technology use *can* differ from design intent, but that it can also change over time and that practices and structures can change *in response to* technology and the way it is used. More recently,

appropriation has been considered as a type of work (e.g., Draxler et al., 2012), especially as an instance of articulation work (Kling & Lamb, 1999) and as collaborative work (Draxler, Jung, Boden, & Stevens, 2011; Draxler et al., 2012).

Other terms have been used synonymously or to refer to technological adaptation—terms that include re-invention (Rice & Rogers, 1980; Rogers 1983), tailoring (Trigg & Bodker, 1994), adaptation (Leonard-Barton, 1998; Majchrzak et al., 2000), and co-evolution (Nardi & O'Day, 1999; O'Day, 2000). Regardless of the terms used and contextual differences, this body of work posits that technology is transmutable—that it is not static in its uses or roles—and some approaches, such as mutual adaptation and co-evolution, talk about simultaneous changes in practices and the social system as a result of technological change (Orlikowski, 2000; Leonardi, 2007; Volkoff et al., 2007).

The theoretical foundation of the appropriation literature is primarily oriented towards adaptive structuration theory (AST), which is based on structuration theory (ST) by Giddens (1979, 1984, 1993). Structuration espouses the production and reproduction of the social systems people create through the system those systems' members' use of rules and resources in interacting with each other. AST expands on this theory, applying it to people and organizations who interact with IT, emphasizing the role of social actors over the role of technology. AST posits groups create perceptions about IT that lead to their use IT in varying ways in order to build, maintain, or revise their structures (Poole & DeSanctis, 1990; DeSanctis & Poole, 1994). Researchers like Orlikowsi (2000) have followed the similar vision that people are both empowered and limited by technology. End users have agency to create institutions, identities, and practices that allow them to act as *social actors* (Lamb & Kling, 2003) within their sociotechnical worlds.

Appropriation has also been described as a way of 'taming' technology into something that is usable in practice. Silverstone and Haddon (1996) discussed the design/domestication dichotomy whereby designers create technology and users

'domesticate' that technology into their everyday practices—a dichotomy that elicits the design vs. use dichotomy.

2.1.1 Interpretive flexibility

The mechanism through which a technology can be decoded and used in various ways lies in the interpretation of its use. Using work first introduced by Pinch & Bijker (1984) and Pinch & Bijker (1987), Orlikowski (1992a) borrows the concept of interpretive flexibility, depicted as "the interaction of a technology and organizations that is a function of the various actors and contexts in its development and use" (p. 405). In other words, technological artifacts with high interpretive flexibility have meanings and uses that are flexible and their interpretation is highly variable across contexts. By contrast, a technology with low interpretive flexibility is more likely to be perceived by potential users as static across contexts. Interpretive flexibility, we can say, is a matter of users' perceptions of the technology in question (what is the intent and how it can/should be used). Different interpretations of a flexible technology will result in varying degrees of faithfulness to its design intent and will lead to different kinds of use across different contexts.

Beyond interpretive flexibility, which can happen at the group or individual level, consensus refers to the degree to which a group has agreed on how the system should be used (Poole & DeSanctis, 1990; DeSanctis & Poole, 1994; Salisbury et al., 1996, 2002). Consensus about appropriation involves a kind of work whereby the group negotiates an interpretation and end uses. Consensus does not mean stasis, however, but rather a current consensus that can shift within the context of needs and tool affordances.

2.1.2 Examples of Appropriation: Unintended Uses and Users

Appropriation is not a rare occurrence. In face, if we consider Draxler et al. (2012) definition of appropriation, every technology is appropriated. However, what this

dissertation addresses are those rare occasions where unintended uses and unanticipated users arise—particularly as examples of the problem of conceptualizing users and uses of technology. The examples presented here illustrate the impact of appropriating technology unexpectedly, the potential to benefit from studying this type of appropriation, and the gap in the literature that fails to address unanticipated users.

Examples of technology adaptation and organizational change can be found in various literatures, ranging from HCI to management. For example, Nardi & Miller (1990, 1991) studied how the use of spreadsheets in an organization evolved to support collaborative work. Their work described how notations within the spreadsheets served as a method of communication. Muller, Millen, & Feinberg (2010) describes a file-sharing system, Cattail, which users adapted in ways that were both more social expected and less social than the researchers expected (i.e., use as personal storage), highlighting the fact that end use can actually be a mix of the expected and the unexpected. Rosner & Bean (2009) provide a popular example of appropriation, showing how some consumers use pieces of different IKEA furniture and lighting sets to create new, unique pieces of furniture. Orlikowski's (1992b) study of the use of 'productivity tools' in a large organization revealed that use of the tools constrained consultants' ability to perform design tasks by virtue of standardization. The design of the system was found to enforce structures of dominance and legitimation. Despite the system's low interpretive flexibility, some users attempted to modify the way they interacted with the system by circumventing certain processes. Subsequently, the developers of the system eradicated such use. These two examples show two very different responses to unintended use—one tries to eradicate it and another learns something from it and incorporates this different use into workflows in some way. The argument that I make in this dissertation is that there is more to be gained from studying an incorporating such appropriations into design than by ignoring them or designing them out, assuming that appropriation is not harmful to the intended users.

Ito (2005) describes the evolution of cell phone use in Japan, where phones and the infrastructure for using them was designed for businessmen to be able to

communicate remotely with colleagues. However, teenagers quickly adopted the technology, finding many uses for it outside of the business context and thus creating new practices around this technology. In her study, Ito explains that mobile telephony allows teenagers to communicate more effectively with their friends, and allows these students freedom from being monitored over shared family landlines. These appropriators' needs led to infrastructure changes as well as new features, such as SMS, and different types of phones. This is one of the few examples in the HCI literature where an unintended audience takes over an existing technology, as it shows how a tool that we might claim was meant to support distance work was adopted and then adapted by unanticipated users. Ito's study also shows how appropriation might influence technology and infrastructure design by teaching designers about their actual users and their uses of their technologies and technology and the way it is used *in vivo*.

The examples discussed above show that users assert their agency to engage with technology in ways that can be unexpected by developers and designers by choosing to ignore, alter, or circumvent the intended use in terms of features and/or affordances. At the center of the act of appropriation remains an important question—why adapt a technology at all? The fact that users will adapt a technology points to the fact that existing technologies do not always keep up with needs as those needs evolve and that users' needs may not be satisfied because of mismatches between reality and designers' conceptualization of that reality, showing a gap in the way systems are designed and users' needs.

2.2 BRIDGING THE SOCIO-TECHNICAL GAP

The appropriation of Project Sites by unanticipated users highlights a gap between these users and their needs—a gap that Project Sites was able to bridge. In everyday interactions between people, technology, and the environment, we often find a design gap—the gap between user needs and the affordances of the environment or tools (Felix, 2010; Ackerman, 2000). Ackerman (2000) re-contextualized the gap for CSCW, calling it the socio-technical gap—the gap between social requirements and technical

feasibility. This gap, Ackerman argues, is a fundamental problem for the field of CSCW; the gap forms because users have fluid needs for social interaction and collaboration that are most often supported by inflexible systems.

Good designers have the interest of their users in mind and developed techniques for 'good' design, trying to close whatever gap might exist. Good design means that users' needs are met and tools are seamlessly integrated into users' context (Lewis & Rieman, 1994). A number of design methods provide best practices to assist designers in 'good' design. Task-Centered User Interface Design, for example places importance on understanding target users and the task the designer is intending to support, using representative tasks to design, prototype, evaluate, and redesign interfaces (Lewis & Rieman, 1994). User-Centered Design (UCD) and Participatory Design (PD) similarly offer best practices that allow designers to leverage the power of users (real or fictional) to better understand the users and their needs.

Unfortunately, the design gap often re-emerges regardless of adherence to best practices. The design gap results from flaws in the design process involving the participants, their communication with one another, and the way the design problem is defined (Felix, 2010). The gap is also related to designers' inability to completely predict contexts of use, particularly because actions are situated in ever-changing contexts (Suchman, 1987). The gap's re-emergence raises the question of whether a system can be designed without the sociotechnical gap. To do so, it seems that a system must be so specified in its application that it closes the gap without leaving room for the gap to re-emerge, or alternatively, the system must be so open to interpretation and flexible in application that it can always close the gap (as long as users are able to manipulate the system to do so). Another alternative to closing the gap is to give users the ability to become designers themselves and develop their own tools, a practice that is called end-user development (extended by meta-design), which I will discuss below.

2.2.1 End-User Development & Meta-Design

Fischer, Giaccardi, Ye, Sutcliffe, Mehandjiev (2004) describe that "end-user development (EUD) activities range of acts from customization to component configuration to programming. As such, end-user development is a manner of appropriating technology with direct manipulation of the IT's structure. At its extreme, it can entail programming from the ground up. It takes a considerable amount of expertise to be able to develop tools. Fischer et al. (2004), for example, point out that EUD happens most frequently in scientific and engineering domains where significant domain knowledge is needed to produce useful tools. End user development also requires programming languages that are difficult to learn. The issue, then, is to bring EUD to a level that is accessible to potential users without developer skills.

In recognizing the problem of anticipating all possible uses of a technology in the design phase, HCI and CSCW researchers and developers Geerhardt Fischer[3] and a number of colleagues propose that users should be given the means to take open systems and use learned techniques to create their own solutions—a practice called meta-design. Fischer et al. (2004) define meta-design as "a vision in which design, learning, and development become part of everyday working practice" (p. 34). Meta-design explicitly makes users into co-designers. Because users act as social actors in creation of their IT, they are also actors in changing IT itself as well as being able to alter how they use it, thus meta-design is the design of systems that can be continually appropriated by being altered *after* the design phase. This process of adaptation is itself a type of work.

The importance of EUD and Meta-design is that they point to existing observations of the sociotechnical gap and acknowledge that designers and technology need not be the sole critical points to keep technology relevant. Instead, they suggest that users should be engaged in this work. Users, through negotiating their emergent

[3] e.g., Fischer & Sharff, 2000; Fischer et al., 2004; Fischer & Giaccardi, 2006; Fischer, 2007

needs and the potential of the IT at their disposal, are able to appropriate technology (in the sense that appropriation is a process of incorporating technology into everyday life).

2.2.2 Configurability/Tailorability: Designing for Flexibility & Tailoring as a Type of Work

That different groups may have different requirements for their groupware at different times suggests that flexible technologies will be better suited to bridging the socio-technical gap formed by evolving contexts of use and needs. To that effect, the CSCW literature claims that groupware tools that are rigid are problematic (Betbeder & Tchounikine, 2003) and that flexibility and tailorability are crucial to the success of a CSCW system (Koch & Teege, 1999; Stiemerling, Kahler, & Wulf, 1997). Flexibility has been so important that it has appeared as a key feature of collaboration systems (e.g., Dourish 1998, 2000) and proponents of tailorable systems proponents, such as Stiemerling & Cremers (1998, 2000), Pipek et al. (2005), Draxler & Stevens (2011a), Draxler et al. (2011b, 2012), Wulf (2009), Wulf et al. (1999, 2001, 2008, 2011), and Stevens, Pipek, & Wulf (2010).

When system use is not constrained in how it can be applied, users are able to implement technology in ways that designers had not imagined (Bentley & Dourish, 1995). Tailorable systems give end users the option of adapting the technology to suit their emergent contexts and needs, while also allowing user to make the technology more relevant over the long-run which makes them less dependent on intervention from designers. Tailorability, configurability, customizability are terms used to describe systems where users can cause changes so that the technology matches their own emergent needs (Stiemerling & Cremers, 1998; 2000). Tailorable interfaces come in many types, ranging from low-level changes (e.g., font changes, colors, etc.) to higher-level, abstract functionalities such interaction preferences (Marsic & Dorohonceanu, 2003). Many of the ways in which technology can be designed to be tailorable overlap with Dix's (2007) idea of 'designing for appropriation.' Designing for appropriation

means making intentions for use known, but supporting and allowing configurability and multiple interpretations.

The act of tailoring systems is similar to, EUD activities described above except that tailoring requires less developer expertise than the EUD, which requires a vast skillset. Despite lessor barriers, it takes a certain amount of training and expertise to tailor a system (MacLean, Carter, Lövstrand, & Moran ,1990). If users do not sufficiently understand tailorable and configurable systems, they may not be able to effectively use the systems for their tasks. Lack of understanding can lead to users' perceptions that the system has poor usability or they may abandon the system altogether.

Johnson-Lenz (1991) has proposed that good tailorable systems would require no programming at all, instead providing easily modified paths to support and guide users through the tailoring process. Components-based design, one attempt to reduce the requirements for tailoring activities, allows users to tailor their systems based on configurable components that act much like multifunctional building blocks (MacLean et al., 1990; Roseman & Greenburg, 1992; 1996; Wulf, Pipek, & Won, 2008). However, even with components based design, users must be knowledgeable in how components function and how they can be pieced together into a usable tool. MacLean et al. (1990) have shown that even simple tailorable systems can be problematic for users to customize and configure.

Tailorability has been accepted as a desirable property for the support of long-term collaboration (Pipek et al., 2005). There are a number of commercially available collaboration systems with varying degrees of configurability such as Drupal and SharePoint. Examples of tailorable collaborative systems throughout the literature includes systems such as POLITeam, a tailorable search tool for documents (Wulf, 1999), Disciple, a tele-collaboration framework based on JAVA components (Marsic, 1999; Marsic & Dorohonceanu, 2003); Groove, a system that supports virtual workspaces (Dustdar & Schmidt, 2004); and GroupKit, a toolkit for building real-time conferencing applications (Roseman & Greenburg, 1992; 1996); and Eclipse, a

collaborative environment for developers (Draxler et al., 2011; Draxler & Stevens, 2011, Draxler et al. 2012).

While tailoring allows for multiple ways of appropriating a system to support practices and structures, it is unclear to what extent the tailoring process or a system's tailorability might impact the kinds of users that would eventually appropriate a system. Project Sites could be characterized as a configurable system more than as a tailorable one given that it can be adaptable through configurations and customizations, but does not involve changes to the system.

In summary, these sections show the importance of systems that are designed flexibility in supporting group work. These sections also frame adaptation as an activity that users engage in to adapt to IT as well as to manipulate IT itself to fit their emergent needs. In the following chapters, I will show that Project Sites is configurable and discuss the types of work being done to tailor it to the context of unexpected use by staff.

2.3 GROUP WORK AND GROUPWARE

In order to frame how university staff, as unanticipated users of the CTools system, appropriated Project Sites for their collaborative work purposes as groupware, it was necessary to explore and understand groupware and what activities it supports, especially with regards to group work. Group work can be viewed as the coordinated efforts of multiple individuals attempting to work together on a shared task (Schmidt, 1991; Schmidt & Rodden, 1996). Group work is collaborative in nature, but also involves coordination to ensure that collaborations remain organized.

Workers, in addition to their individual efforts, must engage in articulation work with each other (Gerson & Star, 1986; Schmidt & Rodden, 1996). Articulation work takes the form of additional work to make things (the group, the organization, technology) work in addition to the actual work they must perform. These articulation activities are

also elsewhere defined as coordination, "the act of managing interdependencies between activities" (Kittur & Kraut, 2010; Malone & Crowston, 1994).

Designers and implementers of technological systems have sought to support group work, particularly in the increasingly global workplace where organizations want to leverage the ability to draw talent from many locations. The seemingly limitless power of technology has thus lead to such expectations as "the death of distance" (Cairncross, 1997). Groupware became the *de facto* the term used for collaborative systems that are situated between single-user applications and organizational support systems (see Figure 4). Groupware has become synonymous with collaboration and has been studied since the mid-80s when systems like Lotus Notes gained momentum as a standard tool in the business world (Johnson-Lenz & Johnson-Lenz, 1990). Note, though that the origins of groupware can be dated back to Engelbert (1962, 1968, 1983) and his various demos for "augmenting human intellect".

Over the course of groupware's proliferation into the workplace, definitions of computer support and cooperative work have evolved, leading to a number of frameworks from which to conceptualize and design tools and systems, as well as the specific needs and users they address. As part of the issue of appropriation and design, it is important to understand who the audience is that groupware is designed for and what it supports in order to be able to have further discussions over how course managements systems also can function as groupware.

2.3.1 WHO GROUPWARE SUPPORTS

Ellis, Gibbs, & Rein (1991) define groupware as "computer systems that support groups of people engaged in a common task or goal and that provides an interface to a shared environment" (p. 40). "Groups of people" is a broad category that can scale from dyad and small teams to entire organizations, both large and small—companies, organizations, hospitals, etc. Typically, however, organizations must divide themselves into small groups that are able to successfully collaborate and coordinate around

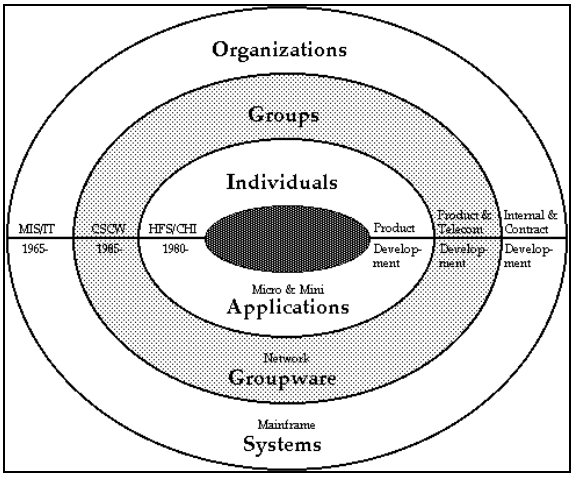


Figure 4. Development and research context (Grudin, 1994)

subtasks. According to Schmidt & Bannon (1992), groups are comprised of individuals who are situated in different contexts, have difference responsibilities and perspectives, interact with each other, and rely on each other in order to conduct their work. Groupware, therefore, seeks to support groups within the organization, rather than the supporting individuals or the organization as a whole (see Figure 4).

Groupware has increasingly become the solution for groups who want to collaborate over varying degrees of distance, ranging from collaborators in close proximity to each other to those who are more geographically distributed. However, not all groups are geographically distributed. Proximal, or collocated, groups can be located close to each other and, at extremes, can be 'radically collocated' (Teasley, Covi, Krishnan, & Olson, 2000; Olson & Teasley, 1996), that is, located within the same workspace such as a software development 'war-room.' Proximity can also be judged in terms of shared workspaces (e.g., same floor or building). In cases of relative proximity, groupware supports the standard functions of these collocated groups, but it can also allow collaborators to engage in with each other and their work in ways that overcomes the limitations of unmediated collocated work.

At the extreme, members of a distributed team might all be remote, a type of group often called a 'virtual team' because they only exist in virtual spaces (Kirkman, 2002; Potter, 2002; Powell, 2004). Team members might be distributed for any number of reasons and their level of distribution can run a wide spectrum from different buildings to different countries. Distance has the effect of impeding the ability of collaborators to have spontaneous interaction and forces them to rely on computer-mediated communication.

Another aspect of group work is the fact that many groups exist somewhere between being collocated and being totally distributed. Partially distributed groups have members that are collocated, as well as some who are remote (Burke, Chidambaran, & Johnson, 1999). Partial distribution means that groupware designers and developers have the additional challenge of supporting the needs of both the collocated and the remote team members and their interactions (Johnson, Aytes, & Burke, 1996; Burke, Chidambaran, & Johnson, 1999).

CSCW suggests that distributed teams have fewer opportunities for face-to-face interactions than collocated ones. For example, virtual teams might never meet in person because of their short duration and because they are usually distributed across space (and sometimes time-zones). Teams with few face-to-face interactions incur communication and coordination costs, and the effectiveness of their collaborations can be greatly affected. It is also important to note that distance alone does not mean a team is virtual; teams can be in close proximity and still be virtual. Thus 'virtuality,' a term used by Kirkman & Mathieu (2007), might be better suited to describe the extent to which a team is virtual without entangling virtual interactions with distance.

In addition to collocated/remote/mixed groups, there are other kinds of groups that groupware supports. Another dimension described in the literature is that of *ad hoc* (spontaneous) groups and established groups (Dennis, Easton, Easton, George, & Nunamaker, 1990). Ad hoc groups tend to disband after the task is complete, typically with no expectation that they will necessarily reform in the future. Established groups

represent the other end of the spectrum, remaining intact and often performing tasks over a long period of time.

Lastly, we can view groupware as supporting groups who work together synchronously in contrast to groups who work together asynchronously. The nature of distance work leads to the possibility that members of a group will not always be performing tasks synchronously, for example in the case of distributed teams where members are located across different time zone. Even collocated groups may face synchronicity issues depending on various factors such as work schedules.

In terms of the research presented in this dissertation work, groupware supports staff, who are distributed around buildings. In Chapter 3 and Chapter 6, I describe staff as being partially collocated, but also distributed in relation to their collaborators. In particular Chapter 6 addresses the need for group platforms to assist staff intheir collocated and distributed work.

2.3.2 WHAT GROUPWARE SUPPORTS

In order to understand the appropriation of Project Sites, it is important to understand what it supports compared to what groupware systems support. Researchers in the field of CSCW have sought to design and investigate groupware in order to support a vast array of activities comprised by the terms collaboration and coordination—which are often used interchangeably. 'Cooperative work' is vague term that can refer to a vast array of activities that fall within the spectrum of collaboration. Collaboration has been said to take place when two or more people communicate and interact to reach a goal (Weiseth et al., 2006).

At the core of cooperative work is the interdependence—mutual dependence and cooperation—between group members in their work (Schmidt, 1991; Schmidt & Bannon, 1992). Coordination, defined as the management of dependencies among activities (Thompson, 1967; Malone & Crowston, 1994), arises from the fact that dependencies emerge when labor is distributed among group members. Malone &

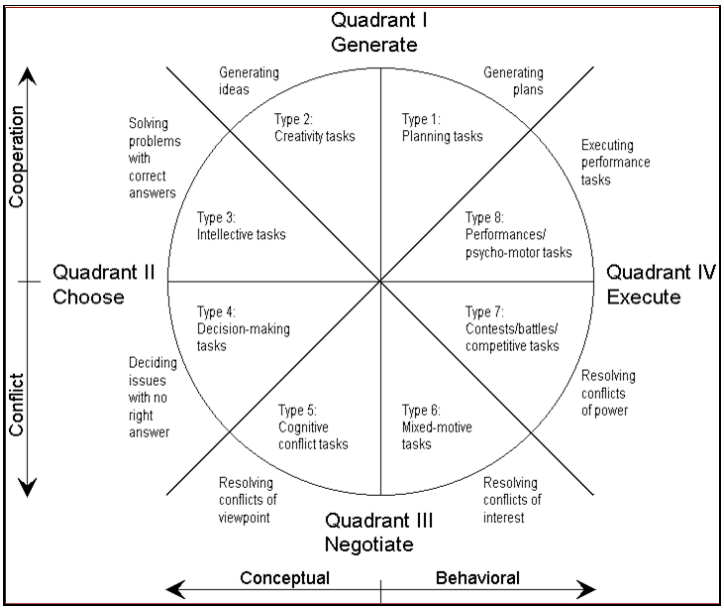


Figure 5. The Group Task Circumplex (McGrath, 1984)

Crowston (1994) describe the sharing of resources, managing producer/consumer relationships, simultaneity (synchronicity and scheduling), and task/subtask dependencies as parts of the coordination process.

As important as coordination theory is, it is not the only lens through which we can examine group work. Other researhers have examined groupware features through the lens of organizational theorists, particularly in regards to the kinds of tasks that groups routinely perform together. Hackman, for example, lists three types of tasks—discussion, production, and problem-solving (Hackman 1968; Hackman & Vidmar, 1970).

One of the most widely used delineations of group tasks comes from the Group Task Circumplex (McGrath, 1984; Strauss, 1999) (see Figure 4). The Group Task Circumplex (GTC) creates a framework of eight kinds of tasks that groups perform, combining aspects of cooperation/competition and conceptual/behavioral tasks to reveal four quadrants of task types—generation, choosing, negotiating, and executing. Different types of groupware will support different tasks within the GTC to different degrees based on the tools they provide.

In addition to the creation of task frameworks, many researchers and designers have sought to address the kinds of tasks groupware should support by creating lists of requirements. One such list, provided by Engelbert (1983) includes: collaborative dialog, document development, production, and control, research intelligence, community handbook development, computer-based instruction, meetings and conferences, community management and organization, and special knowledge work by individuals and teams." Schmidt and Rodden (1996) provide a different list of requirements, suggesting that groupware should support informal interactions, information sharing/exchange, decision-making, coordination/control, and domain directories.

2.3.3 GROUPWARE FRAMEWORKS

In coming to an understanding of the role that Project Sites plays in supporting staff's group work, I drew on a number of frameworks, particularly those that highlight functionalities that Project Sites provides.

WHEEL OF COLLABORATION TOOLS

Weiseth et al. (2006) provide a framework for classifying collaboration tasks and related technologies—the Wheel of Collaboration Tools (see Figure 6). The Wheel of Collaboration Tools places emphasis on three layers: the collaboration interface, collaboration functions, and content and process management. In the middle layer, the collaboration functions, they propose three tasks—production, coordination, and decision-making—each of which is comprised of further subtasks. The core of the wheel is dedicated to content management.

Oddly enough, there is no mention of communication as a task in and of itself, although the authors acknowledge that the collaboration requires communication. Communication, as an activity, is not only important for content and knowledge management, but is also important for establishing rapport in long-term groups and in establishing common ground, making it more of a core task of collaboration.

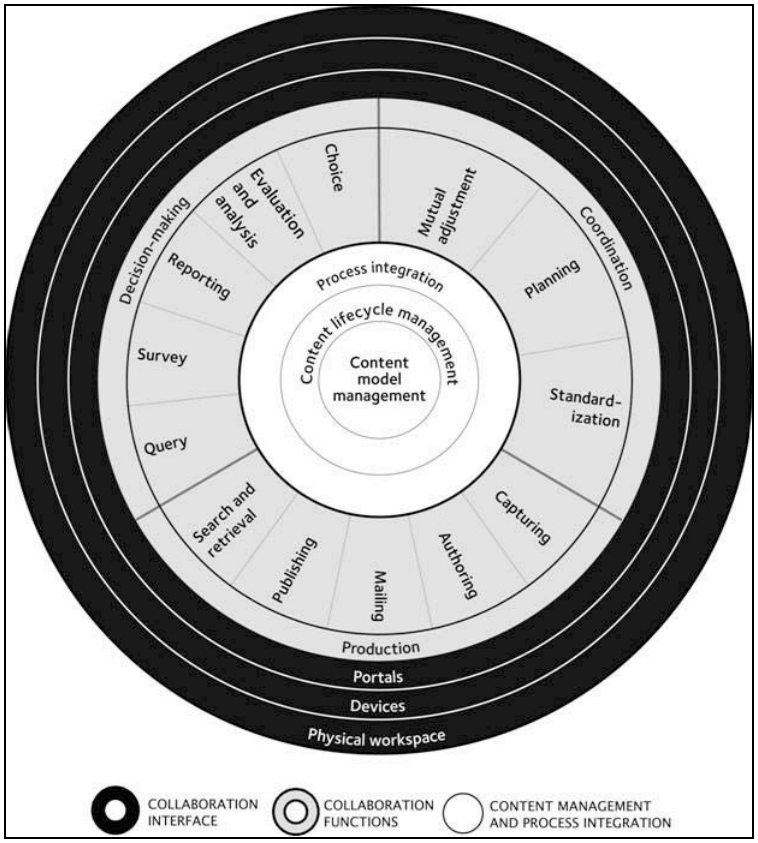


Figure 6. Wheel of Collaboration Tools, Weiseth et al. (2006), pg 243.

GROUP TASK CIRCUMPLEX

Tools can be classified using the Group Task Circumplex (GTC) by matching tools to their ability to support any combination of the tasks described in the framework. This classification is more aptly applied to tools than to whole systems that can be broken down into their component tools. One example of the circumplex in action is the use of communication tools that serve as facilitators for idea generation or tools that aid in task execution. However, there is also the potential that tools will not fit into tasks delineated by the GTC.

2.4 APPROPRIATION OF GROUPWARE

The importance of appropriation within the CSCW community is demonstrated by virtue of the fact that *CSCW* journal had a special issue dedicated to the topic of evolving use of groupware (See Andriessen et al., 2003; Törpel, Pipek, & Rittenbruch, 2003; Huysman, Steinfel, Jang, David, Huis in t' eld, Poot, & Mulder, 2003; Karsten, 2003; Dourish, 2003).

In addressing these issues, the literature moved beyond early literature that equated groupware's success with its adoption. The decision to adopt is only one aspect of determining successful appropriation of tools. Once tools have been adopted, users need to establish practices around their use. It is these processes that I described in the section about appropriation.

Lamb & Kling (2003) note that individuals do not always get to choose the technologies they would prefer to use, though they have opportunities to exert their agency in other ways. They also raise the issue that people who use technologies are not just simply *users* of technology, but also active participants in establishing patterns of use, developing practice and structures within their organizations. Thus, Lamb & Kling emphasize that tailoring is a type of work. Draxler & Stevens (2011b) stated that appropriation is both the process and the result of adapting technology—work that is embedded in ordinary activities. Draxler et al. (2011a, 2012) and Draxler & Stevens (2011b) claim that appropriating technology is a collaborative activity and that it is in itself a type of work. Appropriation work has also been described as a type of *articulation work*, the ongoing work that is composed of social and technological arrangements and divisions of labor that make technology work (Balka & Wagner, 2006; Strauss, 1985, 1978; Suchman, 1996; Kling & Lamb, 1999). Thus, appropriation of groupware is a type of activity that occurs socially as people make sense of these systems. Because of the social nature of appropriation work and the importance of these processes on the eventual end use of systems, there is also a need for supporting this type of work.

Because appropriation is a type of work, researchers have identified types of people in organizations who are crucial in supporting the appropriation process. MacLean et al. (1990), for example, described that *handymen* are people in organizations who bridge the world of the worker and the computer professional. Mackay described *translators* as people interpret the needs of their colleagues and create customization files to fit those needs, meanwhile translating between highly technical groups and the organization. Okamura, Orlikowski, & Fujimoto (1994) suggests that *mediators* guided and manipulated the use of a computer conferencing system over time. Nardi & O'Day (1999) described people who perform similar activities who they call *gardeners*—people within a socio-technical 'ecology' who are informally responsible for introducing technology in addition to appropriation work. In describing organizations and organizational redesign, Weick (1993) points to *bricoleurs* (Levi-Strauss, 1966), people who make sense of the available materials to get their tasks done; because bricoleurs are not constrained by previous uses and are more expert in the tools they are employing, they are the types of tinkerers that are needed in the individual phases of appropriation.

While researchers have focused on individuals to whom they can attribute successful appropriation of technology, it is understood that appropriation work is collaborative in nature. Some research on tailoring, such as MacLean et al. (1990), show that most individuals will not actively engage in active adaptation. The lack of user engagement in appropriation work may be due to skill or it is due to the fact that this articulation work is tangential to the primary activities that people are engaged in (MacLean et al., 1990). The challenge then is to create what MacLean called a "tailoring culture" that supports active adaptation at the organizational level. This tailoring culture is in addition to supporting the learning that needs to happen at the end-user level.

In designing for systems that are flexible and configurable, Robinson (1993) developed the concept of the *common artefact* as a way to design for unexpected use—i.e., the use that arises *in situ*—suggesting that such tools have to be predictable, support peripheral awareness, support implicit and explicit communication through

double-level language, and provide overview of the work world. These requirements, however, do not create sufficiently actionable design principles for designing flexible/tailorable systems. In the tailorability literature, Draxler et al. (2012) suggested design principles for sharing user-generated configurations, positing that systems should:

- Facilitate collaborative appropriation
- Integrate features closely into the ordinary working environment
- provide features that make appropriation activities publicly visible
- Support browsing of others' behaviors and tool configurations
- Support awareness of appropriations by notifying others
- Support peer installation

These design principles specifically relate to supporting appropriation work within specific types of flexible/tailorable systems where configurations take the form of plug-ins and where there are experts, usually software developers, readily available to reconfigure the tools. The design principles work on the assumption that tools should support these requirements rather than to relegate any of them to social mechanisms. Thus, it remains to be seen whether these same principles are generalizable to tailorable systems that function differently in vastly different organizations.

The state of the appropriation literature seems to focus on the appropriation of particular systems and tools without considering the much broader ecologies and implications of the systems on ecologies. Specifically, I question how flexible systems and tools interact with other tools that users are using—do they compete? Coexist? How is groupware appropriated in such complex contexts? What practices and social structures arise in the boundaries between these flexible, tailorable tools?

Another issue lies with the definition of "success" in studying appropriation. By this, I point to the ill-defined nature of what constitutes success in the appropriation

process. Similarly, it is unclear what constitutes unsuccessful appropriation. Orlikowski (1992b) noted that Notes was unsuccessfully appropriated because its users failed to understand how to appropriate and subsequently did so in ways that were deemed 'incorrect.' More recent literature seems to assume that adaptation itself is demonstrative of success insofar as the tools support users in after tools have been adapted.

One issue that is common to literature on appropriation is the context of studying use is focused on the intended user. Törpel et al. (2003) examine groupware use within a network of freelancers; Huysman et al. (2003) look at US-Dutch virtual student teams; Orlikowski (1992b) examines different, but predictable, players of an organization using NOTES. The research on flexible/tailorable systems also similarly looks at deployments in organizations of intended users. In doing so, the literature has completely missed that users other than those who were conceived as the target user may appropriate technology. It is unclear whether this oversight is intentional (ignoring them), due to a lack of sensitivity (being unable to notice them), or by neglect (not realizing there are such users). Studying technology use among target users is useful, as that is the purpose of the research. Yet, studying unintended use by intended users gives only a limited vision of use. Use by unintended users, whether that use is itself intended or unintended, can be equally informative and the appropriation literature does not seem to notice this gap within itself.

SUMMARY

The previous sections of this chapter have focused on the research literature about the ways in which appropriation plays a role in the evolving use of groupware and highlights a gap in the appropriation literature that is generally blind to unanticipated users—people who were not conceived as users of IT, but who nonetheless become end users. Much of the CSCW literature has focused on groupware's potential to help bridge the gaps between geographically distributed collaborators and groups. Decades of research has shown that flexibility plays an important role in terms of the social

requirements that groupware should support, and overlapping features of configurability, tailorability, and customization are instances of this kind of flexibility. While flexibility allows users to adapt groupware to their unique contexts, it also expands the ways that users can interact with the system or application, including ways that were not envisioned in the design intent. This kind of use, appropriation, has been studied in many contexts, but I have highlighted an aspect of appropriation that is often ignored. Cases where unanticipated users have appropriated a system or application to their own purposes are often only told in terms of case studies about the phenomenon, leaving the iterative design processes and research methods surrounding this type of use unexplored.

It is important to connect unanticipated users back to the foundations of design. If we follow the prescriptions of user-centered design (UCD) and participatory design (PD) techniques, then good design begins with the specification of intended users. There is a a large body of literature that highlights the importance of user involvement in the design process (Grudin, 1991; Muller, 1992; Karat, 1997) or the use of hypothetical users, also known as personas (Sinha, 2003; Grudin & Pruitt, 2002; Pruitt & Grudin, 2003; Cooper, 1999). When designing based on user involvement, selected users must be representative of the intended users (Kujala & Kauppinen, 2004; Grudin & Pruitt, 2002); similarly, personas should be representative of intended users since they serve as surrogates for actual users (Cooper, 1999; Blomquist & Arvola, 2002). This work primarily addresses initial design processes, but this design methodology—that is, selecting representative users—is carried through in iterative design processes as well. While selecting representative users is crucial at the beginning, when narrowing down the design space, it can be potentially hazardous to ignore unanticipated users in later phases of iterative design, where the representative users—whether real users or fictional personas—might not be as representative as expected. The problem that results is that designers cannot create personas for unanticipated users. This raises the case for the use of scenarios of use over the use of personas or, alternatively, broadening

personas to encompass broad user types rather than specific types of users defined by arbitrary demographics that may not accurately reflect real-world users.

Grudin (1991) remarks that the actual users are not known until an item is implemented and used. I take this a step further: if this is true, designers know neither which users will adopt the system nor how these users will adapt it. Yet, design needs to be bounded by such conceptualizations in order to have parameters to guide design. Paradoxically, these conceptualizations (of users and uses) both enable design and limit it. Many times personas and use scenarios function accurately enough that the practices still remain in use even when we find cases where these conceptualizations were incomplete. With this paradox, the only solution is that flexibility and re-configurability are crucial to the sustained relevance of systems. This is particularly true for groupware systems, where intended and unintended users might interact with each other, and where there is a very real possibility of unintended usage that diffuse into the intended user population. Examining unintended users can also help highlight designers' oversights in terms of the use of their systems, needs that users might have, and audiences they hadn't anticipated.

What happens when there are unexpected users? What steps do designers take in studying them? What research questions can be applied to this finding? The HCI literature remains relatively silent when it comes to investigating unanticipated users and what repercussions they have to iterative system design. This dissertation addresses this gap in the literature by examining a learning management system (LMS) that is used as groupware by an unanticipated audience. In the chapters that I follow, I describe the system and the setting, followed by a set of three studies that use the lens of information ecologies to investigate both how these users have incorporated the system into their practices and structures.

By asking and answering these questions, we can begin to understand unintended users, the use of the system in their collaboration practices, and the system's role in the collaboration ecology. Given these findings, I provide the

foundation for a discussion that asks how we might provide lightweight interventions to elevate CTools' role within the collaboration ecology in the spirit of iterative design.

CHAPTER 3. RESEARCH SETTING & RESEARCH QUESTIONS

INTRODUCTION

The context for the research performed and proposed in this proposal builds upon the initial finding that that staff members at the University of Michigan have appropriated a learning management system in the sense that they have both adopted it and adapted it to their requirements, but also that they have taken ownership of the Project Site toolkit despite not being the anticipated users (according to the designers and implementers). As Lucy Suchman (1987) suggests in *Plans and Situated Actions*, activity and the context in which it is performed are interrelated. Thus, to study how individuals and organizations act, we must understand how they act in a given situations (or multiple situations). In this chapter, I describe the research setting—The University of Michigan—and establish staff as a social world comprised of a number of communities of practice.

3.1 STAFF & THE UNIVERSITY OF MICHIGAN

The University of Michigan is a large research institution with three campuses—a main campus in Ann Arbor, MI and two commuter campuses Dearborn, MI and Flint, MI. The university enrolls approximately 26,000 undergraduate and 15,000 graduate and professional students; the university employs 5700 faculty and over 20,000 staff. The focus of this research is the main Ann Arbor main campus, which consists of 19 degree-granting schools and a number of institutes, libraries, museums (to name a few) as well as units within the university whose purpose is the ongoing business of supporting the operation of the school (e.g., purely administrative units). Staff at the UM Ann Arbor

are distributed among these departments and units in various buildings both on and off campus.

According to the *Michigan Almanac*[4] report published in January, 2013, the Office of Budget & Planning lists 13,494 non-Medical FTE (full-time employment) staff in the Ann Arbor campus. The staff population is skewed towards having more women (63.%) than men (36.7%). Staff are also predominantly Caucasian, with slightly more then 20% identifying as minorities. According to the same report, the age of the staff population is increasing in the sense that the number of staff over the age of 50 has grown since 2002, while the number of staff below the age of 49 has been shrinking. These staff statistics mirrored the demographics of the participants who responded to the interview invitations. The relevance of this information, as the Almanac points out, is that many of the current older staff members are likely to retire from their jobs, both leaving large gaps in the university, but also creating space for many restructuring opportunities in the organization, as it works to add newer and younger staff.

The Almanac, in addition to reporting general information about the staff population, also describes the role of staff in the university ecosystem with the following statements:

> *"Staff members play key roles in the efficient and productive operation of nearly all facets of the University. Staff members are involved in the conduct and administration of research; they provide academic, housing and other services for students; handle financial operations of the institution; manage the physical and digital infrastructure of the campus; and monitor the many federal, state and professional compliance rules the institution must follow."*

This description situates staff in a social world that functions both in support of the university's academic and research missions as well as working in support of the university as an organization, handling needs that are established both internally and

[4] http://sitemaker.umich.edu/obpinfo/the_michigan_almanac (accessed March 2013)

externally. It acknowledges staff in supporting students, although it does not mention support to faculty or the greater Ann Arbor and Michigan communities.

Given what we know about the university as inhabitants of this larger ecosystem, we also know that staff are distributed among the many units on campus. These units act as boundaries between the academic disciplines—physically, organizationally, and in practice. Because staff are hired into units, staff are exposed to the influences of their home units.

These demographics and descriptive information paint an image of the staff community as one that is core to the university's ability to function, largely female, and largely older than students. In terms of framing the appropriation of Project Sites, this description

3.3 CTOOLS PROJECT SITES

As previously mentioned, my interest in staff at The University of Michigan was based on the finding that they had adopted and appropriated a parts of a system that was not designed for them—CTools. CTools, the current learning management system (LMS), is an open-source courseware system based on the Sakai open-source architecture. Courseware systems are designed for educational settings to support learning activities where students and faculty interact with each other and with content. The use of LMSs is ubiquitous throughout higher education in the United States (Smith & Caruso, 2010). Previous work has shown that students and faculty use these systems predominately as a repository for information and files and, to a lesser degree, to support learner-instructor and learner-learner interactions (Lonn & Teasley, 2009). At the University of Michigan, 91% of faculty and 99% of students use CTools, making CTools the most prevalent way of supporting learning activities.

On its website, CTools is described as "an advanced web-based course and collaboration environment… designed to help instructors, researchers and students

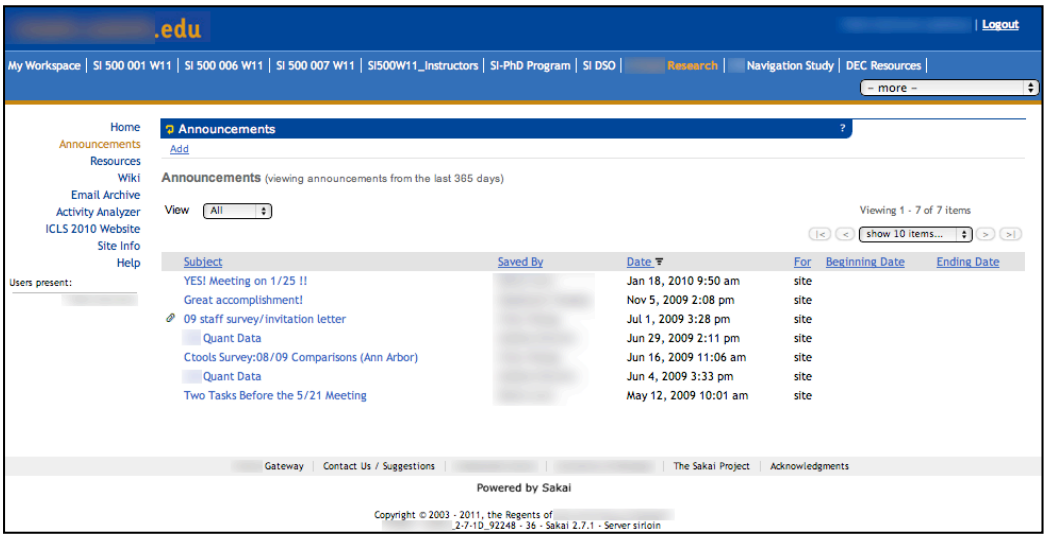


Figure 7. Sample screenshot of a Project Site

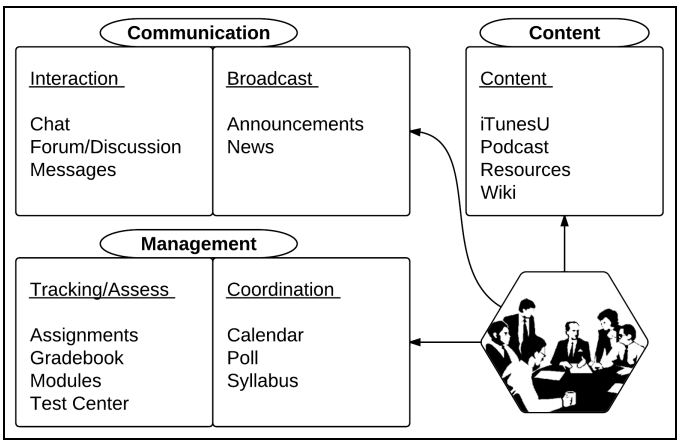


Figure 8. Project Site Tool Brekdown by Categories

create course websites and project websites." To achieve these ends, designers and implementers created a learning toolkit that gives faculty the ability to create Course Sites dedicated to a specific class; the system also gives anyone at the university the ability to create Project Sites. Course Sites and Project Sites both look the same (see Figure 7) and operate in the same ways, the difference being that only faculty can create Course Sites. Both types of sites support learning and research through a toolkit that includes communication tools, content management tools, and course-specific tools that support coordination, tracking progress/feedback, and scheduling. Figure 8 shows the

way that I've sorted a subset of these tools based on their general functions (a full list of these tools and their descriptions can be found in Appendix A). The subsets of tools I've identified and classified offer certain affordances that are not designed to replace synchronous collocated collaborations but rather to supplement these collaborations. The tools found within the CTools toolkit give users the capabilities of communication, albeit only through text. Co-presence is not supported in the traditional sense that collaborators can see each other via video, though the toolkit supports co-presence/awareness with a list of other collaborators who are visiting the site simultaneously. While it does not provide tools for sharing a synchronous workspace, what it *does* support is an asynchronous shared workspace through a wiki, a shared repository for knowledge and content management and a set of common tools for various coordination and process-type activities (e.g., setting up task lists in Assignments). Communication-support is achieved through text-based means through both asynchronous and synchronous interaction (2-way communication) and broadcasting (1-way communication), a distinction described in Lonn & Teasley (2009).

3.2 APPROPRIATION OF CTOOLS PROJECT SITES BY STAFF

When designing CTools and implementing the Project Sites feature, there were few expectations that the system would be widely adopted by staff at the university since the system was designed to support educational and research activities. ITS, who implemented and maintained the CTools infrastructure, expected that some staff in research roles would potentially use Project Sites—thus staff had been considered as an existing population in the university, though one that was not expected to have a stake in the development of CTools.

However, years after the launch and use of CTools, implementers and researchers noticed a trend—there were actually a large number of Project Sites created by staff and it did not seem that these sites were being created on the behalf of faculty and students. In fact, as an unanticipated audience, staff users of the Project Sites tool have created an increasing number of sites—a greater number of sites than faculty, one

of the intended audiences. This finding highlights the importance of understanding this user group in order to continue with the iterative design process. While these kind of unanticipated users led to questions about system use, it quickly became apparent that consulting both the appropriation literature and the design literature did not sufficiently address unanticipated users as much as it considered unanticipated use. Returning to the topic of design, this gap in the literature led to the following question:

If, as designers and researchers, we should design technology with users, tasks, and needs in mind, then what is our responsibility to understand the way it is actually used by users outside of our intended audience and why they use it the way they do? And once we decide to tackle this challenge, how do we go about doing so?

Perhaps the reason why unanticipated users are ignored is because they are perceived as a minority. This may often be the case. However, in the context of collaboration systems, where there are very tangible network effects in the sense that the way unanticipated users use the system could potentially diffuse throughout a network, it is important to note these users and how they use the appropriated technologies. Even if unanticipated users use technologies the same way as their anticipated counterparts, it is also true that the *reasons why* they use technology in the same way may differ. Even without the concern of diffusion of potentially unintended use by unanticipated users, understanding these users is very much in line with user-centered and task-centered approaches that make the understanding of users their foundation.

3.3 RESEARCH PARADIGM & QUESTIONS

Given that we did not know much about this staff user group or their use of the system, I decided to employ a three-pronged approach that mixes both quantitative and qualitative methods to triangulate Project Site use. This method of triangulating data on use employs information about the way users value the system and how they use the system as characterized by use logs and through their practices as revealed by

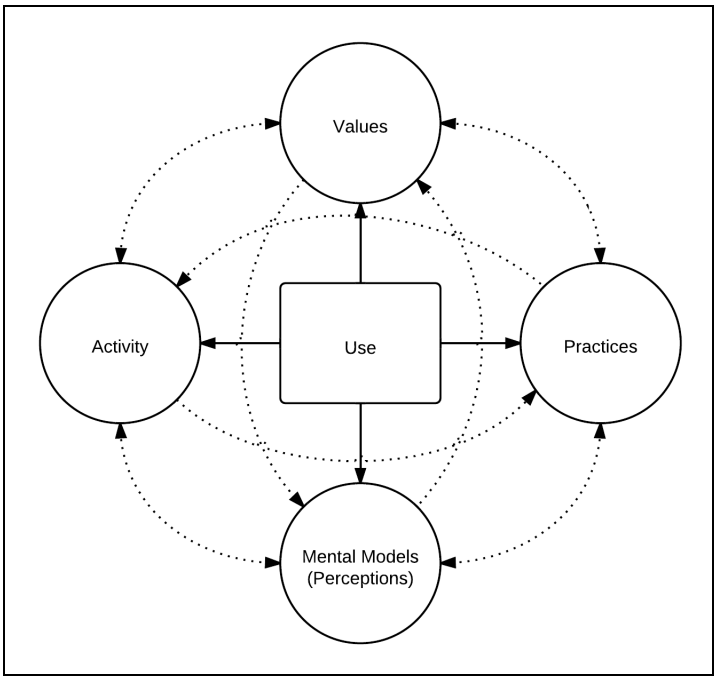


Figure 9. Triangulation Scheme

interviews (see Figure 9). Triangulation has been proposed as a valid HCI method by researchers such as Millen (2000), particularly for field research, as a method of describing systems.

The overarching research questions in the coming chapters are as follows:

RQ 1. Why did staff appropriate Project Sites?

RQ 2. How did staff appropriate Project Sites?

RQ 3. What does appropriation by unanticipated users say about design and implementation processes?

RQ 4. How can the understanding of staff appropriation of Project Sites inform iterative design?

RQ 5. What is the theoretical impact of appropriation by unanticipated users?

CHAPTER 4. SURVEY STUDY

I conducted a staff technology use survey during October 2010, the majority of which was a general technology use survey and part of which sought to examine certain aspects of about CTool's Project Sites toolkit. I was particularly interested in how users of the toolkit valued it, their perceived frequency of use, and incentives/barriers to its adoption. In addition to data from this survey, we also had access to data from the prior student/faculty survey that laid the groundwork for the staff survey. Thus I was able to make comparisons between groups in many cases. Because the faculty/student comparison is out of the scope of this paper (both groups are intended users), I sought to examine only the difference between staff/faculty and staff/students.

4.1 REASONS FOR APPROPRIATING TECHNOLOGY

In describing reasons for staff's appropriation Project Sites, I looked to the Information Systems (IS) literature. Within this literature, there are a number of researchers who have studied technology adoption using the Technology Acceptance Model (TAM) (Davis, 1989, 1993; Davis, Bagozzi, & Warshaw, 1989; Venkatesh, 2000; Venkatesh & Davis, 2000; Venkatesh & Bala, 2008). Proponents of this model postulate that two major factors drive the adoption of technology— perceived usefulness (PU) and perceived ease of use (PEoU). Ease of Use—which I will equate to *usability*, the term used most commonly in HCI—and usefulness each have been redefined in various iterations of TAM to include social factors (such as voluntariness, increase of status, job relevance, etc.) as well as attitudes towards technology and experience with the technology in question.

The full TAM model (shown in Appendix B) has been shown to predict whether people will adopt a technology. However, in adapting the model to describe appropriation, I refer back to the previous chapter where I point to the tailorability literatures' suggestion that technology should be flexible and the appropriation literature's concepts of interpretive flexibility. Together, these literatures suggest that IT that is flexible is capable of being appropriated and that potential users will want to adopt and appropriate flexible technologies. However, because I am examining unanticipated users, I also propose that perceived design intent might hinder adoption if the tension between the unanticipated user and the perceived intended user cannot be resolved. Thus, I propose that usefulness, usability, flexibility, and design intent might be able to explain part of the question, "Why did staff appropriate Project Sites?"

4.2 RESEARCH QUESTIONS

RQ 1. Which staff members use CTools Project Sites? Specifically, how can we define this population of unanticipated users in terms of their job roles, their unit affiliations, and their self-reported computer efficacy? How can we define their relationship to technology as a way of explaining their appropriation of Project Sites?

RQ 2. How do staff users perceive the toolkit's usability and usefulness? How do they perceive its design intent and how do they view its adaptability?

RQ 3. How can we use information from RQ1 and RQ2 to explain the appropriation of Project Sites?

RQ 4. How do staff users value the system? What particular toolkit features (tools) do they value and how valuable is the toolkit for achieving tasks?

RQ 5. How do these perceptions compare to students and to faculty?

4.3 METHODS

I conducted a two-part survey using a branched design. The first part of the survey consisted of questions concerning demographics and general information technology (IT) job-related use (see Appendix C). The last question of the first half of the survey

was a branching question that asked users to rate their use of the Project Site feature of the LMS along a continuum, ranging from nonuse or one login, few logins, past use, seasonal use (use related to specific events in the academic calendar, such as the tenure review process), and current use. The second part of the survey was only available to those respondents who had some past experience with the system.

Staff members who described their use as seasonal or current were asked to respond to a series of questions concerning their Project Site use (See Appendix D), including: rating the value of specific tools, rating the system's adaptability, and rating the value Project Sites for general purposes and specific activities. Respondents provided ratings on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree, and 0=Have Not Used). I compared data from the staff survey to findings from a similar instrument used in a student/faculty survey from 2010.

PARTICIPANTS

I invited all full time staff members at the university who have regular appointments (i.e., not temporary staff) to take part in a technology use survey. Out of the 27,477 staff invited to participate in the study, I received 6,590 responses, resulting in a 24% response rate. Of these respondents, 15% (990 staff members) claimed to be current users, a number that is significantly lower than student and faculty.

Staff members who described themselves as current users were next asked to respond to a series of questions concerning their Project Site use, including: rating the value of specific tools, rating the value of Project Sites for general tasks, and rating the value Project Sites specific day-to-day activities. Respondents provided ratings on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree, and 0=Have Not Used).

Respondent Use Type	Respondent Percentage
Non-User	48.7
1x User	5.6
Occasional User	16.8
Past User	9.5
Seasonal User	6.8
Current User	12.0

Table 1. Breakdown of staff Project Sites Use (Branching question)

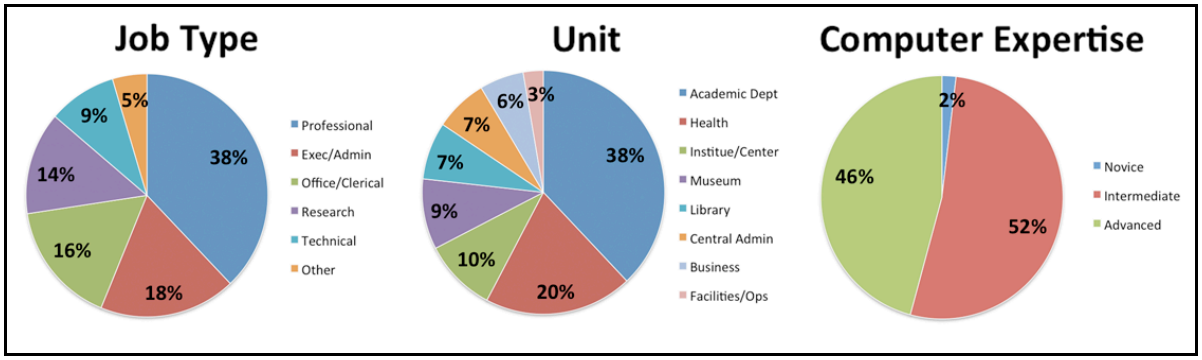


Figure 10. Pie Charts for respondent unit, job type, and computer expertise

4.4 RESULTS

4.4.1 DESCRIPTION OF STAFF PROJECT SITE USERS AND RELATIONSHIP TO TECHNOLOGY

I performed a broad descriptive analysis of general Project Site use among staff, using categories created for the faculty/student surveys and existing data about staff. A large number of staff had not heard of CTools' Project Site feature (66%). Of those users who have heard of Project Sites, 48.7% have never used it, 31.8% have some experience with the system, and 18.8% can be said to be current users. (see Table 1 for the full breakdown). Shifting focus from all respondents, I examined those who claim to be current users (both seasonal and current) along job types, unit of employment, and computer expertise. The results (seen in Figure 10) show a that the majority of

	r	*M (SD)*
IT Value		**4.42 (.62)**
IT is value for:		
- Improving my work	0.85	4.45 (.71)
- Saving me time	0.85	4.48 (.76)
- Accessing material	0.81	4.57 (.71)
- Managing work	0.79	4.29 (.83)
- Improving communication between me and my:		
(Coworkers)	0.85	4.43 (.76)
(Boss)	0.82	4.28 (.82)
Technology-seeking attitude		**3.37 (.82)**
- I am the first to try new technology	0.86	3.05 (1.05)
- I present new technology to others	0.87	3.06 (1.10)
- I try new technology after being told about it	0.73	3.87 (.79)
- I seek out new technology to use in my job	0.85	3.50 (.99)
Computer Self-Efficacy		**3.81 (.72)**
I could use IT if:		
- Someone showed me what to do	0.77	3.82 (.98)
- I had used a similar package before	0.82	3.86 (.88)
- I had a manual	0.71	3.66 (.97)
- There is a facility for assistance	0.78	3.90 (.89)
Computer Playfulness		**3.50 (.75)**
When I use IT, I feel:		
- Spontaneous	0.82	3.44 (.89)
- Creative	0.86	3.64 (.86)
- Adventurous	0.85	3.42 (.90)
Computer Anxiety		**1.49 (.66)**
Working with computers makes me feel:		
- Nervous	0.92	1.47 (.72)
- Uncomfortable	0.92	1.51 (.74)

Table 2. Component Matrices for Attribute variables with one (1) component

respondents come from non-research jobs, are mostly in academic departments, and considered themselves to be intermediate-level computer experts.

I used a number of variables from the survey to measure staff's relation to technology in the workplace, using both original items as well as some other items adapted from TAM. These items corresponded to the value of IT in the workplace, technology-seeking propensity, computer self-efficacy, computer playfulness, and computer anxiety (see Table 2). Items were measured on a 5-point Likert scale (1=Strongly Disagree, 5=Strongly Agree). I verified that the items I borrowed from

	r	*M (SD)*
Technology Aversion		**1.88 (.65)**
- Learning to use IT is too time consuming for me	0.87	2.14 (.93)
- IT is too complicated to learn	0.92	1.82 (.79)
- IT has no connection to my job	0.60	1.63 (.74)
- IT use take up too much time from my day	0.77	1.93 (.84)
Implementation Issues		**2.54 (.80)**
- My supervisor does not know how to implement IT	0.74	2.31 (1.03)
- New IT is too expensive for my unit/department	0.87	2.58 (.96)
- There is no recognition or reward for using IT	0.73	2.74 (1.09)

Table 3. Component Matrices for Technology Adoption Barriers variables

TAM and the new items factored as expected. I conducted a principal components analysis (PCA), using the standard of Eigenvalue = 1 to determine that each set of items factored into one component. The items factored into their corresponding components, verifying TAM's constructs while also showing that the new constructs measured what the same variable.

A separate set of survey questions was designed to measure barriers to technology adoption. These items were taken from previous annual CTools surveys distributed to faculty and students (see Table 3) and they mapped onto constructs from later TAM models. Following the same criteria I used for the previously mentioned items, I verified that these items factored into the appropriate components. I also verified that these items did not load into the same components as the staff attribute items, particularly noting potential overlaps with playfulness and anxiety components. The result of the PCA was two factors that I labeled 'technology aversion' and 'implementation issues. I removed some items that did not have a large enough relationship with any other items ($r < .60$).'These items were as follows:

- "IT does not function properly on my computer"
- "I need greater tech support in order to use IT in my work"

- "None of my coworkers use IT"

On average, staff users were skewed towards highly valuing IT in their work (*M* = 4.42, *SD* = .62) and having an above-average perception of their own computer self-efficacy (*M* = 3.81, *SD* =.71). Staff rated themselves low computer anxiety (*M*=1.89, *SD*=), but only a little above average in terms of computer playfulness (*M*=3.5,*SD*=*.75*) and their reported technology-seeking behavior (M=3.37, *SD*=.82). Among Project Sites users, these staff's responses to the implementation barriers construct suggested that staff did not agree to widespread barriers to technology adoption (*M*=2.54, *SD*=.80).

4.4.2 Using Survey Measures & Models to Explain Staff Adoption & Appropriation

To understand staff adoption and appropriation of Project Sites, I drew on staff's perceptions of Project Sites' usability, usefulness, the flexibility of the tools, and the system's design intent. I used adapted versions of TAM's 'ease of use' and 'usefulness' measures, adding my own measures for flexibility to prompt staff to respond to these constructs (see Table 4). I asked users to rate the extent to which they agreed that Project Sites was designed for course work, research, and administrative work on 5-point Likert scale (1=Strongly Disagree, 5 = Strongly Agree). I also asked staff to respond to Project Sites' adaptability and their ability to adapt the system.

PCA largely confirmed the integrity of TAM's usability and usefulness components. However, usefulness items also formed their own individual components, one focused on usefulness to staff's jobs and another that was usefulness contextualized by others—that is, status and voluntariness are determined by others rather than the individual. The flexibility construct and design intent items, intended to be two different measures were highly correlated (*r*=.67), and PCA suggested that these items formed one component that I called 'flexibility.' In general, staff were neutral about Project Sites' usability, usefulness, and its flexibility/adaptability.

	r	*M (SD)*
Usability (Ease of Use)		**3.26 (.60)**
- PSites are easy to use	0.83	3.31 (.82)
- I have the resources necessary to use PSites	0.69	3.48 (.82)
- PSites are compatible with other systems I use	0.77	3.23 (.73)
- I find using PSites enjoyable	0.77	3.04 (.76)
Usefulness (Self-determined)		**3.18 (.72)**
- PSites increases my job performance	0.77	3.16 (.85)
- PSites are useful in my job	0.82	3.32 (.89)
- The benefits of using PSites is clear to me	0.83	3.14 (.96)
- The benefits of using PSites is easy to communicate	0.78	3.12 (.87)
Usefulness (Externally-determined)		**2.91 (.65)**
- My use of PSites is voluntary	0.86	3.21 (.92)
- Using Project Sites raises my status with coworkers	0.65	2.61 (.79)
Flexibility		**3.05 (.60)**
- PSites are easily adaptable to my work	0.88	3.12 (.78)
- I can adapt features of PSites to accomplish my tasks	0.82	3.13 (.75)
- PSites are designed with my work in mind	0.85	2.86 (.76)
- PSites are designed for administrative purposes	0.66	3.09 (.70)

Table 4. Component Matrix for Project Sites-related items questions

Because the intent of exploring these items was to explain why staff appropriated Project Sites. Specifically, I was concerned with explaining differences between why staff attempted to appropriate Project Sites and why staff became users. The 'attempt to appropriate Project Sites' and the 'successful appropriation of Project Sites' were both defined by staff's responses to the prompt about the extent of their use of the toolkit. Users who reported 'Few times' use or more were treated as those who made an attempt and did not succeed at appropriating Project Sites; only those staff who reported their use as 'Past use,' 'Seasonal use,' and 'Current use' were treated as successful appropriators.

	TRIED PROJECT SITES FEW TIMES (X^2 = 541.08, df =1 3, p < .001, R^2_N = .23)						SUCCESSFUL APPROPRIATION (X^2 = 595.61, df = 13, p < .001, R^2_N = .30)					
	B	*S.E.*	Wald	*df*	*p*	Odds	B	S.E.	Wald	df	p	Odds
Tech-Seeking Attitude	.15	0.07	4.32	1	< .05	1.165	.19	0.08	5.39	1	< .05	1.209
General IT Value	.06	0.07	0.71	1	NS	1.063	- .09	0.08	1.29	1	NS	0.913
Computer Self-Efficacy	.13	0.06	4.22	1	< .05	1.138	- .06	0.07	0.67	1	NS	0.946
Computer Playfulness	.01	0.07	0.01	1	NS	1.007	.01	0.08	0.02	1	NS	1.01
Computer Anxiety	- .26	0.08	9.86	1	< .005	.775	- .05	0.09	0.30	1	NS	0.951
Barrier: Tech Aversion	.30	0.09	10.37	1	< .005	1.353	- .20	0.10	3.74	1	= .05	0.819
Barrier: Tech Implement	- .04	0.06	0.41	1	NS	.961	0.06	0.07	0.88	1	NS	1.066
Computer Experience			10.69	2	= .005				1.25	2	NS	
- Novice	- .70	0.26	7.32	1	< .01	.494	- .35	0.33	1.11	1	NS	0.704
- Intermediate	- .30	0.11	7.37	1	< .01	.745	.01	0.12	.00	1	NS	1.005
Usability	.77	0.11	47.73	1	< .005	2.150	.41	0.11	13.8	1	< .005	1.499
Usefulness (Self)	1.40	0.12	190.14	1	< .005	4.072	1.71	0.11	253.08	1	< .005	5.525
External Factors	- .99	0.09	128.58	1	< .005	.372	- .72	0.08	75.05	1	< .005	0.485
Flexibility	- .66	0.12	30.73	1	< .005	.519	- .36	0.11	10.03	1	< .005	0.699
Constant	.15	0.07	4.32	1	< .05	1.165	- 2.88	0.66	19.42	1	< .005	0.056

Table 5. Binomial Logistic Regressions

The outcome measures, trying Projects Sites and effectively appropriating Project Sites, were then quantified as binary outcomes (0=No, 1=Yes). I conducted a binomial logistic regression to verify which components predicted staff's behavior.[5] The result of this analysis was two distinct models (see Table 5)[6]. With the difference between the models being the inclusion/exclusion of 'Few times' users, the results would highlight differences in which factors drove intent to appropriate Project Sites versus which factors drove successful appropriation.

The models were statistically significant when predicting whether staff were likely to try Project Sites as well for predicting whether staff were likely to appropriate the toolkit. I report the pseudo *R*-squared values in the tables, though they should be interpreted with caution as they cannot be interpreted in the same way as true *R*-squared statistics from OLS regression. The *R*-squared values were above zero for both models, suggesting that the full models are an improvement over the null models for each outcome variable. Regardless, the *R*-squared values were low for these models.

[5] TAM uses Structural Equation Modeling (SEM), but I the binary data collected makes such replication of TAM difficult. Future work will address this problem.
[6] The number of users on a site was also used, but was omitted because, though significant, it added little to the model

TAM researchers found that usefulness and ease of use are predictors for intent to adopt technology. The models created from the data mirrored this finding, suggesting that both usability and usefulness were incredibly predictive of a staff member's initial attempts to try the tool as well as being predictive of their successful appropriation of the tools. Usefulness was the most predictive of the constructs, with a unit increase in usefulness resulting in four times the odds for trying Project Sites and five times the odds for successfully appropriating it. A unit increase in usability increased the odds by two times for trying Project Sites and by half for appropriating it.

Technology-seeking attitude only moderately increased the odds of both trying Project Sites and appropriating it. An increase in computer anxiety decreased the odds of trying Project Sites, but had no effect on the odds of appropriating the tools. Being a novice-level or intermediate-level computer user decreased the odds of trying Project Sites compared to experts (.49 and .75 respectively) while there was no significant change in odds for the effect of computer expertise on successful appropriation. Technology aversion increased the odds of trying Projects Sites and slightly decreased the odds of continuing to use them.

There were two interesting sets of unexpected findings. First, computer self efficacy slightly increased the odds of trying Projects Sites while slightly decreased the odds of continuing to use them. Secondly, usefulness influenced by social factors (external factors) and flexibility decreased the odds of both trying Project Sites and successfully appropriating the toolkit—both findings that pointed in the opposite direction than expected. In particular, I was interested in explaining the odd performance of the flexibility metric in the model. When the models only included 'flexibility,' the new construct increased the odds of both trying Project Sites (1.48) and appropriating it (2.3). It was only when stepwise models included usefulness and usability as variables that flexibility decreased the odds of both staff behaviors.

A standard Pearson bivariate correlation of all the variables suggested that there was a strong positive correction between flexibility and usefulness ($r = .655$, $p < .001$), as

well as between flexibility and usability (r = .634, p < .001), which not only suggested a strong link between staff ratings of the perception of Project Sites' flexibility and the perceptions of its usefulness and usability but also suggested that flexibility should increase trying Project Sites and successfully appropriating it.

I also tested the technology aversion and external factors items in a step-wise model. When the model excluded usefulness and usability, the technology aversion item correctly decreased the odds for both trying and appropriating Projects while the external factors item correctly increased the odds for trying and appropriating Project Sites. All other variables, when run through the model without usefulness and usability increased or decreased the odds in the same directions as the models that included the variables. Thus, the odd performance of the three constructs might be due to noise in the data, multi-collinearity issues, or the extreme effect of the usefulness and usability constructs.

Lastly, I checked the predictability of the models by looking to see how predictive the full models were to the null models. According to the classification tables from the binomial logistic regressions, the model for trying Project Sites correctly predicts 74.4% of the cases, though the null model predicts the same outcome variable correctly 74.8% of the time. The model for successfully appropriating Project Sites correctly predicts 71.8% of the cases, compared to 63% of cases predicted by the null model. Thus, only the model for predicting the successful appropriation of Project Sites proved to be an improvement.

4.4.3 Project Sites' Design Intent & Flexibility

Because design intent and flexibility are important parts of the appropriation literature, I further investigated staff's potential reasons for adopting the Project Sites toolkit, using respondents' computer expertise, units, and job types to determine differences between staff that might help to explain why unanticipated users might adopt and appropriate the tools. There were significant differences for both respondents' job

ANOVA: Project Sites was designed with my work in mind				
	df	*N*	*F*	*p*
Job Type	5	3244	9.48	<.001
Computer Expertise	2	3256	14.56	<.001

Table 6. ANOVA results: Project Sites designed with my work in mind

category and computer expertise, but respondent unit was not significant (see Table 6). Post hoc analysis using the Tukey HSD test for pairwise comparisons with a Holm's Sequential Bonferroni Adjustment showed that where there were differences in ratings between job categories (Project Sites designed with my work in mind). Office/clerical staff had agreed most that Project Sites was designed to match their work needs significantly more than other groups (Table 7). However, the ranges of these ratings were still relatively neutral. Effect sizes were small. Tukey HSD post hoc analysis also suggested that the more computer expertise staff had, the less they felt the toolkit reflected their needs and all groups differed from each other significantly. Effect sizes for these intra-staff comparisons were small.[7]

The other way in which I explored user perceptions of Project Sites is by respondent's judgments concerning the toolkit's adaptability. Specifically, I asked staff respondents to rate their agreement with two statements—"The system is adaptable" and "I can adapt the system to my needs"—each rated on a 5-point Likert scale (1=Strongly Disagree, 5=Strongly Agree). The former is related to a trait of the system itself, whereas the latter related to the respondent's ability. Overall, the ratings for both prompts were similar: system adaptability (M=3.12, *SD*=.78) and adaptation ability (M=3.13, *SD*=.75). A Pearson's correlation suggested a moderate, significant correlation between the two constructs ($r(3245)=.66$, $p<.001$). An ANOVA test revealed statistically significant differences between staff types, finding that their job type and unit were

7 Effect size Cohen's d = .2 (small), .5 (medium), .8 (large)

Tukey HSD Post Hoc	
Comparison Groups	*Mean(SD)*
Job Type	
- Office/Clerical	3.03 *(.77)*
- Exec/Admin *	2.91 *(.76)*
- Research *	2.91 *(.75)*
- Professional *	2.78 *(.77)*
Job type	
- Office/Clerical	3.03 *(.77)*
- Other *	2.81 *(.77)*
- Professional *	2.78 *(.77)*
- Technical *	2.77 *(.75)*
Computer Expertise	
- Novice*	2.99 *(.66)*
- Intermediate *	2.91 *(.72)*
- Advanced *	2.78 *(.82)*

Table 7. Post hoc results: Project Sites designed with my work in mind

(*) denotes group that differs significantly at p ≤ .05

ANOVAS: Adaptability				
System is adaptable	*df*	*N*	*F*	*p*
Job Type	5	3251	7.20	< .001
Unit	9	3234	1.94	< .05
Computer Expertise	2	3263	4.48	0.01
I can adapt the system	*df*	*N*	*F*	*p*
Job Type	5	3237	7.03	< .001
Unit	9	3234	2.97	< .005

Table 8. ANOVAS: Project Sites Adaptability

(*) denotes group that differs significantly at p ≤ .05

differed for both items, while user expertise was significant only for system adaptability (Table 8).

Post hoc tests (Table 9) revealed that the toolkit's adaptability was rated higher among office/clerical staff than by a other kinds of staff; there were also statistically significant differences between different levels of computer expertise, where intermediate users rated the system's adaptability lower than advanced users, but not novice users. The effect sizes were small. Post hoc analyses that examined users' self-reported ability to adapt the toolkit (Table 10) revealed differences between some

Tukey HSD Post Hoc	
Job Type	*Mean (SD)*
- Office/Clerical	3.03 (.79)
- Research *	2.91 (.75)
- Professional *	2.78 (.78)
- Technical *	2.77 (.79)
- Exec/Admin *	2.91 (.76)
Computer Expertise	*Mean (SD)*
- Intermediate *	3.07 (.73)
- Advanced	3.15 (.85)

Table 9. Post hoc results: Project Sites is adaptable.

Tukey HSD Post Hoc	
Job Type	*Mean (SD)*
- Exec/Admin	3.20 (.72)
- Professional*	3.06 (.75)
Job Type	*Mean (SD)*
- Office/Clerical	3.26 (.75)
- Professional*	3.06 (.75)
Unit	*Mean (SD)*
- Academic Unit	3.20 (.81)
- Other	3.00 (.78)

Table 10. Post hoc results: I can adapt Project Sites.

(*) denotes group that differs significantly at $p \leq .05$

professional staff and both executive/admin and office/clerical staff, the former rating their ability to adapt the system lower than the latter; academic units also rated their ability to adapt the system higher than staff in the "Other" category. The effect sizes were small.

4.4.4 Toolkit Value

Other possible explanations for the appropriation of Project Sites could relate to some feature that the toolkit offers. We asked users to rate the value of the tools in the toolkit. Staff respondents rated 14 of a list of 17 tools on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree, and 0=Have Not Used). 3 tools, Gradebook, Modules,

Staff Tool Value Ratings		ANOVA					Value Ratings & Post Hoc Comparisons					
							Faculty/Staff			Students/Staff		
TOOL	Mean (*SD*)	*df*	*N*	*F*	*p*	η^2	Mean (*SD*)	*p*	*d*	Mean (*SD*)	*p*	*d*
Resources	4.25 (0.78)	2	2585	54.3	≤ .001	0.04	4.66 (0.72)	≤ .001	0.6	4.41 (0.78)	≤ .001	0.2
Announcements	3.77 (0.95)	2	2744	366.98	≤ .001	0.211	4.64 (0.66)	≤ .001	1.1	4.60 (0.64)	≤ .001	1.0
Syllabus	3.67 (1.02)	2	2397	187.3	≤ .001	0.135	4.41 (0.83)	≤ .001	0.8	4.46 (0.71)	≤ .001	0.9
Schedule	3.63 (1.02)	2	2010	16.03	≤ .001	0.016	3.91 (1.08)	≤ .001	0.3	3.90 (1.00)	≤ .001	0.3
Assignments	3.57 (1.03)	2	2462	298.92	≤ .001	0.195	4.43 (0.83)	≤ .001	1.0	4.53 (0.69)	≤ .001	1.1
Messages	3.57 (0.95)	2	2034	49.63	≤ .001	0.047	4.06 (1.01)	≤ .001	0.5	3.98 (0.93)	≤ .001	0.4
Wiki	3.31 (0.95)	2	1399	1.65	NS	----	3.36 (1.04)	NS	-	3.42 (1.08)	NS	-
Forum	3.26 (1.02)	2	1488	0.86	NS	----	3.23 (1.16)	NS	-	3.33 (1.12)	NS	-
Discussion	3.20 (0.93)	2	1999	12.01	≤ .001	0.012	3.40 (1.19)	NS	-	3.53 (1.10)	≤ .001	0.3
Polls	3.18 (0.87)	2	1367	5.20	≤ .001	≤.01	3.37 (1.08)	≤ .05	0.2	3.36 (1.01)	< .01	0.2
Podcast	3.12 (0.92)	--	----	----	----	----	----	----	-	----	----	-
News	3.01 (0.89)	2	1291	8.05	≤ .001	0.012	3.22 (1.07)	≤ .05	0.2	3.25 (1.03)	≤ .001	0.3
Chat	2.90 (0.97)	2	1864	30.89	≤ .001	0.032	3.37 (1.14)	≤ .001	0.4	3.37 (1.15)	≤ .001	0.4

Table 11. ANOVA & Post Hocs: Tool Value Ratings

and iTunesU, were excluded because previous surveys had established that there were very low-use tools and thus value ratings were not informative. Faculty and students did not rate one of the tools, Podcast, for which I present only the staff scores. I present the resulting value ratings for those users that had used the tool in Table 11.

The ANOVAs suggest that there were statistically significant differences between staff and the other two user groups in value ratings for all tools except for the Wiki and Forum tools. The ANOVA revealed that effect sizes were mostly small, though there were a few medium and large effect sizes.[8] Post hoc comparisons using Tukey HSD with an HSB adjustment confirm statistical significance and effect sizes, calculated using Cohen's *d*. The tool ratings indicated that staff and faculty both gave the highest value ratings to Resources, whereas students rated the Announcements tool highest. Staff and faculty rated the Announcements tool as their second most valuable tool, but the similarity of their highest valued tools diverged after Announcements. In terms of determining value, Students rated Resources as the fourth most valuable tool, followed by the Assignments and Syllabus tools (respectively).

I also asked users to rate how valuable Project Sites were to achieving some general purposes and some specific activities. The purposes identify broad categories of use whereas the activities represent daily activities that we had predicted users would need to engage in given group work needs and system affordances. Users rated these

8 Effect size eta-squared, η^2 = .01 (small), .059 (medium), .138 (large)

Staff Value Ratings	
General Purpose	**Mean (*SD*)**
Administration	3.85 (0.86)
Training	3.60 (0.91)
Faculty-led research	3.53 (0.88)
Managing events	3.50 (0.91)
Non-academic use	3.48 (0.83)
Personal use	3.19 (0.98)
Non-credit learning*	2.37 (1.80)
Specific Activity	**Mean (*SD*)**
Single Access Point	4.30 (0.69)
Distance Work	3.93 (0.82)
Creating Groups*	3.90 (0.81)
Communication	3.84 (0.96)
Post Audio/Video	3.78 (0.90)
Edit Group Materials*	3.67 (0.98)
Tracking Progress	3.53 (0.94)
Scheduling	3.21 (1.09)

ANOVA				
df	*N*	*F*	*p*	η^2
2	2131	47.5	<.001	0.042
2	1634	11.13	<.0-01	0.013
2	1710	9.12	<.001	0.01
2	1709	7.6	<.001	0.008
2	1725	3.11	<.050	<.01
2	1764	22.26	<.001	0.027
----	----	----	----	----
df	*N*	*F*	*p*	η^2
2	2791	18.55	<.001	0.013
2	1880	33.8	<.001	0.035
----	----	----	----	----
2	2839	193.21	<.001	0.12
2	1983	8.71	<.001	<.01
----	----	----	----	----
2	1831	7.7	<.001	<.01
2	2136	36.98	<.001	0.033

Value Ratings & Post Hoc Comparisons					
Faculty/Staff			Students/Staff		
Mean (*SD*)	*d*	*p*	Mean (*SD*)	*d*	*p*
4.00 (1.00)	0.1	< .001	3.43 (1.09)	0.4	< .05
3.53 (1.13)	-	N.S.	3.32 (1.07)	0.3	< .001
3.55 (1.13)	-	N.S.	3.30 (1.09)	0.2	< .001
3.59 (1.08)	-	N.S.	3.32 (1.09)	0.2	< .005
3.39 (1.11)	-	N.S.	3.57 (1.09)	-	N.S.
3.54 (1.20)	0.3	< .001	3.52 (1.09)	0.3	< .001
----	-	----	----	-	----
Mean (*SD*)	*d*	*p*	Mean (*SD*)	*d*	*p*
4.51 (0.78)	0.3	< .001	4.31 (0.87)	-	N.S.
3.53 (1.20)	0.4	< .001	3.55 (1.09)	0.4	< .001
----	-	----	----	-	----
4.57 (0.77)	0.8	< .001	4.42 (0.74)	0.7	< .001
3.69 (1.19)	-	N.S.	3.93 (1.01)	0.2	< .01
----	-	----	----	-	----
3.41 (1.17)	-	N.S.	3.31 (1.12)	0.2	< .001
3.60 (1.14)	0.3	< .001	3.66 (1.12)	0.4	< .001

Table 12. ANOVA & Post hocs: Purpose & Activity Support Value Ratings

prompts on 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). The results of these prompts can be seen in (Table 12). Staff rated the toolkit highest in its ability to support administrative purposes and valued it highest for accessing materials at a central location and for distance work. There were significant differences between staff and the comparison groups for all ratings (except those where no comparison could be made). Similar to staff, faculty rated the value of Project Sites for supporting administrative purposes the highest. Students, on the other hand, valued the system most for non-academic activities. Among the activities that Project Sites supports, staff rated the system most valuable for supporting central access to materials (sharing and retrieval), whereas faculty and students rated this use second most valuable. Instead, faculty and students valued the system most for communication activities. All of the effect sizes were above small except for in three instances.

4.5 Discussion

The first research question asked which staff appropriated Project Sites. I expected that many users would be in predominantly research-related job roles, but actually found few researchers. Instead, it was most common to find users from administrative, clerical, and professional job roles. Many Project Sites users came from degree-granting

departments where exposure to Project Sites would be the greatest, but there were also many staff who were not in units where Project Sites (or CTools) use would be expected to be widespread. Interestingly, the second largest respondent unit was Health Services, which is composed of the Hospital, the Medical School, and health-related departments. Because the hospital system and medical school have other collaboration systems in place, we did not expect to find many users to come from this unit. While this group created a number of Project Sites, it was also evident that the number of Health Services users is small compared to the overall size of the Health Services staff body. The number of users raises questions about their demographics and how they discovered the system and how they use it.

The second research question explored staff's relationship to technology, expecting that the data might have pointed to reasons why staff might appropriate Project Sites. Overall, staff rated the value of IT in their jobs highly and they rated their computer self-efficacy relatively highly. Staff also considered themselves mostly intermediate and expert in their computer use. Staff also rated themselves low in technology aversion and in computer anxiety. Though staff appropriated Project Sites, their responses to their playfulness and attitudes towards seeking out new technologies were neutral. This last finding suggests that staff may not seek out new technologies themselves, but their appropriation of Project Sites may have been die to other reasons.

The third research question explored staff's perceptions of Project Sites' usefulness, usability, design intent, and flexibility as well some of constructs that addressed staff's relation to technology. The results revealed that staff were not strangers to technology and that their judgments of Project Sites usefulness and usability were relatively neutral across all staff. However neutral staff were about the toolkit's usefulness and usability, the binary logistic regression model confirmed that the more useful and usable staff perceived Project Sites to be, the more likely staff were to appropriate it.

In Chapter 2, I described flexibility as an important feature of collaborative systems, allowing them to be adapted to multiple contexts. In this chapter, I postulated that perceived flexibility and perceptions of design intent that favored staff might explain why staff appropriated Project Sites. However, the data showed that users' perceptions of Project Sites' flexibility and its design intent overlapping with staff work goals were generally neutral and that these two concepts were so closely related that they could be collapsed into one construct.

The third research question asked if the survey data could explain why staff appropriated Project Sites through modeling. Having drawn from TAM measures, existing survey measures (from the faculty/student survey), and the new measures for flexibility. I created two models, one to address the attempt to appropriate Project Sites and the other to address the successful appropriation of Project Sites. Only the appropriation model was more predictive than the null model; this model suggested that usefulness had the biggest effect on the odds of appropriating Project Sites, followed by usability. While a preliminary analysis of the effect of the flexibility construct showed that increased perceptions of flexibility increased the likelihood of appropriation, the effects disappeared and reversed in the binomial logistic regression model. This puzzling finding might have been due to multi-collinearity, but it is also possible that a more complex model with interaction terms might resolve the issue. However, for the purposes of this chapter, I was only interested in a basic model and I leave a more complex model to future analysis.

Exploring the flexibility and design intent further, I was particularly interested in the question, "Project Sites were designed with my work in mind" as well as the two adaptability questions. When I broke down these ratings by unit, job category, and computer expertise, I found that even the highest responses among staff were neutral (Neutral=3) or slightly lower. These findings suggest that despite Project Sites' flexibility, staff did not necessarily perceive the toolkit to be flexible. These items were never asked on faculty/student surveys, but a question that arises from these findings is whether staff would differ from faculty and students in these ratings.

The fourth research question asked how users valued the toolkit. To investigate this question, I asked users to rate the value of the tools, and to indicate how valuable the system was for supporting a number of purposes (broad categories of use) and for a list of daily tasks activities. The results indicated that staff rated the value of the tools lower than faculty and students, perhaps an indication that this group of unanticipated users found less value for the system than the anticipated users. The Resources tool had received the highest value rating among staff. Staff rated the system most valuable in its support of administrative purposes and in supporting the sharing of information from a single access point. There were significant differences between the staff and the comparison groups and there was a mix of effect sizes. The most notable of these was the large effect size between staff and both comparison groups on a few course-related tools (Syllabus and Assignments) as well as the moderate effect sizes between staff and faculty for Resources. The other notable difference came in the large and medium effect sizes between staff and faculty (respectively) for valuing Project Sites for supporting communication.

One notable observation in these findings was the extent to which there were significant results with relatively small effect sizes. However, in pursuing effect sizes, I hoped to mitigate the extent to which I drew conclusions based on significance alone. After accounting for significance related to the large sample size, I found that there were fewer differences between staff, faculty, and students than anticipated. Effect sizes being small suggests that though there are differences between the means of each group, those differences were not huge, possibly implying that staff values are similar to those of students and faculty and points to the values-related aspect of their appropriation as potentially being similar between the target and unanticipated user groups. Effect sizes also tended to be small within the staff community itself, suggesting that there were no big differences that could be attributed to staff in academic vs. non academic roles and units, nor did there seem to be differences between those few staff (research) who might have been anticipated compared to those administrative staff who were never anticipated to become users.

LIMITATIONS

One question that arose from the research was whether there was any response bias due to our sampling method. Because the survey was advertised as a technology use survey, there may be over-representation of technology-friendly staff and under-representation of technology-averse staff. While there is a possibility of a bias in the general computer tendencies of the respondents, there was little reason to suggest that this biased extended to staff's use Project Sites. If anything, the extent to which respondents had never used or heard of Project Sites suggests that respondents were not particularly biased towards use.

Another potential limitation of this study was related to the set of items used in the survey. In order to limit the length of the survey, many of the TAM items had to be excluded. In staying true to TAM's constructs, items were chosen based on how well they loaded onto their given components. It is possible that having more items in the survey would have resolved some of the issues with the model by providing more accurate data. Similarly, it is possible that the addition of more flexibility-related questions would have impacted the results.

A divergence from previous work was the decision to use binary data (use versus nonuse of tools) as an outcome variable. This method of measurement could have potentially oversimplified actual activity on Project Sites to the extent that it was difficult for a statistical model to be more accurate. Because the binomial logistic regression models proved to be less predictive than expected, the SEMs were never conducted. However, it is possible that recreating the SEMs might resolve some of the issues in the current models. It is also possible that reanalyzing the data with different outcomes could result in models with more explanatory power.

Another issue that arose was the formulation of the flexibility and design intent constructs. These constructs, which I designed as separate sets of items proved to be just one construct. This might have occurred because of the number of items that were

retained as a result of the factor analysis. The questions under the flexibility construct I described were those questions that survived past survey pretesting and after validating components analyses that led to the exclusion of a number of other items. With only two items representing 'adaptability' and two more representing 'design intent for staff,' it is possible that the reason for the lack of predictive power for 'flexibility' was due to the instrument.

The results presented in this chapter explained only part of the rationale for staff's appropriation of Project Sites. The survey suggested that its usefulness was the greatest factor and that the Resources tool was the clear favorite tool among staff. While this was an important step in understanding appropriation by unanticipated users, more work was needed to understand both why staff appropriated the toolkit and how they use it in practice. The following chapter takes a global view of how staff appropriated Project Sites from a quantitative perspective. Chapter 6 will use qualitative methods to examine "why" and "how" staff appropriated Project Sites at a deeper level.

CHAPTER 5. USE LOG STUDY

INTRODUCTION

In this second study, I was specifically interested in investigating staff Project Site use at a 'global' level to triangulate different aspects of use and create a larger picture of these unintended users. Specifically, I was interested in whether there were global differences between the intended users and the unintended users (staff/faculty and staff/student comparisons). This kind of data and analysis reveals what staff are actually doing at a system level rather than what they report that they are doing.

5.1 RESEARCH QUESTIONS

The following research questions are designed to describe staff usage of Project Sites using qualitative data.

RQ 1. Do staff have different general usage patterns than students and faculty? Specifically, are there differences in the number of site participants, the number of times the sites are visited, and the total activity per site?

RQ 2. To what extent do staff members use the different tools in the Project Sites toolkit?

RQ 3. Does staff usage differ from students and faculty? If so, how?

RQ 4. Does staff use of the tools follow a predictable pattern?

5.2 METHODS

5.2.1 EVENT COLLECTION

The Learning Management System creates "event" logs that capture when a user takes a particular action with a specific tool, such as downloading a document or posting an announcement. I collected Project Site event log data from staff whose survey responses indicated that they were regular Project Site users. Project Site data was collected from faculty and students (see sampling method below). The logged events for each tool were aggregated (after removing extraneous site-level events) for each Project Site in order to examine system activity on a site-by-site basis. Site activity was also analyzed by collapsing tool activity into three categories: communication, content, and management tools. Subcategories were created within the categories; communication tools, were sorted into subcategories of tools for broadcasting (1-way communication) and interaction (multi-way communication) and management tools were divided into those tools designed to assess work and those meant for general site management. In the faculty-student context, assessment tools are valuable in very clear ways, but their use is less expected in staff sites, under the assumption that the tools are interpreted the same across all populations. More specifically, if staff interpret the tools as student assessment tools, they will be less likely to use those tools.

5.2.2 PARTICIPANTS

Project Site event log data was collected for dates between Jan 1, 2010 though December 31, 2010 from staff whose survey responses indicated that they were regular Project Site users. I selected such users because they could guarantee that the site was active at the time of analysis, rather than sampling all sites, which might have included defunct sites. The data collected contained event logs for all site members for all sites affiliated with the respondent. Because some respondents belonged to the same site, duplicate sites were removed, resulting in a total of 2,967 staff sites. For comparison, I collected Project Site data from randomly selected faculty-led and student-led sites, resulting in data

from 1625 sites for each user group for the same dates as staff. I eliminated sites that did not have any logged events as well as those that did not have more than one user (solitary work vs. group work) After eliminating sites that did not meet minimum requirements for analysis, 1594 staff-created sites and 1621 student-created sites remained. These logs were used to look at differences that between all three of the user groups, but attend specifically to the differences between staff/faculty and staff/students.

5.2.3 PROCEDURE

The system log data captured a site's ID (a randomly generated string) and the site's name, the number of users on the site, how many times the site had been logged into, and the number of times each tool had been used. A number of sites identified and removed from the dataset either because they had never been visited (N = 135) or because they had been created, but never logged into (N = 698). A minimum threshold for what constitutes as 'tool use' was set at one event. Using the above criteria, 2.28 million events were captured from 2,976 staff sites. 502,765 events were captured from 1,621 student sites and 529,995 events from 1,594 faculty sites.

5.3 RESULTS

Some general site usage statistics were analyzed in order to address overall system usage of staff sites and differences between these and student and faculty sites. Data on the number of users on each site, the total number of site events, the total number of times a site was logged into, and the number of tools used had been collected. The non-linearity of the usage data makes the use of standard ANOVA inappropriate because the data violates of the assumption of this test, thus the Kruskal-Wallis ANOVA was used instead **(see** Table 13, next page). To verify pairwise differences between staff members and the student and faculty comparison groups, the Mann-Whitney U-test with a Holm's Sequential Bonferroni adjustment was used. Although all three pair-wise

	K-W ANOVA			Staff (N=2976)	Faculty (N=1594)	Students (N=1621)	Post Hoc Comparisons					
							Faculty/Staff			Students/Staff		
	χ^2	*df*	*p*	Median	Median	Median	|Z|	*p*	*r*	|Z|	*p*	*r*
# Users	1245.7	2	≤ .001	13	5	4	24.1	< .001	0.5	32.9	< .001	0.4
# Total Site Events	50.8	2	≤ .001	97	88	153	1.14	NS	-	5.62	< .001	< .1
Number of Logins	230.72	2	≤ .001	48	36	95	5.37	< .001	< .1	11.19	< .001	0.2

Table 13. K-W ANOVA: Number users, total events per site, and log-ins by site type

comparisons were tested, the two comparisons of particular interest for this paper are staff/student and staff/faculty comparisons.

The results of the Mann-Whitney U-tests (Table 13) indicated that staff sites differed significantly from both faculty and student sites for the number users on a site and the number of total events occurring on a site. Staff sites had more members than student or faculty sites. Staff sites had fewer total events than student sites, but more than faculty sites. Staff sites also differed significantly from student sites, but not faculty sites for the total number of logins per site. Staff and faculty sites were visited less frequently than student sites. Differences in the number of users on a site had a medium to strong effect size[9] for staff/students sites (r=.5) and staff/faculty sites (r=.4). For the total number of actions on a site, the effects sizes were small to none (Students, r=.1; Faculty, r =.0) as were the effects for the number of logins (Students, r=.2; Faculty, r=.1).

Tool Usage

One of the ways in which I expected staff would differ from faculty and students was in the way that staff used the tools, specifically, because staff's and faculty's work are different. One of the ways in which this was measured was simply through the number of tools that staff used. The number of tools that were active on a site was calculated by establishing the rule that use meant that the tool was activated more than once. Because I examined sixteen different tools, the minimum of active tools was 1 and the maximum was 16.

[9] Effect size $r = \frac{z}{\sqrt{N}}$, .1 (small), .3 (medium), .5 (large)

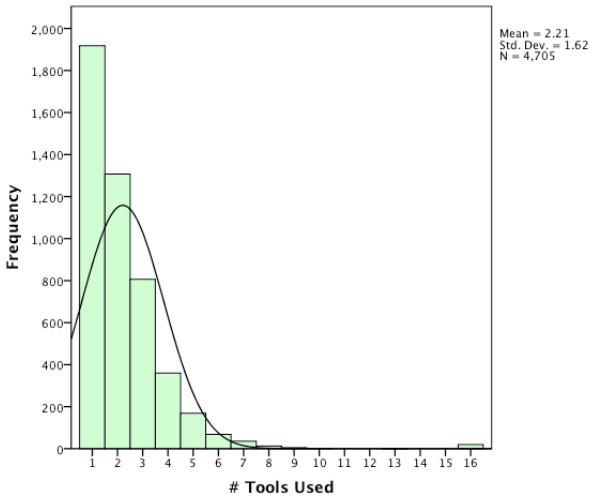


Figure 11. Project Sites by number of tools used

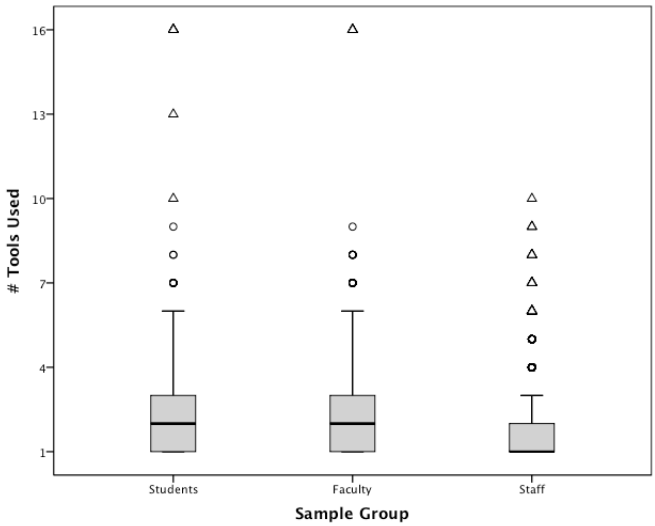


Figure 12. Comparison of number of tools used (Sample population)

Most of staff's Project Sites (82%) used 5 or fewer tools, though the majority of staff's Project Sites were heavily skewed towards using few tools (see Figure 11). Sites created by staff were compared to those created by faculty and students with a Kruskal-Wallis ANOVA. The differences in tool use were statistically significant (χ^2 (2, 4705) = 263.89, p<.001). Staff sites used fewer tools than faculty-created and student-created sites (see Figure 12).

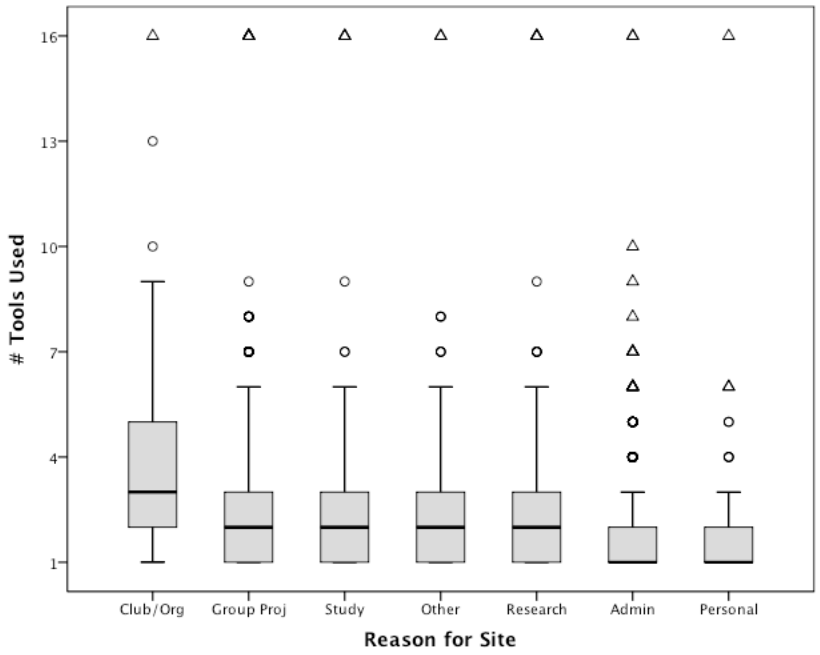


Figure 13. Number of active tools by site purposes (Staff sites)

Data also suggested differences in tools used within staff themselves depending on the site's purpose ($\chi 2$ (6, 4705) = 210.04, p<.001). Specifically, sites created for clubs and organizations appeared to use more tools than any other type of site (see Figure 13).

I identified tools as belonging to general categories (communication, content, and coordination tools), sub-categories for communication tools (interaction and broadcast) and management tools (general management and assessment). I investigated usage of the tools both individually and along the categories and sub-categories. This analysis (see left side of Table 14, next page) shows the distribution of tool usage, using percentages to describe the percent of site usage attributed to each tool for staff sites, student sites, and faculty sites. Content tools accounted for most of the events on all Project Sites regardless of the user type. For individual tools, the results showed that the Resources tool alone accounted for the largest percentage of overall tool use across all user groups.

	Staff	Faculty	Students	K-W ANOVA			Post-Hoc Comparisons					
							Faculty/Staff			Students/Staff		
	(N=2976)	(N=1594)	(N=1621)	*H*	*df*	*p*	| *Z* |	*p*	*r*	| *Z* |	*p*	*r*
Content Tools	**93.30%**	**92.90%**	**90.30%**	**388.2**	**2**	**≤ .001**	**5.55**	**≤ .001**	**0.1**	**14.87**	**≤ .001**	**0.2**
- Resources	91.70%	91.00%	89.70%	167.6	2	≤ .001	6.51	≤ .001	0.1	13.04	≤ .001	0.2
- iTunes U	0.30%	0.40%	0.00%	5.1	2	NS	1.60	NS	-	0.92	NS	-
- Podcast	0.70%	0.30%	0.30%	0.4	2	NS	0.59	NS	-	0.05	NS	-
- Wiki	0.60%	1.20%	0.30%	215.4	2	≤.001	4.46	≤ .001	< .1	0.69	NS	-
Communication Tools	**3.60%**	**5.40%**	**8.70%**	**364.6**	**2**	**≤.001**	**8.5**	**≤ .001**	**0.1**	**17.75**	**≤ .001**	**0.2**
Broadcast Tools	0.50%	0.80%	1.80%	465.1	2	≤ .001	7.4	≤ .001	0.1	19.69	≤ .001	0.3
- Announcements	0.40%	0.70%	1.70%	13.5	2	≤ .001	8.68	≤ .001	< .1	21.58	≤ .001	0.3
- News	0.10%	0.10%	0.10%	251.3	2	≤ .001	2.36	≤ .05	< .1	3.34	≤ .001	< .1
Interaction Tools	3.10%	4.60%	6.90%	20.5	2	≤ .001	6.33	≤ .001	< .1	16.01	≤ .001	0.2
- Forum/Discussion	1.50%	0.50%	0.40%	46.6	2	≤ .001	4.28	≤ .001	< .1	3.22	0.001	< .1
- Messages	1.30%	2.80%	2.10%	27.2	2	≤ .001	4.15	≤ .001	< .1	6.68	≤ .001	< .1
- Chat	0.30%	1.30%	4.40%	742.5	2	≤ .001	3.86	≤ .001	< .1	24.82	≤ .001	0.4
Management	**3.10%**	**1.90%**	**0.90%**	**19.8**	**2**	**≤ .001**	**0.32**	**NS**	**-**	**4.28**	**NS**	**-**
Tracking Tools	2.10%	1.30%	0.50%	49.8	2	≤ .001	2.96	≤ .005	< .1	5.18	≤.001	< .1
- Test Center	1.40%	0.20%	0.10%	30.8	2	≤ .001	0.21	NS	-	5.53	≤.001	< .1
- Assignments	0.50%	0.70%	0.20%	26.2	2	≤ .001	3.60	≤ .001	< .1	2.01	≤ .05	< .1
- Modules	0.20%	0.30%	0.20%	8.8	2	≤ .001	1.22	NS	-	2.23	≤ .05	< .1
- Gradebook	0.00%	0.10%	0.00%	7.4	2	≤ .001	2.04	NS	-	0.86	NS	-
Coordination Tools	1.00%	0.60%	0.40%	5.4	2	NS	1.85	NS	-	1.95	0.05	< .1
- Schedule	1.00%	0.50%	0.30%	22.3	2	≤ .001	3.86	≤ .001	< .1	3.71	≤ .001	< .1
- Poll	0.00%	0.10%	0.10%	22.8	2	≤ .001	1.07	NS	-	4.61	≤ .001	< .1
- Syllabus	0.00%	0.00%	0.00%	17.5	2	≤ .001	3.90	≤ .001	< .1	0.38	NS	-

Table 14. Percent of total activity. K-W ANOVA, & Post hocs

The data, which were based on counts, revealed that tool use was heavily skewed with high variance, revealing that the use of each tool followed a power law distribution—overall tool use was heavily concentrated in the relatively low use (or non-use) through the medium use range, while exhibiting a long tail (See Anderson, 2004), violating preconditions of a normal distribution. In one case, Resources, there was a bimodal distribution where the tool appeared to have a peak towards low use and another peak at high use. Additionally, some sites have more events than others likely due to the number of users on these sites. In order to control for sites with high/low variance of events and users, the counts of events for each tool on each site were converted into the percentage of overall tool use (middle of Table 14). After being converted, the data was still skewed, suggesting further use of nonparametric tests.

The Kruskal-Wallis ANOVA used to compare tool use across the variables (at the tool, sub-categorical, and categorical levels). For the sake of comparison, I also conducted the same comparison tests using standard ANOVAs with similar results. The

Kruskal-Wallis results (see left side of Table 14) revealed statistically significant differences between groups at the categorical level, the sub-categorical level, and the individual tool level.

According to the Mann-Whitney U post hoc results (again, using Holm's Sequential Bonferroni adjustment), staff sites were significantly different from faculty sites in all categories and subcategories of tool use. However, the effect sizes for these differences were small. Staff sites were also significantly different from student sites in the use of communication and content tools, but not management tools. Where significant, the effect size of the differences between staff sites and student sites was small. The post hoc tests showed significant differences between staff, faculty, and student sites in the use of content tools, but the effect sizes were small.

Similar patterns arose at the sub-categorical level (broadcast, interaction, tracking, and coordination tools). The Mann-Whitney U post hoc tests suggested that staff sites were significantly different from faculty sites in all categories, and from student sites in all categories except coordination (marginally significant). While there were many significant results, most of the effect sizes were small. There were medium effect sizes between staff and students in the use of the Broadcast tools

At the tool level, The Kruskal-Wallis ANOVA showed that there were statistically significant differences site types for the use of all tools across site types save for two instances, iTunesU and Podcast, both of which are underutilized by users across all site types. Another set of Mann-Whitney U post hoc tests revealed small effect sizes among the majority of significant results. The exceptions to this were differences between staff and student sites for the use of the Announcements tool and Chat tool, both of which were moderate effect sizes.

Tool	% Sites Using	Factors			
		1	2	3	4
Assignments	< 7 %	0.81			
Gradebook	< 7 %	0.68			
iTunesU	< 7 %		0.76		
Modules	< 7 %	0.53			
News	< 7 %		0.65		
Podcast	< 7 %		0.63		
Poll	< 7 %	0.42			
Syllabus	< 7 %	0.75			
Test Center	< 7 %	0.45			
Wiki	< 7 %				
Calendar	10%			0.49	
Forum/Discussion	11%				0.69
Chat	14%			0.61	
Messages	27%		0.44		
Announcements	35%			0.77	
Resources	96%				-0.85

Table 15. Percentage of Project Sites using each tool & PCA Tools Used Together

Patterns of Tool Use

The last research question in this chapter asked whether staff's appropriation of Projects Sites led to uses of Project Sites that followed discernable patterns. However, patterns such as those used in prediction models were deemed inappropriate because of the lack of variation in the most used tools (Resources) and the least use tools (see Table 15). Because there was significant variation among a few tools, I conducted a Principle Components Analysis with a Promax rotation to determine if there were tools that were likely to be used together. It was interesting to find that patterns emerged even including the least used tools. The Announcements, Chat, and Calendar tools were often used together. Many of the course-related tools were often used together in those rare cases where one was activated. It was interesting to note Resources and the Forum/Discussion tools were negatively correlated in use.

I conducted binomial logistic regressions for the very few tools where there was variation in use/non-use (Calendar, Forum/Discussion, Chat, Messages, and Announcements) using the staff/faculty/student and the site's purpose as predictor

variables. However, what I found was that even among these tools, the data was mostly insufficient to make a predictive model for staff's use.

5.4 DISCUSSION

The research questions proposed in this study investigated if there was a difference in how staff members use their Project Sites as compared with students and faculty (the anticipated users). I used system log data to determine whether these differences existed between staff, student, and faculty sites.

The data suggested that staff sites differed from student and faculty sites in terms of the some general attributes (the number of users) and the frequency with which they were visited, and the amount of site activity. The data also pointed to the general finding that most of the activity on Project Sites involves the uploading and downloading of materials. Although this study confirmed the importance of Resources, it fails to distinguish between the kinds of activities that staff are performing with these tools. Specifically, this analysis does not look at *what* staff are uploading nor does it address the larger question of *why* staff are performing these activities from within Project Sites because it is strictly numerical data. Analysis of the content would be another study that would require very specific selection of a few sites and could be future work, though the same data could be obtained more effectively with interviews and walkthroughs of existing sites.

The issues above pointed to the limitations of 'click data,' which only gives a very cursory view of what is happening within a system. Not only is this type of data incapable of conveying intention and actual use, it is also potentially messy data. For example, a tool that was experimented with a few times and later abandoned appears the same way in this data as a tool that is rarely, but consistently, used with the same number of clicks. Part of this limitation was due to the way the data was gathered, absent time as a variable. Future work could look at tool use across time, but such an analysis will most likely continue to show the consistent use of the Resources tool.

Resources played a large role in this chapter's findings because it is the most used tool across all of the university's populations. It is also the case that many tools that are used result in fewer data points being created. Take, for example, the Announcements tool; when an Announcement is made, the event that results is its creation and all of the site participants who read the message do not create events. Thus, the Resources tool is very likely over-represented in this dataset.

A question that still remains is the high rating of tools in the survey that this log analysis suggests remain relatively unused by staff. For example, there was no evidence of significant use of the Syllabus tool on staff sites, though staff rated it very highly in the survey. This finding is more aligned with the expectation that the Syllabus tool would not be appropriated given its label and staff's likely interpretation of it as a tool designed for faculty and students.

In this study, I expected to be able to explain staff behavior with the tools through advanced statistical modeling, yet the overwhelming use of the Resources tool and the almost entire lack of use of many of the other tools made such modeling difficult due to a lack of variation. Even when there was variation in use, the models were inconclusive, possibly because inconsistent use making the data too random for predictions.

In addressing some of the limitations of this study, the following, and final, methods chapter will address the questions of why and how staff appropriated Project Sites using qualitative methods by interviewing staff and understanding their use through their perspective.

CHAPTER 6. COLLABORATION ECOLOGIES: INTERVIEW STUDY

INTRODUCTION

The previous studies used quantitative methods to determine if and how the group of unanticipated staff users of CTools Project Sites differed from the anticipated, target users (faculty and students)—work that raises as many questions as it answers with regard to explaining staff use of the toolkit. The differences in values and use demonstrated in these studies call into question the design of the toolkit, which was not designed for staff needs and practices, and continues to be improved only for faculty and students, the intended audiences. Improving the toolkit for unanticipated users is a process that needs to be rooted in an understanding of the users, the practices that it supports, and the other technologies with which it co-exists and competes. This is especially apt given that staff members comprise such a large number of Project Site users. In addition, improvements to the toolkit aimed at staff users could benefit the intended user groups by making Project Sites easier to appropriate into any given number of contexts beyond teaching and learning.

Project Sites exists within a diverse set of available collaborative tools and systems. With that said, Project Sites use is not a given and it has to compete with other tools for visibility and relevance to staff needs, ultimately resulting in its appropriation was a result of both social and technical factors. In reality, staff have access to a large number of systems that support their different needs—needs that vary depending on the staff member's role(s) within the university. Thus, to fully understand staff practices surrounding Project Sites, we have to situate it within a wider context that not only

includes the users and their practices, but also provides a clearer image of how it is situated within a wider network of work tools.

Furnas (2000) talked about the MoRAS, a web that consists of a multi-scale hierarchy of human actors. A technological change in the one part of the web has effects across the entire system. For example, the introduction of a new technology in the ecology can change the ways in which people communicate; its adoption could then reinforce certain practices, cause structural change, and displace other technologies.

Nardi & O'Day (1999) used *information ecologies* as a lens through which we can study networks of users, technologies, and practices. They defined an ecology as a "system of people, practices, values, and technologies in a particular local environment." (p. 49). Viewing technologies and their uses through this lens allows us to "focus attention on relationships involving tools and people and their practices" (p. 50). Ecologies experience continual evolution; people, objects, practices, needs, and structures in the ecology co-evolve according to system-wide changes. Though Nardi & O'Day describe ecologies as being in constant change, their ecological lens does not specifically address the appropriation of technology. However, it is important to note that appropriation will occur in an ecology and that this lens is, in many ways, ideal for examining the appropriation of IT within complex sociotechnical systems.

In thinking about the role of CTools, it is important to think about networks of users that it supports, the networks of technologies in existence, and their embeddedness in a continually evolving contexts, especially when the research goals are to understand people and to support their ongoing practices. We should also consider how the results of such an analysis could lead to improving design practices while also recognizing that these changes will also create in the ecology.

This perspective of ecologies that are prone to change is especially relevant in the sociotechnical system under study in this thesis. The University launched an initiative for transferring a number of diverse services to be maintained by a single provider,

Google, a change that will surely affect the technological ecology on campus including the role that CTools Project Sites plays for the entire university population. In the previous studies, I explored CTools use prior to the decision to migrate to Google services (and the ensuing transition) had taken place. Examining the sociotechnical ecosystem at the university after the transition provides a different snapshot of CTools' role—one where the narrative of its role and where the ways in which it supported workplace practices are evolving in response to changes. This snapshot could also be used to explore something that Nardi & O'Day did not address in their book, Information Ecologies—competition and co-existence between tools in the ecology.

Because of the extent to which collaboration is central to the research in this chapter, I propose to use the term *collaboration ecology* to stress the extent to which the information ecologies that staff are engaged in are centered around activities that are driven by coordination and collaboration. Specifically, I consider the university as a vast ecosystem in which there are numerous ecologies of the scale that Nardi & O'Day examined. However, in applying the idea of collaboration ecologies to such a large organizational setting means that I narrow the focus of this work on collaborations and the activities and practices that sustain them; I will draw connections between the types of ecologies to see how they form a greater university-wide ecosystem. Information ecologies that focus on collaboration—collaboration ecologies—can be used to examine the tools that support collaboration in terms of which activities they are supporting, how they support activities, and how they relate to each other and their users. In the following sections, I focus on describing staff, the greater network of tools, and CTools Project Sites' place within the ecology.

6.1 THE UNIVERSITY-WIDE TRANSITION TO GOOGLE

In ecology and related fields, it has been long understood that ecosystems, are not frozen in space and time. Similarly, information ecologies (and, thus, collaboration ecologies) evolve. As I described in Chapter 2, the natural state for social interaction and collaboration is a state of flux, where this flux is in response to shifting physical, social,

or technical contexts. Sometimes, a new species or tool is introduced into the technology and adjustments will have to occur. One such shift occurred in the time after the research survey and log studies. The university made the decision to shift a number of its services to Google after a deliberation process to assess a number of options—a process that had been started by the central administration as part of the 'NextGen Michigan' strategy for growing the university IT infrastructure and which resulted in an announcement of the transition on October 26,2011. The migration officially began on March 5, 2012 and concluded on August 31, 2012. Most units transitioned in August, though a few units transitioned earlier as test cases; some staff work groups also transitioned early, independently of the rest of their units.

Only a few units within the institution, primarily the hospital and other healthcare-related units, did not make this transition. For the rest of the university, switching from a diverse set of services to a single Google-supported suite meant that all of the university email services would be replaced by Google Mail, while still using the university-assigned credentials and email address ([Uniqname]@umich.edu). This also meant that ITS would no longer support Outlook, as all users would then gain access to the Google Calendar system and all other Google tools through those same university credentials. The number of tools made available to the campus community is extensive and includes, but is not limited to, Google+, Google Docs/Drive, Google Chat, Google Sites, a number of widely-known Google tools (e.g., Maps, Scholar search, Web and Image search, Chrome, etc.) and a number of other tools/systems that Google has acquired over the years (e.g., Picasa and YouTube). The functionality that some of the newly available tools provide overlaps with those of the legacy information and collaboration technologies that staff might be using in their everyday practices. Referring back to Chapter 2 (Table 2), it is clear that some of the tools available to the staff community provide ways to communicate, coordinate, share resources and workspaces, and collaboratively edit documents. These tools also provide some of the same affordances as CTools, so the work in this chapter also addresses the role of these Google tools and how they affected the appropriation of Project Sites. In addition,

because staff were intended users for Google (according to ITS), studying staff's appropriation of this new set of tools also provides a comparison case. Interestingly, Google's tools are so flexible that anybody could have been perceived as an intended user and thus staff could be more likely perceived as intended users from the Google designer's perspectives. However, in the treatment of staff's appropriation of the Google tools, I do not treat staff as unanticipated users from the perspective of the implementation teams and key decision-makers on the campus.

6.2 RESEARCH QUESTIONS

In studying staff and their local collaboration ecologies, I developed a research agenda where I identify different kinds of staff user groups within the University of Michigan, uncover the activities they are involved in, and study the technologies they use, and how staff developed practices around the use of technology. Using the information above, I examine how CTools plays a role in supporting staff's work. With a vast number of possible collaboration possibilities that fit different needs, goals, and practices, a collaboration ecology within this setting is bound to be very complex and diverse. Yet, with all the possibilities available to staff members at the university, CTools Project Sites are widely, and increasingly, used despite its design focus that favors teaching/learning and research objectives for faculty and (and to some extent, research staff). Staff members, because they are not directly involved in research and learning, are not generally in a position conducive to learning knowing about the system and learning to use it both within its intended contexts and outside of that context.

Given the number of staff Project Sites users, we know that they are an important part of the staff collaboration ecology. Various aspects of their use have been investigated in Studies 1 & 2, particularly in relation to job types and departmental units, but to better understand staff appropriation of this system and how it fits into the changing collaboration ecology, I employed qualitative methods. Specifically, this third

study is designed to understand what staff do (activities) and how they do it (practices) to reveal why and how they appropriated Project Sites.

In addition to collecting data about collaboration ecologies and the role of Project Sites in the ecology, I was also interested in the ways that staff made sense of the toolkit, investigating how these unintended users' understandings about it might extend the quantitative results from the previous studies. In particular, interview data can further explain staff's values and perceptions of the toolkit. The data will potentially explain why staff valued tools that they never used and why their use of the system is so heavily reliant on the Resources tool.

Finally, because of the Google transition, I designed this study to be sensitive to the plethora of collaboration tools that access to Google provides as a way of highlighting coexistence and conflict between the two systems. Also, because staff were perceived (by ITS) to be intended users of the Google tools, studying both systems allows me to make comparisons of the implementation and appropriation of the toolkits across the two different cases.

6.3 METHODS

I used qualitative methods to understand the issue of staff adoption of Project Sites and how this use is situated within a larger ecology. To this end, I conducted semi-structured interviews with staff members across the university who are Project Site users or who were Project Sites users at the time of the survey used in the first study (Chapter 4). The methodology included four tasks: first, a descriptive analysis of staff's social and technical environment, investigating the tasks that Project Sites supports, expanding focus on the greater ecology while paying attention to Project Sites' role within it while also being sensitive to collecting data about Google.

To examine users' knowledge of the Projects Sites toolkit (specifically, the purpose and function tools in the toolkit), I developed a think-aloud card-sorting task

that was conducted the end of the interview. Card sorting, often equated with pile sorting (Bartunek & Seo, 2002), is a common methodology in HCI (e.g., Martin & Hanington, 2012)and is an adaptation of the Wisconsin Card Sorting Test (WCST)—WCST being used as a measure of executive functions (Berg, 1948). Card Sorting involves giving the participant (the sorter) a number of cards with various stimuli, and asking to the participant to sort them along specified criteria. In HCI, card sorting is commonly used to investigate existing or potential usability issues by discovering user-generated taxonomies, identifying common or confusing terminology, and generating information structures (Capra, 2005; Levi & Conrad, 1997; Hudson, 2005; Muller, 2001). In this context, I am interested in user-generated categories of tools and the perceived functions of these tools (via open sorting) as opposed to predefined categories (closed sorting). The method also borrows from successive pile sorting, which asks participants either to merge or further divide piles for hierarchical clustering techniques (Boster, 1994) and I employ this loosely for dividing overly large or small piles. The resulting card sorts reveal an underlying rationale about tools and similarities in function, which proved vital in the understanding of how these users perceived the functionality of the system and its affordances.

I incorporated the think-aloud method to the card-sorting task in order to understand the participants' sense-making and reasoning about the tools and the categories as they perform the activity *in vivo*. The think-aloud method, one of the most common usability methods, asks users to talk aloud while performing a task, allowing the observer to record the mental process of a task rather than just the outcome (Lewis, 1982; Lewis & Rieman, 1994). Think-aloud testing has been used extensively in usability evaluations (Gulliksen, Bovie, Persson, Hektor, & Herulf, 2004; Hornbaek & Frøkjaer, 2005; Jeffries, Miller, Wharton, & Uyeda, 1991, John & Mashnya, 1997; Lewis, 1982; Lewis & Rieman, 1994; Karat, Campbell, & Fiegel, 1992; Nielsen, 1992; Nielsen& Landauer, 1993; Vredenburg, Mao, Smith, & Carey, 2002; Norgaard & Hornbaek, 2006) and is a not considered to affect the outcome of the elicited tasks (Ericsson & Simon, 1980; 1987; 1993; Ericsson & Crutcher, 1991). In this case, I used the *concurrent think-*

aloud rather than *retrospective think-aloud* (Kuusela & Paul, 2000), which allowed the participant to explain as the activity occurs rather than thinking aloud at the end to retrace the thinking to the final outcome. The benefit of the concurrent think-aloud method was that the participants did not forget their rationale for the categories once the task was complete. In addition, the retrospective think aloud method made users focus on the rationale as dictated by the end product, where I gained valuable insight from the way that users iteratively created, evaluated, and edited their categories.

Sampling of Participants

Because I was specifically interested in staff who had appropriated Project Sites tools, I draw participants from the pool of staff who I knew to be users. A set of potential participants were already identified through a question in the survey administered for Study 1 that simply asked staff CTools users if they would like to participate in future studies. I combined this list of users with data obtained from the MAIS database about job titles and unit affiliations for each staff member on the list, resulting in a detailed participant recruitment database.

It was evident both from both the survey data and the database query that staff at the University of Michigan form a very diverse population with respect to departmental affiliation, work units and job types. Combining both department/unit and job type, I found an extremely complex and varied group of users whose practices may differ greatly from one category of jobs to another. Because the university is so large and staff types are so numerous, it was necessary to refine which staff to study. Those staff in administrative and office/clerical positions, from both academic and non-academic units were chosen because they are most critical to the administrative infrastructure of the university within both the academic and research missions. I also made a minor distinction between technology-based academic units (Computer Science, Engineering, and the School of Information) and those that placed less of an emphasis

		Unit		
		Acadmic Technical	Academic Non-technical	Non-Academic
Job Category	Office/Clerical	3	2	5
	Administrative	5	3	6

Table 16. Staff participant subtypes

on technology (Psychology, Social Work, LS&A)[10]. This distinction was made to determine whether staff in technology-related units had vastly different practices with technology than their counterparts.

Interview participants were recruited by email (for the recruitment email, see Appendix E) in batches defined by job types and units, allowing me to ensure as representative a sample of staff as possible. As incentive, participants were offered a $10 USD VISA gift card.

I collected interviews from twenty-four (24) participants across a number of units and roles, intending to collect data from roughly equal amounts of office/clerical and administrative staff as well as equal numbers of staff from academic and non-academic units. Participants were predominantly women (19 female, 5 male) and most participants were Caucasian (19 Caucasian, 4 African-American, 1 Asian-American). I did not collect information pertaining to age, but most participants were over the age of 40. As seen in Table 16, I collected data from roughly equal numbers of staff from academic (N=13) and non-academic units (N=11) and slightly fewer staff identified as being in Office/Clerical positions (N=10) compared to Administrative positions (N=14).

[10] The College of Literature, Science, and the Arts

All of the participants have been at the university for at least 2 years, though it was common to find that participants had been at the university for over a decade. It was typical for participants to have held a number of different positions during their time at the university—in fact, all of the participants reported having held at least one other position, whether it was a lateral move within the same type of job or a shift to a completely different kind of role.

Protocol & Testing

The interview protocol was developed over a number of previous iterations, each using staff from the School of Information as pilot subjects. It was first developed and pre-tested in April 2010 (before the transition to Google) as a general interview about job roles and general technology use in the workplace. The second iteration of the protocol added a section of questions specifically relating to CTools Project Sites use and was pre-tested with 2 additional staff. The final iteration expanded the protocol to include questions about the transition to Google (Appendix F). The changes were pre-tested with 2 staff members.

An optional card-sorting task (Appendix G) was added to the final version of the interview protocol. Participants were asked to sort a stack of 19 index cards labeled with tool names (from CTools). They were asked to develop criteria for sorting their pile as they went through the cards and were assured that there was no correct or incorrect set of criteria. They were also asked to talk through their understanding of the tools while they sorted, specifically the tools' functions and how they might interact with each other (whether known or based on speculation). The think-aloud task is designed to assess staff knowledge of the tools and how these tools could possibly be used. This task also allowed me to see the kinds of categories that staff members generate when given a large number of possible interaction types and tools.

PROCEDURE

The semi-structured interviews were conducted either at the staff member's office or at a location of their choice. I first led the interview participants through the introduction to the study and the consent process. Then I administered the interview protocol. Because interviews were semi-structured, I prompted participants for more details about certain statements and I added/skipped questions as needed. Though respondents were given access to a laptop to access their Project Sites during the interview, most staff declined the opportunity.

Because interviews where scheduled to last 90 minutes, the duration of the main interview determined whether participants were asked to participate in the card-sorting task. When time permitted, interviewees were given the option of participating in the optional card sort after the main protocol. The interviews and card sorts were recorded for audio transcription, which were later transcribed by a professional transcription service. At the end of each card sort, I photographed the resulting piles and coded the data into a spreadsheet for later analysis. I subsequently checked each transcript for errors and to ensure quality, by resolving issues related to transcription error, grammar, and local jargon.

After one participant produced an organizational diagram for me to use in my records, I subsequently collected similar diagrams from participant's unit's websites, which were publicly available. I also collected a few public reports from the Office of Budget & Planning that contained Human Resources information about staff. The information contained in this document included demographic data such as gender, age, race data. I used the reports primarily to verify that my final sample was not skewed in terms of demographics—age, gender, ethnicity/race.

ANALYTICAL FRAMEWORK

Because I draw from Nardi's work for my analytical framework, I also inherently used Activity theory (AT) to describe the entire system of work and activities beyond the

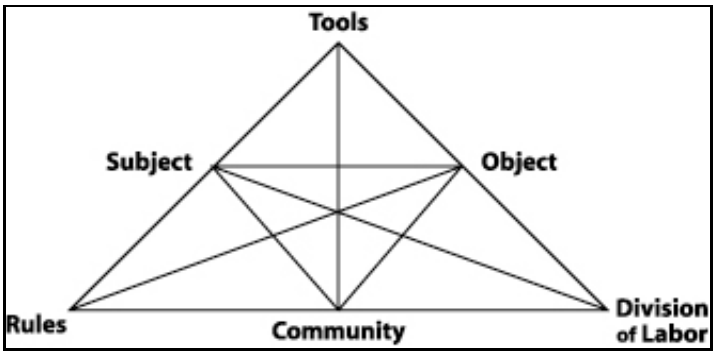


Figure 14. Elements of Activity Theory, postulated by Engeström (1987) pg. 78. Further explored in Cole & Engeström (1993), and Engestrom (1999)

individuals I interviewed. Activity Theory, according to Bryant, Forte, & Bruckman (2005), describes activity in a sociotechnical system as 6 elements shown in Figure 14. The elements can be summarized as follows: **Subjects** in a **community** engaged in activities towards a set of **objectives** that are supported by **tools, rules,** and, the **division of labor**. Activity theory can be traced back Leontev (1974, 1978, 1981) and has a history of application within HCI and CSCW research to understand the intersection of users, activities, and technology (e.g., Kaptelinin, 1996, Kaptelinin & Nardi 2006; Kaptelinin, Kuutti, & Bannon, 1995; Nardi, 1996, Bødker, 1991).

Nardi & O'Day (1999)'s ecological framework builds onto activity theory with a number of related elements; a ***system***, which is marked by "strong interrelationships and dependencies among its different parts (pg. 51); a ***diversity*** of different subjects that fill different *niches* in the system; ***co-evolution*** between the various elements in the ecology, especially in light of continually changing contexts; ***keystone species***, who are subjects without whom the ecology cannot survive; and, ***locality***, which capture the locally-constructed essence (*name*) of a tool and its location within the interrelated connections of the system (*habitation*).

In my adaptation of this framework, I pay special attention to the tools and how they support (or don't support) practices and structures. Because of this ability to provide and withhold support, tools themselves often 'act' as subjects in the ecology. I refer to tools as belonging to a *tool ecology*. I also focused on issues of what I call

simultaneity, a term that I use to refer to multiple tools with the similar or overlapping sets of affordances. Simultaneity could result in both co-existence or competition between tools.

Lastly, the interview analysis was influenced greatly by the ideas of communities of practice, boundary objects, and boundary work. *Communities of Practice* (CoPs), as defined by Lave & Wenger (1991) are a group of people who share a profession or interest and learn from each other by virtue of sharing both information and their experiences, thereby providing a foundation for situated learning.

Quite a bit of work in sociology has considered how groups form and establish practices by using the concept of symbolic *boundaries*, which dates back to Durkheim (1971). Boundaries delineate the sacred from the profane (Durkheim, 1971) and science from non-science (Star & Griesemer, 1989). Boundaries form when communities define themselves and engage in *boundary work* (Gieryn, 1983), the activity whereby demarcations between domains of knowledge are created, maintained, and revised in order to distinguish participants and practices as internal or external to the community. Star & Griesemer (1989), Wenger (1998), Bowker & Star (2000), and Star (2010) explore the concept of *boundary objects* as entities that link communities together to allow them to collaborate. In thinking about staff, I consider the boundaries that exist between staff from both on a unit-level and on a role-specific level, resulting in communities of practice that whose activities differ and who, as a result, may have different uses for IT in their activities. Because so many of their activities are to be mediated through common objects and tools, boundary objects also can potentially help to frame the activities that staff are engaged in. Taken together, CoPs and boundary objects can both enrich the understanding of activities within this sociotechnical system.

Analysis

I used iterative coding processes to develop the coding scheme, drawing from traditional coding methods. Saldaña (2009) provides an extensive list of possible coding

techniques, a number of which were used in the process of developing the coding scheme, which include attribute coding, magnitude coding, simultaneous coding, structural coding, descriptive coding, in vivo coding, process coding, emotion coding, values coding, and evaluation coding. The final coding scheme, which can be seen in Appendix H, addresses both activities, technologies, and practices as well as reasons for their emergence.

Some coding did not happen via the methods described by Saldaña, but rather through methods relying on diagrams and maps. This was especially true of the locations of participants, their collaborators, and connections between units, which were best understood when visualized (as opposed to textual codes). Initially, each participant's interview was followed by memo-writing, part of which included diagramming the participant's connections to other individuals and units. I also created an additional diagram of each participant's network of technologies and the function of those technologies in the staff members' ecologies. Another diagram was created using maps of the campus to show physical distance for each participant and their collaborators.

6.4 STAFF 'SOCIAL WORLD': DEFINING ECOLOGIES & PRACTICES

Up to this point, the quantitative work that has been described in this thesis has largely examined staff as a very vaguely defined group of users, often relying on self-reported membership in categories. In following the tradition of qualitative work, however, I take advantage of the interview data to describe staff in greater detail—their communities, their responsibilities, and practice, and how information technology (IT) plays a role in supporting staff as a vital part of the larger university ecosystem.

For the rest of the thesis, I describe staff as belonging to a staff "social world", borrowing the term from Strauss (1978) to suggest that staff, as a body of actors in the university ecosystem, are a semi-cohesive group. I further refine this world through the lens of communities of practice (Lave & Wenger, 1991; Wenger, 1998), groupings of

actors within the staff world whose activities are centered on one of the university missions/goals. It is truly at this finer-grain level distinction that collaboration ecologies truly began come to life, as staff interacted with technology and each other to achieve the goals of their roles and the university's missions.

6.4.1 COMMUNITIES OF PRACTICE

In Chapter 3, I described staff as a body of people within the university who performed a number of roles, and were structured and organized by units. Throughout the interviews, it was evident that staff's roles were enacted similarly across the various units; staff in similar roles often worked together in some capacity or their work was siphoned into one of the same central offices. Because there were so many connections between staff and so many roles resembled each other, a structure emerged within this complex staff world. As a result of the interviews I was able to distill these staff roles and responsibilities into three communities of practice: research, academic, and oversight communities. These communities differentiate themselves from each other by boundary work (Gieryn, 1983)—that is, the very work they performed enshrined staff's membership in that community and separated them from the other communities that were engaged in different work. Figure 15 shows participants' placement both in their units and in their communities of practice, including connections between these communities.

Staff in the academic community performed activities that were related to the support of the academic mission of the university, working with students and faculty in non-learning, administrative types of activity. Often, this entailed administration of student records, being a "point of contact." Some staff were involved in curriculum-planning and non-credit learning (such as arts programs, etc.).

Staff in the research community supported the long-term research missions at the university. Some staff were involved in research administration from the unit-perspective—working with faculty, students, and other staff to manage proposals in the

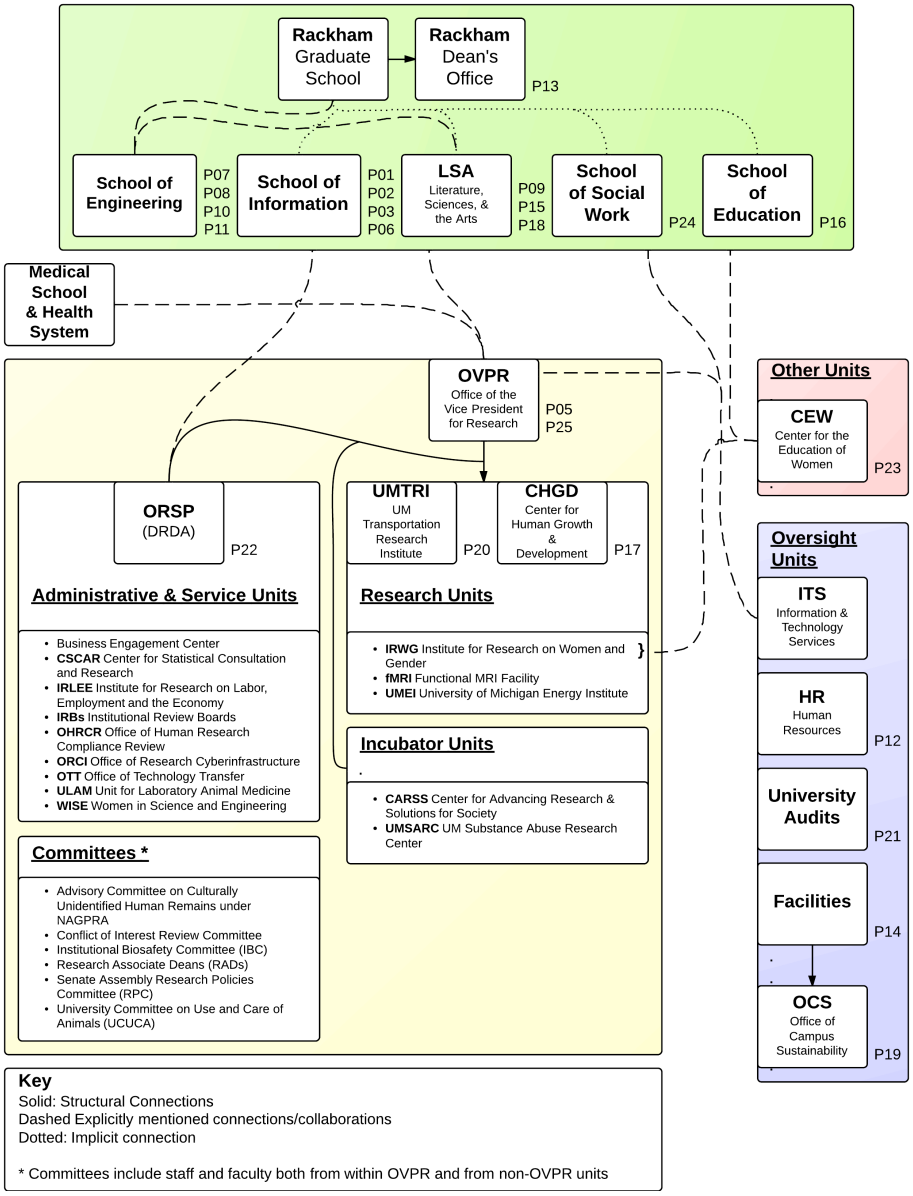


Figure 15. Staff Ecology and resulting Communities of Practice (from staff participants) and connections between these communities

submission phases (pre-award) and, in cases of a successfully funded grant, the management of funds (post-award). Another crucial sub-component of this community was the central administrative body for the conduct of research, the Office of the Vice President for Research (OVPR), which was responsible for overseeing compliance to university and federal compliance guidelines for the funding and conduct of research.

OVPR was also engaged the overseeing a number of non-degree research units. While I described staff who performed administrative activities within this community of practice, it is also true that some staff perform research within these units, but I excluded them from my analysis, thus they are unrepresented in this description of the research community of practice.

Staff in the oversight community served in units and roles that were central to the university's ability to function, working in positions and units that oversaw processes at the university that ensure its growth. Some of these staff were related to Human Resources and Finances, which were core to the university's ability to function as a business entity. Staff in these units were often engaged in work with financial and personnel data.

Other oversight units included the Information Technology Services (ITS), the Office of University Audits (OUA), and the Office of Sustainability (OCS) among others. Unlike the HR and Finances staff, staff in these units did not generally deal with confidential information and mostly worked to maintain or improve conditions the university to keep it evolving on the sustainability and technology fronts.

One of the findings that arose in conceptualizing the staff world was that staff are engaged in a substantial amount of group work. This collaboration often happened within the staff members' home units, but often extended far beyond into other units, thus staff were often working across unit-defined boundaries. However, much of this work was conducted by staff within the boundaries of the communities of practice that I have just described here. The implications of this are that 1) these findings supported the communities of practice just described and 2) that because of spatial and social boundaries, technology would play a substantial role in supporting staff in their ongoing work.

6.4.2 Activities Within & Across Communities

Despite the observation that staff participated in various of communities of practice (in addition to their various work groups), many of the daily activities that staff were engaged in were quite similar. Chief among the numerous activities were communication & coordination. Communication allowed staff to connect with others who were in their units, outside of their units, and even outside of the university. The extent to which participants described their communication with others mirrored the extent to which they were spatially distributed around the campus and the importance of information technology in supporting their everyday needs. Table 17 shows that most participants collaborated outside of their physical spaces, also pointing out that this was especially true of staff in the research and oversight communities. Staff had come to rely on practices around the use of email to fulfill their communication needs, both for formal and informal communications. While staff also relied on email to coordinate with each other, most of the people I interviewed also relied on calendaring as a method for scheduling and coordinating in formal ways.

Production tools were the main vehicle for the work that staff performed, using a myriad of tools to create documents both for their own use and to share with others. Staff reported that they most often used production tools to work on their own, but they also occasionally worked collaboratively with others. When speaking of the kinds of documents they created and what they did these documents, staff rarely failed to contextualize them within the need to distribute or relay the information to another person or to input information and documents into a database or content management system, thus production was almost always a precursor to sharing or storing information.

Participant	Within Unit	Within Campus	Outside University	Role-related Staff Community
P01	√		√	Academic
P02	√			Academic
P03	√	√		Academic
P05	√	√	√	Research
P06	√	√		Academic
P07	√	√	√	Research
P08	√			Academic
P09	√			Academic
P10	√			Academic
P11	√			Academic
P12	√	√		Oversight
P13	√			Academic
P14	√	√		Oversight
P15	√	√	√	Academic
P16	√			Academic
P17	√	√		Research
P18	√			Academic
P19	√	√	√	Oversight
P20	√	√	√	Research
P21	√	√		Oversight
P22	√	√		Research
P23	√	√	√	Oversight
P24	√			Research
P25	√	√	√	Research

Table 17. Collaboration across distance in relation to community of practice

(Dark green = all categories of collaborators; light green = 2 categories of collaborators)

Sharing information was such a crucial aspect of staff activity that no staff failed to mention it. Staff used technology to support their ability to share documents that were in progress, as well as those documents that were ready for public consumption. Some staff identified themselves more as information gatherers whereas others described themselves as information creators/sharers, but the majority of staff were engaged in the access and posting of information and documents. Throughout the interviews, staff noted different sharing needs for collaborating depending on whether their collaborators were within their unit, outside of their unit, or outside of the university. Other sharing practices that staff developed were focused on the type of information being shared (personal, confidential, general).

In many cases, staff also linked sharing information with storing it. Staff often developed separate practice for storing information for their personal use that differed when collaborating with others. Much like with the sharing of information, staff noted that their storage practices varied depending on whether their collaborators were within their unit, outside of their unit, or outside of the university.

Lastly, there were a number of core activities that did not fit the categories above, but relied on the products of the above processes. Many jobs, particularly administrative jobs, required staff in those roles to engage in the upkeep of unit or university records and the manipulation of information and documents. I call these 'core activities' because they served the core needs of the units and the university, and often utilized tools that formed part of the core IT infrastructure that ITS supported.

6.4.3 Tools Supporting Activities Within the Social World

Across the interviews, staff emphasized the role of technology in supporting their various activities. Those activities were supported by a combination of tools that are centrally supported by ITS and by a number of commercially available tools (both paid and free). These tools both created a foundation for staff's practices within their work groups, which I call their *collaboration ecologies*. I also observed that staff were able to adapt themselves and their practices around technology in their collaboration ecologies.

In describing the technologies that staff adopted and appropriated in their practices, I use the term '*tool ecology*' to reflect the technological aspect of the socio-technical system in place within the university that results in collaboration ecologies. In general, I found that tools served as support for three main processes (see Figure 16) that were important to staff. They helped produce information and documents, they aided staff's abilities to communicate and coordinate with each other within and across boundaries, and they supported the sharing and storing of the information and documents that staff created. The full tool ecology (shown in Figure 17) contained tools that were both mandatory to use as well as tools over which staff had the agency to pick

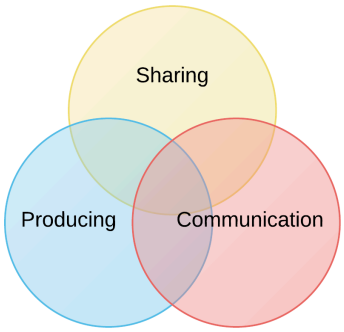


Figure 16. Types of tools in the ecology

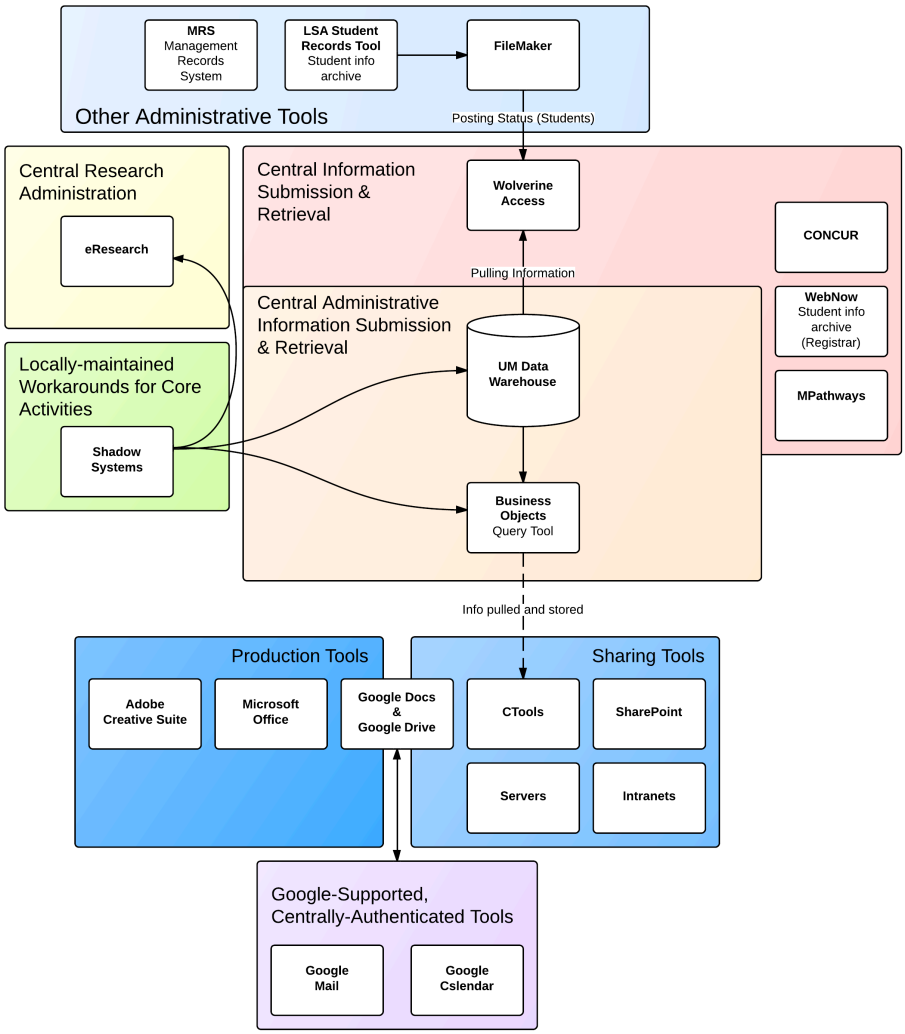


Figure 17. Tool Ecology

and abandon, thus reflecting observations by Lamb & Kling (2003) that people, as social actors, are sometimes unable to select the technologies that they will use in their contexts. Specifically, there were a number of tools supported by ITS that facilitated the core administrative activities that occurred at the academic, research, and oversight staff communities. These core activities—consisting of information retrieval, storage, and records management—often resulted in the need for centrally-located access points for this sensitive administrative information. These core tools formed the university's basic information infrastructure for this important data. Administrative staff described the use of these systems as mandatory.

In addition to the core tools and systems described above, ITS previously supported the university's email infrastructure. Prior to the email migration, staff reported rarely using the university's webmail services, instead using Outlook or Apple's Mail and iCal applications for their communication/coordination needs, which were supported by ITS. After the Google transition, email support was shifted to Google, ITS was no longer supporting other email and calendar clients, resulting in the perception that the Google client was official.

While the use of the core systems was mandatory for much of the daily activities of administrative staff in all three communities of practice, staff as whole had a variety of tools to select from in other aspects of their work. For communication tools, staff developed practices that almost always relied on email, thus Gmail was the predominant communication tool. Very few other instances arose where a participant noted the use of telephone services and even fewer cases arose where staff reported the use of a chat tool (e.g., GChat). Staff occasionally mentioned teleconferencing for meetings when a collaborator was remote, particularly within the context of committee meetings. Many of the production tools that staff described as part of their local tool ecologies were the same tools that would be familiar in most workplace environments (e.g., Microsoft Office, Adobe Creative Suite, etc.). The most interesting observation about the production tools was that Google Docs provided staff with tools that bundled production and sharing.

Finally, the tool ecology contained a number of tools that competed with each other to support staff's sharing (and storage) activities within the context of collaborative work. Staff signaled their need for platforms that would allow them to store information and share it with others. Particularly, because so much of staff's work involved collaboration and the transfer of information, "storing" and "sharing" often were often used interchangeably. Thus, the same technologies that staff described as supporting storage were also described as supporting sharing. It was within this area of the tool ecology that I found CTools Project Sites to play a key role in supporting staff's activities and practices. Within the ecology, there was evidence of both coexistence and competition between Project Sites and commercial platforms (Google Docs/Drive and SharePoint) as well as platforms supported locally within the unit (servers and intranets). In the following sections of this chapter, I provide evidence for this competition/co-existence and discuss the effect on the ecologies.

Interestingly, despite the CTools system's ability to support a number of different interpretations for its potential uses, results from the interviews indicated that it was solely interpreted and used as a sharing platform. In the sections that follow, I describe in further detail why university staff appropriated Project Sites despite not being target users, and how they used the system. I draw attention to how staff interpreted and appropriated the Project Sites feature as a repository/dispensary and further elaborate on how staff's lack of knowledge and poor (often perceived as non-existent) training led to many of its tools not being appropriated. I also discuss the effect of the Google transition on Project Sites and draw parallels to the adoption and appropriation of Google's collaborative tools; in this comparison case, I describe how staff were an anticipated user group, yet many of the same knowledge barriers also led to its poor appropriation.

6.5 THE APPROPRIATION OF PROJECT SITES

The main purpose of the survey study was to build on the finding of the survey study and log analyses presented in earlier chapters. In the following sections, I describe the results of the interviews, which supported the survey and log studies in their suggestion that staff's appropriation of Project Sites consisted mostly of the Resources. I build on those findings by describing how staff use the tools in practice—primarily to support activities and practices regarding information, using it as a secure repository for documents (storage) and a dispensary for information and documents (sharing), while taking of its affordances of security and inter/intra-organizational information exchange. While related, storage implied a place to access information without necessarily having to share it, while sharing always meant exchange (though not explicitly long-term such as with storage).

6.5.1 THE REPOSITORY/DISPENSARY

Throughout the interviews, many staff referred to Project Sites as a repository, archive, or dispensary. This led to what I call the *dominant narrative* of Project Sites—the common interpretation of Project Sites' possible uses—as a sharing/storage platform. When staff appropriated Project Sites, they had done so primarily because it was a place where they could store and distribute documents. Prior to discovering CTools, a number of staff would collect and distribute information over email, which was often problematic, or they would have information scattered throughout different file-sharing tools. Staff often elaborated on the simplicity of having a central place for information, saying,

> *"I like CTools because it's easy to be able to have information available to a lot of different people without just sending it as attachments, and that's how we tried to get the faculty to go here and look for stuff. It's like instead of trying to find an e-mail that I sent you six months ago with the list on how to invite a visitor, just go to the department CTools site and the procedures are out there. But I don't know.*

I just think it's an easy … I like CTools. I think it's an easy way to keep information together for groups of people." – P08, Business Admin

"You know, it's not something I use every day or necessarily every week. I don't set up sites that often, but when I need to set up a site, a search committee, ***it seems to be the most efficient way to get things out to people…****" - P20, Admin Specialist*

"I guess one of the things that I thought was really useful about it was the idea that you could have an email archive and files and documents and surveys and other kinds of things that ***you could have all together in one context [in CTools] as opposed to things just scattered all over file-shares and your email****, a LISTSERV. There's potential there for organization. A lot of it was just being able to share files with anyone at the University." – P21, IT Auditor*

Because staff were highly involved in the information sharing process, having Project Sites as the central location for information alleviated the burdens of information sharing for both those who distributed the information and those who accessed it. As suggested in the quotes above and by a number of other participants (e.g., P14 & P23), the sharing alternative that many staff identified was to use email for sharing, which supported dissemination but proved to be unreliable for long-term sharing needs. P06 (Research Admin) was one among a handful of staff who noted that people still emailed her for information; however, the existence of a Project Site allowed her (and other staff) to easily redirect information-seekers to access the information themselves. On a few occasions, staff also suggested that they would assist others in locating information within a site.

To say that Project Sites was adopted as merely a place for sharing information and storing documents is an overgeneralization, especially considering that there are other systems with very similar affordances. Beyond the need for a repository, there were a number of ways that Project Sites was interpreted—ways that provide insight into the kinds of decisions staff had to make in order to initially adopt and to appropriate (re-appropriate) the toolkit.

THE FILING CABINET

> *"Our group currently uses CTools primarily for files that we either need to share… I would say more* ***the files that we need to share on a long-term basis****. The emailing of files back and forth is really more where somebody has a quick question about something..." – P14, Project Manager*

Very closely related to the interpretation and appropriation of Project Sites as a repository was the way in which the toolkit was interpreted as being like a filing cabinet, a metaphor used by P25 (Business Admin) to describe a dominant (though not universal) narrative Project Sites as a place for finalized work. There were numerous examples of staff (such as P08 and P09) for whom Project Sites represented a location for *finished* materials rather than work-in-progress. For example, P07 (Research Admin) said, "… you don't want to put anything up here that's half-baked, so it's kind of a driver to get things in respectable shape." Similarly, P08 (Business Admin) noted that whereas the unit's server was the space for work-in-progress, Project Sites was where updated documents were stored for sharing. P09 (Curriculum Specialist) distinguished between technology for doing work (email, personnel systems) and technology that capture the "products of the work," listing Project Sites as the latter. Taking their comments into consideration, this finding refines the points made earlier about staff's appropriation of Project Sites as simply a repository/dispensary, while also extending the finding to show that the defining aspect of this use is the practice of storage and sharing of completed documents as opposed to storing and sharing work that was still in progress. However, another crucial aspect of the Project Site use is the content structure that it provides. P25 explained that the metaphor she created worked for her because she could make both group and personal folders, while also attaching hierarchies to those folders. For her, the filing cabinet then meant that she had a "safety net" and "permanent storage" (compared to the desktop, which she stated was neither safe nor permanent).

Many staff confirmed this interpretation of CTools and produced similar narratives of its use. For example, P14 (Project Manager) described a site where his

group employed a hierarchical "cascading" structure of folders and subfolders, each of which had its own privacy settings. P17 (Business Admin) and P20 (Admin Specialist) described how folders were used in their groups to create document categories for easy retrieval; P07 (Research Admin) voiced the opinion that the hierarchical structure of Project Sites was beneficial for file management when comparing the toolkit to other less-structured options.

While the interpretation and use of Project Sites as a place for static work was widespread, some staff proposed that it could be used for dynamic work, albeit more problematically. A few participants, such as P07 (Research Admin), said they used Project Sites for storing temporary work. However, staff generally reported the difficulty of version control in an environment that was very hierarchical and rigid. Staff revealed that the same hierarchical structure that supports the filing cabinet metaphor also made it difficult to appropriate Project Sites as a shared workspace. For some staff, using Project Sites for unfinished work was perceived as inevitable because of the types of information that needed to be shared, file sizes, and security needs. P07 noted the importance of establishing good file-management practices, such as naming conventions, coordinating labor, etc., in order to navigate around the static nature of the Project Sites toolkit and its inability support collaboration within the tools.

The Boundary-Bridging Space

One interpretation of Project Sites that arose from the interviews was as a space that was both native to the university and capable of supporting collaboration and coordination processes within the university boundary, while also working as a space capable of blurring the boundaries between the staff, student, and faculty worlds, as well as blurring the boundaries defined by units and staff's communities of practice.

Staff confirmed that they used Project Sites for information sharing both within their units and across units, the process being supported by virtue of these collaborators already having Uniqnames and a university affiliation. Less frequently, staff reported

having used Project Sites to work with collaborators outside of the university. In most of these cases, staff were still able to appropriate Project Sites into their sharing practices by creating Friend Accounts for their external collaborators. Thus, Project Sites was also interpreted as a platform for sharing that could blur boundaries between the members of the university and external collaborators.

THE SECURE SPACE

> *"…for a lot of our research groups, we store documents.... because we can assign who's allowed to see them" –P25*

Many staff, especially those in administrative positions, worked with sensitive or confidential data. In the interviews, these staff described that this information required a level of secure storage that other documents did not—secure information needed to be protected from access by non-university people and people in the university who do not belong to the site. When participants needed a place to store and share this sensitive information, Project Sites was one of the leading competitors because, as P25 asserted, "It has been rated good enough," by which she meant that the CTools system is compliant with the most stringent security and confidentiality standards. Additionally, she claimed that "[information] feels better protected in CTools," compared to other sharing platforms. Unlike other spaces (primarily intranets and servers), Project Sites was the only tool that staff deemed to allow them both a secure space and a guarantee of being able to share across organizational boundaries.

The guarantee of protection is only part of why staff came to interpret Project Sites as secure space. Many staff described a sense of control over the content in their sites. Many staff alluded to similar security concerns within their own collaboration groups, where not every site participant should be able to access all of the files in a Project Site. P14 (Project Manager) characterized a particular site that he uses to distribute campus maps and technical specifications as a site where "90% of the users have no ability to edit and update." Meanwhile, other sites that he participates in had looser restrictions on who was able to edit documents. Another participant described a

committee process where these internal controls allowed her group make documents private until they were ready to be released, saying:

> *"It's just an easy place to **control who has access** to the minutes because, until the minutes are approved by the executive committee, they're not for public record." - P09, Curriculum Specialist*

6.5.4 The Convenient Tool

Aside from Project Sites usefulness as a storage/sharing platform, there were three other reasons why staff appropriated Project Sites—it was free to use, student and faculty collaborators were familiar with it, and there was a perception of an established body of faculty who were users (critical mass). The issue of cost is fairly self-explanatory; a number of staff found it advantageous to appropriate Project Sites rather than seeking out new tools that might incur costs to their unit. P13 (Admin Supervisor) described that she had attempted to replace Project Sites with SharePointx and that the monetary cost of the switch was a decision point. Her unit was able to incur this cost, but she added that her collaborators (Deans) would be thrilled to revert back to Project Sites because they were much familiar with this tool due to their past university roles as faculty. A few other participants mentioned that faculty were familiar with the tools, and thus switching away from Project Sites would require for either staff or faculty to learn new tools. Project Sites provided common ground—both in terms of a tool that was accessible to both staff and faculty communities, but also understood by both. P08 (Research Admin), for example, mentioned that because faculty were so accustomed to the platform, she would keep it in her set of tools for her role in sharing grant documents; there was also established precedent for this use of Project Site between her and the faculty she helped, so moving away to another system or tool would be inconvenient. Other participants explained that the lack of cost and familiarity worked together to make Project Sites the best choice in most cases *except* when there was a function that they needed. In P13's case, it was the ability to create workflows in SharePoint that outweighed the convenience of Project Sites.

The last point, about critical mass, relates to staff's collaborators driving Project Site use. There was a general feeling among staff that faculty are comfortable around Project Sites because of their use of it in their teaching. Many of the staff who were involved in information sharing with faculty revealed that faculty's knowledge about Project Sites would sometimes drive the group's use of Project Sites. Regardless, staff did not suggest that catering to faculty needs was the primary impetus for their appropriation of Project Sites.

6.5.5 Project Sites Use & Disuse[11] (A Life Cycle)

The survey study described in Chapter 4 showed that a vast number of staff had either not heard of CTools (or Project Sites) or never used it despite knowing about it; the survey also showed that a number of staff had appropriated Project Sites and had subsequently abandoned it. While the interviews were aimed at examining how staff appropriated Project Sites, they also provided the opportunity to examine continued use and disuse, highlighting the evolving contexts that ultimately result in the toolkit being phased out. Because of my recruitment method, all of the recruited staff were Project Sites users at the time of the survey. However, the time that elapsed between the two studies resulted in a few staff who had abandoned the Project Sites toolkit. The reasons for their abandonment of the tools (disuse) uncovered important conditions that explain why staff adopted and appropriated of Project Sites.

The interviews suggested overlaps between reasons for adopting technology and reasons to appropriate it (continued, evolving use). The Technology Acceptance Model (TAM) suggests that perceived usefulness (PU) and perceived ease of use (PEoU) are determinants in the adoption of technology (Davis, 1989); in particular, the model attributes the most weight to overall outcomes to technology's usefulness. In reviewing the reasons why staff appropriated Project Sites, the interviews confirmed overwhelmingly that Project Sites' usefulness within the context of a group's needs was

[11] Disuse is equivalent to abandonment (Parasuraman & Riley, 1997). I use this term to reflect technology use cycles.

reason to adopt and appropriate it (usefulness as a shared, secure repository). The most common reason for which staff abandoned Project Sites was that the group no longer had the need for the tools (e.g., P15, P16, & P24). 'Usefulness', in this case, was mostly a matter of job relevance and functionality.

The interviews did not suggest that participants' continued use of Project Sites was affected by how easy it was to use. In general, staff noted that Project Sites was simple to use, but also judged it as awkward and 'clunky.' Ease of use and enjoyment were relatively split among participants. Staff also expressed attitudes towards Project Sites ranging from "love " to "hate" that directly impacted the extent to which staff visited Project Sites—most visited their sites rarely. P25, an Associate VP for OVPR, noted her negative feelings towards Project Sites by saying, "I hate it. I really hate CTools. I find CTools as a very awkward environment," and later following up her previous comments by suggesting that she visited her sites as infrequently as possible. This interviewee also had to continue using Project Sites both because it was familiar to her collaborators and because of the sensitive secure information that could not be stored on her preferred medium (Google Drive). Examples such as these suggested that functionality and organizational constraints sometimes outweighed personal attitudes and judgments of the toolkit.

Project Sites' disuse also occurred as a result of direct competition with other tools with overlapping affordances. Primarily, the context for this was that staff needed to share, but there was no particular necessity to use Project Sites or when staff did not have secure files or confidential information. This resulted in the appropriation of Project Sites being judged solely on its usability and its usefulness as a central storage location, where participants deemed that the toolkit lacked the competitive edge necessary to establish is place for it among other tools like Google Docs/Drive and SharePoint. One participant pointed to the multiple tools at her disposal, saying:

> *"Well… I think that **CTools was just another thing**. I could always think about ways to do what I needed to get done with my other tools."*
> *- P15, Arts Program Director*

> "***We have other stuff that would do the same thing**, and I think much more efficiently" – P24, Research Admin*

The other stuff that staff had at their disposal are the very tools shown in the tool ecology diagram, but this judgment was also common when staff described the reasons for not using the communication tools. Staff had not adopted (and thus, did not appropriate) the communication tools because there were better, more efficient tools that staff had easy access to. P13 (Admin Supervisor) stopped using Project Sites in favor of SharePoint as a result of learning to use the latter, noting that there were many things that she needed that SharePoint could do more efficiently than CTools—specifically, creating specific types of automated communications.

Lastly, a small number of staff described that their appropriation of Project Sites was hindered was due to the perception of not being the intended user group (faculty and students) and that their use was not the intended use. Quite a few staff revealed their assumptions that Project Sites was a toolkit designed for students and faculty; this belief, as described earlier in this chapter, kept staff from experimenting with the tools and prevented them from considering ways of appropriating the toolkit. P24 (Research Admin) enumerated a list of classroom related activities that he was not engaged in as rationale for abandoning Project Sites. P16 (Marketing Specialist), who had created a site for non-credit learning in her previous position, hesitated to re-appropriate Project Sites because the way she would use the toolkit defied what she perceived to be the 'correct' usage. Specifically, she determined that the Project Sites was intended as a tool for use at work, which resulted in the perception that it would be inappropriate conduct to use it otherwise even though she knew of others who used it in non-work contexts.

> *"Yes, I would want to use it, I guess. **The only downside to it is I would want to use it for more non-University of Michigan related things.** The fact that it's connected to the university and you have to have a Friend Account and all that kind of limits… there are a lot of features on there that I could totally take advantage of—for my church, for example. –P16, Marketing Specialist*

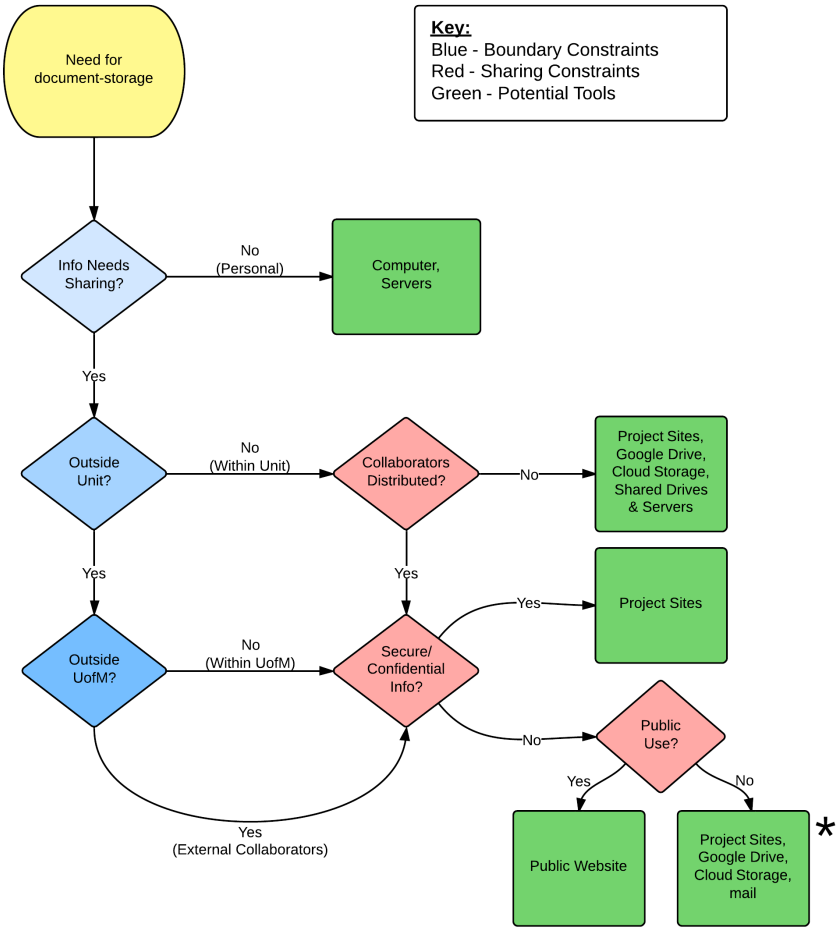


Figure 18. Decision tree for use (and disuse) of Project Sites

Because she could not appropriate Project Sites to other contexts, this participant eventually abandoned the tool.

Ultimately, a number of reasons led to some staff's disuse of Project Sites—the most prevalent of these reasons were related to staff's perception that the toolkit no longer supported their needs or that they no longer needed CTool's Project Sites feature because they no longer needed a central storage/sharing location. Understanding why users abandoned Project Sites helped to reinforce the reasons for having appropriated it. What emerged was a decision structure for when staff were likely to use Project Sites and cases where staff were likely to consider other alternatives. Figure 18 shows this

structure and reflects some of the decision markers that I called 'conveniences' in Section 6.5.4.

When asked if they would ever reconsider Project Sites, staff noted that they would do so without hesitation if the situation warranted, thus disuse is not necessarily a final decision. This observation from the data points to the fact that technology is while IT is adopted and adapted according to need, that it is also discarded and re-appropriated according to need—that these decisions are not permanent, as needs are always in flux.

6.5.6 Project Sites – The "Course Tool"

While the previous sections have described staff's interpretation of the Project Sites toolkit, another interpretation existed that had implications for how staff considered and appropriated the tools. This second interpretation relates to the original design intent for Project Sites—to support coursework. Even though only three of the staff I interviewed were students, interviewees were all highly aware of Project Sites' focus towards teaching and that staff use was something altogether different, explaining:

> *"…my understanding of it, it's designed for use by instructors with their classes." - P17, Business Admin*

> *"I had a professor [collaborator] who did teach and I had access to his [Course Site] so I could help with some scheduling. So* ***I know there's a whole 'nother way to do it if it's course-related.****" - P20, Admin Specialist*

> *"****There are some things that are obviously more geared toward the academic environment.*** *There are some things that maybe they are, but they have equally valid uses in the business environment." – P21, IT Auditor*

It was this narrative of academic uses that participants, like P21, used to distinguish staff use (unanticipated) from faculty and students (anticipated). Interestingly, this perception revealed that staff themselves had determined the boundary between themselves and the learning mission of the university—and that these boundaries were

embedded in CTools system's design. This academic narrative of use framed how staff perceived Project Sites in ways that I describe later in this chapter.

6.6 PRACTICES AROUND PROJECT SITES

The user log study described in the previous chapter looked at staff's overall usage patterns on Project Sites, suggesting that Resources was the most popular tool and all others were used very minimally. Due to methodological issues, I could only draw conclusions very broadly, but the use of interviews helped elaborate how staff use Project Sites. The main findings support the results of the survey and log study—that staff use Project Sites primarily for storage, using the Resources tool—but it also reveals that this limited appropriation was primarily a result of deeply-seated organizational barrier—the lack of knowledge, founded on poor communication about the tools and how to appropriate them.

6.6.1 TOOL USE

Taken as a whole, the staff's perceptions of Project Sites, using metaphors such as filing cabinets, repositories, dispensaries, etc., supported a dominant narrative of Project Sites as a central location for the storage of information. This narrative led to staff appropriation of Project Sites being limited to a default use of the Resources tool. When asked about other tools, however, most staff relayed that their use of other tools was rare or, in most cases, non-existent. One participant, P17 (Business Admin) said of a site shared with OVPR, "… pretty much the only part of it they use is the Resource section. It's basically a repository for that documentation, to make it in one place…" Almost all the staff I interviewed made similar comments about their nearly exclusive use of Resources. Staff explained that the other tools were not used because they were not perceived to be useful for sharing purposes, thus those tools did not support the dominant narrative about Project Sites as usable by staff. This finding confirmed what the log analysis suggested—that staff primarily used one tool. Yet, the log analysis also showed high usage of the tool among students and faculty, both being anticipated user

groups who are much more familiar with the tools. What the interviews highlighted about the use of the Resources tool is that staff, as a group of unanticipated users, had not been introduced to its use early in the implementation process and since being recognized as users, continued to lack the knowledge and learning opportunities to help them make sense of Project Sites and its features in ways that extended beyond the filing cabinet metaphor.

6.6.2 Factual/Experiential Knowledge About Project Sites

As mentioned previously, CTools provides a platform that is intended to be adaptable to varying contexts of use, allowing it to be appropriated in different ways. Despite this flexibility, staff's appropriation of Project Sites was heavily focused on Resources. What was most telling regarding the prevalence of the Resources tool was it was the only tool that staff interviewees could consistently identify and understand.

The card-sort/think-aloud task confirmed that staff had little to no prior knowledge of the other tools in the Project Sites toolkit. Besides Resources, staff had some familiarity with the Chat, Announcements, Wiki, and Schedule/Calendar tools, but this knowledge was uncommon, limited to fewer than half of the participants. Staff who participated in the task often made educated guesses or hypothesized aloud about what they *imagined* a tool would do, having prefaced their comments by stating that they had never used the tool or heard of it prior to the interview. Though some of the responses were close, staff guessed the majority of the tools' uses incorrectly or they were altogether unable to guess. Nearly half of the participants excluded one or more cards from their sorted card piles because they were uncomfortable sorting a tool they did not recognize into a pile. The card-sort/think-aloud task showed that knowledge about the Project Site toolkit was incomplete and that staff did not know about the tools *prior* to the task, but that staff were able to vaguely infer tool functions by trying to guess, though not well enough to spur thinking about ways to appropriate these tools.

Because not every interviewee participated in the card-sort/think-aloud, I asked participants about their knowledge of the tools, having framed the question by the tools list that staff would see either at site creation or through other site interactions. When prompted about the site's tool list, about half of the participants recognized the list and, again, staff overwhelmingly admitted their lack of knowledge of the tools. Most staff had seen the list as part of the site creation process, but despite its existence, they did not investigate the tools and thereby failed to increase their knowledge about functions and possible interpretations about these tools. Instead, past experience most often established knowledge about tools. Staff continued to use the tools that they'd already used before because these were the tools they understood, usage indicative of the functional fixedness bias (Duncker, 1945). P17 (Business Admin), for example, stated that her group outright ignored the list when creating sites, adding:

> *"Yes, I think it's pretty much like we're using this to share documents;* ***I just need to just need to use the Resources section and I didn't pay any attention to the rest*** *of the stuff" – P17, Business Admin*

P06 (Research Admin) had briefly examined the tool list, but had not explored it either, saying:

> *"I know I've glanced at it before.* ***I didn't really dig into it to see what all those really were and what they could do****. I know I've looked at it, but in passing more of and nothing stood out as "you should use this." I think sort of what we've done in the past is, "Okay, what kind of initial…* ***What have we used in the past that we think people might use or might be helpful?" and keep those things.*** *There hasn't been a big… I haven't put a lot of thought into what we might use, what the different features might be." – P06, Research Admin*

Excerpts like the ones from P17 (Business Admin) and P06 (Research Admin) suggested that, even with a list of tools readily available, staff ignored most of the Project Site tools and made the decision not to appropriate them even without knowing their functions and how they could be appropriated. Part of the hesitation to learn

about the other tools was related to the sense that learning about them was time-consuming, but there was also a sense that the CTools system, with its focus on teaching and learning, did not offer much for staff. In almost all cases, staff noted that the way they made sense of the tools was affected by their perception that the tools were designed for coursework.

Thus, if we consider that knowing about technology allows one to appropriate it (Orlikowski, 1992), these examples show that knowledge about the tools in Project Sites did not exist *a priori*, partly explaining how the toolkit is used; knowledge did not exist *a posteriori* because the list itself did not motivate staff to further investigate how to appropriate Project Sites' tools into practice. Furthermore, staff did realize when new tools were added because of the practices behind site creation and use—a finding supported by comments in the card-sort/think-aloud, where staff were often surprised by the kinds of tools available in Project Sites.

The lack of knowledge of other tools was also due to workarounds that never exposed staff to other tools. When prompted about the list of tools at the site creation stage, some staff did not even know this list existed. They had no knowledge of the tools Project Sites had to offer because the toolkit also made it easy to bypass the tool selection process altogether by allowing site creators to clone the structure of an existing site. To clone a site, participants only need to specify the site they want to clone, and then they can customize the content. A number of staff explained that this process was much easier than creating a site anew because it removed a few steps, including tool selection. Thus, cloning was used in many cases as a method of creating a site a new site without having to learn more about the specific tools and setting up a site. Cloning also guaranteed that the new site would work as desired because it had worked in other contexts.

As a result of cloning, staff could guarantee a workable site without learning about site creation, but cloning was also common among staff who were more familiar with the tools (and recognized the existence of this list). In this latter case, staff were

sure they had found all the tools they needed and were confident in site creation, but relied on cloning as an expedient and quick way to create sites without thinking about the process in depth. In essence, cloning allowed both novice and expert users to ignore the tools list and resulted in staff not considering (and reconsidering) available tools, while also never allowing them to know when new tools were added (or removed).

A number of staff, when judging the system's ability to support their work practices, expressed a desire for a Project Sites feature for which there was already a tool or procedure built in. For example, P13 (Admin Supervisor) reported that she would use Project Sites again if it could allow her to share with people outside of the university—a function afforded by creating Friend Accounts; she also wished that CTools could hold links (it actually allows this through the Web Content tool). A few other participants similarly failed to realize that Friend Accounts existed—a lack of knowledge that led some staff to believe that CTools could only be used within the university.

With a dearth of knowledge about Project Sites, staff relied on beliefs about the system to guide the narratives of use that determined how they appropriated Project Sites. Ultimately, these beliefs and the lack of knowledge led to both the dominant narrative of Project Sites as a repository/dispensary and the ongoing use that supported this narrative. Even when staff were faced with their lack of knowledge about the rest of the system, the dominant narrative about its use was strong enough that it justified staff's focus on the Resources tool and directed them away towards the very kind of knowledge-based thinking that would allow them to appropriate tools in different ways.

6.6.3 EXPOSURE & TRAINING

The way that staff used Project Sites and their knowledge of the toolkit were also due in large part to how staff were exposed to Project Sites and how they were trained in its

use—that is, had staff been exposed to effective use of other tools or had received training, their appropriations of Project Sites might have been more varied.

Staff were almost always unable to recall the specific person who introduced them to the toolkit, but identified that faculty or another staff member were responsible. In the interaction that led to using Project Sites, one of these unnamed collaborators shared a document with a staff member through Project Sites or they told the participant to upload a document there. Staff described that as a result of these interactions, they either had to learn about Project Sites on their own or they learned by being shown in informal hands-on training. Because the way staff had been exposed to Project Sites emphasized its ability to support storing/sharing information and the Resources tool, this became the only interpretation of Project Sites available to them and the only narrative of use that staff learned, resulting in the kind of appropriation I have described in the previous sections.

If word-of-mouth did not convey Project Sites' potential appropriations via alternative narratives of use, it was because these alternative narratives had never been spread, as evidenced both by the lack of other existing narratives and by staff's inability to state any such narratives when prompted to describe their use of the tools. There was no indication among the staff I interviewed that the greater staff community wasaware of any colleagues who had created different uses for Project Sites or, if they had, that this information flowed through their informal information channels.

If staff themselves were unable to create these narratives or convey them to each other, they could have learned to appropriate Project Sites differently through training measures. There was, in fact, formal training that could have taught staff about potential Project Sites uses. However, from staff's perspective, there was no formal training available.

> *"So, my impression is… life moves fast around here… is that* ***CTools training is for faculty and courses. And I might be mistaken.*** *And if I am, I would sign up for the training." – P07, Research Admin*

*"**I certainly don't remember any formal training on it**. I don't tell staff to go get formal training on it. **I don't even know if it's offered.** I just teach them myself if I need them to use it. I'll just teach them myself. To me, it's that simple." – P02, HR/Business Admin*

*"Yes, there's little packets of people using [CTools] for different things around the University but **there was no big push. There was no big message of, "Hey, staff. You can use this too.**" They could have done that, but there just wasn't that kind of drive." –P21, IT Auditor*

The conflict between ITS's efforts and staff's perceptions of ITS's efforts suggested a communication breakdown where the visible work ITS thought it was doing had essentially become invisible—or nonexistent—to the staff they were trying to reach. Without the perception of accessible formal training, staff continued to appropriate Project Sites in the way that was most familiar to them.

6.7 GOOGLE, A COMPARITIVE CASE STUDY

Initially, understanding Google was important because its transition into the tool ecology was expected to have widespread effects on staff. Many things were different from the CTools transition; staff were anticipated users and there was a visible effort to promote Google among the community. Rather than finding this to be the case, what I discovered was the general failure of Google's collaboration tools to replace Project Sites within the tool ecology, partly because of what the tools afforded (or failed to afford), but also because of staff's lack of knowledge surrounding the very tools they were anticipated to use.

6.7.1 APPROPRIATION OF GOOGLE DOCS/DRIVE & SITES

In the university-wide transition to Google-supported email, staff gained access Google's collaboration tools through their Uniqnames, which also connected their amail and calendars. The collaborative tools that staff were able to access were Google Docs (now known as Drive) and Google Sites. Whereas Google Docs allowed just the

creation, storage, and sharing of documents within the Google apps, Google Drive extended these capabilities to allow a user to upload any file types without converting them into Google Docs. Google Drive could be set up in such a way as to allow shared folders, thus it was a possible competitor with CTools. At the time of the interviews, roughly a third of participants were using Google Drive as a sharing platform and some of these staff were only using it to access information that a collaborator had placed on Drive. P21 (IT Auditor), for example, described that the documents he accessed on Google Drive were from a specific unit he was working with and the documents contained the information he needed to perform IT audits; he himself was not using Drive to reciprocate in the process of sharing.

Whereas Project Sites allowed staff to share finished work, Google Docs/Drive was appropriated to support the sharing of unfinished work that was still in progress. P25 described spreadsheets that she used collaboratively with two other colleagues; the collaborative editing feature allowed the three colleagues to divide the labor of tracking research proposals such that they had awareness of the progress. P24 (Research Admin) described using the Google spreadsheet in a similar manner, using the feature to mark potential collaborators as having been contacted, a feature that was helpful to both her and her unit.

Experience with Google Sites was limited to five participants in this study. Of these, one was still in the process of deciding if their group should adopt it (P13), two had used it only in personal contexts (P05, P21), and two others (P06 & P22) successfully appropriated Google Sites and were actively using them. P06 (Research Admin) had adopted the tool to replicate the function of a wiki, which had previously been done with the Wiki tool in a Project Site. P22 (Writer) had been using Google Sites with her colleagues as an intranet. One additional participant, P15 (Arts Program Director) knew enough about Google Sites to direct students to use it in creating online portfolios.

In assessing the impact of Google's collaboration tools on the appropriation of Project Sites, a few observations stood out. First, Google's tools offered only one

significant advantage over Project Sites—collaborative editing. Most staff, however perceived collaborative editing as messy and not as a desirable workplace practice. Much like Project Sites, Google's tools offered free web-based solutions to work needs. This affordance only surfaced with P06's use of Google Sites; yet even in this case, cost was not a deciding factor. Lastly, there was a perception among a few staff that Google's tools were easier to use for collaboration outside of the university.

The other notable observations about Google's tools' impact on Project Sites' appropriation highlighted the reasons why Project Sites still remained relevant and how the two systems can co-exist within the tool ecology. One of Project Sites' advantages was that the toolkit provided hierarchical structures and a secure space. Although Google Drive permits users to establish folder structures, it was unclear that staff had known this and made use of the feature. Staff also viewed Google, as whole, to be too dynamic for work that required more static, hierarchical structures. In regards to security issues, staff noted that, unlike Project Sites, Google was an inappropriate choice for storing and sharing sensitive information.

6.7.2 Problems Appropriating Google Tools

Knowledge

Almost every participant had, at some point experienced a Google Doc, regardless of whether this past experience resulted in their appropriation (adoption and adaptation) of the tool. Whereas all participants were familiar with Google Docs, many of them were not familiar with how to evolve their practices with regard to Google Drive. Staff knowledge of these tools, however, was enough that their decisions to adopt the tools were founded on experience and knowledge rather than belief. The interviewed staff developed practices that were both supported and limited by the limited knowledge.

Sites, the collaborative tool, was expected to be a competitor for CTools within the ecology because it supports production tools in addition to supporting storage and sharing. However, most staff were not familiar with Google Sites at the time of the

interviews. Most participants, when asked about Google Sites misinterpreted the question, believing the term referred to the Calendar, Docs/Drive, and the various other tools. Other staff, like P23 (Outreach Director), believed the term referred to the toolbar or the Google website with links to all of the tools. Halfway through the interviews, I added a question to the recruitment emails to inquire whether staff were using Google Sites. As a result of this question, I suspected that staff unfamiliar with Google Sites would have to investigate it and that they would be able to respond more accurately to questions about their knowledge of the feature as a result of their research. Instead, quite a few staff had misinterpreted the name "Google Sites," having responded according to their use of Docs/Drive and other non-Sites features. In two cases, participants took the time to research what I meant by 'Google Sites' and claimed that this work raised awareness of the Google Sites feature's existence, but did not ultimately result in increased knowledge nor did it motivate them to experiment with the Sites feature. The most telling response came from P17, who contextualized her lack of knowledge about Google Sites:

> *"**I know virtually nothing about Google Sites. In fact I had to go look it up when you asked that in your email.** 'Google Sites, does he mean Google Drive?' and I went out and I went, 'There's Google Sites. I wonder what that is.' Then I went back to answer your email to say 'No, I don't use Google Sites.' **I verified what you were asking, and what I found out, 'That's what he's asking. Nope'**" That was the first I heard of it, when you asked about it."*
> *- P17, Business Admin*

The appropriation of Docs/Drive was more successful than that of Google Sites both as a result of—and evidenced by—staff's knowledge and experience with the tools. However, some staff who had heard of the feature and decided not to appropriate it also noted that they might adopt the feature and appropriate into their practices if they had reason to—namely, critical mass.

TRAINING

"Oh, use the website. ***Just read about it.*** *Maybe there's a video." – P12, HR Analyst*

Much like with Project Sites, staff's lack of knowledge about Google could have been mitigated by the availability of training, yet training was an issue even though staff were an anticipated user group. While staff noted the presence of ITS's support for the email migration, the problems staff encountered were due to their perceived lack of training for collaborative tools that might have allowed them to cultivate new practices. Similarly, the staff I interviewed highlighted that their units' IT specialists had also focused specifically on supporting the email migration and calendaring, ignoring the other tools.

A few of the interviewees, such as P06 (Research Admin), voiced the concern that they were left to learn on their own, which was problematic given that the majority of staff asserted that they were unlikely to pursue learning to use technology on their own. Because learning-by-doing and word-of-mouth were the ways that staff's reported avenues for learning about technology use and new practices, staff hesitated to invest the time and energy into a process they did not perceive was likely to be recognized or fruitful. Instead, staff often admitted that they would rather wait for another colleague to tell them about new practices and technology with comments like:

"So you know, yeah, if somebody presents … ***this again is me not going out and searching for it, but if it's presented to me*** *as a better way to do something, I would seriously consider it. I'm in the Engineering department, we're all about efficiency." –P08, Business Admin*

"I think the only way is if somebody tells me, you know some people that I work with or something. If I'm emailing them and I'm like 'Hey how'd you do that?' I think it's going to be a word of mouth thing. That's how I found Google Drive, I thought you got Google Docs, somebody would email it to you and then you would download it. But somebody told me just the other day, "Oh no it's on this drive and you go up to the top and find drives"' and I hit that and I was like "Oh my god there's a whole bunch of stuff there that I didn't even know was there." So

it's things like that that will take some time to figure out." – P19, Sustainability Rep

Staff recounted another issue with training: the ITS migration assistants helped staff only very briefly (1 work day, according to the staff I interviewed) and many of the questions about practices and technology use arose after the assistants were gone. Participant 19 describes this as follows:

> *"… when we made the changeover, they made this big deal they were going to have all these Google Assistants or whatever around to answer all of your questions but it seemed like they were there for maybe one day and then they were gone. That one day, you were just getting organized and* ***all your questions didn't come up until a week later when you're actually trying to start to use it; and by then, they were gone and I didn't know what to do.*** *They had assigned one or two Google Reps, which were people here who had gotten a little extra training, but they're not IT people and they're not computer experts, so it was more like I would ask them and they'd be like, "Oh, let's see," and then they would start pushing buttons and I was like… "Well I can push buttons myself." " – P19, Sustainability Rep*

Whereas Google training was generally portrayed as unsuccessful by most staff, one interviewee described one particularly intriguing exception. P06 (Research Admin) described successful "brown bag session" where staff in her unit were able to come with questions about the various collaboration tools. This kind of training was able to motivate her to further explore Google Sites to replace her group's wiki. She also described that these local experts, though unable to directly guide her in adopting and appropriating new technology, were able to answer her questions in such a way that she felt confident and informed enough to pursue appropriation work on her own.

The findings suggest that staff, whether anticipated or unanticipated users, are limited in their ability to use technology by limits on their knowledge of the systems they've appropriated, reflecting bounded rationality (Simon, 1991). Differences in knowledge and training point to the fact that, rather than being bricoleurs who are expert at using technology, unanticipated users my be less knowledgeable than their

target user counterparts and may be at much higher risk of limited information and cognitive biases.

6.8 TECHNOLOGY-RELATED SPECIES IN THE ECOLOGY: THEMES AND VARIATIONS ON GARDENERS

The results of the previous sections highlighted that there staff, on their own, were not able to create multiple narratives of use around the use of the flexible Project Sites feature and were similarly unable to cultivate new practices, likely due to the fact that the system was never designed for their use. Staff acted as their own social actors (Lamb & Cling, 2003) in the articulation of work of adopting and adapting technology. However, the literature notes other such actors in ecologies, who are important to cultivating practices and supporting appropriation work. I follow Gantt & Nardi (1992) and Nardi & O'Day (1999), who described distinguished between types of technology experts in ecologies—local developers (in formal positions) and gardeners (in informal positions). Under their ecological framework, Nardi & O'Day propose that gardeners are technologically savvy technical experts who experiment with technology, introduce it to their colleagues, walk them through technology usage, and create new practices. In essence, gardeners are able to perform any and all of the articulation work that is a part of the process of appropriating technology and cultivating new practices around its local use.

6.8.1 GARDENERS

There were participants who were gardeners, but more who were affected by the work of gardeners. For example, P24 (Research Admin) described that one of his colleagues on the research administration team was very knowledgeable in macros and had created a very complex spreadsheet that was in use for local financial tracking within his unit in lieu of using the central Finances system. Similarly, P23 (Outreach Director) assistant was a gardener who often was the first point of contact for assistance with technical issues (even before the dedicated IT woman on staff); P23 explained that even

when her assistant did not know the answer to a question, her expertise in technology use meant that she could quickly find answers or they would turn to the IT staff. Finally, (Admin/HR Assistant) described herself similarly to what Nardi & O'Day (1999) called a gardener in her unit's administrative staff group, having engaged in tinkering, by introducing new technology and work practices, and in helping others with transitioning.

The common thread between these three cases was that the gardener was acquainted with their coworkers, existing practices, technology use, and needs; they were also informal in the sense that their roles within the groups are not defined by technology expertise. Even despite the lack of formalized influence, gardeners had influence over how practices evolved and even actively changed the way the local ecology grew. What I noticed, however, was the absence of consistent gardeners when participants spoke about the people who influence their use of the Project Sites. All staff had heard about Project Sites from someone else, a staff colleague or faculty, and the interactions conveyed the dominant narrative about CTools and Project Sites. Beyond these initial interactions, there were no gardeners to push the evolving use of Project Sites beyond a sharing/storage platform. By comparison, all staff mentioned behavior consistent with the concept of gardeners when describing the transition to Google with regard to the new email and calendaring tools. However, like with Project Sites, staff reported very little gardening work in relation to Google's collaboration tools.

In the analysis, it was evident that there was a further distinction in what Gantt & Nardi (1992) and Nardi & O'Day (1999) call gardeners. Specifically, it was that introducing new technologies and practices was not the same as successfully leading others in the appropriation of this use. In particular, I differentiated between individual activities of catalysts, who introduced change, and shepherds, those who made sense of technology and led others in cultivating practices around it.

6.8.2 CATALYSTS – INCITING CHANGE

Nardi & O'Day recognize that gardeners will sometimes be the sparks that motivate changes in practices and technology use among the numerous other possible aspects of gardening work. It became obvious in the interview data that people who sparked change were often engaged in just this aspect of the work and not necessarily invested in the articulation work that led to appropriation. I attribute these attempts at ecological change to *catalysts*, those who I define as either gardeners who introduce new technologies or practices into their local ecologies. I use the term 'catalyst,' using the term that P23 (Outreach Director) gave to these members of her ecology as she described students who worked at her unit and the role they played in driving the local use of Google Docs:

> ***Participant23:*** *And the students – we have a lot* ***of student workers who sort of… in some ways they drive our use of technology*** *because they are the ones who kind of got us all using the Google Docs. They were trying to figure out, "Okay, who's going to do this, who's going to do this?" They said, "We'll put it on a spreadsheet on Google docs," and* ***before you know it, the front office is using it. My assistant was sharing it with me and everybody else was sort of spreading throughout the Center****, how we can use these Google Docs.*
>
> ***Interviewer:*** *Was this before the transition or after the transition?*
>
> ***Participant23:*** *This was actually before the transition.*
>
> ***Interviewer:*** *In a way you, guys were ahead of the transition then.*
>
> ***Participant23:*** ***With the students serving as a catalyst****, yeah. I had seen Google Docs, but I wasn't using it. Mostly from students.*

This case was a clear example of catalyst work being performed by these students. P23 described that the students were knowledgeable with Google, their work environment, and how Google Docs could fit within the scope of IT needs within the unit. Their standing within their local ecology was strong enough that the suggestion

was picked up with what seemed to few issues and they managed to instigate this change long before the transition. Also, these students were involved in the broader definition of gardening work in that they not only introduced the tools into the local ecology, but they also taught how it could be used.

The same participant above also reported having been exposed to a Google Doc before she knew what it was but noted no change in her practices as a result:

> *"… there was a student who asked me to review an essay for her and **she sent it to me as a Google Doc**. I'm thinking, **"Okay, how do I open it?"** That was my first time ever seeing a Google doc. I had to ask my 11-year-old daughter how to open it because she was using it at school. This was a couple of years ago, so she was 11 or 12 then. **I didn't even know what to do with it at that point.** That was my first time. Thereafter the students started driving that here." - P23, Outreach Director*

By virtue of sending this document, the student had unwittingly exposed P23 to Google Docs, though this event only catalyzed one use and P23 did not appropriate Google Docs into everyday work practices at home or at work. However, having used it in this one case made it such that when the real catalyzing events happened within her unit (before the university's transition), she was familiar enough with the tool to readily adapt to the transition.

It difficult for staff to remember who was a catalyst for using Project Sites because it was a change that staff described as being in the past. When asked if they could remember who sparked this change, staff were rarely ever able to remember specific details though they often suggested that faculty and staff colleagues were the likely catalysts. In some cases, Project Sites were already in use before the interviewed staff had started in their positions and thus tracing the catalysts would require going farther back in the history of that person's job. While staff were unable to remember the exact identity of the catalyst or the original reason for adopting Project Sites, all staff were able to point to ITS and the university's central administration as the catalyst for the Google transition. Catalysts for Google Docs were uncommon; catalysts for Google

Sites were particularly rare, supporting the lack of Google Sites adoption. Most often catalysts for Google's collaboration tools were staff and other collaborators.

On a rare occasion, I interviewed staff members who described themselves in way similar to what I call a catalyst. For example, P11 (Admin/HR Assistant) described her role in introducing new technology into her work group. She had only just recently started her current position less than half a year prior to the interview and she had experience using different tools in her previous work group. As she learned the needs of her new group, she thought of ways she and her new group could incorporate some of what she knew in their work groups' practices. More importantly, she also described herself as being technologically adventurous—she stressed that she enjoyed experimenting with technology and seeing how she might improve her work and the workflows of the people around her. She was interested in seeking out new technologies and after our interview, asked me to point her to Google sites so she could introduce is as a work option to her administrative supervisors and colleagues.

P11 (Admin/HR Assistant) was not the only catalyst that I discovered, but was the best example of a participant who was engaged in the kind of tinkering and introduction of new tools and practices that composes the catalytic aspect of gardening work. P24 (Research Admin) described that he performed this catalyst-type work in his previous job, but had abandoned this work because his new job had strict practices around information sharing that he stated left no room for introducing new technology in general, therefore no reward or incentive to tinker. He also felt like he could not cultivate new practices because of his perceptions that the financial responsibilities of his research administration role were set and unchangeable.

Across people who described themselves or others who were involved in catalyst work, it was evident that these people were usually young and technologically savvy and adventurous. However, youth is not necessarily an indicator of someone who is willing or capable of being a catalyst. P24 (Research Admin), who I just described being a prime example. While older participants were generally comfortable with technology,

they rarely identified themselves as catalysts. The one exception to this was P15 (Arts Program Director), who described that she felt the need to keep up to date with technology because she tends to work with students. As such, she felt the need to introduce these information technologies and social media into her group's work in order to stay on pace with arts engagement and non-credit curriculum planning.

While catalysts provided fresh injections of technology into their work environments, it was not necessarily true that the catalyst was responsible for the successful appropriation of the technology. For instance, when P13 (Admin Supervisor) described her one other colleague as a catalyst in the sense that this colleague sought out new technologies to use in their partnership, but she was not necessarily as the one who *continued* the work to successfully implement IT past the original discovery and tinkering:

> ***Interviewer:*** *I wonder, does that one co-worker of yours who tries things out through trial-and-error, do you know if she's been trying it out or …*
>
> ***Participant13:*** *I think so. I believe so. She hasn't said a lot about it other than "Oh, this is a cool feature," but I know she hasn't created one altogether to show me yet.* ***She kind of starts things and then she hands them off to me and says, "What do you think about this?" and I'm like, "Oh, yes. We can do this and we can do that."***
>
> ***Then she's like, "Okay. I need you to finish it." Then, usually, I get excited and I'll finish it.*** *That's how we're kind of a team in that way. She finds something and she's like pretty much "Learn all about it and figure it out and do it." It's how we're working on it.*

This excerpt shows that the catalyst can instigate change, but that it actually requires more than discovering the technology, tinkering, and telling people about it for it to be adopted and appropriated; what is needed is a person to make IT relevant and then lead others in its use. Rather, it takes for end users of technology to make sense of it in a way that they can adapt the technology and themselves to their contexts. I describe this as the work of the *shepherd.*

6.8.4 SHEPHERDS – LEADING THE WAY

If catalysts assume the role of igniting a process of change, shepherds were those people who assume leadership roles in moving their collaborators through a transition. Throughout the interviews, it was evident that successful transitions to new technologies were always led either by a formally designated by a particular individual with technical expertise or knowledge of the technology. What I call a *shepherd* is this type of local expert with no formal technology role, who leads others in making sense of and appropriating new technology. The concept of a shepherd arose in the analysis both in cases where such a person existed to transition others in technology use as well as in cases where there was no shepherd to lead a group in appropriating technology and cultivating new practices. For example, P07 (Research Admin) worked in a group to submit a proposal, using DropBox to manage their documents; She described that "chaos" and "mess" ensued without a clear leader to establish practices and rules for how they would use the sharing platform in this short-term project, the result of which was a failed, messy proposal that did not get funded.

P08 (Business Admin) was one of the shepherds among the staff I interviewed. She recounted a story from the time when she switched to this position a few years prior to the interview from a unit that had made extensive use of their unit server. Upon arriving in this new unit, she found that there was a server that was already present in her unit, but was extremely under-developed and under-utilized as a space for sharing their research and HR administrative work. She used her skills in setting up folders and shared drives in order to lead the staff in her unit to use it and develop new file-sharing practices. She raised the issue to the staff she now supervised that the existence practice of using the desktop for storage was not a viable long-term solution because it was not backed up, suggesting that the server is a safer place for storage and sharing within the unit. Though she was unable to convince everyone in her unit to change their practices, she perceived that she was able to get most people to use the server and was able to find workarounds with the local IT specialists to back up the desktops of those

individuals who resisted the newly restructured server. P11 (Admin/HR Assistant) also had transitioned from one unit to another, bringing to her new unit her previous work practices that, when combined with a technologically adventurous spirit, made her a leader in changing practices in her current work group.

For staff to appropriate Project Sites, which was not designed for them, staff needed to be shepherded through the process. However, it was surprising to see that staff never mentioned shepherding-work in their development of practices around Project Sites use. In the few cases where staff could elaborate, they alluded to a very ephemeral shepherding moment where an unspecified individual (either faculty or another staff member) showed staff how to add documents to an existing site or taught staff how to make a site. For example, P07 (Research Admin) briefly mentioned that "some faculty" told her to upload a file to a site. P08 (Business Admin) also described a similar interaction. Staff almost always portrayed these lightweight shepherding interactions as being very casual and focusing solely on the Resources tool. It was, perhaps, so casual that it explains why staff were unable to describe both who introduced Project Sites and why. What became clear from the interviews was that staff had not been shepherded in other potential manners of using Project Sites in their early experiences and later on once staff had settled on this type of use. This initial shepherding emphasized and resulted in the dominant narrative of Project Sites as a repository. Even in the rare occasions that staff attempted to activate a new tool, the lack of shepherds was usually associated with the failure of that tool to be appropriated.

By contrast, shepherding was a more visible in the Google transition, particularly with the email and calendar tools, and most often was the result of interactions with local IT specialists. There were, however, a few instances of shepherding that occurred beyond those two basic tools. P06 (Research Admin) suggested that her unit's IT group as hybrid between what I deciphered as catalysts and shepherds, explaining that these individual held lunch sessions where they described the Google Sites feature and how it might be used. Prior to these 'brown bag' sessions where the Computing staff walked the other staff through the transition, P06's knowledge about Google Sites was limited

to knowing they existed and that they were free. The IT groups' support added to her knowledge by providing information and examples. P06 continued the process of tinkering and learning herself, making sense of Google Sites and finding ways of incorporating it into her practices. She shepherded herself into using the tool for her own work, but was in the process of sharing this knowledge with her colleagues, thus becoming a future shepherd to her colleagues. Although she did not use the tools herself, P15 (Arts Program Director) had been shepherded through the use of Google Sites by a library technician. By learning about Sites and how it worked, she was able to direct students to use Google Sites as a platform for their online arts portfolios (previously supported by CTools ePortfolio tools). P23 (Outreach Director) was shepherded in the appropriation of Google Docs and Drive by a combination of student staff, her assistant, and the unit's IT specialist.

In summarizing the analytical theme of leadership in appropriating technology, I propose that this assuming the role of a *shepherd* and engaging in this type of work is one of both making sense of technology in general, while also onboarding others into potential ways to use it, thus ensuring its appropriation in ways that support practices. Despite the existence of examples where there was successful shepherding (mostly in Google tools), staff provided many more accounts that revealed the lack of shepherds, especially with regard to Project Sites. Given the findings in the staff I interviewed, this lack of shepherds led to a staff population that was mostly either uninformed or misinformed about Project Sites' and Google tools' uses. With most of the staff, there had been no clear leadership—from within their groups or externally—that emerged to guide them in the articulation work required to appropriate the tools, particularly Project Sites. This lack of leadership in cultivating new practices resulted in staff's narrative by which they appropriated the toolkit in the ways that staff first learned and never evolved beyond this point. In stating the importance of the shepherd, however, I note that not all shepherding was successful. P19 (Sustainability Rep) discussed a tactic used by ITS to create shepherds in his unit, staff who could be appointed as experts to help others through the transition. However, he found that those staff experts knew

little more about Google tools than what he himself knew. Because of this, he could only rely on these staff to help him through the most basic things; he claimed that he needed to learn new things on his own, by "clicking around," thus negating the usefulness of the local 'experts.'

6.8.2 FARMERS

From shepherding, there arose a third category of people who were (or who could have been) influential in the supporting appropriation work. Specifically, these are people in the organization for whom IT support is their job role, as opposed to gardening work that can be done in parallel to other activities. In keeping to the theme of gardeners described by Gantt & Nardi (1992) and Nardi & O'Day (1999), I call these groups of IT specialists *farmers*. Throughout the interviews, staff described the organization-level of farmers and their local farmers in their units.

Staff described that ITS was the largest influence on technology use within the campus--both in terms of maintaining the campus IT infrastructure and making decisions about which technologies will be supported. ITS maintains the campus's central databases and tools that administrative, academic, and research-related staff depend on. Until the migration to one mail application, Google, ITS provided and supported a very diverse set of email and calendaring tools. To date, they still influence the core technologies being used on campus while also providing a number of other campus-wide technology resources and needs such as the campus-wide network, printing, information security, computer security, and some storage. Because of this unit's central role within the infrastructure of the ecosystem, changes that the ITS unit implemented affected the university at large.

Throughout the interviews, ITS was mentioned as the group that supports tools for finances, human resources, and other administrative tools for managing the business of the university. ITS influenced the university ecosystem by providing this standard set of tools and by declaring their ability provide support for these tools.

Aside from this role, ITS also provided help documents, technical support, and training. The only role that ITS played in staff's reported use of Project Sites was one of technical support, thus ITS was not perceived by staff to be cultivating practices or helping them to appropriate Project Sites. Staff interviewees indicated that ITS provided limited support for the appropriation of Google Mail and Calendar, though most of this work had been offloaded locally to the units' IT staff.

Another formalized source for technology support—one that was seemingly overlooked by participants—was the Office of University Audits (OUA). This unit only arose as a result of interviewing a staff member from there, who describes his job there as an IT auditor; the group of auditors work with clients (units) to examine their IT use and to create reports of findings that give departments guidelines for improving work processes. Their role in the university, as described by P21 (IT Auditor), is to figure out how staff are undergoing work processes and to provide reports on those processes and provide feedback, articulating:

> *"… **how our departments are using the tools effectively. Are they using the university systems effectively?** We're operational auditors and process auditors at heart, so we're looking at whether things are being done efficiently."*
> *- P21, IT Auditor*

Thus, OUA has the potential to engage in work that overlapped with gardening as well as overlapping with my conception of catalyst and shepherd types of work. It was interesting to see that no staff mentioned OUA's IT auditors as a possible resource for cultivating any of their technology and practices. Because P21 described that they are 'hired' to collaborate with units, it is conceivable that the staff I interviewed were not at a level within their units to know about them or make use of them as potential ecology-changers and cultivators of practice.

Lastly, there are farmers who are situated locally within units who were influential in technology use and support within their units. These local farmers are IT personnel who have formal roles in maintaining and supporting IT within their units

and every participant mentioned these people either as helpers who provided tech support, as people who could influence the technologies that were supported in the unit, or true experts who could assist in implementing technology. Staff perceived an indeterminate degree of connection between IT and ITS; although staff often suggested that their IT staff and ITS could provide similar services. Staff referred to their local helpers as the first resources they would seek because local experts were easy to access and knew more about their work. Sometimes, these unit-specific IT staff would implement central standards from the ITS office and, at other times, they acted independently of ITS in the kinds of support services they offered. P06 and P18, both of whom were administrators who used their own locally-created shadow systems[12], were able to create these workarounds for the core tools by working with their local IT farmers.

No staff mentioned their local IT units in regard to cultivating their use of Project Sites. All staff recognized that their local departments were responsible for assisting them in the technical aspects of the Google transition, but IT staff rarely cultivated practices of led staff in appropriating the new Google suite beyond the use of the email and calendaring tools. In many cases, staff even felt like their local IT units did not help them to cultivate new practices around the email and calendaring tools either.

6.9 DISCUSSION

6.9.1 THE ECOLOGY OF FILE SHARING

The main goal in the qualitative analysis was to better understand staff practices and build on what the previous two quantitative studies suggested about why and how staff appropriated Project Sites in to their everyday practices. Staff appropriated Project Sites because they had access to it, because it was convenient, and because it filled a previously underserved niche in their tool ecologies as a place for centralized, secure

[12] Applications that rely on business processes and are not recognized or supported by ITS

document/information storage and sharing. Staff used Project Sites in practice solely as a storage/sharing platform, having ignored the other possible functions it afforded. The results of the interviews revealed a collaboration ecology where staff's communities of practice communicated and worked extensively within their own internal boundaries and across the university's organizational boundaries, resulting in technology's role as one that supported communication, coordination, sharing, and information production while also allowing staff to perform activities that are the core to the university's everyday functions.

Whereas Olson, Grudin, & Horvitz (2005) and Ackerman & Cranor (1999) found that people differ in their willingness to share, I found the opposite to be true in this study. Sharing information and documents is a central part of staff's role within the university. Staff needed to share files, primarily because their roles as administrators required it. As staff illustrated their many sharing options and organizational needs, what emerged was a complex set of tools and decisions to be made. These decisions impacted Project Sites in terms of determining when staff would use Project Sites.

Olson, Grudin, & Horvitz (2005) provided a framework for the pieces of information needed to share information: what is being shared and who it is being shared with. Voida, Edwards, Newman, Grinter, & Decheneaut (2006) added that *how* sharing takes place was a third piece of information that people needed to support file sharing. He also points out that users may be forced into certain choices especially sub-optimal ones because of a required feature needed for file-sharing, giving the example of email to transmit files because of its universal accessibility for recipients.

In terms of 'who' was being shared with, the data showed that file-sharing was an activity that allowed staff to share with each other, but it also supported them in bridging boundaries—whether these boundaries were between staff from similar roles across disparate units, those between staff in different roles within the same unit, or bridging the boundaries between the staff world and the faculty and student worlds. In practice, sharing provided a set of constraints regarding which sharing platforms could

be used. 'What' was being shared created a second constraint for staff's selection of sharing tools. While staff described many types of files, the only distinctions with any impact on tool decisions were between general work documents and sensitive/private ones. In Section 6.5.6 and Figure 18 (p. 106) it became clear that staff had quite a variety of sharing tools to choose from in most cases. However, it was also the case that the combination of information security and collaborators outside of the physical confines of the unit formed the particular set of requirements that always led to Project Sites use.

6.9.2 Project Sites: Its Appropriation & Impact on Theory

In Chapter 2, I described appropriation as a process where users adopt IT and then adapt it to their changing environments, noting that this adaptation may sometimes result in unexpected use. I also postulated that in the same way that target users appropriate technologies, unanticipated users also appropriate technologies and that these different types of users may not necessarily appropriate technology the same way. I argued that studying unanticipated users could reveal uses of technology that are very different from those of the intended user group. Unanticipated users may, for example find only aspects of a tool useful, may find alternative uses previously unknown by target users and designers, or they may even go so far as to hack the IT in order to extend its capabilities. As a group of unanticipated users, it would have been interesting to find that staff developed alternative modes of Project Sites use to highlight that unanticipated users are different that intended users. However, what emerged in the early stages of the interviews was that even though Project Sites provided considerable interpretive flexibility, staff were limited in the ways that they created interpretations about its use. I found evidence to support that staff who had adopted the toolkit had appropriated it as a central location for information sharing and storage, their use of it being limited to the Resources tool. This particular use that overlapped with some of the ways in which faculty and students use Project Sites in their own contexts, but *why* staff used Project Sites in this way was related to needs that are particular to staff's roles within the university ecosystem.

In thinking of the whole range of appropriation activities—from intended use to hacking—staff's interpretation and appropriation of the Project Sites toolkit was not inventive and leveraged only a very small fraction of its possible applications. I make this observation without attributing value or 'correctness' to staff's appropriation of the tool. Instead, in noting this minimal appropriation of Project Sites, I questioned why staff did not appropriate more of the toolkit's features. Staff suggested relevance of Project Sites to their jobs was one concern, but a deeper issue was that staff evaluated relevance without knowledge of the capabilities or full functionality of the system they were appropriating.

In her study of an organization that adopted Lotus Notes, Orlikowski (1992b) found that when users lacked knowledge about technology, they were unlikely to appropriate it effectively. She had further attributed the lack of knowledge to poor (or nonexistent) communication and training. Even though 20 years elapsed between her study and ours, it was surprising to find that the lack of communication and training once again emerged as problems. The study presented here confirmed that the lack of knowledge continues to be a barrier to the adoption and appropriation as demonstrated by the use of Project Sites among university staff. Although similar findings exist in the literature, the use of unanticipated users to assert this claim is new. Given the staff community's status as unanticipated users, the staff I interviewed perceived that their limited knowledge of CTools was based on the lack of a visible push to inform them and help them appropriate the tools. Regardless, these finding may be enough to suggest that simply appropriating a tool does not mean that appropriators, especially unanticipated ones, will learn enough about it to appropriate it in ways that maximize their benefits from it.

It was interesting to see that similar issues arose in the comparison case of Google, where staff *were* identified as a user group. Even though staff were anticipated users of Google tools. We might predict that because staff are anticipated users for Google, that they were more likely to be better informed about the tools and the transition. However, the lack of knowledge about how to appropriate and cultivate

practices around Google's collaboration tools led to its haphazard appropriation into staff practices. In summary, Google's tools lacked transparency, much like Project Sites. Information about appropriating the tools was either perceived to be non-existent or perceived to have been stuck in limbo between ITS and the staff users. As a direct consequence of these issues, staff were unable to appropriate Google in ways that leveraged the full capacity of available features. Even when additional training was available, staff were not usually aware of it or they perceived it to be for someone else. The problem then becomes one of identifying how to cultivate technology use and practices, regardless of whether users are anticipated or unanticipated. However, it may still be the case that supporting appropriation work requires different types of solutions for target and unanticipated users.

In cases of target users, cultivating good technology use and practices has already shown itself to be formidable problem. Orlikowski (1992b) was one researcher who demonstrated the impact of under-cultivated practices as barriers to successful appropriation. For example, Heath & Luff (1996) found the prevalence of paper records in primary healthcare despite the availability of technology due to practices that surrounded the use of paper records. The problem is compounded with non-target users because they may be at a disadvantage in terms of access to information and training that would aid them in their appropriation, potentially using incomplete or incorrect information to drive decisions about use. As such, it is unclear how to cultivate practices within these communities before they have been identified and establishing new practices within these communities once such users have been identified is equally difficult.

Aside from being an issue of training, I described this problem of appropriating technology as an issue of bounded rationality, framed by the functional fixation bias. Researchers have identified the problem of the use of objects strictly according to their traditional uses and have considered ways of fixing the bias by having people break objects into components, then disassociating and abstracting the parts such that they consider new possibilities for the use of these objects (Dusink & Latour, 1994;

Carnevale, 1998; McCaffrey, 2012). In considering unanticipated users, if such users are bricoleurs, they would potentially be able to engage in this type of activity (bricolage) on their own. Yet, from the findings, it was evident that unanticipated users may not be bricoleurs and they may be less well-equipped to appropriate technology in ways that break these biases. It is likely that the ability to be a bricoleur who can piece together new uses and meanings for tools may be inherent to the extent of existing knowledge residing within certain individuals and the ease of transmitting this knowledge across an ecology, a community of practice, or an organization and that whether unanticipated users have this knowledge is highly dependent on the context for discovering the technology as well as other situational factors.

6.9.3 SPECIES OF THE ECOLOGY

Most people in will not engage in appropriation work. Appropriation work is often perceived as tangential to the actual activities and tasks that people are engaged in, thus appropriation work is addition work. MacLean et al. (1990) refers to these types of people as "workers." However, there are people who *are* interested in this kind work. The literature has a wide array of terms to refer to these types of people, emphasizing different qualities such as whether the person involved in the appropriation work is designated formal vs. informally, whether this person is an end user or a decision-maker, and if this person is involved in the design of the system. Such terms have included:

Researchers have proposed that it is important to have people in work groups who are able to cultivate practice. Gantt & Nardi (1992) and Nardi & O'Day (1999) used the term 'gardeners' to describe these people informal people. In response to Nardi & O'Day, Ranney (2000) suggested that the design specialists called technical communicators are already responsible for this kind of activity. However, in noting technical communicators, Ranney suggested intervention from a formal actor to perform work that Nardi & O'Day suggest should be performed informally. MacLean et al. (1990) suggest that there are tinkerers (savvy workers), and handymen (bridge

workers and computer professionals); handymen were designated to the role by their group and engage in appropriation work. Okamura et al. (1994) also argue for technology champions, trainers, and/or experts in this role—all of these roles are essentially intervention work performed by people called mediators, who are organizationally sanctioned, formally-designated agents. With so many perspectives on how to provide adequate support, ranging from formal to informal, inside to outside the organization, the literature seems to lack consensus on answers to this difficult problem. Over the course of my interviews, however, I detected types of people who were important to appropriation work. In the following section, I describe the importance of these people and what we can learn about appropriation work through them.

The findings on technology-related species (Section 6.8) was interested in those people in an ecology who create changes in it—either through tools or practices. I expanded on Nardi & O'Day's (1999) concept of gardeners by adding that formally-designated technology actors—farmers—also existed and at times were able to perform work that supports appropriation work. I also emphasized that Nardi & O'Day's broad concept of the gardener included many types of activities that are better thought of as individual activities—primarily, I expanded on catalyst and shepherding work as types of gardening work. I highlighted how both the lack of gardeners created an atmosphere where there was no re-appropriation of the Project Sites toolkit, a problem that was exacerbated by communication failures on behalf of farmers, whose intentions to affect staff ecologies failed to be noticed by the users they were trying to reach. Coincidentally, the use of Google's collaboration tools followed a similar trajectory—not because farmers had not reached out staff, but because farmers provided the wrong kinds of training.

The absence of gardening work was surprising given other examples of technology appropriation. For example, gardening work occurs within the community of IKEA hackers (Rosner & Bean, 2009) and within and through networks of freelancers (Torpel, Pipek, & Rittenbruch, 2003), examples where there is obvious exchange of

ideas, interpretations, narratives, and adaptation. Why, then, was it that Project Sites' appropriation seemed so static? I attribute the stasis in use and apparent absence of CTools gardeners to critical issues. The first issue originates with the way that staff initially learned to use Project Sites, essentially consisting of an initial gardening event where staff engaged in learning-by-doing or learned through word-of-mouth from users who only demonstrated one use. This initial gardening work established a pattern of use, but what followed was the lack of critique of this narrative of use because staff lacked incentive to explore ways to re-appropriate the tools. This finding relates back to MacLean et al. (1990), who suggested that many people in organization, who he calls 'workers,' are unlikely to reconfigure tailorable systems because of a lack of incentive and expertise, also noting that success in tailoring systems can be attributed to a "culture of tailoring" where evolving use and practices are things are not only accepted, but encouraged. Staff within the university lacked this culture and very few staff were interested in engaging in this type of behavior

In 6.8, I identified farmers as formal helpers as a contrast to informal gardeners. In the results, I described farmers as those people who, in their formal roles, aided staff in the use of technology and those who made decisions. In reality, ITS and local IT specialists performed different types of farming work. ITS, because it is unit that serves the entire university, was engaged in very general activities that included decision-making maintenance, and technical support and training. I attribute ITS's inability to support cultivation as an issue of scope—that ITS serves a very large and diverse community and are perhaps unable to impact the micro-level sociotechnical systems that are staff's collaboration ecologies. Local IT groups also performed many of the same activities, but they did so at the unit-level, a much smaller scale, so they were able to work within a scope that was much closer to staff's collaboration ecologies. Yet, it was interesting to note that despite their physical proximity to staff's ecologies and likely understanding of their unit's needs, these local IT groups were not engaged in the cultivation of staff's practices around CTools. The interviews did not reveal why these IT specialists failed to cultivate practices around Project Sites because none of the staff

interviewed reported successful cases or attempts. It may be, however, that cultivation of practices is truly the work of the gardeners and the other workers in an ecology. On the other hand, perhaps this work *should* have been part of IT specialists' work, but had never made it into their mission—a possibility that is outside of the scope of this research and an issue for future research to address.

The interviews also highlighted that there were two separate kinds of work that were occurring in staff's sensemaking about tools and in their continuing process of re-evaluating practices. The first part of the process was creating change and the second was leading others through the change. What was most interesting about these distinctions was the tension between how staff learned to use technology (in a grassroots method that occurs at a micro ecological level) compared to how formal actors distribute information (in a depersonalized macro-level). Borrowing from Nardi & Day's (1999) metaphor again, gardeners share tips for practices with others—i.e., relating personal experience and tricks—compared to farmers, who relay information about practices through manuals, mandates, broadcasts, and other formal media that the general non-gardening population often fails to see.

Interpreting this communication failure highlights the necessity for there to be agents in an ecology who are able to translate technology into narratives of use. What still remains unclear, however, is which agents are best able to do this appropriation work. In response to these questions, I have mapped out the extent to which various expert actors from the literature have been involved in the process of the appropriation timeline (Figure 19, next page). In creating such a diagram, it becomes evident that formal technology experts play a role only early in the process and at the organizational level, whereas local informally-designated experts are the people who cultivate practice and affect technology at the worker level. If we consider the problems ITS faced in communicating their efforts to provide training to staff, we might consider that they are much too far removed from specific work processes to be of help; local IT units, who are much closer to the staff's collaboration ecologies are more likely to be able to help when they provide potential narratives of use. Looking to informal agents, user-experts

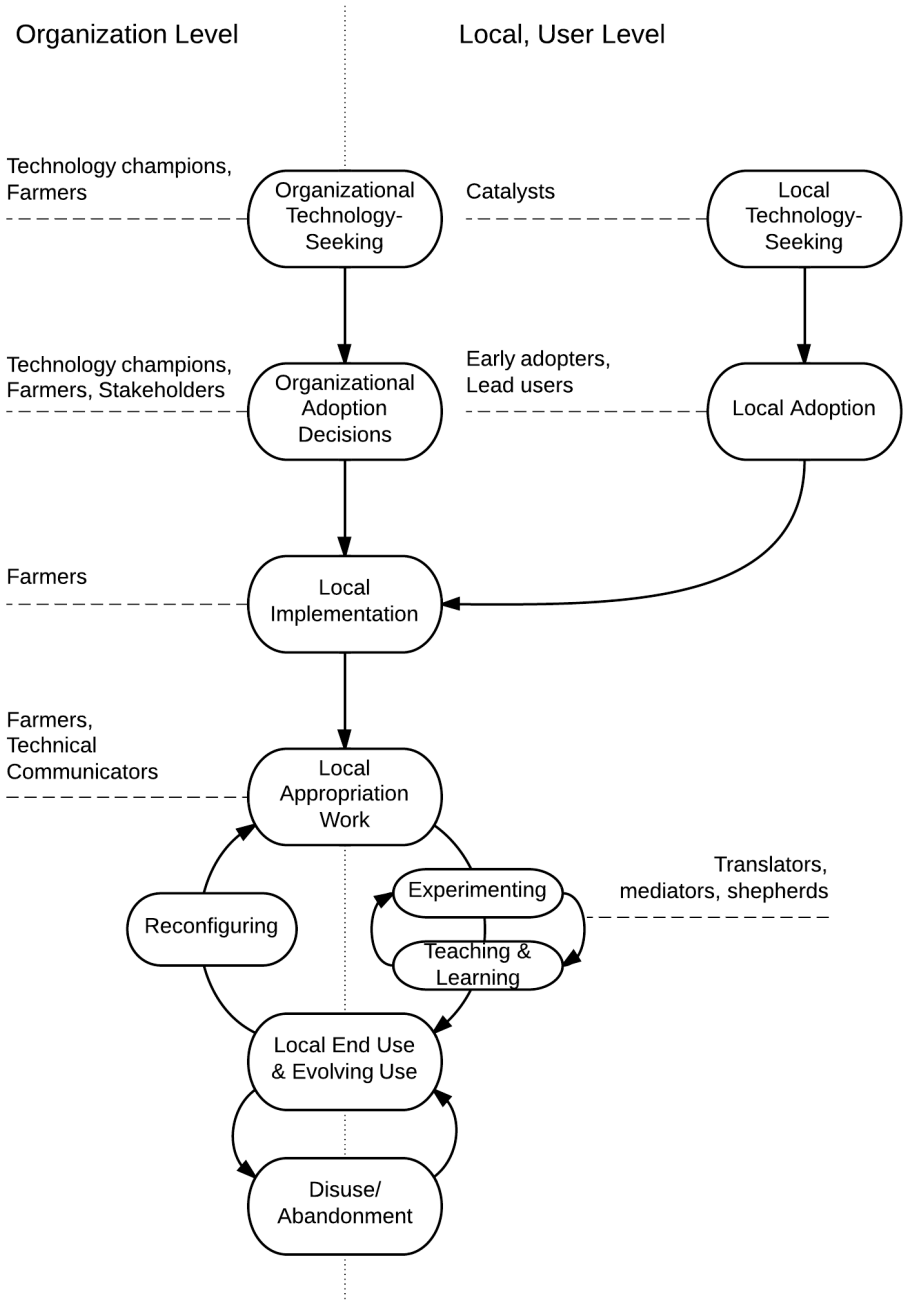


Figure 19. Actors in the appropriation process

(gardeners) are the most likely to be able to be able to aid the process of creating narratives and driving appropriation within their groups. Two issues arise, one of which is that gardening types of work, specifically what I called shepherding, require experimentation, knowledge-creation, and meaning-making, a problem that is already

difficult within target user groups and a problem that is complicated when considering unanticipated users. The second problem is to share this work with others throughout the organization. Draxler et al. (2012) suggested a number of design requirements for tailorable systems that is relevant to customizable toolkits like Project Sites; these requirements can be summarized as: 1) to support appropriation work and 2) to make it visible and searchable to others. It is possible that by making configurations of Project Sites more visible that staff will be able to find new ways of appropriating the tools.

In closing, it was clear that once Project Sites was adopted, some appropriation work needed to occur to make it function better in their local ecologies. Most staff were too involved in their main activities or were not motivated to engage in appropriation work because of a lack of incentives. Keeping in mind that I've defined appropriation mostly as the process of using and adapting technology to the given context, what is needed for this adaptation process is for people to be involved in translation and interpretation of the system to its users, especially in the creation of multiple narratives of use that lead to different appropriations of the toolkit. In this study, there was evidence that successful appropriations were more likely when the experts (expert users or IT specialists) were physically and organizationally closer to staff's collaboration ecologies—that is, they knew and understood their colleagues' activities and practices within their unit and how to evolve them. However, there were many more examples of just the opposite. Thus without people to do the translation work, appropriation suffers.

6.9.4 TRAINING

As Orlikowski (1992b) showed, when people have poor knowledge of a system and its functions, they may use it inappropriately. In this case, we see that staff felt like there was no training for CTools, thus they use the system the best way they know how—to share. When we think of design recommendations in HCI, we often think of interfaces and features. We may sometimes underemphasize or under-develop training as an aspect of design and implementation. In many ways, a system that is flexible should not be made to seem like a black box through training, but there should also be enough

training available that users feel supported and lie they understand system features and the various ways they can be pieced together. Because of this widespread lack of understanding, it is especially interesting that staff appropriated the system in the first place. Yet, at the same time, it makes sense that when the understanding of the system is low, that users fall back on what they learned about its use. In this case, staff learned that they could upload and download files on CTools, so that remained their only interpretation and script for use, even though the system affords more manners of use.

Not only is the availability of training necessary, but it is important that is available in ways that are visible. The fact that many participants did not know there was training for Project Sites shows that however well-intentioned the trainings are, staff will not benefit from the resources if they do not know they exist and if they are not easily accessible. This finding highlighted the importance of avenues of communication in order to convey this information. Throughout the interviews, a number of staff relayed the importance of word-of-mouth, the importance of knowledgeable others, and learning-by-doing as valuable learning techniques. These responses point to the breakdowns that occur organizationally between people who are doing work (who rely on informal learning practices) and upper management-type groups who distribute information in ways that do not follow these same informal paths. Mediators play a big role in bringing information from the organizational level to the local level where the appropriation work actually occurs.

One last issue in learning to use technology is the importance of creating training and establishing potential narratives of use before end users settle on a narrative. Tyre & Orlikowski (1994) noted that people rarely adapt technology past a window of opportunity for doing so, thus appropriation happens in bursts, rather than in constant state. Part of training knowledgeable users is to capture these windows and to use them as opportunities to retrain end users such that they can adapt technology. Leveraging these windows is a challenge and can potentially be crucial for unanticipated users, particularly those who may have less of an understanding of the system.

6.9.4 CTools and Design for Appropriation

In Chapter 2, I pointed to literature proposal that design that is flexible will naturally evolve into changing contexts. In the case of Project Sites, it is a system that is flexible to various needs, but staff users did not leverage the flexibility of the toolkit and its full functionality. Rather, they believed that the toolkit's flexibility was applicable only to the intended users (faculty and students); staff's own interpretation amongst their user group was inflexible—not because the system did not afford multiple narratives for use, but because staff interpreted one and this one narrative was such that it became relatively inflexible once staff had settled on it. Throughout the results and discussion, I noted social reasons for creating narratives—lack of knowledge and training—but the way Project Sites are themselves designed also created this problem.

The design of Project Sites was prominent issue at the root of how staff interpreted Project Sites. CTools' Course Sites and Project Sites did not differ either in terms of the interface or tools nor in how they were accessed. The result is that Course Sites and Project Sites looked exactly the same. Then, because many of the tools had academically-oriented names on Course Sites, staff did not consider ways to appropriate the same features when they were encountered in Project Sites. Because Project Sites was not perceived to be adaptable to non-teaching/non-learning settings, staff lacked the motivation to explore and truly attempt to interpret the tools in different and creative ways. The card-sort/think-aloud showed this very problem, where staff often commented that they didn't know about a tool because it was for faculty or students to use in the classroom.

In a few interviews, staff raised the possibility that more obvious hints about how to appropriate other tools could be helpful. Yet, staff's hesitation to pursue such information and the existence of unused help documentation raises further concerns about how to design interventions that could help staff. However, given the strong implications of tools' names on their potential uses, further work could look into the effects of changing their names. However, what emerges from this is that for staff to

really consider Project Sites and appropriate it, perhaps a redesign that matches tools to less academically-focused names would lower the barriers to appropriation. Perhaps, even a new toolkit created just for staff would allow them to feel more ownership and engagement with the tools in ways that staff might find more ways of appropriating the same tools. Both changing the names of tools and a new toolkit resolve some issues in creating narratives, but they also may lower the bar for experimentation with Project Site configurations and, as a result, shepherds may emerge within the staff community.

6.9.4 LIMITATIONS

Throughout the interviews, staff gave responses based on their perceptions and memories. One limitation of this is that, as a researcher, I can only report what people say. Part of this means that sometimes participants will deny that there was ever training from ITS when I know there was. I relied on participants to remember the kinds of tools they would use, but they would often remember another tool halfway through an interview. While I can except that some things may have been left out of their responses, the study was designed in such a way as to be able to capture most of the ecology and to let other, similar participants fill in the gaps for me that others might have created. The result is that there may be more shadow systems and more SharePoint users than I recorded. Regardless, the focus on Project Sites and Google were solid.

One example of incorrect statements from staff was that staff perceived that there was little training for both CTools and the Google Suite of tools. I know from communications with ITS and through my research that there was, in fact, an effort to provide training for CTools by way of workshops. Similarly, there was training available to staff learning about the Google transition and tools. It is interesting to note that the *perception* that there was no training available was formed. Future work will interview staff from ITS to determine how they went about implementing these training programs and to see how the breakdown in communication occurred.

Another example of knowing more than what staff were saying relates to connections between units. I only discussed the connections between the staff I interviewed and their collaborators. Naturally, the focus on these particular connections means that I ignored the connections that I know exist because of personal experience at the university, but which staff did not mention. This can be attributed to the fact that these connections are not necessarily relevant to the interviewee and their role or it might have been a connection that was not mentioned due to forgetfulness. This makes the organizational structure as I show it in (Figure 15, pg. 89) true to the context of the staff I interviewed for this study, but perhaps not generalizable to the entire staff world or to the university at large.

Another limitation for this study's generalizability is that there were also a number of staff I excluded from the interviews. These include staff in a number of academic units (such as Music, Art, etc.) as well those in the health-related units (the hospitals, the medical school, and a few other units). Research staff, were within the CTools intended user group and were also excluded. Technical staff do not use CTools frequently, but there are some users there who are also not reflected in this work. Future work will involve interviewing a number of health-related staff and researchers, to explore their use of Project Sites.

CHAPTER 7. CONCLUSION

INTRODUCTION

This work was motivated by the discovery of unanticipated users of CTools—university staff. At the core of this interest was the idea that good technology design often works because it focuses on identified users and intended uses, yet the appropriation literature and the results of this dissertation suggest that the assumptions of intended users and expected use are often violated. These violations occur because users interpret and use technology in ways that designers cannot completely predict in their original user specifications. These violations also occur because users adapt technology and evolve their practices as needs emerge. By designing for a target user and a specific modality of use, designers also define *what technology does not support and who is not a target user*. In doing so, design can dictate the "user experience." Yet, users are able to appropriate technology in any way they please—either by selecting parts to use, by using features in ways that defy the original design intent, or by hacking the software to extend its affordances. When we consider appropriation as the way that users incorporate technology into their practices, then it becomes clear that designers of technology need to consider the unpredictability of end use and the evolving landscape needs. It follows that it is important to design IT in ways that ensures that appropriation is possible is important—both in terms of use and users—because the failure to appropriate a system is a failure of users' ability to adapt it to the activities, practices, and structures of their ecologies. As a result, IT can fall into disuse.

This final chapter considers the various findings in the previous chapters, where I describe how and why staff at the University of Michigan adopted and appropriated the Project Sites toolkit, which was not designed for them. I summarize the findings by

triangulating between the three studies and I also discuss the implications of this work for the issue of unanticipated users.

7.1 SUMMARIZATION OF FINDINGS

The research questions addressed throughout this dissertation have focused on why staff at the University of Michigan appropriated CTools Project Sites and how they appropriated the toolkit into their practices, especially given that the system was not designed for their needs. I collected data from university staff using various data sources—surveys, user logs, and interviews—in order to better understand staff's activities, work practices, and the role of Project Sites in supporting these practices. The survey data pointed to Project Sites' value as a central repository for administrative purposes, which was valued less by the intended user groups (faculty and students). The importance to staff of using Project Sites as a repository was confirmed by the log data. Although the content-related tools were highly used among all user groups, staff in particular used them more than either faculty or students. The interview study also revealed that staff interpreted Project Sites in such a way that the emerging narrative developed around Project Sites appropriation was primarily one that relegated it to the role of a repository for their various administrative documents. I was able to determine that there were several reasons why staff had developed affordance-based narratives that supported Project Sites' continued presence in staff's collaboration ecologies for several reasons, including:

> *Project Sites had security mechanisms that both allowed staff to collaborate and share information within and across boundaries while simultaneously adhering to the strictest guidelines required for the kind of sensitive data that staff often work with.*
>
> *Project Sites supported a hierarchical filing method that matched staff's work styles and needs.*
>
> *Project Sites allowed staff to perform their sharing activities within their unit and role boundaries as well as across these overlapping boundaries.*

The questions that remained for the interview study were the reasons behind tool value ratings and why staff rated tools highly in the survey that the log study suggested they almost never used (e.g., Syllabus, Schedule). The interviews and the card sorting task showed that staff actually knew very little about these tools and had almost no experience with them, thus staff's responses about value of these tools seemed to be either a) speculation on *potential* value or b) speculation of value for the intended users.

7.2 REVISITING APPROPRIATION

The initial introduction to appropriation described in this document established that it is a murky concept because it describes both a number of processes as well as an outcome. Draxler et al. (2012) describe it as "an entangled process" (pg. 2835) that includes awareness, implementation, configuring, and learning. To further complicate the term, appropriation is considered to have occurred based on the efforts of individuals, but the process of appropriating technology is ultimately collaborative in nature (Draxler et al., 2011a; 2012). Appropriation is not about the technology itself, but about the resulting reconfigurations of structure and work practices (Draxler & Stevemns, 2012; Orlikowski, 1999; Orlikowski & Yates 1993,1994). The multitude of applications of the term led to the most recent definition, by Draxler et al. (2012), describing it as the process of "incorporating objects into one's life," which includes adapting IT, learning to use it, actually using it, and possibly modifying it.

In this section, I once again draw attention to this complex term. The research conducted in this project describes a conceptual model of the sequential flow of the appropriation process (Figure 20). While Draxler et al. argued that the adoption of technology is part of appropriation, I argued that the adoption of a technology is a pre-requisite for the appropriation of technology to begin, but that the adoption decision is not itself part of the process of mutual adaptation. Rather it is the catalyst. Because there is no mutual adaptation unless a technology is adopted, I made the distinction throughout this document between adoption and adaptation.

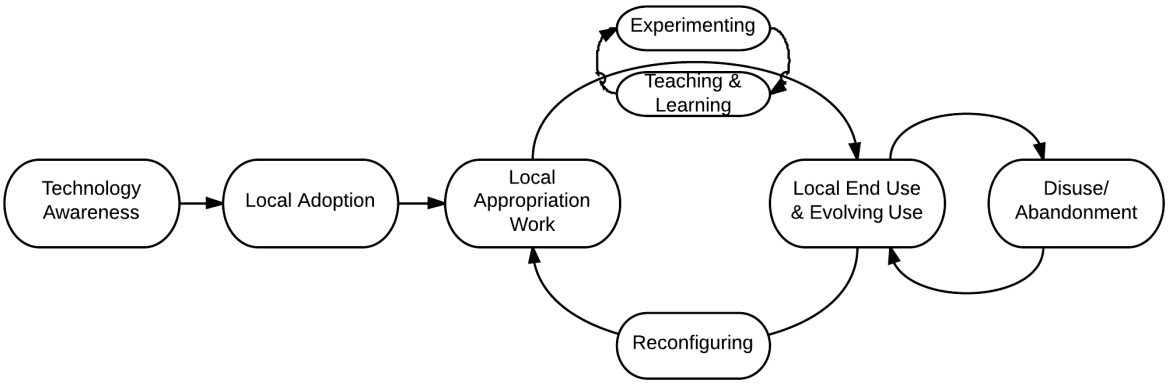


Figure 20. Appropriation Cycle

In examining the appropriation of CTools Project Sites within the staff community, it was their unexpected adoption and continuing use that led to this series of studies. Namely, staff adopted CTools and adapted it to their work context by making sense of it according to the information available, they learned how to use it and propagated a story about its use, many staff continued to use it, and they sometimes let it fall into disuse. Because this type of appropriation was new to the literature, I introduced the phrase *appropriation by unanticipated users*. But who exactly is an *unanticipated user*?

In describing the design process, I pointed to 'target users' and 'intended use' as concepts that are crucial to the design of technology. I proposed that any user that is not a target user is potentially an unanticipated user. Thus whether users are anticipated or not lies mostly within the conceptions of the designers by way of the personas they create throughout the user-centered design (UCD) process. In the case of Project Sites, ITS did not expect staff to use Project Sites and the design of the toolkit reflected this expectation. Even though ITS recognized such users once they were detected, the Project Sites toolkit continues to be designed without regard to staff needs. The result of this is that staff, though recognized as users, are still not target users. This results in the definition that:

- *Unanticipated users are not conceptualized in the design phase as target users.* Even after detection, they may not be considered to be *target* users. Thus, I add to the work presented here that there may be a distinction between *unanticipated users* (in the design/use phase) and *non-target users* (in the iterative design phase).

Whether users are anticipated or not also lies within the users themselves—users who may or may not be aware of their own belonging to a group that was the target group. In the case of staff at the university, the staff I interviewed were aware that Project Sites was officially designed for students and faculty in academic contexts, yet they found that it supported a previously unfulfilled need for storage in their administrative contexts. This showed that staff were capable of interpreting the system in a way that led to a narrative for its use. Yet, staff were not experts in system use and their appropriation of it mainly reflected one potential use of the system. Broadly speaking, it was evident that appropriation by unanticipated users can occur regardless of whether users are knowledgeable about its use. This has further implications for defining unanticipated users:

- *Unanticipated users may purposefully become end users.* In particular, I mean that some unanticipated users will knowingly appropriate technologies. This is an observation based on the thought that staff users of the LMS could have sought PSites as a solution for their needs. While this did not happen in our case, this is still a potential reason why unanticipated users may exist.

- *Unanticipated users may incidentally become end users.* That is to say that people unintentionally become unanticipated users because of a connection to anticipated users. In our case, this often happened by virtue of staff's belonging to the university community, which granted them access and occasions for interaction with people who either recommended or requested that staff use PSites. Some staff also became end users by virtue of entering into a role where PSites use had already been established.

- *Unanticipated users are not necessarily knowledgeable users*. While we might be tempted to think that it takes knowledge to know about a technology and appropriate it, unanticipated users are not necessarily making informed decisions about appropriating technology. In particular, because they are unanticipated, they may lack information and resources to incorporate technology in ways that maximize available affordances.

- *Nor are unanticipated users necessarily creative in their use*. Rosner & Bean (2009) described a community of IKEA hackers who combine pieces of IKEA products and reconfigure them to make new objects. Such users interact with their objects creatively and appropriate them in a way that shows ownership. We call this type of activity '*bricolage*' (Weick, 1993, Levi-Strauss, 1966) or tinkering (Nardi & O'Day, 1999). Among the staff community, there was a lack of such ownership that co-existed with both the perception of not being a target user and the perceived design intent. Staff did not engage with tools to abstract them away from their academic applications in the classroom to other generalized potential types of use.

In closing, unanticipated users complicate the study of how end users appropriate technology because unanticipated users may or may not reflect what target users are doing with the same technology. Yet, they can offer many insights that make their investigation more worthwhile.

7.3 THEORETICAL IMPLICATIONS OF UNINTENDED USERS

In describing the literature on appropriation, I pointed to the gap created by the focus on studying unexpected and evolving use and thus inadvertently ignoring unanticipated users. The research described in this dissertation used such a case to extend the understanding of appropriation by showing that such unanticipated users interpret technology and develop narratives around use in ways that do not necessarily need to mirror those interpretations and narratives of intended users. Findings that staff

were not knowledgeable about the system they appropriated mirrors the problems with *appropriation by anticipated users* described by other researchers (e.g., Orlikowski, 1992a).

In Chapter 6, I described bricoleurs, people who make use of whatever tools they have available (Levi-Straus, 1966; Weick, 1993). While considering that bricoleurs might be experts at adapting available technologies to their needs, it was the case that the staff community, as bricoleurs, faced problems in understanding and adapting Project Sites after their initial adoption. These problems arose both in terms of their understanding of the system and as a result of their perception of being non-target users. Unanticipated users may face problems in the appropriation of IT due to low cognitive absorption (Agarwal & Karahanna, 2000) or to a lack of ownership of the tools (Gaskin & Lyytinen, 2010) that follows the recognition that a tool or system was not designed for their use. Thus one implication of this work is to suggest that just because an unintended user (or group of users) adopts and appropriates IT, that it does not follow that they will do interesting things with the IT—that is, there needs to be a sense of absorption and ownership to drive the motivation to reinterpret tools. This can be compared to cases where users engage in hacking (Rosner & Bean, 2009) or tailoring (MacLean, 1990), describing how certain users take ownership of existing objects and are engaged in altering them or adapting them to their needs.

Much of the existing theory on appropriation either examines technology use or the co-evolution of practices and structures in response to changes in technology. Some research also deals directly with identifying the specific actors that drive how technology is appropriated and the newly emergent practices, but this research does not reach consensus on who these actors are when they play crucial roles. I used a broad lens that focused on staff's appropriation of Project Sites within the context of a greater ecology of people and technologies in order to answer the questions of who and what factors drove the appropriation of Project Sites. Triangulating between this work and previous research, I confirmed the importance of the knowledgeable users—anticipated or unanticipated—in their interpretation, creation of narratives, appropriation, and re-appropriation of their work tools. I borrowed from the concept of 'gardeners' from

Nardi & O'Day (1999), following their observation that there need to be people in information ecologies who are able to spark change, share information, and help mold technology use in order to "grow productivity." While the idea of the 'gardener' was helpful, it was too limiting in its definition as it only accounted for people who informally work as people involved in appropriation work; gardeners were also defined in such a way that they assumed too many responsibilities. I noted that what Nardi & O'Day called gardening is the entirety of appropriation work, so I refined this conceptual term into two different activities—the first being sparking change (catalyst work) and the second being leading others in the use of technology and in cultivating practices (shepherding). In elaborating on these activities, I also emphasized that catalyst work itself only exposes ecologies to new tools and that it is the actual shepherding work that makes sense of the tools and guides others towards building knowledge about technology use through the cultivation of practices, which Orlikowski (2002) calls 'knowing in practice.'

While Nardi & O'Day (1999) argued that people in formally-designated IT roles in an ecology are too far removed from workers' practices to be able to be helpful in workers' ecologies' growth, I argue that this is not necessarily true. In the interviews, I found that it was *often* true that formally designated IT specialists did not cultivate practices, but I also found that exceptions to this. I introduced the concept of formal IT specialists as 'farmers,' keeping to Nardi & O'Day's metaphor. I use this term to suggest both a sense of ownership and formality—a farmer both owns a farm and is dedicated to growing, as compared to what Nardi & O'Day called gardeners, who most often perform many similar activities as an enjoyable act. Like informal influencers' ability to spark change within groups, farmers are able to spark change both locally and at the organizational level by making decision about tools within the ecosystem (organizational level) or within ecologies (units, communities of practice, etc.). Informal actors are able to cultivating practices at the grassroots level from within their local ecologies, and one would think that formal influencers *could* influence local technology use and practices. Interestingly, neither local and organizational farmer groups at the

university were described as being influential on the use of Project Sites among staff. The failure was not due to their lack of trying, but rather because the communication channels to reach staff were inappropriate for the very staff they were trying to reach. Without having conducted interviews with ITS and other IT specialists, I don't have the data needed to understand why this breakdown in communication occurred. However, the size of the university and the staff community is so large that for ITS to attempt reaching all staff with information about Project Sites use would likely be difficult, especially considering that staff noted that word-of-mouth was the preferred method of learning about technology. Therefore, the diffusion of information at this scale would likely be difficult.

In addition to exploring the importance of those who assumed the role I call farmers, I refined Nardi & O'Days concept of gardeners to be more sensitive to the various types of activities that occur around technology. I further differentiated between the kinds of people who spark technological change (catalysts) and the kinds of people who lead others in successful adoption, implementation, and appropriation (shepherds). In my analysis of the interview data, I drew this distinction because catalysts were able to introduce new technology such that they might cause the initial attempts to appropriate technology, whereas people I called shepherds are the ones responsible for the ongoing successful redefinitions of narratives of technology and ultimately do the appropriation work that keeps technology relevant.

In addition to the contributions to the information ecology literature, I also explored the competition between similar tools and their coexistence within collaboration ecologies, which Nardi & O'Day (1999) did not discuss. Because there were so many IT options available to staff, there was competition among tools in the ecology—especially among those tools that supported file sharing. Exploring issues of competition and co-existence in ecologies highlighted that ecologies are always changing. The transition to Google-support for email had created conditions for reframing Project Sites use, as well as to explore issues of competition and co-existence as they were occurring during the transition period. Therefore, I was also able to

compare appropriation across cases where the staff were unanticipated users (CTools Project Sites) and anticipated users (Google).

Throughout the appropriation and tailorability literatures, there was little to no evidence of work that compared appropriation cases within the same user group. By using the Google tools as a comparison case, I was able to understand the adoption and appropriation of Project Sites more fully than by having studied Project Sites alone. For example, the concepts of catalyst and shepherding work could only arise because they were revealed in the context of Google; the absence of shepherds led to the failure to successfully appropriate Project Sites, whereas the presence of shepherds in the Google transition led to successful appropriation. The comparison of these cases also helped to highlight how the appropriation of Project Sites persisted despite the presence of Google—specifically, Google failed to replace CTools due to a perceived lack of safeguards and protections for sensitive or private information.

Another theoretical contribution from this thesis work relates to the concepts of boundaries and boundary objects. The literature on boundaries often looks at distinctions between people on a single defining set of criteria—usually some aspect of boundary work that results in defining the membership and non-membership in a given community (Gieryn, 1983; Burri, 2008). University staff existed in a social world where they had membership in co-existing sets of boundaries (staff/faculty/students, units, and job role boundaries). Because staff often engaged in work that bridges boundaries for the institution, both within their units and across other university populations, I consider them to be *boundary workers* (Lawson, 2002). Specifically, staff engage in processes that work like boundary objects to blur lines between communities. When staff use IT, it often connected them to other units, people from other communities of practice, and to the staff who work as the core of the university. The implication for our understanding of boundaries relates to what a boundary object is and conversely, what it *is not*. Star (2010) defines boundary objects as those things that exist across multiple communities of practice, allowing them to convene and collaborate, and which also have both a common and a local meaning. Other

researchers have created variations on the boundaries object concept to discuss *boundary organizations* (Cash, 2001) and *boundary layers* (Shanahan, 2010), both of which work to connect separate communities of practice. Bowker and Star (1999) discuss *boundary infrastructures* in their book called Sorting Things Out, suggesting that boundary infrastructures contain networks of boundary objects. Yet, the idea of Project Sites as infrastructure does not quite work within the staff context because the toolkit is not a structurally necessary for staff—unlike the centrally-maintained HR, financial, and research tools, which play a more central role in their day-to-day activities. Whereas CTools (particularly Course Sites) is has become basic infrastructure for the learning mission of the university, Project Sites has not (even among students and faculty). Instead, I observed that Project Sites worked as a space that supported communication and the sharing of boundary objects, yet is not a boundary object, layer, or infrastructure.

My contribution to the literature on boundaries is to introduce the concept of a *boundary space*, which can apply to a physical or digital space (or a channel) that supports the creation and sharing/storage of boundary objects in ways that are less formally recognized than an infrastructure. Other similarly-acting spaces were described in this work's interview study findings—intranets, shared drives, etc. However, I introduced this concept to account for the finding that Project Sites supported boundary-crossing by facilitating information sharing and file storage independent of boundaries. As a boundary space, Project Sites support boundary workers (staff) and may even be able to support boundary layers and organizations. In this project, I refer to CTools and Google tools as boundary spaces because they allow for the creation and storage of boundary objects, while also supporting what I call boundary processes (i.e., cross-boundary communication and coordination), yet they are not so central to staff communities' practices to be considered infrastructural.

7.4 DESIGN IMPLICATIONS

DESIGNING IT, TOOLS, & SYSTEMS

My initial interest on appropriation was based on the observation that design intent need not reflect the reality of what occurs once technology is deployed. Yet, design intent is an inescapable part of the design process, which requires that a designer specify users and uses. This path allows designers to guide themselves in addressing actionable user needs, narrowing the scope of the design space to a specified problem and set of users. An unrealistic expectation would be to design with no intended user or purpose in mind—an impossible design space that needs to be refined into a problem with a solution. Thus, developing IT requires some extent of specification of users and use with the implication that doing so defines users, their problems, and how these users might solve these problems through the use of the particular IT system or application. Yet, the issue remains that neither end users nor uses necessarily reflect the models that designers created. Instead, as I have discussed in this dissertation, users and their use may never completely match a designer's specifications. The way to design responsibly, I have argued, is to design in such a way that technology is flexible enough to be used in a multitude of ways. Dix (2007)supports the idea of designing for appropriation, "You may not be able to design for the unexpected, but you can design to allow the unexpected" (pg. 27).

In Chapter 2, I pointed to the contingent of CSCW researchers and designers who have written about the importance of flexibility in the design of systems and toolkits. An important design recommendation for collaborative systems to remain relevant within their given contexts was the *flexibility of use*. Given that unanticipated users exist, I suggested that flexibility should also be applied to a collaboration system's ability to support users who were not anticipated by designers. I called this *flexibility of audience*, suggesting that if systems are designed in such a way that they can appropriated by users that were not specified, toolkit development could benefit and grow through the

iterative design process by studying such users and their use of technology. In essence, I considered flexibility—of use or of audience—not as a problem, but as an opportunity to expand the design space beyond what designers originally intended.

However, from the user perspective, the caveat to designing for flexibility is the resulting increase in the difficulty for interpreting the system and the narratives of use that users create around those interpretations. This observation is supported by the staff (unanticipated users) adopted Project Sites in very simple ways due in large part to the lack of their understanding of the system they adopted and then adapted to their work contexts. By opening up systems, users may need more help in creating narratives—a process bypassed by rigid technologies, which force the user through a single narrative for system use. In Chapter 6, I described how, in the face of a lack of information, these staff relied on assumptions based on limited knowledge of Project Sites to guide their use of the toolkit. Users' appropriation of the flexible toolkit into practice was heavily influenced by their understanding of the tools, but another important aspect of the appropriation story was the design of the system itself, which was not transparent enough for users to see, understand, and leverage its flexibility. The tension for designers is to create technology that is both predictable enough to be understood "out of the box" and flexible enough that users are able to adapt it to their needs, but *also* transparent enough for users to understand how it can be adapted.

The issue of transparency in adaptation ties back to one of the themes in this work, which was interpretation (Chapter 2) and the way in which users created narratives of use. I found that when staff lacked sufficient alternative narratives of use for the tools they had appropriated, they were unable to appropriate Project Sites in ways that leveraged its affordances. In Chapter 6, I described this as a problem of the functional fixedness bias (Duncker, 1945) that results in people using objects only in the traditional ways that their narratives dictate. While creative appropriation has often been a matter of technologically adept users engaging in bricolage, tinkering, and hacking that is the opposite to functional fixedness, it is also true that such savvy users do not necessarily exist. As such, IT should be designed in ways that address the

problem of functional fixedness *from the perspective of the users*. Researchers have sought ways to reduce this bias, primarily by thinking about the objects as components that are easily abstracted away from prescribed meanings and uses (Carnavale, 1998, McCaffrey, 2012). Design decisions can alleviate functional fixedness by making IT easier to abstract and, hopefully, resulting in multiple interpretations and narratives of use. In the case of Project Sites, this might mean tools with more generic names that can be applied to multiple contexts.

In the case of CTools, staff rarely created alternative narratives beyond using it as a secure repository for inter- and intra-boundary sharing. Alternative narratives were not promoted or offered to staff through comprehensive training. While it is important for users to be able to develop multiple narratives over a system's possible uses, it is also important for users not to be overwhelmed by narratives to the extent that the system is too complicated to use and interpret. Design can address the creation of narratives while also limiting the number of narratives being created. Draxler et al. (2012), for example, suggest that the sharing of configurations will allow for users to learn successful configurations from each other. The biggest obstacle to this, as evidenced by Project Sites, there need to be multiple narratives of use in order for users to learn from each other. Other designers, technical communicators, often fill the role of establishing narratives by working as intermediaries between designers and users to convey information about how to use technology (e.g., Ranney, 2000). As is the case with establishing narratives of use, however, there is always the potential for narratives to become fixed. Therefore, an important aspect of designing technology to support narrative creation is to promote evolving narratives for shifting needs.

Designing in a way that allows for appropriation by unanticipated users adds an additional layer of complexity to the issues of designing for flexibility. Specifically, these users are difficult to design for because they have not been identified and it is unclear who they would be at the initial design phases. However, the staff population I interviewed highlighted an important aspect of appropriation by unanticipated users—that they were able to adopt and adapt the system to their needs because of they

already had access. As a result of this access, they were able to skip the first barrier to appropriation. I propose that the *purposeful* design for appropriation by unanticipated users means that the IT in question should:

- *Provide open access to users of many types (beyond those who were the target audience)*
- *Be transparent enough for any potential user to understand its intended use as well as potential uses*
- *Be flexible in the way that features can be interpreted and implemented across both expected and unexpected contexts*

I add these requirements to those proposed by Draxler et al. (2012) for the design of technology to support appropriation work (implicitly, within target user groups). I stress the design requirements that suggest that technology should facilitate the collaborative work of appropriating technology, while also supporting searching and browsing for ways in which other people have configured the technology, and to raise awareness of the appropriation activities that have been developed by other users.

For designers to be able to learn from these users in the iterative design process, there is an additional design requirement—to design systems in such ways that designers and implementers have ways of identifying unanticipated users and collecting data about them. Doing so ensures that these users can be identified so that we can glean insights from them, rather than letting them be confused for anticipated users by both designers and implementers. For Project Sites, this was done by attaching uniqnames to data on site activity and by self-identification, thus it was much easier to distinguish between users from different populations. In instances where users are not tracked, this may be more difficult. Unanticipated users may be difficult to detect because of insufficient system data or system data that is not sensitive to detecting them. I argue that actively trying to find these users is important. Iterative design methods, such as interviews and focus groups, can be made more sensitive to

uncovering these new personas by actively trying to find users who are not the targets and pursuing their study to improve system design for all users.

Because flexibility also introduces complexity to users' sensemaking around IT's use, it is important to design a way to bolster understanding of the system and to make the existence multiple narratives possible. In the design world, technical support staff might perform this task by communicating about technology or instructing others, yet these staff are rarely sufficiently knowledgeable at the ecological level about the people they help—that is to say, that they are too far removed from the specific work and practices of the people they seek to help. For this reason, I suggest that part of the design of flexible systems is the design of scaffolds to users become more self-sufficient in developing relevant expertise in the use of technology.

Designing Scaffolds For Creating Knowledgeable Users

The interview data showed that many of the staff's problems in appropriation were due to their lack of knowledge about the systems that were being appropriated. Throughout the interviews and card-sort/think-aloud task, staff demonstrated very limited and selective knowledge regarding the collaboration systems that they appropriated. In particular, there were few experts in the local ecologies who were engaged in the work to interpret and reconfigure tools, and there was a lack of technological experimentation among the staff community. These observations led to my exploration of training within this community, also leading me to consider how to create a technologically knowledgeable base of staff members who are capable of sustaining a thriving, continually evolving collaboration ecology. What I found was that these staff, whether anticipated or unanticipated, were not a knowledgeable base of users. In their study of a tailorable interface's implementation, MacLean et al. (1990) suggested that increasing computer skills enabled tailoring and knowledge gaps between workers and implementers are natural, resulting in discrete jumps in the amount of skill needed to engage in tailoring (see Figure 21, next page). Most staff were what he called *workers*, uninterested in learning about Project Sites and in evolving their use of it themselves

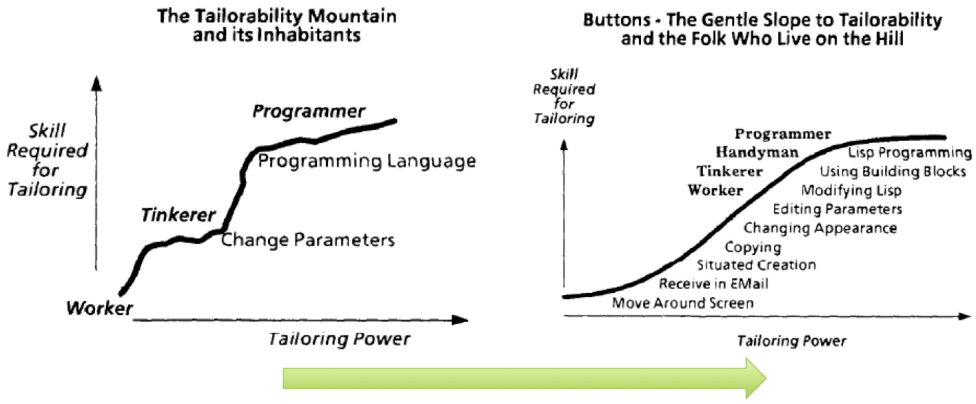


Figure 21. Tailoring Appropriation and skill level. MacLean (1990)

because it was tangential to their work. As a point of comparison, MacLean et al. described Buttons, which was a system designed in such a way that it smoothed out the discrete jumps in knowledge into a smooth continuous curve. This example showed that it is possible for a redesign that would assist Project Sites users in moving from the graphic on the left (high barriers to tailor beyond Resources) to be more effective in their appropriation (as shown in the graphic on the right). Such a design might entail making the tools' functions more transparent or providing a sort of roadmap that will ease the burden of connecting needed functionality to available tools.

Transparency is a design hurdle for any population, but especially with unanticipated users. Transparency was a big issue for staff with regard to the design of CTools and its Project Sites feature, where the long list of tools and their academic labels obfuscated other possible uses, resulting in staff's overall inability to jump the knowledge gap towards more varied use of the toolkit. Without staff experts in Project Sites' features inhabiting the local ecologies, staff rarely overcame the lack of transparency of tools. Google's appropriation, like CTools, was limited to the tools that staff could understand—tools that were the only ones to have been systematically taught by the colleagues I called *farmers*. Without staff present who were knowledgeable of the various workplace IT systems and toolkits, staff often remained uninformed of tools that could support their practices. The conclusion of my observations was that 'designing' ways to help users understand systems is vital to its

successful adoption and appropriation into practice, reinforcing a point made by Orlikowski (1992a). By making IT more transparent, users may be more likely to feel empowered to appropriate technology. In terms of unanticipated users, better transparency may lower the cognitive barrier to appropriation.

One alternative to creating knowledgeable individuals is the design of scaffolds to support the process of learning how to use technology and appropriate it into practice. The term "scaffolding" dates back to literature on learning (e.g., Vygotsky, 1976) and refers to the creation of effective strategies and practices for supporting learning (Pea, 2004). Scaffolds provide assistance when needed, and disappear unless they are needed again. Scaffolding work in the learning sciences has recently focused on computer-mediated scaffolds for learning (e.g., Quintana et al., 2002, 2004) and often looks at supporting students. However, 'learners' need not be limited to students. HCI can make use of scaffolds as features that support users in general, as learners in the context of learning to use and readapt technology. Scaffolding can be built into Project Sites to help staff learn to use their tools in an incremental hands-on approach. CTools provides scaffolding in an only very minimal way, having descriptions next to the list of tools in the tool selection screens for both Course Sites and Project Sites. However, my interviews with staff suggested that this list was largely ignored, thus most staff did not learn to appropriate far beyond the use of the Resources tool. Throughout the interviews, it was evident that other ways of scaffolding would be needed to help staff find other ways to appropriate Project Sites. Specifically, there is a way to leverage existing system capabilities or easily implementable ones to support the process. In particular, removing the guesswork about tool functions and how they could apply to staff's work could alleviate the problem. While documents can help to scaffold learners, the results of the interviews suggested that these documents actually provided a poor source for learning because they were not incorporated into the learning process. Staff did not view them as valuable learning tools, expecting that these using these documents would take additional effort with little perceived knowledge gains. Aside from help documentation that was available to staff, I identified two potential types of

scaffolds that could alleviate this issue by placing emphasis on applications of tools rather than the functions of those tools—cognitive maps and templates.

Quintana et al. (2004) outlined a number of scaffolding guidelines, one of which was the use of representations that bridge learner's understanding. Specifically, they propose that "tools can support learners by using representations that connect with learners' intuitions and also map onto expert practice," further suggesting the use of visual conceptual organizers to be this 'bridge,' matching work that previously proposed graphical organizers and notations as appropriate scaffolds in supporting processes (Quintana et al., 1999). Similarly, Scaife & Rogers (1996) point to graphical representations as a form of external cognition. The wayfinding literature has used maps as visual representations that are capable of offloading cognition in terms of navigating physical spaces (Golledge, 1999; Arthur & Passini, 1992). Maps might also function well as a method for designers to convey information and build scaffolds that support the initial sensemaking about technologies by delineating paths that lead users to think about and appropriate technology differently. In particular, such visual representations can help introduce tools and their functions by mapping them to generalized functions and purposes. Doing so means that users can easily explore tools by 1) learning about the tools in a more direct way by seeing their functions more clearly, and 2) working backwards from their needs to the tools that will fulfill their requirements. For CTools and Project Sites, such a cognitive map might consist of images like the one in at the bottom of Appendix G. When staff were shown this diagram after the card-sorting task, the image elicited new ways of thinking about the tools and how they might function aside from how staff expected before having been the diagram. For example, showing staff a diagram with the Assignments tool listed as a "Management" tool generated the response from two participants about how they could use the tool as a to-do list. Such a map might allow staff to jump the knowledge gap and help them to create new narratives around the tools, thus having the potential of supporting appropriation work.

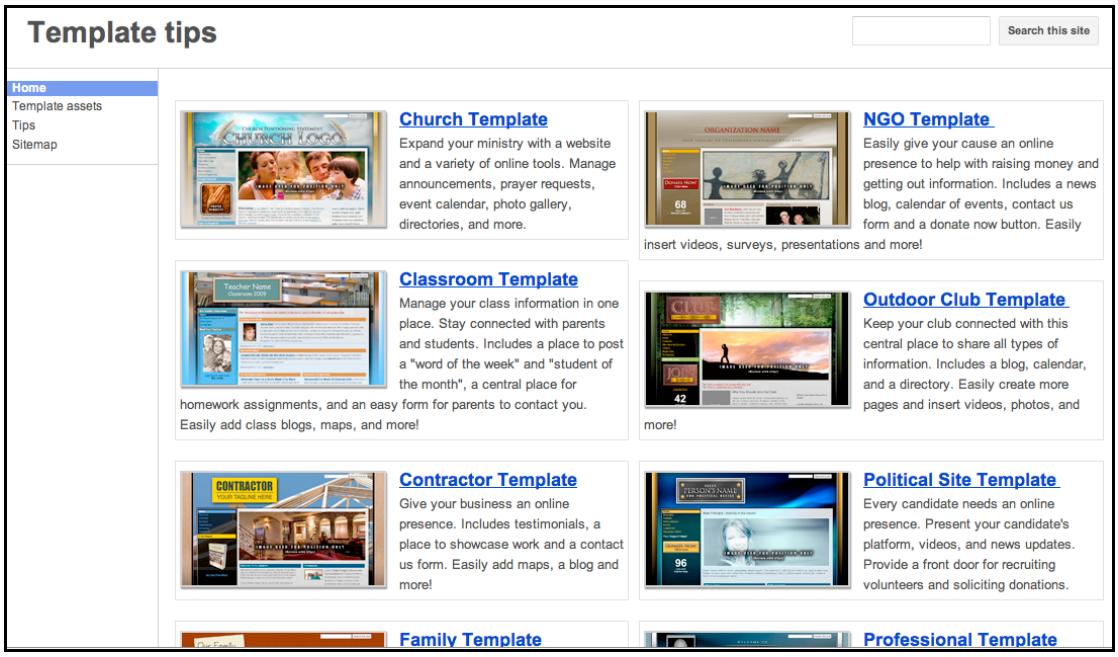


Figure 22. Templates provided by Google

The participants who used Google Sites were largely able to do so because the templates helped them through the sensemaking process (Figure 22, next page)—alleviating some of the burden of learning what Google Sites could do. I propose that templates are another solution for scaffolding technology use and they could ease the burden of learning about new or unfamiliar tools in Project Sites by framing them as part of a template. I have discussed templates with members from the Information & Technology Services (ITS) group for supporting the use of Project Sites and getting staff to think about the other tools. In studying staff, a number of potential templates emerged from the activities that staff are engaged in: in particular, templates for intranets, publicity (public sharing), research management, HR management, committees, and project wikis would help staff to choose different sets of tools for the kinds of sites they are already creating.

The main limitation of this work is related to its generalizability to other contexts and systems—I examined a type of appropriation (unanticipated users) that occurred at

the University of Michigan. However, as discussed earlier, other examples of unanticipated users in the literature are rare, which raises the question of how often this type of appropriation arises. For example, Wan et al. (2008) pointed out that Orkut began in the US, yet South American and Asian users had mostly populated the social networking site. Perhaps it is not the case that unanticipated users are rare, but that studying about them or writing about them is rare. In either case, the existence of unanticipated users raises questions about what it means when we find such users. Such users may be incorporated into the iterative design process and we simply never hear about this—neither in the literature on design nor the appropriation.

Because this is a case study, the context and systems that I investigated are not the same as those described in other studies, such as Ito's example of mobile phones in Japan (2005). However, I do stress that the concepts of designing for flexibility in terms of use and audience, the need for designing transparently, and the goals of designing in ways that easily scaffold potential users' knowledge can affect both the extent to those potential users will adopt and appropriate those tools. As posited by tailorability research, designing flexibly also manages to keep technology relevant and maximizes the number of potential users.

Aside from this general limitation, there were limitations within each of the three studies presented here. For the survey and log studies, the limitations of these methods to address actual practices was described in their respective discussion sections. These studies, however, had been conducted to inform the interview study, the latter being designed to generate qualitative data about practices while also explaining the quantitative results. The issue that remains from the survey study is that the length of the survey prohibited the addition of more items and constructs that I would have liked to explore. It is possible that the addition of more items could have made the results stronger. Another concern in the survey study was the potential bias towards respondents who are deterred by technology—i.e., technology averse or those who do not use information technology in their jobs. While this might be an issue for some data (i.e., technology comfort ratings, daily technology use, etc.), demographic comparisons

between the overall staff at the university and the study respondents did not indicate that staff I interviewed were unrepresentative of campus staff. Regardless, response bias remains a common concern for survey data and may, to some degree, affect the data collected here.

The issue that remains with the log study is the use of staff as a single cohesive group of users who could be viewed as one category, problematic considering the amount of variation known to exist within student and faculty user populations. This problem is difficult to overcome, however, because the collaborators on staff-created Project Sites come from numerous units and job types, and occasionally faculty and students. It is also, perhaps, the messiness of the data that prevented higher statistical power despite significant differences between the staff/student/faculty groups. The logs also used measurements of use that are problematic because of the shifting nature of staff use of the Project Sites toolkit. The data are not sensitive to occurrences like recent adoption or abandonment of tools when it is collected from the servers at a specific time. It is possible that using different methods of collecting and preparing the data (e.g., a longitudinal study) would have yielded more explanatory results.

In the log study I assumed that sites created by staff, faculty, or students would mostly consist of those same types of members. The implication of this is that comparing sites created by staff, students, and faculty would be less reliable because members of any group may be populating sites created by a member frin a different group. The interview study revealed that sites were sometimes mixed in terms of who populated them, but staff did not report that this occurred often. More important than who was on the site, the interviews revealed that the site creator usually set the tone and purpose of the site. This was the case for administrative staff who created sites for pushing out information to faculty/students as well as research proposal sites, where it was mostly faculty posting information.

The main limitation of the interview study relates to the timing of the study. In my attempt to capture the transition as it occurred, I began to conduct the interviews at

a time just before the university-wide migration, when some staff had yet to begin their transitions or were very early in the process. As I proceeded with the interviews, I found that staff were still in a sense-making process about their newly extended collaboration ecologies. Many of the staff participants reported that they were still having issues adjusting, some even mentioning that they were so focused in recovering and approximating their previous work practices with email and calendaring that they were not yet looking at other collaborative tools. As more staff proceed through the transition and learn to appropriate Google's tools, the use of Google's collaboration tools might increase whileProject Sites use decreases. In addition, as a critical mass around Google's collaboration tools builds, the same staff who had not wanted to use either Google Drive or Google Sites might be obligated make such a shift. Taking these items into consideration suggests that studying an evolving ecology may yield different results and reveal a different ecology when selecting one time versus another.

Related to the issue of timing is the fact that interviews were collected over a period of two months, so those staff I interviewed at the beginning may have been affected somewhat differently by the transition than others, particularly in relation to Google's effect on their use of Project Sites. However, because the staff I interviewed towards the end of data collection were still adjusting to the transition, this may not be a significant issue with my data.

7.5 CURRENT & FUTURE WORK

In this dissertation I emphasized the need to explore unanticipated users once they are detected, and the importance of flexibility in design such that systems can be adaptable to emergent contexts and can be appropriated by many types of users. While this study was informative and suggest some next steps in addressing the design and organizational issues uncovered by the data, the research described here still leaves openings for further research, particularly in addressing Project Site use among groups that I excluded from the interviews, such as staff from health-related units, research staff, and technical staff. Due to their experience with WorkTools, the precursor to

Project Sites before ITS combined CourseTools and WorkTools under the CTools interface, research staff were an anticipated user group for Project Sites. Because of their unique position in the staff community as target users for Project Sites, it would be beneficial to understand both their practices and the ways in which Project Sites supports (or fails to support) their everyday practices.

Staff from the health-related units had created the most Project Sites out of any single staff sub-population, yet the number of sites created within their unit is only a small portion of all healthcare-related staff. It would be interesting to understand this group of staff and their collaboration ecologies, especially considering that the health-related units did not transition to Google along with the rest of the university. Additionally, these health-related units made a transition of their own, having adopted a new patient information management system, MiChart, that may or may not have affected their use of Project Sites. The transition to MiChart was a mandatory change, much like the Google email migration. In this way, it was disruptive to their collaboration ecology, much like Google's mail and calendar were disruptive for the rest of the university. Because of the ecology and their transition, the hospital setting provides a second context for studying collaboration ecologies after a transition.

Because I collected data from staff who were in the middle of the Google transition, I recorded a number of frustrations and unresolved questions about these tools. However, as one interview participant pointed out, staff would eventually settle on new practices and they would solve their problems—perhaps even by creating approximations of their previous practices. In future work, I will investigate how the same staff I interviewed have settled into new practices and gauge the extent to which they may have abandoned Project Sites for Google tools or to explore whether the balance between CTools and Google have shifted at all.

Earlier in this chapter, I discussed templates as a possible intervention for scaffolding CTools use. Templates have been, to some extent, provided for Course Sites, but not for Project Sites. Following similar protocols might improve usage. By creating a

set of templates specific to Project Sites and staff work, and then deploying them among staff who are active participants on Project Sites, I can observe if other tools receive more attention than what I detected in the log analysis study. Because CTools is capable of providing this functionality, I can develop templates based on findings in this dissertation that are testable either in a lab setting, as usability tests, or they could be deployed and tested in field experiments.

SUMMARY

The main focus of this work was to introduce the issue of unanticipated users into the design and CSCW literatures. In the effort to understand unanticipated users and their adoption/adaptation of Project Sites, I drew from both HCI design methods and the literature on appropriation. Two gaps stood out from the literature: First, appropriation was an imprecise concept that has had a twenty-year history with a multitude of uses in the literature. Second was an apparent paradox: as creators of interactions and tools, we must specify the populations being served and the purposes of IT despite the evidence that actual users and their technology uses are often not perfectly aligned to what designers and implementers might expect. The design recommendation for flexible technologies grew out of this gap because flexible IT (i.e., customizable, tailorable, etc.) addressed the issue of applications and systems that are relevant across emergent contexts. However, there have also been issues in the implementation of these technologies; users often need to be experts in computer use to be able to make the most use of flexible IT systems. Users who are not experts at adapting IT may find themselves at a loss—both cognitive and motivational—to adapt flexible systems, a problem that emerged in this study, when staff unexpectedly appropriated Project Sites by adopting and adapting it to their administrative contexts without being experts in its use or being knowledgeable about its full capabilities.

CSCW research examined evolving use in a Special Issue of the CSCW Journal (Vol.12, 2003). Yet even with this broad lens for appropriation (evolving use as opposed to unexpected use), it was still evident that unanticipated users were not being

discussed as a topic of research. This oversight, I argued, limits the design space. IT can be more accessible and democratic by being adoptable and adaptable by many types of audiences—whether expected or otherwise.

In this concluding chapter, I pulled together the findings of a mixed-methods research project that studied university staff and their use of Project Sites, a feature of the CTools courseware platform that was never designed for staff use and continues to be designed iteratively without addressing staff activities and practices. The studies pointed to a single narrative of use, a story that helps staff users interpret Project Sites, and suggested that the main differences between staff and their target user counterparts was the context of their use. However, I found that staff's appropriation of the tools did not to leverage the tools to maximum benefit because the system, though flexible in terms of applications of use, was designed in a way that its tools' uses were not transparent outside of the academic context. In addition, staff were not sufficiently engaged in the articulation work required to appropriate it in different ways since they settled on a narrative that worked well for an immediate need.

I described how these findings extended the existing HCI literature by talking about unanticipated users and the cognitive and organizational problems faced in the implementation and use of collaborative IT. I pointed to how the findings can relate to design theory in terms of designing flexible IT, designing scaffolds to assist in interpreting flexible IT. I also drew focus to improving the appropriation of Project Sites by suggesting ways in which its design could be improved by adding scaffolds. In closing, I have demonstrated that understanding unanticipated users provides a unique opportunity for those who are interested in design and user experience to question what is known about target users, expected uses, and the ever-changing nature of contexts of use.

APPENDICES

APPENDIX A: LIST OF TOOLS IN COURSE/PROJECT SITES

Tools offered by Project Sites and their uses	
Announcements	For posting information
Assignments	For private submission and grading of coursework
Chat	For posting messages among site participants in real time
Discussion	For posting topics and responses
Drop Box	For private file sharing between instructors and students
Email Archive	For displaying email sent to the site
Forums	For posting topics and responses
Gradebook	For posting grades, either entered directly or imported from other tools
iTunes U	For distributing media using iTunes
Library Help	For instant-messaging with a UM librarian
Library Reserves	For displaying items on UM Libraries Course Reserves
Messages	For posting messages directly to individual site participants
Modules	For building and displaying sequenced learning materials
My Workspace	For a personalized view of information from your CTools sites and your CTools preferences
News	For displaying RSS and other forms of syndicated web content
Podcasts	For distributing media
Polls	For collecting feedback on a given question
Resources	For posting documents, website URLs, etc.
Schedule	For posting deadlines, events, etc.
Syllabus	For posting a summary, outline, or requirements
Test Center	For building and distributing assessments (e.g., quizzes)
Web Content	For displaying standard web pages
Wiki	For collaborative authoring of pages and content
Worksite Setup	For setting up project and course sites

APPENDIX B: THE TECHNOLOGY ACCEPTANCE MODEL (TAM)

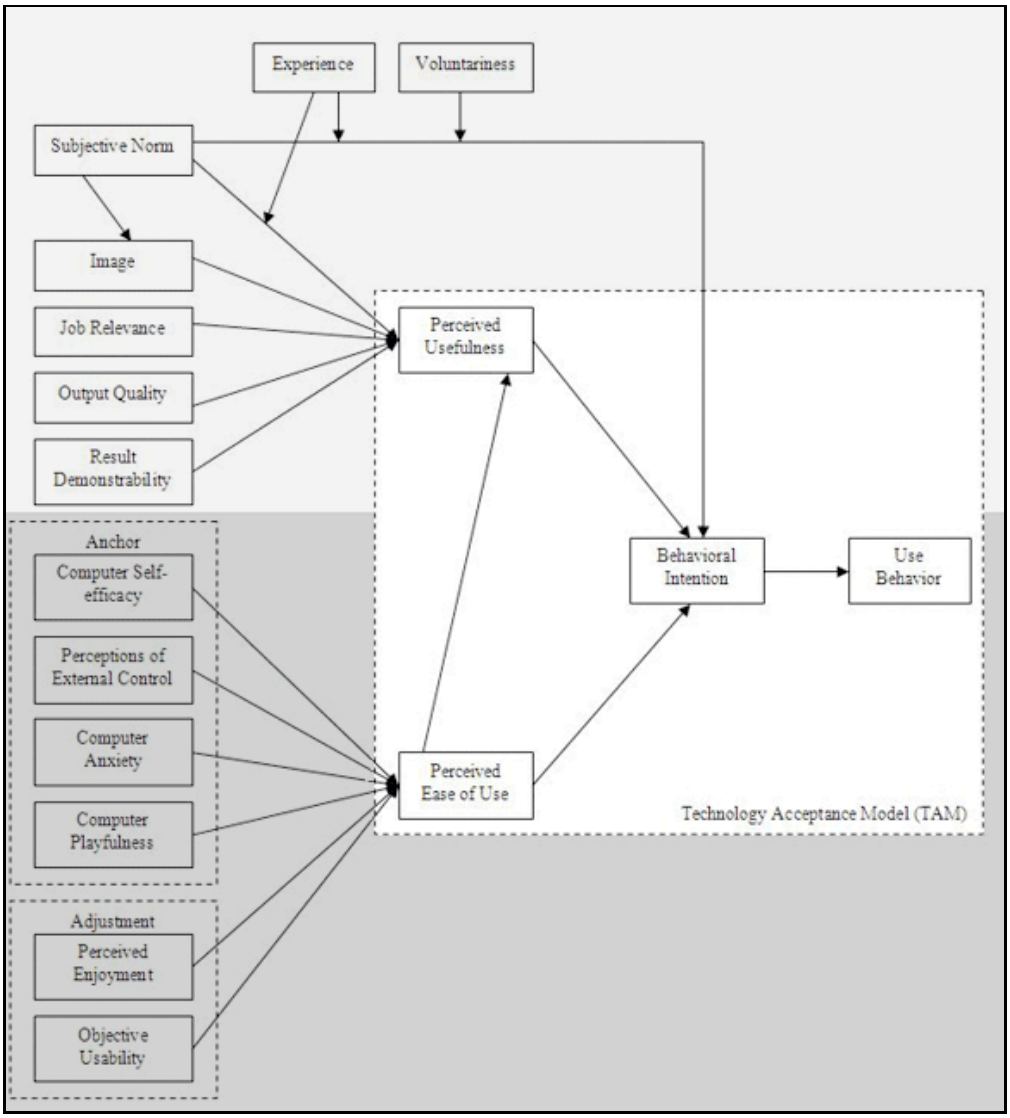


Figure 23. Full Technology Acceptance Model (TAM)

TAM 1 (white), 2 (light grey), & 3 (dark grey)

APPENDIX C: SURVEY INSTRUMENT, MAIN

Page 1.

What unit are you **primarily** affiliated with? Please select one.

- Athletics
- Business/Financial Operations (not school/college affiliated)
- Central Administration
- Degree-granting Department, School, College
- Facilities/Operations
- Health Services
- Institute or Center (not affiliated with Health Services)
- Libraries
- Museums
- Other (please describe):

Which of the following **most closely** categorizes your role in your job?

Executive/Administrative

- Office/Clerical
- Professional - Non-faculty
- Technical
- Research
- Other

Page 2.

How long have you been working at the University of Michigan as a staff member (including all previous positions)?

_____Years Months

Please rate your expertise with computers compared to your co-workers.

- Novice
- Intermediate
- Advanced

Page 3.

Please rate your agreement with the following statements.

The following **information technologies (IT)** are valuable for my **work-related activities**...

Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | Have not used

- Audio/Video conferencing
- Blogging tools
- E-mail
- Group calendars
- Group document-editing software
- Instant Messaging
- Online Media (Video and Audio)
- Social networking websites
- Web-based file servers
- Website creation applications

Page 4.

Which of the following best describes your use of **information technologies** in your work, such as the technologies described on the previous page? Please select one.

- I use no information technology in my work *(Skip to the next page)*
- I use a limited level of information technology in my work
- I use a moderate level of information technology in my work
- I use technology extensively in my work

Please rate your agreement with the following statement.

Using **information technology** in my work is valuable for...

Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree

- Improving my work
- Saving me time
- Accessing material anytime and anywhere
- Managing work activities (e.g. planning, budgeting, etc.)
- Improving communication between me and my co-workers
- Improving communication between me and my boss

Page 5.

Please rate your agreement with the following statements about **information technology (IT)** in your work.

Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree

- Learning how to use IT is too time consuming for me
- IT is too complicated for me to learn
- My supervisor does not know how to implement IT
- New IT is too expensive for my unit/department
- There is no recognition or reward for using IT for my work
- Using IT has little connection to my job
- IT often does not work well on my computer
- I need greater technical support in order to use IT in my work
- Using IT takes too much time out of my day
- None of my co-workers use IT

Page 6.

How do you mainly find out about new **information technology (IT)** for your work?

- My friends
- My co-workers
- My supervisors
- I find it on my own
- Unit/department IT specialist
- Other (please describe):

Please rate your agreement with the following statements about **information technology (IT)** in your work.

Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree

- I am usually the first to try out new technologies
- I often present new technologies to others
- I often try out new technologies after being told about them
- I seek out new technologies to use in my job

What do you most wish you could do with information technology for work-related activities that you **are not currently able** to do?

(OPEN RESPONSE)

Page 7.

How often do you use information technology for work-related activities from home or away from your office?

Not At All | Very Little | Sometimes | Very Often | Always

How much of your job requires you to work with people in other locations?

None | Little | Some | Most | All

People I work with are typically located...

- All nearby (same office / building)
- Part nearby / part elsewhere
- All elsewhere

What is your campus mail 4-digit zip code?

48109 -_____

Page 8.

Please **rate your agreement** with the following statements:

I could use information technologies to accomplish work-related tasks if...

Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree

- there was no one around to tell me what to do
- someone showed me what to do first
- I had used a similar package in the past
- I had a manual
- there is an in-house facility for assistance

Page 9.

Please indicate the extent to which you agree that each of following traits describes you when you use IT.

Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree

- Spontaneous
- Creative
- Conservative
- Adventurous
- Indifferent

Please **rate your agreement** with the following statements:

Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree

- Working with computers makes me nervous
- I feel comfortable around computers

Page 10.

CTools is the University of Michigan's learning management system and collaborative learning environment. A sample CTools screen is shown at the right (show image).

I have used **CTools** for the following (Check all that apply)...

- **Course Sites** (Course sites within CTools are a type of worksite that allows site members enrolled in a course to share course materials, as well as allowing them to collaborate, share materials, and maintain a shared online space.)

- **Project Sites** (Project sites within CTools are a type of worksite that allows site members to collaborate, share materials, and maintain a shared online space.)

- **Grad Tools Sites** (Grad tools sites within CTools are a type of worksite that allows members to manage and view graduate degree progress.)

- **Portfolio Sites** (Portfolio sites allow a learner to store, view, and selectively share parts or all of a digital learning record with anyone, anytime)

Which of the following **best describes** your activity on **CTools Project Sites**? (Project sites within CTools are a type of worksite that allows site members to collaborate, share materials, and maintain an shared online space.)

- I have never logged on
- I logged on once in the past
- I logged on a few times in the past
- I used CTools regularly in the past, but am not a current user
- I am a seasonal CTools user (I only use CTools at specific times during the year)
- I currently use CTools regularly

APPENDIX D: SURVEY, SEASONAL/CURRENT USERS

Page 1.

You have indicated that you use CTools Project Sites at specific times during the year.

- How did you first discover CTools Project Sites?
- My supervisor referred me to them
- A co-worker referred me to them
- A friend referred me to them
- A student referred me to them
- I read it about them
- I found out about them accidentally
- I do not remember
- Other: _____

Page 2.

When did you first begin to use CTools Project Sites?

- Within the last 3 months
- 3-6 months ago
- 6-12 months ago
- Over 1 year ago
- Over 2 years ago
- Over 3 years ago

Seasonal Only: My use of CTools Project Sites relates most to...

- the academic calendar
- the fiscal calendar
- project and grant deadlines
- specific recurring events / activities
- other (please describe):

Why did you first begin using CTools Project Sites? (Open Response)

Page 3.

Seasonal: When you use CTools Project Sites, in how many different sites are you listed as a participant?

Current: In how many different sites are you listed as a participant?

- 1-2
- 3-6
- 7-10
- 11-14
- 15 or more

Seasonal: When you use CTools Project Sites, how many different CTools Project Sites do you actively use?

Current: How many different CTools Project Sites do you actively use?

- 1-2
- 3-6
- 7-10
- 11-14
- 15 or more

Page 4.

Which of the following best describes your participation in CTools Project Sites?

- I create most of my Project Sites
- I create Project Sites more often than I join them
- I create and join equal numbers of Project Sites
- I join more Project Sites more often than I create them
- I join most of my Project Sites

When you use CTools Project Sites, how often do you visit your CTools Project Sites?

- A few times a semester
- A few times a month
- Once a week
- A few times a week
- Daily (once or more every day)

Page 5.

Please rate your agreement with the following statements about CTools Project Sites:

Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree

- Using CTools Project Sites improves my job performance
- CTools Project Sites are not useful in my job
- CTools Project Sites are easy to use
- I have the resources necessary to use CTools Project Sites
- CTools Project Sites are compatible with other systems I use
- I find using CTools Project Sites enjoyable
- My use of CTools Project Sites is voluntary
- Using CTools Project Sites raises my status with my coworkers
- The benefits of using CTools Project Sites are clear to me
- The benefits of using CTools Project Sites are easy to communicate to my coworkers

---

Page 6.

Please rate your agreement with the following statements about CTools Project Sites:

Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree

- CTools Project Sites are easily adaptable to my own work
- CTools Project Sites are designed with my work in mind
- I can adapt features of CTools Project Sites to accomplish my work-related tasks
- CTools Project Sites are designed for coursework
- CTools Project Sites are designed for research projects
- CTools Project Sites are designed for administrative work

Page 7.

Please rate your agreement with the following statements: CTools Project Sites are valuable for...

Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree

- Administrative activities (e.g., search committees, personnel evaluation, departmental information)
- Faculty research (e.g., funded projects, grant proposals)
- Managing non-credit learning opportunities (e.g., workshops / seminars / series, etc.)
- Managing special events (e.g., conferences, lectures, etc.)
- Non-academic activities (e.g., clubs, teams, etc.)
- Personal use (e.g., place to store work, backup files, etc.)
- Training (e.g., professional development, unit staff training, etc.)

Page 8.

Please rate your agreement with the following statements:

CTools Projects Sites are valuable for...

Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree

- Scheduling
- Communication
- Posting audio/video materials
- Editing group materials
- Providing a single access point for materials from various sources
- Creating groups
- Tracking progess
- Supporting distance work

Page 9.

Please rate your agreement with the statements below: Within CTools Project Sites, the following tools are valuable for my work-related

activities...

Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | Have not Use

- Announcements
- Assignments
- Chat room
- Discussion
- Drop Box
- Email Archive
- Forums
- Messages
- News (RSS feeds)
- Polls
- Podcasts
- Resources
- Schedule
- Syllabus
- Web Content
- Wiki

Page 10.

How often do you use CTools Project Sites to share or post these different types of documents/materials?

Never | Infrequently | Sometimes | Frequently | Very Often

- Highly-sensitive (e.g., candidate applications, subject records, etc.)
- Guarded (e.g., proposals, etc.)
- Non-sensitive policy drafts, conference (e.g., meeting agendas, blank templates, etc.)

Page 11.

The CTools Projects Sites I use typically include members who are... (Please select all that apply)

- UM faculty
- UM staff
- UM students
- Non-UM faculty
- Non-UM staff
- Non-UM students
- Only myself

Page 12.

I intend to use CTools Projects Sites...

(If Currently Using CTools Project Sites)

- for at least the next month
- for at least the next six months
- for at least the next year
- for an undetermined amount of time into the future
- I plan to discontinue using CTools Project Sites within the next month

(If Not Currently Using CTools Project Sites)

- resume use within the next month
- resume use within the next six months
- resume use within the next year
- resume use at an undetermined amount of time into the future
- I do not plan to resume using CTools Project Sites

Page 13.

What are the three most effective ways you get help with CTools?

Please rank up to three items below from 1-3 with 1 being the highest.

- Attend a CTools workshop or help session
- Email CTools Support staff at the Duderstadt Center (either directly or by
- using the online web form)
- Call CTools Support staff at the Duderstadt Center (734-615-5512)
- Instant Message CTools Support staff at the Duderstadt Center (ctoolshelp)
- Ask a Computing Consultant at a Campus Computing Site or 4-HELP
- Ask the IT support staff in my unit/department
- Consult the online CTools help documentation
- Ask a colleague
- Ask someone else
- Keep trying on my own

Page 14.

Thinking about how staff use CTools, what single improvement would you recommend?

Thinking specifically about the CTools software, what single improvement would you recommend?

Page 15.

Would you like to participate in future technology use surveys and interviews?

Yes | No

APPENDIX E: RECRUITMENT EMAIL

Dear XXX

I am Pablo Quinones, an SI doctoral student in the School of Information and affiliated with the USE Lab, directed by Dr. Stephanie Teasley. I'm conducting a study of university staff, focusing on their technology needs, technologies used, and how they choose information technologies. You have previously completed a technology use survey conducted by the USE Lab and indicated that you would be interested in participating in follow-up studies.

The study I am conducting consists of an interview lasting about an hour. In appreciation of your participation, I will give you a $10.00 VISA gift card.

The interviews will be conducted person at your workplace or at a nearby public campus location, scheduled at your convenience. Your participation and the content of the interviews will be confidential and will not affect your job. No one outside the study team will have access to any information that identifies you nor will they be able to access the data we collect. In all resulting presentations and publications, we will anonymize any personally identifiable data.

This study has been reviewed by the IRB and is exempt. As with all IRB-approved studies, you are free to withdraw from participation at any time.

Thank you for your time. Your participation would be greatly appreciated!

--
Pablo-Alejandro Quinones

School of Information, University of Michigan

Doctoral Student, Candidate

APPENDIX F: INTERVIEW PROTOCOL, MAIN INTERVIEW

Interview Protocol

Thank you for meeting with us for the Staff Technology Use Interview. This study seeks to understand how different staff members throughout the university incorporate CTools into their work. The long-term goal of this project is to provide information to CTools designers to better provide university staff with better work tools.

By agreeing to be part of this study, you are agreeing to be part of a one-on-one interview. The interview should last no more than 30-45 minutes. I will be recording the interview so that we have a record of the conversation for analysis. As compensation for your time, you will receive a $10 VISA gift card.

You may not receive direct benefits from this study immediately, though the possibility of having your input inform university-wide design of work tools from staff is a possible future benefit.

The content of these interviews is strictly confidential. Any personally identifiable information will be stripped from the interview recordings and transcriptions. Interviews will use codes to refer to our participants. Files will be password protected.

Your participation is optional and would be greatly appreciated! There may be occasions where you may not want to reveal certain information. You may feel free not to answer specific questions if you feel uncomfortable. You may also end the study at any time and still receive the gift card.

Job Descriptions

What is your job title?

a. *How long have you been doing this job?*
b. *Have you held other positions at the university?*
c. *How long have you been employed by the university overall?*

2. *What tasks/activities does your job as X consist of?*
(Your job title is X, what does that mean about what you actually do on a regular/daily basis? Other things that are important that you don't necessarily do daily?)

3. *How often would you say you work in groups?*
    a. *What kind of groups? What are they for?*
    b. *How many groups?*
    c. *How big are these groups?*
    d. *Where are these group members located?*

4. *Given the tasks you do by yourself and those you do as part of a group, what role does technology play in your job?*

5. *For each task that you perform (alone and in groups), what technologies do you use?*
    a. *How are the technologies selected?*
    b. *Who picks them, how do you decide which to use, etc.*

6. *Who, if anyone, is influential in your choice of technologies?*
    a. *Both yours and your groups.*
    b. *What resources, such as Internet, blogs, forums, training sessions*

Project Sites

In the staff technology survey, you indicated that you use Project Sites. Are you still using Project Sites?

I will ask you some questions about how use Project Sites and their role in your job.

First, would you mind walking me through your Project Sites?

Take notes and ask questions as they come up

a. *Which of your activities do Project Sites support?*
b. *Which tools are you using?*
c. *How are these tools useful?*
d. *What information are you sharing (communicating or up/downloading)?*
e. *Are there tools you think are useful, but that you never use?*
    i. *FOLLOW UP!*
f. *Why don't do you use some of the other tools?*

1. *Are you using this Project Site to work with mostly people you see face-to-face? Or people who are remote?*

    a. *How often do you see these people in person?*
    b. *How are your interactions different from how you interact over Project Sites or through other tools?*
    c. *How does a Project Site support your interaction with these people?*

2. *Who created this Project Site?*

    a. *Is this the same as who creates some of your other sites?*
    b. *How is it that you and your groups decided which tools to use?*

3. *Can you remember when you set up this site?*

    a. *How would you say that PSites changed the way your group works?*

4. *Since your group initially set up the site, have you changed how you use it or what you use it for?*

    a. *How often would you say that the way you use the site changes?*
        i. *For example, you use a tool and then switch to something else?*
    b. *Can you remember a time when you or someone else mentioned the use of a tool you previously didn't use?*
        i. *How was it received?*
        ii. *What was the outcome?*

5. *How would you describe what Project Sites means to you?*
    a. *How would you describe its place in your groups and in your job?*

6. *How does it fit (or not fit) within your network of tools?*

Comments :

If No:

1. *Is there a reason for this?*
    a. *People?*
    b. *Technology?*
    c. *Tasks/Needs?*
2. *What tasks did you previously perform with Project Sites and what are you using to accomplish these tasks now? Why the change?*
3. *Would you consider using Project Sites again? Why?*
   Or Why not - What would you need from Project Sites to make it appealing as part of your collaboration technologies?

Google Transition

Let's talk about the transition to Google. Are you using any of the Google products?

Are you using Google Sites?

If Yes:

1. *What motivated the use of Google Sites?*
    a. *Who played a major role in this?*
    b. *Was this a decision made as a group? By one person?*
    c. *Was it mandatory?*
2. *What did you know about Google Sites before the transition?*

3. *Is there someone who helped you transition to Google?*

    a. *Who is this person? What kind of position do they hold?*
    b. *What unit are they from?*
    c. *How did they help you?*

Would you mind walking me through one of your Google Sites?

4. *How are you using this Google Site?*
    a. *What are you using it for?*
    b. *What features are you using?*
    c. *How does it support your tasks?*
    d. *How does it support collaboration?*

5. *How has the transition to Google Sites affected how you use IT in general to support group work?*
    a. *What about in regard to CTools Project Sites?*

6. *How has this change affected the way your group works?*

7. *Since using Google Sites, how has your role in your work groups changed?*

8. *What do Google Sites mean to you?*

a. *How would you describe their place in your groups and in your job?*
b. *How do you feel you are connected to them?*

7. *How would you place it within your network of tools?*
8. *I'm interested in talking to some other people who use Google Sites. Do you know anyone who is using Google Sites? Could you recommend up to three people to me? (Preferably a mix of people who have used Project Sites or those who were not using Project Sites.)*

If No:

1. *Is there a reason for this?*

2. *What do you know about Google Sites before the transition started?*

3. *Do you expect to be taking part in the transition?*

4. *If yes, when?*

5. *If so, how might you expect this to happen?*
6. *(Who is driving this change?)*
7. *Might there be something about Google Sites that would lead to you abandoning Project Sites?*

Would you mind me contacting you at a later date to touch base on your Google Sites usage (if any)?

Comments :

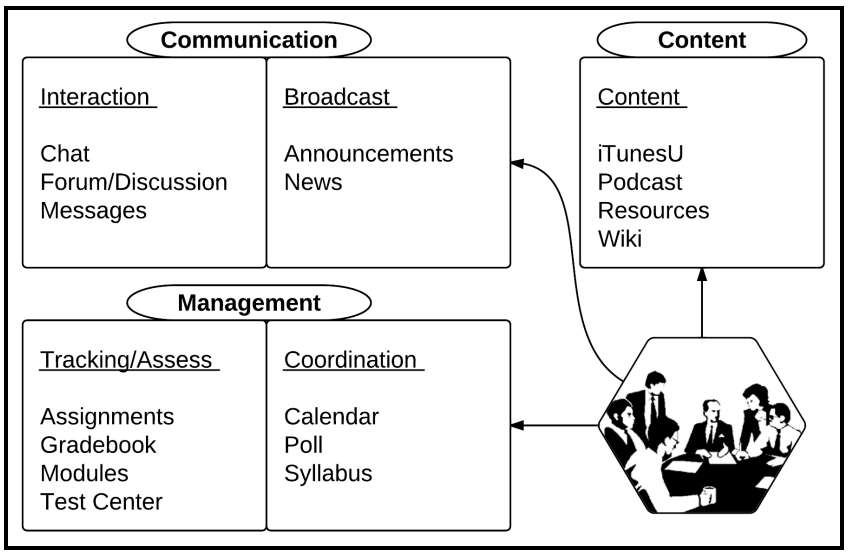
APPENDIX G: INTERVIEW PROTOCOL, THINK-ALOUD

Now we are going to do something a little bit different. Pretend that you are responsible for clustering Project Site tools into categories based on your experience with them. We've narrowed down the number of tools to a few that we see get more frequent use. What I would like to see is how you sort the tools and have you tell why as you sort them.

(Hand them cards with tool names and allow them to sort the tools)

As you sort through the notecards, please describe your thought process about what the tools do and how you are deriving your categories. If you don't know what a tool is, guess what it does and sort it according to your guess. There is no right or wrong answer, so do your best and don't worry if you feel stuck or if there are tools that you do not want to sort into a category.

Great. We had come up with a categorization in this way (*Hand over diagram*). Can you take a look at this diagram and tell me what you think? How does make you think of tools differently? In what ways is it appropriate or inappropriate? How are your work practices captured and not captured by this type of categorization scheme?



APPENDIX H: CODING SCHEME

JOB-RELATED CODES

[JOB] Role	Current role
[JOB] EmpTime	Employment time at time of interview
[JOB] Previous (Y)	Previous positions – Yes, similar
[JOB] Previous (Y)	Previous positions – Yes, different roles
[JOB] Previous (N)	Previous positions - No
[JOB] Process	Job responsibilities. E.g., managing
Examples:	[JOB] Process – Reporting benefits
	[JOB] Process – Communicating
[JOB] Groups	Discussions of group work
[JOB] Groups [GRP]	Type of group
Examples:	[JOB] Groups [GRP] Committee
[JOB] Groups [SIZE]	Size of group
Codes:	2-3, ≤5 (small group), 5-10, 10-15, 15+
[JOB Groups [FREQ]	Frequency of group work
[JOB] Collab	Who are collaborators?
[JOB] Collab [EXT]	External collaborators
[JOB] Collan [LOC]	Local collaborators

TECHNOLOGY-RELATED CODES (GENERAL)

[TECH] General	
[TECH] General [ROLE]	Role of technology in general
[TECH] General [ATT]	Attitudes toward technology
[TECH] General [BLF]	Beliefs about technology
[TECH] General [SEEK]	Extent of seeking out technology
[TECH] General [SPEC]	
[TECH] General [DECI]	People who make technology decisions
[TECH] General [HELP]	People who provide help
[TECH] General [INFL]	People who influence technology use

[TECH] General [TRAIN]	People who provide training
[TECH] General [OBS]	Obstacles appropriating tools
[TECH] General [MULTI]	
[TECH] General [TOOLS]	
[TECH] (Tool Name)	
[TECH] (Tool Name) [FREQ]	Frequency of use
[TECH] (Tool Name) [AFF]	Affordances of tool
[TECH] (Tool Name) [PURP]	Purpose of tool
[TECH] (Tool Name) [PROC]	Process supported by tool
[TECH] (Tool Name) [ATT (+)]	Attitude towards tool (positive)
[TECH] (Tool Name) [ATT (-)]	Attitude towards tool (negative)
[TECH] (Tool Name) [JDG (+)]	Judgment of tool (positive)
[TECH] (Tool Name) [JDG (-)]	Judgment of tool (negative)
[TECH] (Tool Name) [BLF]	Belief about tool
[TECH] (Tool Name) [INFL]	Who influence technology being used
[TECH] (Tool Name) [SHEP]	Those who drive how tech is used
[TECH] (Tool Name) [OBS]	Obstacles to tool use
[TECH] (Tool Name) [OPP]	Opposition to tool use
[PREV]	Previous tool use
[CURR]	Current tool use

CTools-related Codes

[TECH] CTools	
[TECH] CTools [USES]	Current uses of CTools
[TECH] CTools [SITE]	A specific named site or stated site purpose
[TECH] CTools [AFF]	Affordance of CTools
[TECH] CTools [PROC]	Process supported by CTools
[TECH] CTools [ATT (+)]	Attitude towards CTools (positive)
[TECH] CTools [ATT (-)]	Attitude towards CTools (negative)
[TECH] CTools [BLF]	
[TECH] CTools [JDG (+)]	Judgment of CTools (positive)
[TECH] CTools [JDG (-)]	Judgment of CTools (negative)

[TECH] CTools [KNOW] Knowledge about CTools
[TECH] CTools [MSTK] Mistakes or gaps in knowledge of CTools
[TECH] CTools [TRAIN] Use of training

[TECH] CTools [FREQ] Frequency of CTools use

[TECH] CTools [PREV] Previous uses of CTools
[TECH] CTools [ABAN] Reasons for abandoning CTools
[TECH] CTools [FUT] Potential future use of sites indicated

[TECH] CTools [SPEC] Species in ecology important for CTools appropriation
[TECH] CTools [DECI] People who make decisions (locally)
[TECH] CTools [HELP] People who help with tech assistance
[TECH] CTools [INFL] People who influence tech used or practices

[TECH] CTools [D.USE] Different uses of CTools
[TECH] CTools [TOOL]
[TECH] CTools [T.OTH] Tool used other than Resources
[TECH] CTools [T.RES] Tool other than Resources

[TECH] CTools [OBS]
[TECH] CTools [OPP]

GOOGLE-RELATED CODES

[TECH] Google [MAIL]
[TECH] Google [CALN]
[TECH] Google [SITES]
[TECH] Google [APP]
[TECH] Google [APP] *(Name)* [FREQ], [CURR], [FUT]

[TECH] Google [APP] *(Name)* [AFF], [PROC],
[TECH] Google [APP] *(Name)* [BLF], [ATT (+/-)], [JDG (+/-)],
[TECH] Google [APP] *(Name)* [KNOW], [MSTK], [TRAIN],
[TECH] Google [APP] *(Name)* [SPEC], [DECI], [HELP], [INFL], [CATA], [SHEP]
[TECH] Google [APP] *(Name)* [OBS] [OPP]

TRANSITION CODES

[TRANS] Google

[TRANS] Google [ATT (+/-)]
[TRANS] Google [BLF]
[TRANS] Google [JDG (+/-)]

[TRANS] Google [KNOW]

[TRANS] Google [MAIL]
[TRANS] Google [APP] Mail [AFF], [PROC],
[BLF], [ATT (+/-)], [JDG (+/-)],
[KNOW], [MSTK], [TRAIN],
[SPEC], [DECI], [HELP], [INFL], [CATA]
[OBS] [OPP]
[PREV], [CURR]
[LOSS]

[TRANS] Google [CALN]
[TRANS] Google [APP] Calendar [AFF], [PROC],
[BLF], [ATT (+/-)], [JDG (+/-)],
[KNOW], [MSTK], [TRAIN],
[SPEC], [DECI], [HELP], [INFL], [CATA]
[OBS] [OPP]
[PREV], [CURR]
[LOSS]
[TRANS] Google [SPEC], [DECI], [HELP], [INFL], [CATA], [SHEP]

[TRANS] Google/CT [COMPAR]

[TRANS] Google [PREV], [CURR]

APPENDIX I: ADDITIONAL CARD SORT ANALYSIS

In order to obtain a better understanding of the knowledge that staff had about CTools, I had invited a number of the participants to participate in a think-aloud card-sorting task. I both recorded their walkthroughs and photographed their final card sort categories. The final card sorts were transposed into a card-sort analysis spreadsheet.

Thirteen staff participated in the card sorting task. P10 only created two piles based on the tools she recognized and the tools she didn't, which resulted in a pile with the Resources and Announcements tools and another pile with the other 17 cards. Rather than asking her to redo the task, I omitted her data in the spreadsheet, but I do refer to her transcript for the think-aloud descriptions of the tools. P04, who had been omitted from the interview analysis because of a damaged/lost transcript, was used in the statistical analysis because the contents of his card sort were recovered (though the talk-aloud recording was also lost).

I coded the interviews to capture incorrect descriptions of tools as well as cases where the participant did not know what a tool did. The final card sort was input into a spreadsheet provided by Donna Spencer, the author of the Card Sorting methodology book (Spencer, 2009). Participants created their own categories as per the open card sort technique, resulting in 3-6 categories per participant (mean = 4.3, median = 4) over the 19 tools. Because open sorting results in categories that are not the same across all participants, I designed 4 main categories that captured the essence of the user-generated folksonomies—Communication, Collaboration, Information, and Classroom.

Card name	Communication	Classroom	Collaboration	Information
Announcements	64%		9%	27%
Assignments		100%		
Chat	55%		36%	
Discussion	55%	9%	27%	
Email Archive	18%	18%		55%
Forum	40%	20%	30%	
iTunesU		70%		20%
Gradebook		100%		
Messages	70%		10%	20%
Modules		45%		9%
News	45%	9%	9%	36%
Podcast	10%	60%	10%	20%
Polls	18%	45%		
Resources		27%	18%	55%
Schedule		27%	36%	18%
Syllabus		100%		
Test Center		100%		
Web Content		45%		36%
Wiki	9%	27%	9%	27%

Table 18. Percentage of tools sorted into each category

(25%-50% light green; 50-75% medium green; 75-100% dark green)

Overall, the card-sorting task mirrors findings from the interviews—for the most part, staff did not know what most of the tools were as they described what the tools were for and often spoke about the tools in terms of how they would be used in the classroom. Unanimously, every staff member recognized the Resources tool. Note, however, that they did not agree upon what category of tools it fits (Table 18). Beyond resources, no single staff person was able to correctly guess the functions of the entire list of tools. One thing that was noticeable, however, was that staff, upon encountering a card with a tool that sounded like something designed for teaching or learning, were able to discern this purpose but were almost always did not consider alternative uses beyond education. There were a few exceptions to this. Both P07 and P19 considered that Assignments could be used in a non-academic setting to assign each other work, using it as a to-do list.

Staff were still able to create a folksonomy despite their lack of knowledge of the tools. However, the fact that staff did not recognize most of the tools and their functions likely had strong impact on how they engaged the activity of making categories. Because knowledge was vague, staff would sort in almost predictive ways based on whether or not they thought the tool could be used by staff. Almost all of the participants created separate categories for tools that might be used in either the classroom setting or in *both* the classroom and work setting. The only exception to this was P15, who defined all of the tools within their academic context, never mentioning how tools might be applied in a staff context. Overall, it appeared that the most consistently agreed-upon tools and categories were for tools belonging in the classroom category (see Table 18), where staff placed a significant portion of the tools. This category contained many of the tools that we had labeled as 'Management' tools in our earlier chapters. The main exceptions to this was the Podcast tool, which we had labeled as a Content tool; iTunesU, which we conceived of as a Content tool, was split among staff as a classroom and Information tool; and staff were split on the Calendar/Schedule tool as a Classroom/Collaboration tool. Another relatively strong category created by staff was for Communication tools, where participants had agreed with our general Communication category.

Given that CTools has so many tools available and that the training that staff receive comes from 'tried-and-tested' tools that they learn to use with faculty and other staff, it is not surprising that the tool that is most understood is also the one that is most used (and vice versa).

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