Understanding the Roles of Technology in Improvising

by

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Abstract

What are the roles of technology as groups of individuals innovate in work environments they describe as dynamic and unpredictable? In organizational studies, a growing number of researchers are using the framework of improvising to make sense of the processes of innovation and transformation in dynamic environments. The roles of technologies in improvising, however, have not been well articulated in this literature.

My dissertation research addresses two general questions: What core activities constitute improvising? and What are the roles of technology in improvising? I ground my work in two practice-based theoretical frameworks, structuration theory (Giddens, 1984) and an extension of structuration theory, technologies-in-practice (Orlikowski, 2000). Drawing on a growing literature on improvising in organizations and accounts of improvising in African American quiltmaking, I develop a framework describing the activities that constitute improvising and the different kinds, roles, and aspects of technological artifacts in improvising. I then apply this framework to examine the findings of field research I conducted into the work practices of two groups: a team of chemists developing new formulas for personal care products, and a management team developing a funding pitch and prototype web service during the initial stages of their small Internet-based start-up business. I define improvising as a structured process of innovation that involves responding to changing situation(s) with resources at hand by creating a production and adapting it continuously. Overall, I find that two kinds of artifacts are significant to improvising: stable artifacts (i.e., artifacts that do not change significantly during an improvisation) and emergent artifacts (i.e., artifacts that are created and adapted during an improvisation). In addition, I find that there are three general uses of artifacts in improvising: tool (the use of an artifact to build an outcome), component (the use of an artifact as part of an outcome), and product (the use of an artifact as an outcome). Finally, these uses tend to involve two aspects of artifacts: practical (the use of an artifact for its functional capabilities) and symbolic (the use of an artifact for its representational capabilities). Artifacts, particularly emergent artifacts, were an integral part of enacting structures (the use of emergent artifacts as structural referents), assessing continuously (the use of emergent artifacts as products of the improvisation to solicit feedback and examine the progress, or lack thereof, of the collaborative endeavor), creating resourcefully (the re-use of emergent artifacts as components of the final product), and adapting extemporaneously (the use of artifacts as tools to adapt the emerging output).

My research addresses calls for IS researchers to theorize more specifically about the nature and influence of IT artifacts and offers a framework to think about technology not simply as a stable tool that is used for practical purposes, but also as an artifact that can be stable or emergent, it can be used as a product, component, or tool, and it is used for both practical and symbolic aspects.

Thesis Supervisor: Wanda J. Orlikowski
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To my parents, Clif and Carmenza Fonstad.

Chapter 1: Introduction and Motivation

1.1 Introduction

What are the roles of technology as groups of individuals work together in environments they describe as dynamic and unpredictable? With business environments increasingly marked with ambiguity and uncertainty due to greater competition, organizational changes, and increased investment in new information technologies, improvisation as a metaphor for organizing seems increasingly relevant. In the same manner that a group of jazz musicians who have never played together before is able to create fresh music in the moment, or a group of women is able to piece together a practical and aesthetically pleasing quilt from whatever discarded scraps of cloth are available, organizations strive to have teams that are flexible and coordinated enough to develop resourceful solutions in the moment from the unpredictable and dynamic environment.

In organizational studies, a growing number of researchers are using the framework of improvising to make sense of the process of change and innovation in dynamic environments (e.g., Bastien and Hostager, 1988; Brown and Eisenhardt 1997; Ciborra, 1996, 1999; Crossan et al., 1996; Eisenberg, 1990, Garud and Karnøe, 2003; Hatch, 1998, 1999; Kamoche and Cunha, 2001; Lau et al., 1999; McGinn and Keros, 2002; Miner et al., 2001, Moorman and Miner, 1998; Orlikowski, 1996; Weick, 1993, 1998; Zack, 2000). The roles of technologies in such improvising, however, have not been well articulated in this literature.

My dissertation research is exploratory and inductive. I set out to address two general questions: What core activities constitute improvising? and What are the roles of technology in improvising? I define improvising as a specific kind of innovation process that involves creating something in a structured manner, assessing the situation continuously for feedback, potential opportunities and challenges, using whatever resources are available, and adapting them in the moment. I develop a theoretical framework that describes what activities constitute improvising and the possible roles and influences of

technology in improvising. I then apply this framework to examine the findings of field research I conducted on the work practices of two groups: a team of chemists developing new formulas for personal care products, and a management team developing a prototype web service during the initial stages of their small Internet-based startup business. The findings of my research offer a richer understanding of the complex roles of technology in the increasingly important practice of improvising in the workplace. In particular, I highlight how participants create and use emergent artifacts to reflect on the progress (or lack thereof) of the collaborative process, piece together productions, and structure non-routine interaction.

Two general factors simultaneously motivated me to examine the roles of technology in improvising: the emerging findings from a field study I was conducting (on changes in work practices associated with the introduction of a new software tool) and an emerging literature in organizational studies on improvising. In what follows, I first describe how I became interested in technology and improvising based on my experience in the field. I then provide a brief overview of relevant literatures to explain why improvising, as described by several recent articles at the time, was an appropriate framework with which to analyze my data. Finally, I present a brief outline of the rest of my dissertation.

1.2 Motivation

When I started my fieldwork at a large multi-national chemical manufacturing company in Europe, I did not intend to study the roles of technology in improvising. Initially, the structure of my research was simpler: study the work practices of employees at two small businesses before and after the introduction of the same new software tool. The intent was to spend a month at each business, just as the new software tool was being introduced, and then return to each site six months later to see how their work practices had changed. On the Sunday I arrived, the headlines of the local newspapers announced a leaked report that the multi-national chemical company was significantly changing its product portfolio and selling off over a billion dollars

of its businesses. For the employees, the event was as shocking as it had been for automobile workers in United States, during the late 70s and early 80s, when several plants closed down - i.e., the traditionally strong social contract between employees and their employer was suddenly shattered. Thus, when I arrived at the company's principal office complex on Monday, everyone was abuzz with the leaked story. At 10AM, everyone was asked to convene in the cafeteria, where the CEO officially announced and explained the re-organization via broadcast from his offices at corporate headquarters. After the company-wide meeting, employees spent the rest of day discussing the announced changes, speculating on future changes, and accomplishing very little else. Needless to say, over the following days, the news dominated conversations and few were interested in conducting their normal activities or talking about the use of technology.

Eventually, the people I was observing managed to get work done, albeit under new stresses and pressures and I managed to collect a great deal of interesting data. In the following months, however, the corporation began to sell off many of its small businesses and lay off workers in a manner that caused a great deal of stress and distraction to employees. One of the businesses to be sold was the first business I spent time at; it was sold during the six-months I was waiting to return. There was no way for me to re-gain access to the business and so I had to search for another. The second business was fortunately not sold off, but when I returned six months later to see what had changed, I found out that the new software tool had not even been distributed to all relevant employees. Upon discovering this finding, my research sponsors gave up any hopes of finishing the originally intended project, and because they were interested in my dissertation, gave me free reign to do whatever I needed to do to collect valuable data.

By this time, the data analysis from my previous visit had revealed how participants were struggling to work under conditions they considered extremely stressful due to their uncertainty. And although they struggled, they managed to innovate. I had not seen any literature in organization studies or in information

technology discussing the challenges of innovating under such conditions (see following section for a brief review). As I was going through my data, my advisor suggested I investigate the emerging body of research on improvising. Around that time, the journal *Organization Science* had published a special issue on improvising. I found that improvising was a particularly helpful framework to make sense of my data. Consequently, when I returned to the field and realized that my original research plan was not going to work, I decided to turn a misfortune into an opportunity, take advantage of the fact that I would be at the site for a month, observe the working practices of two teams - a formulating team and a sales team, and compare and contrast two different kinds of improvising and uses of technology. From that point on, I decided to focus on understanding the roles of technology in improvising. I maintained this focus throughout my field work, even as I continued to adapt my data collection strategy in response to unanticipated events (in the end, four out of the five businesses had been sold off from the chemical company and I conducted an additional field study at an Internet startup).

It is interesting to note that I was initially drawn to improvising because I believed it would help me understand how participants were coping amidst a sudden shock of uncertainty and ambiguity. As I learned more about improvising, however, I realized that it was a helpful framework to understand how groups of individuals innovate together on an ongoing, day-to-day basis. Improvising was not simply what people did to cope with unexpected events but also a routine way of innovating. This realization underscored the usefulness of the improvising framework to understand the roles of technology in the small groups I was observing.

1.3 Focus on Improvising

There are several literatures that relate to the general question that motivated my dissertation research, "What are the roles of technology as groups of individuals work together in environments they describe as dynamic and unpredictable?" These include, in addition to research on improvising, research

on small groups, decision making, creativity, and innovation. Although each of these fields of research offers several important insights into the question, I found that improvising was the most useful for describing the emergent processes that I observed small groups engage in during my fieldwork. Based on the growing literature on improvising at the time, improvising was a theoretical lens that integrated insights from several other areas of research and approached the phenomenon as an emergent, dynamic, situated process that spanned multiple levels of analysis (e.g., individual, group, organization) over an extended period of time. Even so, one of the greatest challenges of conducting my research was to relate and distinguish improvising from these other areas of research, particularly because these fields are continuously evolving.

In what follows in this section, I provide a very brief overview of some of the relevant literatures on small groups, decision making, creativity, and innovation. In all these fields, there have recently been calls for more research on the *processes* that constitute the phenomena of interest, and in several cases, there have been specific calls for the use of ethnographic methods to collect detailed descriptions of what actors actually do in real work settings when engaged in the subject of interest. Several researchers in the field of innovation have embraced the concept of improvising in response to these calls. The following brief overview explains why improvising was an appropriate framework for examining the roles of technology as groups of individuals work together in dynamic and unpredictable environments (in the following chapter, I describe in greater detail the growing body of literature on improvising in organizations, as well as the small number of articles related more directly to the roles of technology in improvising).

1.3.1 Research on Small Groups

Traditionally, most research on groups and teams subscribed to a positivist paradigm and collected data from tightly controlled laboratory settings (McGrath, Arrow, and Berdahl, 2000). More recently, researchers have noted that these studies, because of their assumptions and methods, rarely examine the dynamic

nature of groups (Weingart, 1997) and have limited applicability to groups in the "real world," since in reality, groups of persons are not isolated from society, group goals and tasks are loosely connected to other external goals and tasks, group membership is not always consistent or present, and people belong to more than one group (McGrath, 1991). These critics have led a new body of research on small groups that examines groups as open, complex, adaptive, and dynamic systems in real-world contexts and uses data collection strategies such as field studies, field experiments, and sample surveys (e.g., Arrow, McGrath, and Berdahl, 2000; Hackman, 1990).

Up until the mid-1990's, before digital communication technologies such as the Internet and mobile technologies became pervasive in the work place, research on the role of technology in groups was dominated by the study of group support systems (GSS) (for overviews, see Broggs, Nunamaker, and Sprague, 1998; Fjermestad and Hiltz, 1999; Fjermestad and Hiltz, 2001; and McGrath and Hollingshead, 1994). McGrath and Hollingshead (1994) classified group support systems (GSS) based on the functional role intended by designers to support group collaboration into four general categories: group information support systems designed to provide group participants access to information (e.g., databases of sales records or production and cost data, archives of documents), group performance support systems designed to improve group effectiveness (e.g., decision support systems that support brainstorming, analyzing, evaluating, organizing, and voting on ideas), internal communication support systems designed to facilitate communication within work groups, and external communication support systems designed to facilitate communication with key actors outside of the group (e.g., tele-conferencing, video walls, synchronous and asynchronous computer conferences). They found that most of the research on GSS had been conducted in laboratory settings (involving ad hoc groups of college students) rather than in organizational settings (involving groups of organizational actors) (McGrath and Hollingshead, 1994).

Since then, there has been a growing number of case and field studies of GSS. A 1991 review of field studies of GSS, for example, found only 10 field studies

that had been published in journals, whereas a decade later, a review of the same subject found 54 field studies (Fjermestad and Hiltz, 2001). Most of the case and field studies of GSS examined the effects of systems designed to support group communication and decision making processes on the effectiveness of group performance as compared to face-to-face methods. None of the case or field studies reported by Fjermestad and Hiltz (2001) examined either groups using GSS for multiple, overlapping tasks (instead, the groups focused on a single task, typically strategic planning or business process reengineering) or groups using GSS for more than 3 weeks.[1]

Research on GSS has focused on the design of hardware and software systems rather than on the interaction between technology and the work practices of a group (Hollingshead and Contractor, 2002; McGrath and Hollingshead, 1994). McGrath and Hollingshead, for example, (1994:2) noted:

> [Much] of the theoretical and empirical research regarding uses of computers for collaborative work in groups has been done from the perspective of technological development. Relatively little of it has been done from a group perspective; that is, it has not taken into account the ways in which group processes intrinsic to groups affect the ways in which groups adopt, adapt, and use technology.

McGrath and Hollingshead (1994) note that an important exception to this has been the work related to adaptive structuration theory (AST), developed by DeSanctis and Poole (1994). Drawing on Giddens' (1984) structuration theory, DeSanctis and Poole focus on the activities of group members to explain both group outcomes and the effects of technology. Technologies are embedded with rules and resources that enable and constrain group members' activities. Group members do not necessarily use technology as designers intended it to be used, but rather, adapt it to their own needs and incorporate it into their own structured interactions.

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[1] Fjermestad and Hiltz (2001:121-2) noted that, of the 54 case and field studies, 21 did not report the number of sessions that the group participated in and "59 percent of the groups spent extensive time on their task: either they had multiple sessions (9), or between 1 and 4 days (7), or between 1 and 3 weeks (6), to complete their tasks."

Also drawing on Giddens' structuration theory, Orlikowski (2000) notes that while AST is a significant contribution to research on technology and group processes (e.g., it has helped focus research on information technology on the activities that constitute the uses of information technology) it is problematic with respect to one of its fundamental aspects: it assumes that structures are *embedded* in technologies. As Orlikowski (2000) notes, this assumption is problematic from the point of view of structuration theory, which posits that structures are virtual and only exist as enacted.

In my dissertation, I too draw on structuration theory (Giddens, 1984) and the work of Orlikowski (2000) to explore the roles of technology in improvising. As a result, my research is an example of the kind of research that McGrath and Hollingshead (1994:117-8) call for in their review of the literature on groups interacting with technology:

> All of the issues discussed [in this review] suggest that the impact of technology in groups depends on a myriad of conditions and factors. How well a given group with a given technology fulfills its intended purposes depends not only on what function(s) the technological system is intended to serve and on other features of that technology but also on attributes of the group and its members, on the type of task the group is doing, on the operating conditions under which they are working, and on the interaction of features of group, task, technology and context.
>
> Furthermore, the impact of such technology on group process and performance operates in dynamic interdependence with key features of the group, task, and situation, and therefore is contingent on the detailed, specific history of the particular group, its task, and its circumstances. Group technology can have an impact on each of several key functions: internal and external communications, information access and processing, consensus generating and conflict resolution, and task performance. Technology can aid or hinder the group in its performance of processes that lie at the core of group existence: its development of norms, its member participation patterns, its members' satisfaction with themselves, their group, and its work. The technology can become an integral part of the meaning of the group as a continuing, dynamic, functional social system. Research should be carried out on those systems that is both more comprehensive and more systematic than what has been done so far, and that explores key issues within a long-term, context-embedded research paradigm [...]

The main message we convey here is that future research needs to be (a) more comprehensive with respect to the variables being studied; (b) more systematic with respect to the study of those variables, and their interactions, in ways that allow comparisons of findings across multiple studies; and (c) more concerned with studying long-term and in-context effects of the use of technology in groups, rather than studying only short-run effects under context-stripped, relatively artificial operating conditions.

1.3.2 Research on Decision Making

The field of decision making has also witnessed the emergence of several streams of research that seek to describe how actors make decisions amid uncertainty. Naturalistic decision making (NDM), dynamic decision making (DDM), and sensemaking offer distinct but complementary perspectives on how individuals behave in complex dynamic environments that differ from the traditional rational decision making models from the fields of psychology and economics.

Based on interviews with participants acting under great time pressure in complex dynamic environments (e.g., fire fighters fighting wild fires in the Rockies), NDM models emphasize the role of narrative for situation assessment and for the evaluation of different courses of action (e.g., Cannon-Bowers, Salas, and Pruitt, 1996; Klein, 1993, 1998; Orasanu and Connolly, 1993). Rather than weigh different choices and their corresponding probabilities concurrently, as traditional decision making theory prescribes, participants work sequentially. Participants assess the situation and run a mental simulation of that assessment to see if it makes enough sense. If it does (or if they have run out of time), then they act. Otherwise they modify their initial assessment or they eventually discard it and develop a new one. Regardless, because the situation is constantly changing, participants are constantly reassessing the situation. Research from the field of DDM, based on computer simulations that are able to control such situational characteristics as the complexity of the decision environment and the delay of feedback loops, reveals that novices have difficulty incorporating feedback loops into their mental models of the situation (e.g., Brehmer, 1990, 1992; Gibson et al., 1997, Paich and Sterman, 1993; Sterman, 1989a, 1989b).

Because DDM compares actual behavior in a lab setting to an ideal heuristic, its focus is on the *limits* of people's decision making. NDM, on the other hand, draws on retrospective accounts and focuses on the *strengths* of people's decision making. Given their different subjects and methods, one needs to be cautious combining the findings of the two approaches. NDM examines the decision making strength of experts in complex dynamic environments while DDM examines the decision making weaknesses of novices in complex dynamic environments. Both NDM and DDM allude to the importance of sensemaking (Weick, 1993, 1995) - i.e., how people make sense of a situation retrospectively. They are both examples of streams of research in the field of decision making that have been critical of traditional decision making models for "ignor[ing] the procedural dimension of behavior and focus[ing] instead on outcomes" (Sterman, 1989a:306) and have sought to correct that by focusing on the process of decision making in their research.

Improvising promises to complement these streams of research. Brown and Eisenhardt (1997:16), for example, consider improvising as a metaphor more helpful than rational problem solving because improvising "captures the flexibility and dynamism of rapid, continuous innovation that occurs in many high-velocity industries." In my dissertation I draw on the insights of DDM and NDM (particularly with regards to continuously assessing the situation) and complement them by developing a framework on improvising that is based on what people do in organizational settings.

1.3.3 Research on Creativity

In recent years, research on creativity has shifted from a predominant focus on individual-level variables (e.g., personality traits, values, expertise, intrinsic versus extrinsic motivation, discovery orientation) to a multi-level analysis including individual-, group-, and organizational- level variables, and from modeling creativity as a set of variables that are linked to creative outcomes to modeling creativity as a set of variables that constitute a process (e.g., Amabile, 1988; Drazin et al., 1999; Ford, 1996; Ford and Gioia, 2000; Glynn, 1996; Woodman

et al., 1993) (detailed reviews of the creativity literature can be found in Drazin et al., 1999; Ford, 1996; and Ford and Gioia, 2000)

Reflecting on his own research history, for example, Csikszentmihalyi (1994, p.135) commented:

> I came to the conclusion that in order to understand creativity one must enlarge the conception of what the process is, moving from an exclusive focus on the individual to a systemic perspective that includes the social and cultural context in which the "creative" person operates. Being trained as a psychologist, I came to this conclusion reluctantly; but now I am convinced that it is not possible to even think about creativity, let alone measure it, without taking into account the parameters of the cultural symbol system (or domain) in which the creative activity takes place, and the social roles and norms (or field) that regulate the given creative activity.

What is considered "creative" by one person may not be considered "creative" by another because each person may either subscribe to a different set of values and norms or use different references for evaluation. Creativity is socially constructed and changes with time. Csikszentmihalyi (1994, p.144) emphasizes: "creativity is not an attribute of individuals but of social systems making judgments about individuals." Csikszentmihalyi (1994) proposes a "systematic view of creativity," made up of three subsystems: the person, the domain ("any symbolic system that has a set of rules for representing thought and action"), and the field ("that part of the social system which has the power to determine the structure of the domain" and consequently, determine whether or not, and if so, how much, a domain may change). These three subsystems are all inter-related (p.145): "the domain transmits information to the person, the person produced a variation, which may or may not be selected by the field, and the field in turn will pass the selected variation to the domain."

Similarly, Drazin et al. (1999, p.287) consider creativity as a sensemaking process:

> In contrast to existing models, we define creativity as the *process* of engagement in creative acts, regardless of whether the resultant outcomes are novel, useful, or creative. This process orientation focuses our inquiry on how individuals attempt to orient themselves to, and take creative action in situations or events that are complex, ambiguous, and ill defined. In

other words, this is an issue of how individuals engage in sensemaking in organizations.

From the perspective of those examining creativity as a process, improvising, as I have defined it, involves creative actions and, consequently, is a type of creative process. In addition, my research approaches the subject of IT and creativity using ethnographic methods and thus complements research on the same subject conducted using other methods.

1.3.4 Research on Innovation

Research on innovation is closely related to (and often overlaps with) research on creativity, particularly when either is focused on their respective phenomenon as a process. Several researchers, for example, treat creativity as a subset of activities in the process of innovation (e.g., Amabile, 1988; Ford, 1996). Ford (1996) argues that the creative process involves generating novel ideas, whereas the innovation process also involves implementing those ideas successfully. King (1995: 83-4) proposes three differences between creativity and innovation: (i) the audience judging the novelty of the product (creativity requires the product to be novel to the creator, whereas innovation requires the product to be novel to its organizational setting), (ii) where the activity takes place (creativity is more of an individual activity influenced by social and cultural factors, whereas innovation is more of a group activity influenced by social and cultural factors), and (iii) the type of process (creativity is more of a cognitive process, whereas innovation is more of a social process). In my dissertation work, I do not subscribe to the distinctions between creativity and innovation proposed by King (1995). I do not limit my data collection to examples where the outcome was deemed "novel" by a particular audience (i.e., "successful examples"), nor do I attempt to collect data on the cognitive processes. I examine the situated practices that constitute processes in which productions are pieced together. My findings highlight the difficulty in distinguishing between generating and implementing ideas in an organizational setting (e.g., they show that organizational actors are continuously creating,

adapting, and building on ideas in an attempt to implement a production). I consider improvising to be a process of innovation that involves creative activities.

Of all the fields of research related to the motivating question, the field of innovation is the only one to explicitly embrace improvising. In new product development, improvising is considered an essential practice for developing new products quickly (Brown and Eisenhardt 1997, Eisenhardt and Tabrizi 1995), an important type of learning (Miner et al. 2001), and a valuable model for new product development in general (Kamoche and Cunha 2001, Miner et al. 2001). In the context of new product development, improvising is an alternative to models that assume that the process of innovation is predictable and, consequently, can be planned out in detail and optimized; instead it models the process of innovation as an iterative process that occurs in unpredictable environments (Brown and Eisenhardt 1997, Eisenhardt and Tabrizi 1995, Kamoche and Cunha 2001, Miner et al 2001). Brown and Eisenhardt (1997) even argue that improvising is a key strategy for continuously changing organizations engaged in multiple-product innovation:

> Successful multiple-product innovation involves improvisation of current projects through limited structures and real-time communication, experimentation into the future with a wide variety of low-cost probes, and rhythmically choreographed transitions.

In the following chapter, I explore in greater detail the literature on improvising from research on innovation. There have only been a handful of studies that draw on field study data to empirically examine improvising in organizations (Brown and Eisenhardt 1997, Miner et al, 2001, Orlikowski 1996, Orlikowski and Hofman 1997) and of these, the majority are in new product development (the exception being Orlikowski 1996 and Orlikowski and Hofman 1997 which look at IT implementation). My dissertation expands the variety of organizational settings in which improvising has been examined by exploring improvising in two very different organizational settings (a group of chemists developing new recipes for personal care products, and the management team of

an Internet start-up). My research complements this literature by developing a practice-based framework that articulates the key activities that constitute improvising and shows how, for example, emergent artifacts are a critical type of technology that can be used resourcefully for assessing the situation (e.g., the use of "low-cost probes" to explore new markets) and structuring non-routine interaction.

1.3.5 Summary

This brief overview of various areas of research shows that the research on improvising in the field of innovation is beginning to follow the growing trend of research in organization studies that draws on detailed descriptions of what actors do in workplaces to examine emergent dynamic processes in organizations. Another recent example of this trend is a study by Wrzesniewski and Dutton (2001) examining the work practices of engineers, hospital cleaners, nurses, and restaurant kitchen employees. They found that employees engage in "job crafting," which, in their words, "is a creative and improvised process that captures how individuals locally adapt their jobs in ways that create and sustain a viable definition of the work they do and who they are at work" (Wrzesniewski and Dutton 2001, p.180). From the perspective of job crafting, improvising is a valuable and empowering skill that many employees in service industries engage in to respond to the demands of the moment. Wrzesniewski and Dutton's (2001) work is a good example of the kind of research that Barley and Kunda (2001) argue is needed to make sense of recent changes in work. In their call for modes of scientific inquiry based on "close empirical observation of the phenomena" of interest, Barley and Kunda (2001: 90) argue:

> The field of organization studies currently confronts a significant challenge: discovering, analyzing, and perhaps even shaping, the organizational implications from an industrial to a postindustrial economy [...] we contend that organization theory's effort to make sense of postbureaucratic organizing is hampered by the absence of what once served as its empirical foundation: detailed studies of work. The dearth of data on what people actually do - the skills, knowledge, and practices that comprise their routine work - leaves us with increasingly anachronistic theories and outdated

images of work and how it is organized.

In the field of information systems, there have been similar calls for the use of ethnographic methods to collect "thick descriptions" of situated work practices in order to study phenomena such as innovation. In a recent issue of MISQ, for example, one of the senior editors, Ritu Agarwal, remarked on the need to better understand the process of IT-based innovation:

> In my opinion, an enduring question for IS researchers and a fertile area for continued attention and research emphasis is the phenomenon of IT innovation. In particular, I believe we need to better understand how organizations facilitate and promote innovation and creativity in the use and application of IT to achieve strategic success as well as operational excellence [...]
>
> What I do wish to emphasize is that richer, more rigorous, and field-based research in these areas is likely to have substantial impact both on the advancement of theory development in our discipline as well as on the practice of IT management.

In addition, in information systems, there has been a call to develop research on the IT artifact (Iacono and Orlikowski, 2001). In their review of recent articles in the journal *Information Systems Research*, Iacono and Orlikowski (2001) observe that ironically, most research on IT in organizations has not considered the role of the IT artifact in its research. They argue for the importance of doing so, both as an interesting area of inquiry and to help distinguish and highlight the value of the IT discipline from other disciplines (e.g., computer science, economics, organizational studies).

In summary, I found improvising to be an appropriate framework to make sense of my field data. Even so, as I describe in the following chapter, there is very little research on improvising that examines the practices that constitute the process of improvising and even less research, in general, that addresses the roles of technological artifacts in improvising. Thus I set out to address both issues in my dissertation research.

1.4 Outline of the Dissertation

The remainder of this dissertation is organized as follows. In **Chapter Two**, I examine the diverse and growing literature on improvising in organizational studies and find that few articles examine the roles of technology in improvising. To begin to make up for the lack of research on this subject, I present an overview of the roles of technological artifacts in jazz, the primary source from which the original organizational studies articles developed their definitions of improvising. Although accounts of uses of technology in jazz offer several important insights into the roles of technology in improvising (e.g., the role of a technological artifact is strongly dependent on how the person uses it), they are limited relative to possible uses of technological artifacts. The reliance on accounts of improvising in jazz, rather than a broader range of disciplines, may explain why there has been so little exploration of the roles of technology in improvising in the organizational studies literature.

In **Chapter Three**, I develop my framework on improvising by drawing on the tradition of improvising in African American quiltmaking. In this framework, improvising consists of enacting structures as participants assess continuously, create resourcefully, and adapt extemporaneously. I introduce the notion of structural referents - mental and tangible "guide posts" (e.g., a quilting pattern) that actors draw on to guide their activities as they enact structures - to describe degrees of improvising. My framework also expands the view of technology from technology as simply being a stable tool that is used for its practical capabilities to technology as emergent, dynamic, and involved in multiple ways in the improvising (e.g., as product, component, and tool) for both practical and symbolic purposes.

In **Chapter Four**, I describe my empirical approach to collecting and analyzing the data from my two ethnographic field studies. I describe my choice of research sites, gaining access to them, and collecting data. I also describe how I analyzed my data in light of my research questions and my theoretical framework.

In **Chapter Five**, I present the findings from my field study of a formulating team at Blockasun, a division of a multi-national chemical company. I present a

descriptive overview of the setting and then describe in detail the activities that constitute the process of developing a new formula. I explore two representative cases of how formulas were created. I focus on how, in both cases, the formula itself evolved from numerous iterations between adapting a formula and testing it (the "macro-level" process). I then describe the routine practices that each iteration involved (the "micro-level" process). The overall process of creating a formula was an example of improvising and the formulating team at Blockasun was an example of a team that managed to introduce new structures to formalize improvising without stifling the creativity of the process. Of particular interest, emergent artifacts were an essential part of the routines critical for continuously assessing the situation and informing extemporaneous adaptation.

In **Chapter Six**, I present the findings from my field study of a non-profit Internet-based startup. Participants were engaged in multiple urgent interconnected projects. I first describe in detail the work practices that constituted the two most significant projects: developing a funding pitch and developing a web prototype (which was used to acquire their first client) and then examine both as examples of improvising. In the process, I illustrate several challenges associated with a group of individuals improvising together for the first time without any shared guidelines or rules to structure their collaboration. Of particular interest, emergent artifacts served as structural referents to guide participants through an unstructured process. Emergent artifacts, however, were not enough to ensure collaboration. For that, team members needed to share a basic sense of group identity - an aspect of collaboration that was unanticipated by all participants and proved very difficult to achieve.

In **Chapter Seven**, I compare the findings from my two field studies in the light of my framework to define more precisely degrees of improvising, introduce the distinction between routine and non-routine improvising, and then explore in detail the integral role of emergent artifacts in improvising the identity of the collaborative endeavor ("project identity"). In non-routine improvising, the structures that guide the group effort must themselves be

improvised and in the case of the startup, the process of improvising a project identity became contentious. The challenges of developing consensus around a project identity highlighted the salience of the symbolic aspects of emergent artifacts and their use as components to piece together a project identity. Together, my findings from both field studies highlight the use of emergent artifacts to bridge occupational and temporal boundaries, elicit, represent, and piece together new knowledge, assess progress (or lack thereof), and structure the ongoing process.

Finally, in **Chapter Eight**, I examine the contributions and implications of my dissertation work to both academics and practitioners. My findings contribute to fields of research in organization studies related to improvising (e.g., research on small groups, decision making, creativity, and innovation) by providing a practice-based framework of improvising that describes what people actually do when they improvise and, more specifically, highlights "creating resourcefully" and "adapting extemporaneously" as interrelated sets of activities that are fundamental to what small groups do as they innovate in organizational settings. My findings also contribute to research on information systems (IS). I address calls from the IS community for researchers to theorize more specifically about the nature and influence of IT artifacts (Benbasat and Zmud, 2003; Orlikowski and Iacono, 2001) and offer a framework to think about technology not simply as a stable tool that is used for practical purposes, but also as an artifact that can be stable or emergent, that can be used as a product, component, or tool, and that is used for both practical and symbolic aspects.

Chapter 2: Relevant Literatures

2.1 Introduction

To explore the two questions that guide my dissertation (i.e., What is improvising? and What are the roles of technology in improvising?), I first examined the organizational literature on improvising. I found a diverse and growing literature on improvising in organizations, although few articles try to integrate the literature or examine the roles of technology in improvising.

My research consists of a detailed conceptualization of what it means to improvise and an identification of the roles of technology in that process. As a result, it is situated at the intersection of three broad areas of research, depicted as circles in Figure 2.1: research on improvising, which includes improvising in the arts and in organizations; research on organizations, which includes research on strategy development, innovation, creativity, small groups, and decision-making; and research on technology, which includes research on information systems. In developing my theoretical frameworks, I drew more specifically from the areas of research where the three broader areas of research overlapped - specifically, research on improvising in organizations, technology in organizations, and technology in improvising.

With regards to research on technology in organizations, I was especially interested literature that examined the role of IT from a practice perspective, to better understand what people actually do with technology as they innovate with it (e.g., Barley, 1986; Bijker, 1987; DeSanctis and Poole, 1994; Markus, 1994; Orlikowski, 2000). As I mentioned earlier, there is very little written on the roles of technology in improvising. I define it as any material artifacts involved in the process of improvising. Although most of the research on improvising does not explicitly theorize about the role of technology in improvising, a few researchers note the importance of artifacts (e.g., Miner et al., 2000). To begin to make up for the dearth of research on technology and improvising, I examined literature on improvising in jazz used by those writing on improvising in organizations, to

examine the roles of technology in jazz improvising.

In this chapter, I first present an overview of what seem to be the most significant aspects of improvising, as discussed in organizational literature. I then examine more closely the few articles on the roles of technology in improvising. I complement this examination with a discussion of the roles of technology in jazz improvising.

2.2 Several Different Takes on the Same Phenomenon: Recent Literature on Organizational Improvisation

2.2.1 Overview

In organizational studies, a growing number of researchers are using the framework of improvising to make sense of the process of change and innovation in dynamic environments (e.g., Bastien and Hostager, 1988; Brown and Eisenhardt, 1997; Ciborra, 1996, 1999; Crossan et al., 1996; Eisenberg, 1990; Hatch, 1998, 1999; Kamoche and Cunha, 2001; Lau et al., 1999; Miner et al., 2001; Moorman and Miner, 1998; Orlikowski, 1996; Weick, 1993, 1998; Zack, 2000). Several researchers draw predominantly on improvising as it is done in jazz and theater to theorize about improvising in organizations (e.g., Bastien and Hostager, 1988; Crossan et al., 1996; Kamoche and Cunha, 2001; Weick, 1993b, 1998). Those drawing from examples of improvising outside of the artistic disciplines of theater and jazz have examined improvising during emergency situations such being caught in a firestorm (Weick, 1993a) and coping with a failed navigational system (Hutchins, 1991), improvising as a process of change associated with the introduction of new information technology (Orlikowski, 1996), improvising as a key micro-process in negotiating (McGinn and Keros, 2002) and improvising in the process of innovation, particularly in new product development (e.g., Brown and Eisenhardt, 1997; Eisenhardt and Tabrizi, 1995; Kamoche and Cunha, 2001; Miner et al., 2001; Moorman and Miner, 1998).

Just as witnesses describe the same phenomena differently, organization researchers have overlapping but different interpretations of improvisation,

each focusing on a different set of aspects that is particularly interesting to them or best captures what they view as defining improvising or as essential to improvising well. When taken as a whole, the literature on improvising in organizations examines several different aspects of improvising, including structures in improvising (e.g., Bastien and Hostager, 1998; Eisenberg, 1990; Hatch, 1999; Kamoche and Cunha, 2001; Miner et al., 2001; Weick, 1999), novel productions (e.g., Miner at al., 2001; Crossan et al., 2000), degrees of improvising (e.g., Zack, 2000; Moorman and Miner, 1998; Weick, 1998), transcendence of experience (e.g., Eisenberg, 1990), group and individual characteristics (Barrett, 1998; Pasmore, 1998; Mirvis, 1998), and expertise (e.g., Barrett, 1998; Pasmore, 1998; Mirvis, 1998).

After presenting a few definitions of improvising, I discuss these aspects of improvising. I conclude the section with several questions that emerge from examining the organizational literature on improvising.

2.2.2 Definitions of Improvising

Although several articles examine improvising in organizations, not all of them offer explicit definitions of the practice. Table 1 (following page) is a list of definitions of improvisation collected from the articles I reviewed on improvising in organizations.[1] Several of these definitions emphasize that improvising is a creative process where something (e.g., ideas, productions, outcomes, achievements) is created (e.g., composed, executed, invented, reworked, adapted) in the moment (Bastien and Hostager 1988, Brown and Eisenhardt 1997, Eisenberg 1990, Kamoche and Cunha 2001, Miner et al. 2001, Orlikowski and Hofman 1997, Vera and Crossan 2001, Weick 1998).

[1] A more comprehensive set of definitions, including definitions from the perspectives of theater, music, and education, can be found in Cunha, Cunha, and Kamoche 2000 and Moorman and Miner 1998.

Table 1: Examples of Definitions of Improvising

Definition	Author(s)
Jazz is a process of musical innovation in which a group of performers collectively invents new musical ideas by incorporating them into their performance and by using them as bases for further musical inventions.	Bastien and Hostager 1988: 586
Improvising is an organizing strategy ... in the context of product innovation, it means creating a product while simultaneously adapting to changing markets and technologies ... [improvisation] involves (1) performers intensively communicating in real time with one another, yet (2) doing so within a structure of a few, very specific rules (e.g., order of soloing, valid chord sequences). The limited structure provides the overarching framework without which there are too many degrees of freedom. The communication allows the players to coordinate and mutually adjust within that framework.	Brown and Eisenhardt 1997: 15
Improvisation is situated performance where thinking and action seem to occur simultaneously and on the spur of the moment. It is purposeful human behavior which seems to be ruled at the same time by chance, intuition, competence and outright design. In improvising, features of a situation are "suddenly" framed and combined by the actor, so that they become resources at hand for invention.	Ciborra 1996: 369
Jamming experiences [are] instances of fluid behavioral coordination that occur without detailed knowledge of personality [...] highly rule-governed, structured activities in which little or no personal information is exchanged, yet important goals may be accomplished, and a strong, ecstatic bond is formed among participants. Jamming has four essential characteristics. Jamming (a) is transcendent, (b) embraces diversity, (c) is fragile, and (d) can be risky.	Eisenberg 1990: 146
A working definition of improvisation may be taken from jazz music, where it entails composing and performing contemporaneously. Within organizations, it can be described as the conception of action as it unfolds - acting without the benefit of elaborate prior planning.	Kamoche and Cunha 2001: 735

Table 1: Examples of Definitions of Improvising (continued)

We define an improvisation in the context of a negotiation as a coherent sequence of relational, informational, and procedural actions and responses created, chosen, and carried out by the parties during the social interaction. A coherent sequence has an identifiable logic of exchange that can be located within the interaction. "Relational, informational, and procedural acts" reflects the complexity of the negotiation task and the various levels at which sensemaking takes place. "Created, chosen, and carried out by the parties" implies that the parties work out the logic of exchange in accord with one another, based on previous understandings and new ideas that emerge as the negotiation evolves. The relational, procedural, and informational acts created and chosen by the parties simultaneously reflect and help define the rules of interaction.	McGinn and Keros, 2002: 445
Improvisation is the deliberate and substantive fusion of the design and execution of a novel production	Miner el at. 2001: 314
Improvisation is the degree to which composition and execution converge in time.	Moorman and Miner 1998: 698
[E]nacting an ongoing series of local innovations that embellish the original structure, respond to spontaneous departures and unexpected outcomes, and iterate and build on each other over time	Orlikowski and Hofman 1997: 13
Improvisation is the creative and spontaneous process of attempting to achieve an objective in a new way.	Vera and Crossan 2001: 5
'Improvisation involves reworking precomposed material and designs in relation to unanticipated ideas conceived, shaped and transformed under the special conditions of performance, thereby adding unique features to every creation' (Berliner 1994, p. 241)	Weick 1998: 544

Articles with no explicit definitions of improvising include Barrett 1998, Crossan et al. 1996, Crossan 1998, Eisenhardt and Tabrizi 1995, Hatch 1999, Orlikowski 1996, Weick 1993a, Weick 1993b, and Zack 2000.

For example, in the introductory essay to the special issue of *Organization Science* on jazz improvising and organizing, Weick (1998: 544) offers a definition of improvisation that serves to guide his essay and presumably that of the others in the issue (it is the only explicit definition offered in the issue):

> I have found it hard to improve on the following definition, which is the one that guides this essay: 'Improvisation involves reworking precomposed material and designs in relation to unanticipated ideas conceived, shaped and transformed under the special conditions of performance, thereby adding unique features to every creation' (Berliner 1994, p. 241)

Several researchers consider the temporal dimension of improvising, specifically spontaneity, a defining aspect of improvising (e.g., Kamoche and Cunha, 2001; Miner et al., 2001; Moorman and Miner, 1998; Vera and Crossan, 2001). Miner et al. (2001: 314), for example, define improvisation as "the deliberate and substantive fusion of the design and execution of a novel production." This definition emphasizes that improvising involves producing something new and that during this "process of innovation," design and execution occur simultaneously. Similarly, as part of their comprehensive analysis of improvising, Vera and Crossan (2001: 5) define improvisation as "the creative and spontaneous process of attempting to achieve an objective in a new way."

Although not part of most definitions (with the exception of Orlikowski, 1996 and Hofman, 1997), and closely associated with the notion of creating in the moment, unpredictability is often considered integral to improvising. Improvisers surrender control to the unpredictability of the situation (Eisenberg, 1990: 156); they embrace it (Weick, 1993: 639). As Hatch (1998: 80) argues: "Incorporating the unexpected is essential to great jazz improvisations."

As a whole, these definitions suggest that improvising is a creative process, where the improvisation emerges unpredictably from the situation.

2.2.3 Structures in improvising

Contrary to popular notions of improvising as simply "winging-it" or "off the cuff," improvising is a structured process. The research on improvising includes a variety of discussions on structures in improvising (e.g., Bastien and Hostager, 1988; Brown and Eisenhardt, 1997; Crossan, 1998; Eisenberg, 1990; Hatch, 1999; Kamoche and Cunha, 2001; Miner et al., 2001; Weick, 1999). Some discussions focus on the forms and functions of structures in improvising (e.g.,

Bastien and Hostager, 1988; Crossan, 1998; Miner at al., 2001; Peplowski, 1998) while others also emphasize that structures in improvising are distinct from other kinds of structures (e.g., Eisenberg, 1990; Brown and Eisenhardt, 1997; Kamoche and Cunha, 2001). Finally, others contend that structures in improvising are distinct because of how they are used, rather than because of their form, although there are structural forms that are particularly enabling of improvising (e.g., Eisenberg, 1990; Hatch, 1999). In what follows, I discuss examples from each group.

In their seminal work on improvising, Bastien and Hostager (1988) focus on the forms and roles of structures in improvising. They observe two sets of "structural conventions" - "social practices" and "musical structures" - that enable a group of professional jazz musicians who have no previous experience playing together to improvise successfully. Social practices include behavioral norms or shared expectations about appropriate behavior (e.g., the role of the nominal leader, the role of the soloist) and communicative codes (e.g., shared verbal and physical syntax). Musical structures include conventions for generating music (e.g, rules for proper chords, chordal relationships, and chordal progressions) and musical templates (e.g., song, chorus, riff). These structures are non-deterministic, open to variation, and are both enabling and constraining (Bastien and Hostager 1988, p.586):

> These structures served to constrain the turbulence of the jazz process by specifying particular ways of inventing and coordinating musical ideas [...] Paradoxically, these structures enable collective musical innovation by constraining the range of musical and behavioral choices available to the players.

Miner et al. (2001) similarly note that improvisations tend to have a "referent" that structures the improvising. A referent "provides an implicit starting place and continuing touchstone for the improvisational activity [...] and both infuses meaning into improvisational action and provides a constraint within which the novel activity unfolds" (Miner et al. 2001, p.316). Examples of referents include behavioral and interpretive routines, preexisting artifacts, and factors particular to the situation at hand (e.g., unexpected problems, temporal

gaps, unanticipated opportunities). Although the concept of referents covers a wider collection of structuring factors than the social conventions described by Bastien and Hostager (1998), the central idea in both cases is that these factors enable improvising by limiting choices, defining relationships and coordinating creative activities.

Another practical value of structures is that they enable both improvisers and audience to assess the performance both as it emerges and after it is complete. In theater improvising, for example, Crossan (1998: 595) notes:

> Perhaps the most important factor [in determining the "quality" of improvisational activity] is the structure in which the improvisation takes place, since the structure imposes the grammar through which the actions are interpreted [...] And the structure is not uniform across the audience. Everyone uses a different frame of reference to interpret the actions.

Structures such as language and storylines enable audience members and improvisers to assess the performance, although their assessments may differ, given their different frames of interpretation. Peplowski (1998: 560) has also noted that structures are necessary for musicians to communicate with the audience; structures are "what makes [an improvisation] music instead of noise."

In addition to describing structures in improvising and their roles, several researchers emphasize that structures used in improvising are distinct from other structures, particularly in a sense of being "minimal" (e.g., Barrett, 1998; Brown and Eisenhardt, 1997; Eisenberg, 1990; Kamoche and Cunha, 2001). For example, Eisenberg (1990: 154) claims that the ability to improvise in jazz ("jamming") is enabled by structures similar to the formal and informal roles and rules of games:

> This improvisational freedom is only possible against a well-defined (and often relatively simple) backdrop of rules and roles. In this sense, jamming is a kind of minimalist's view of organizing, of making do with minimal commonalities and elaborating simple structures in complex ways. Relying on the basic rule and role structure, each player sets up interesting possibilities for the others and keeps the action going.

Structures in improvising enable individuals to interact without having to deal extensively with each other's personalities. Again, Eisenberg (1990: 154) elaborates:

> [A] lack of emphasis on individual personalities frees people to engage unself-consciously in coordinated action. Precisely because they are highly structured and place few requirements on coping with individual personalities, jamming experiences permit a sense of community that is difficult to achieve through more disclosive interaction

Structures in improvising provide the minimum commonality needed for a diverse group of participants to coordinate their individual creative actions and negotiate shared meanings, and enable a sense of community without the need for reach full consensus; they are a common template around which participants can manage "a dialectic between autonomy and interdependence" (Eisenberg 1990: 145).

Others have built on the work of Bastien and Hostager (1998) and developed the notion of "minimal structures" (e.g., Barrett, 1998; Kamoche and Cunha, 2001). Jazz improvising, they contend, is "loosely structured" around "minimal structures that allow maximum flexibility" (Barrett, 1998: 611). In the context of new product development, Kamoche and Cunha (2001) argue that two sets of structures - "social structures" and "technical structures" - are essential to improvising new products successfully.[2] Both are examples of "minimal structures" - structures that are "largely implicit and tacit", provide specific guidelines and a high degree of flexibility, and serve as templates upon which improvisation can take place (Kamoche and Cunha, 2001: 748-50).

Similarly, Brown and Eisenhardt (1997: 28-9) argue that improvising in successful multiple-product innovation is enabled by "semistructures" which

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[2] Social structures include behavioral norms (e.g., team objectives and expectations regarding each other's work ethic), cross-functional communication (e.g., networking), intense interaction to develop "partnering" (the collaborative spirit that develops over time between individuals committed to working together), trust, leadership, and a culture supportive of risk-taking. Technical structures include specification of quality and performance standards, new product development templates, individual competence and skill, "extensive knowledge of available technology and how it leads to collective action," experimenting with new "tools, methods and technologies," and constant systematic remodeling.

sufficiently structure the process to avoid chaos but not so much that change cannot occur:

> [T]he effective management of current projects lay between very structured, mechanistic organization, in which bureaucratic procedures were tightly determined, and very unstructured, organic organization, in which there were few, if any, rules, responsibilities, or procedures. For the successful portfolios, some responsibilities, meetings, and priorities were set, but the actual design process was almost completely unfettered [...] Although speculative, our underlying argument is that change readily occurs because semistructures are sufficiently rigid so that change can be organized to happen, but not so rigid that it cannot occur. Too little structure makes it difficult to coordinate change. Too much structure makes it hard to move.

Brown and Eisenhardt (1997) found that prescribing features such as responsibilities, project priorities and time intervals between projects, while leaving the design process unstructured, seemed to be the right balance of order, between very rigid and completely unstructured processes (Brown and Eisenhardt, 1997).

In contrast to those who focus on the constraining and enabling nature of structures, Hatch (1999) emphasizes that what is significant to improvising is how they are used. In general, it seems the principal intent of those who focus on "minimal strutures" and "semistructures" is to emphasize that structures in improvising provide enough constraints to coordinate and enable creativity, but not so many as to stifle it.

Hatch (1999: 82) argues that structure is not a state or outcome but a set of practices or processes, and consequently to understand the role of structure in improvising, one must move beyond the question "what structure should/do we use" and focus instead on the question "how should/do we use our structure?" Jazz "is distinguished from other genres of music (e.g., classical, rock) in the improvisational use it makes of structure" (Hatch, 1999: 78); in improvising, musicians do not simply play structures but are playful with structures (Hatch, 1999: 84-5):

> Jazz musicians do not simply use structure to organize themselves, they play their structures implicitly by explicitly *not* playing them and in doing so *play with* their structures in the dual senses of interacting with structure and

> altering it via improvisation [...] structure is not sacred to the jazz musician, it serves its own alteration [...] for the jazz musician, structure is interpretively open and often ambiguous, which means that, on any particular occasion, a tune can be taken in multiple directions; the directions in which it will be taken are only decided in the moment of playing and will be redetermined each time that tune is played.

A structure's form is significant because it can serve to guide how participants play with structures. For example, structures in jazz tend to have ambiguous "empty spaces" (Hatch, 1998). Their ambiguity serves an important dual role: it supports "multiple and diverse contributions" and provides "enough unity to support the interpretation of the varied contributions of several players as a single tune" (Hatch, 1999: 87). As Hatch (1998) emphasizes, though, these functions are not inherent in the structures, but rather, emerge from how the structures are played with.

A final aspect of improvisational structures that several authors focus on, and one related to the notions of "semistructures" and of playing with structures, is their implicitness and tacitness (e.g., Barrett, 1998; Hatch, 1999; Kamoche and Cunha, 2001). Hatch (1999: 82-3), for example, contends:

> In the most general terms, instead of trying to find ways to express their structures explicitly, jazz musicians constantly make structure implicit and discover what they are able to express - it is a structure that supports, but does not specify [...] You should understand that jazz musicians do not need or even want to play their structures explicitly [...] [They] do not accept their structures as given [and instead] interpret their structures as loosely as possible

The implicit and tacit aspect of structures in improvising also seems to be an important factor in making structures, such as behavioral norms, "minimal" (e.g., Barrett, 1998; Kamoche and Cunha, 2001). For example, Kamoche and Cunha (2001: 748) note: "The definitive aspect of these structures is that they are largely implicit and tacit." And, when referring to the rules "that govern musical progressions," Barrett (1998: 606) contends:

> Once integrated these rules become tacit and amenable to complex variation and transformation, much like learning the rules of grammar and syntax as one learns to speak.

In these cases, it is not clear whether "minimal" refers to the amount of conscious effort required to enact structure or to the structural form itself. Regardless, the implicitness and tacitness of structures seems to help make them "minimal" and enable improvisers to play with them.

In summary, the literature on structures in improvising includes a range of insights. Some pertain to the form and function of structures, some to characteristics of structures that make them unique to improvising, and some to the use of structures that make them unique to improvising. In examples of successful improvising, the form of structures is such that they provide a balance between constraining and enabling creativity, they serve as templates for coordination and action, and they define roles and goals clearly.

2.2.4 Process of Improvising

In this section I present two aspects that stand out from the organizational literature related to what happens in the process of improvising: novel productions and degrees of improvising.

Novel Productions

Improvising involves creating something new from unpredictable situations; one creates an improvisation (e.g., Miner et al., 2001; Vera and Crossan, 2001; Weick 1993). In jazz, that something may include a new piece of music; in theater, an original skit; in new product development, a prototype. Novel achievements are a defining aspect of Vera and Crossan's (2001: 3) definition of improvising ("Improvisation is the creative and spontaneous process of attempting to achieve an objective in a new way"). There may be several things created during improvising that constitute the improvisation. Miner et al (2001), looking at improvising in new product development, refer to these creations as "productions" and observe three general kinds: behavioral productions (e.g., new ways of doings things), artifactual productions (e.g., new products, new product features), and interpretive productions (e.g., new ways of

seeing things). Thus, novel productions are both tangible (e.g., artifactual productions) and intangible (e.g., conceptual productions).

As I discuss in greater detail in Chapter 3, Weick (1993) argues that improvising involves bricolage. A bricoleur, according to the anthropologist Levis-Strauss (1996: 18), is one who makes do with whatever is at hand to accomplish whatever task one faces. Similarly, good improvisers are continuously assessing the situation, actively listening to fellow improvisers and the reactions of audience members, as well as looking out for any unexpected circumstances that could be integrated into the improvisation (Crossan, 1998). From this perspective, the productions that emerge from the process of improvising are an assemblage of material and social elements drawn from the situation(s) within which the improvising takes place (Barrett, 1998; Weick, 1993).

In the spirit of bricolage, results traditionally considered "mistakes" are incorporated into the subsequent performance and turned into non-mistakes (Barrett, 1998; Peplowski, 1998). Peplowski (1998: 559-60), for example, notes:

> [I]n jazz music, the point is that you can take any bad situation and make it into a good situation. And as Dizzy Gillespie once said, 'there's no such thing as a bad note, it's where you take the note,' because you're only a half step away from salvation at any point.

"Mistakes" can become both opportunities for innovation, as well as sources of learning (Peplowski, 1998; Barrett, 1998).

Degrees of Improvising

The productions that constitute an improvisation reflect the degree of improvising that took place (Moorman and Miner, 1998; Weick, 1998; Zack, 2000). Several researchers have noted that one does not simply improvise or not, but rather, that there are degrees or types of improvising (Moorman and Miner, 1998; Weick, 1998; Zack 2000). Weick (1996, 1998) suggests that there are four different degrees of improvisation, based on "increased demand on imagination and concentration: " interpretation, embellishment, variation, and

improvisation. Drawing on Leo Konitz in Berliner (1994), Weick (1998: 544) explains:

> 'Interpretation' occurs when people take minor liberties with a melody as when they choose novel accents or dynamics while performing it basically as written. 'Embellishment' involves greater use of imagination, this time with whole phrases in the original being anticipated or delayed beyond their usual placements. The melody is rephrased but recognizable. 'Variation' occurs when clusters of notes not in the original melody are inserted, but their relationship to that original melody is made clear. 'Improvisation' on a melody means 'transforming the melody into patterns bearing little or no resemblance to the original model or using models altogether alternative to the melody as a basis for inventing new phrases' (Berliner 1994, p.70). To improvise, therefore is to engage in more than paraphrase or ornamentation or modification.

It is not clear, however, whether Weick considers the first three degrees to be improvisation, or whether he considers them something less than improvising (e.g., creativity, innovation, etc.) and only counts the fourth as "true" improvisation.

Responding to Weick's proposed spectrum of improvising, Zack (2000) argues that there is an additional level of improvising - what he describes as "*meta*improvising" where, rather than simply playing off the basic structure of the performance (e.g., the original standard, the melody, etc.), the basic structure itself is being improvised. Consequently, Zack (2000: .230) contends "each improviser must determine to what extent they want to improvise - *within* those forms, *with* those forms, or *outside* those forms." Improvising within forms (e.g., classical music) is the most minimal kind of improvising; improvising with forms (e.g., bebop and other standard jazz improvisation, where harmony and basic tune structure are modified) involves more improvisation, and improvising outside forms (e.g., postbop, where structure and content are created) is the most extensive ("maximal" or meta-improvising) (Zack 2000: 232).

Moorman and Miner (1998) present two dimensions along which an activity is more or less improvisational. The first dimension, which draws on jazz and Weick (1998), is the degree to which the performance departs from "the original referent" (Morrman and Miner, 1998: 703). The second dimension is temporal

(Moorman and Miner, 1998: 702): "the more improvisational an act, the narrower the time gap between composing and performing, designing and producing, or conceptualizing and implementing."

2.2.5 Participants in Improvising

Several researchers focus on the participants in improvising, particularly on factors that enable individuals to improvise well or to improve their improvising. I cover three of them in this section: transcendence, group and individual characteristics, and expertise.

Transcendence of Experience

Discussions of degrees of improvising focus on what happens during an improvisation. The greatest degree of improvising, for example, occurs when a performance departs so much from a guiding template that new structure and content are created. In contrast, discussions of transcendence as an important aspect of improvising focus on what an improviser *experiences* while improvising. Transcendence is considered to be the ultimate experience in improvising - when one is so involved in the creative process that it suddenly seems effortless (Barrett, 1998; Eisenberg, 1990; Peplowski, 1998). Peplowski (1998: 561) describes the experience like this:

> When I am playing at my best, I find that I'm not thinking about anything. I can actually have the sensation of going outside of myself and observing myself while I'm performing. It's very strange. You can actually listen to the rest of the group, and be completely objective and relaxed.

One of the paradoxes of improvisation is that only after a great deal of practicing and rehearsing can one become sufficiently comfortable 'playing the game' to 'lose oneself' in it.

Individual and Group Characteristics

Several authors consider improvising as an ideal balance between team and individual growth (Eisenberg, 1990; Mirvis, 1998). This balance is not an easy one to pull off, though, and requires a great deal of experience with balancing "doing

your own thing" and "going with the flow of the group" (Mirvis, 1998: 589). Individual and group characteristics - such as team spirit, self-confidence, and a clear sense of oneself in relation to the group - contribute to achieving that balance.

Group attributes considered important for improvising well include having good relations among group members and a general will for team success (Frost, 1998). Frost (1998: 579), for example, recalled the team spirit that facilitated the development and coordination of a conference he was organizing: "everybody wanted this to be a good event, one which looked good for everybody." This team spirit motivated the hired workers (e.g., technicians, A/V specialists, etc.) to work beyond what was normally expected of them and to make the conference a success.

Confidence, or being sufficiently comfortable to take a risk, is a characteristic of individuals who improvise well (Crossan, 1998; Mirvis, 1998; Peplowski, 1998). Improvisation challenges individuals who strive to be consistent, comfortable, confident, and competent because they must take risks to improvise (Crossan, 1998: 597). Under pressure, "mistakes" are inevitable, and to avoid them, it is easy for the performer to fall back on past successes and repeat stock phrases (Barrett, 1998). "Good" improvisers tend to guard themselves against repetition and develop the confidence to take risks and the skill of turning mistakes into non-mistakes by constantly challenging themselves (Peplowski, 1998: 559-60):

> We are always deliberately painting ourselves into corners just to try to get out of them. Sometimes you consciously pick a bad note and try to find a way to get out of it.

Another strategy for taking risks is to fake confidence (Peplowski, 1998: 561): "Half the battle of getting up and playing music is really psyching yourself into performing and faking confidence."

Other individual attributes that are considered important include "a clarity of self in relation to purpose" (Hatch, 1998: 567), a willingness to do more than the minimum that's required (Peplowski, 1998), and being "skillful enough to be *unself-conscious*" (Eisenberg, 1990).

Finally, individual and group characteristics interact with each other. Notes Eisenberg (1990: 153):

> [T]he skill of any single individual is not stable from group to group; my ability to play well is conditioned by the level of talent of my fellow players.

A talented improviser has a more difficult time improvising with a group of untalented improvisers than with a group of talented improvisers, and similarly, the ability of a group to improvise well is partially dependent on the individual abilities of the group members.

Expertise

Improvisers in jazz and theater develop their improvising expertise by spending countless hours improvising in rehearsals and performances (Barrett, 1998; Pasmore, 1998; Mirvis, 1998).[3] By practicing improvising, performers are able to develop skills for composing in the moment (Mirvis, 1998: 587):

> My thesis is that would be improvisers can up their odds [of improvising successfully] by "practicing" with paradoxes and thereby prepare themselves, tactically and emotionally, to improvise when the stakes are raised.

Barrett (1998: 606) explains the goal of practicing is to have the theory and rules of playing become as tacit as the rules of grammar and syntax that one uses to speak:

> Jazz players learn to build a vocabulary of phrases and patterns by imitating, repeating, and memorizing the solos and phrases of the masters until they become part of their repertoire of "licks" and "crips." [...] After years of practicing and absorbing these patterns, they train their ears to recognize what phrases fit within different forms, the various options available within the constraints of various chords and songs.

Over time, practicing helps one develop skills, such as interpreting the environment, and composing music, and put them into action more quickly.

Intuition is the rapid processing of experienced information and it is critical for interpreting the environment quickly (Crossan, 1998). Crossan (1998) suggests

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[3] The same holds in sports, where repetition and scrimmages are critical aspects of preparing for games (Mirvis 1998).

that in order to learn from the rapidly changing environment, one must develop an intuition for interpreting it as much as possible in its full richness and complexity - free from traditional points of view. In improvisational theater, actors develop their skills by practicing several games that help them break away from their normal mindsets (Crossan, 1998). For example, one exercise, called 'Nonsense Naming,' requires one to go quickly around a room and point to things giving them the wrong name (Crossan, 1998: 595).

Weick (1998: 547) notes a similar relationship between experience and memory:

> Forms and memory and practice are all key determinants of success in improvisation that are easy to miss if analysts become preoccupied with spontaneous composition [...] to improve improvisation is to improve memory, whether it be organizational, small group, or individual. To improve memory is to gain retrospective access to a greater range of resources.

The more one improvises (either by rehearsing or performing), the more one is able to develop an intuition for improvising, including enacting structures.

2.2.6 Commentary on Literature on Organizational Improvising

The organizational literature on improvising covers a wide range of aspects of improvising. In this section I have discussed several of these aspects.[4] Integrating the literature is challenging given the different points of view and interests of the researchers and lack of clarity regarding whether a particular aspect of improvising is considered a defining characteristic of improvising, essential to improvising well, or both. For example, some seem to treat structures as deterministic or inherently improvisational and focus solely on the forms of structures whereas others ground structures in practice and focus on

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[4] This discussion is not a comprehensive one. Rather than attempt to discuss all of the aspects of improvising covered in organizational literature, I discuss those aspects that seem to be considered by researchers most particular to improvising. I did not discuss, for example, the emotional aspect of improvising (Hatch 1998). My intention has been to review the organizational literature in an attempt to understand what activities constitute improvising.

how structures are enacted as well as what forms tend to facilitate improvising. As a result, after reviewing over 20 articles in the organizational literature on improvising, I was still left with several questions, particularly with regards to three aspects of improvising:

- Structures in improvising
- Degrees of improvising
- Activities that constitute improvising

Regarding the first aspect, although the beneficial roles of "minimal structures" and "semistructures" are clear (that is why they work: they provide enough structure to coordinate and guide creative activities but not so much as to stifle them), it is not clear what structural characteristics make them particularly conducive to improvising (i.e., what is it exactly about the structures themselves that makes them "minimal" or "semi"). It is not always clear whether those examining structures in improvising believe these characteristics of form are unique to structures in improvising, critical for improvising well, or simply enable one to improvise. Some proponents of "minimal structures" and "semistructures," for example, seem to suggest that these structures are inherently amenable to improvising (e.g., Barrett, 1998; Brown and Eisenhardt, 1997). For example, Barrett (1998: 611) discusses "minimal structures that allow maximum flexibility" and Brown and Eisenhardt (1997) discuss structures "that balance between order and disorder" (p.3) and are "sufficiently rigid" or "not so rigid"(p.29). Assumptions that structures have inherent qualities that determine whether or not one improvises seems problematic, however, if one accepts the point of view of structuration theory (Giddens, 1984), which argues that structures influence, but do not determine, action.

In structuration theory (Giddens, 1984), structures are both the (enabling and constraining) medium and outcome of reflexive human action. In enacting structures, actors draw on rules and resources, including expectations about what to do, what not to do, how to do it, and how not to do it. I have found the work on genres (e.g., Orlikowski and Yates, 1994; Yates and Orlikowski, 2002) especially

helpful to understand the roles of structures in organizations. Genres (e.g., memos, meetings, resumes) are communication structures used implicitly and explicitly to organize social interactions (Orlikowski and Yates, 1994; Yates and Orlikowski, 2002). Genres have a socially constructed and recognized purpose and form. Genres also embody expectations regarding the purpose, content, roles of participants, time, place and form of the communication practices structured by them (Yates and Orlikowski, 2002). From a genres perspective, for example, a resume does not make one structure personal information into bullet points on a single page but rather, the social expectations that one subscribes to regarding an effective resume structure how one creates a resume. One can also "play" with a structure's normal form and associated expectations, such as when one attempts to create humor by creating a mock resume for a young child (e.g., listed under skills: finger painting). From the point of view of structuration theory and the perspective of genres, to understand the role of structure in improvising, one must consider both the form and use of structure, including the expectations it embodies.

Similarly, as I noted before, Hatch (1999) considers both the form of structures and how they are used as important aspects of improvising, where the use of structures defines improvising (i.e., improvisers "play with their structures") and where form supports but does not determine improvising. Bastien and Hostager (1988) also define improvising by the practices that constitute it and consider structures for their coordinating and guiding role.

Still, the role of expectations regarding how a structure should be enacted, as developed with regards to genres, is missing from the conversation on structures in the organizational literature (even in those articles that emphasize how structures are enacted as defining). The general assumption seems to be that there is consensus between the improvisers and audience (and among the improvisers themselves) regarding the expectations embodied by the structures, as well as a general assumption that structures are enacted as intended and/or expected. For example, in jazz, improvisers and audience expect certain structures to be played with and others not, and those expectations are respected

(e.g., there is a common expectation that songs will be played with some embellishing but that the role of a soloist will be respected). In a different setting, though, the audience may expect the same songs to be played without any embellishment, and if the musician respects the audience's expectations, then no improvising will occur. Thus, in considering the roles of structures in improvising, it seems important to consider their form, the expectations they embody, and how they are enacted.

The use of structures is also critical to the second aspect of improvising that I want to comment on: degrees of improvising. Weick (1998) focuses on the amount of imagination and concentration expended by the performers. Moorman and Miner (1998) discuss two dimensions: a temporal dimension and (in response to Weick, 1988) the degree to which the performance departs from "the original referent" (Moorman and Miner, 1998: 703). Similar to Moorman and Miner's (1988) second dimension, Zack (2000: 230) describes three general degrees of improvising relative to the structures that guide the improvising (what he refers to as "forms"): one can "determine" to improvise within those forms, with those forms, or outside those forms. The dimension proposed by Weick (1998) is extremely difficult to measure because the demand on concentration varies with a number of factors including individual experience, interpretation, and situation. It is also unclear whether the "demand on concentration and imagination" changes with different structural forms (e.g., playing "Happy Birthday" versus playing a relatively more complex song, such as "Cryin' Mood") or with different uses of structures (e.g., playing "Happy Birthday" with or without much embellishing). Similarly, the temporal dimension described by Moorman and Miner (1998) is also difficult to measure, particularly because it would be difficult to determine when either composing, designing or conceptualizing ended and performing, producing, or implementing began (assuming one could distinguish the activities from each other and that the activities occurred in the stated order). Finally, neither Moorman and Miner (1998) nor Zack (2000) seem to consider the relationship

between the form of structures (including the expectations they embody) and how one enacts them.

In Chapter 3, I build on the insights of Moorman and Miner (1998), Weick (1998), and Zak (2000) and consider degrees of improvising as the difference between the performed piece (i.e., the improvisation) and the original "referent" or form. I also highlight a potential factor in the degree of improvising: if the guiding structures are enacted as expected, then the "specificity" of the structures may influence the degree of improvising. In doing so, I avoid trying to measure the amount of imagination expended by the performers or time difference between planning and executing.

Finally, with respect to activities that constitute improvising, a wide variety of aspects of improvising are covered in the organizational literature, but few definitions of improvising integrate them or offer frameworks that explicitly lay out what activities constitute improvising.[5] This, as Vera and Crossan (2001) note, is in part because several authors focus on distinguishing improvising well from improvising poorly, rather than distinguishing improvising from other practices. Those definitions that are more integrative tend not to be very specific or explicit about what activities constitute improvising. For example, in defining improvising as the temporal convergence of design and execution, Miner et al. (2001) "black box" the innovation process, describing it simply as consisting of "designing" and "executing." They consider adaptation, bricolage, compression, creativity, innovation, and learning as relevant activities but none are used to define improvising by what one does when one improvises.

Weick's definition (1998), drawn from Berliner (1994), is one of the most detailed regarding what activities constitute improvising. Berliner (1994) specifies the action of *reworking* precomposed material and designs in reaction to the conditions of the performance situation. In Chapter 3, I build on Berliner's definition and those of others, and offer my own attempt at

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[5] It seems important to understand what activities constitute improvising because if a manager or developer of technology wants to "support improvising," they need to know what specific activities to support.

integrating the aforementioned aspects of improvising. I develop an integrative definition and framework that highlights several interrelated activities that constitute improvising. Before, moving on to Chapter 3, however, I turn to the roles of technology in improvising, as considered in the organizational literature and in jazz.

2.3 A Few Isolated Takes on the Same Phenomena: Recent Literature on the Roles of Technology in Improvising

Although much has been written in organizational literature on the process of improvising, comparatively little has been written on the roles of technology in improvising.

In what follows, I first cover the few articles from organizational research that address technology in improvising. I also discuss research that examines the roles of objects to bridge boundaries and enable collaboration across them. I then examine the roles of technology in jazz improvising, drawing for the most part on Berliner (1994), the most influential source of accounts of improvising in jazz for several organizational researchers writing on improvisation (e.g., Weick, 1998). I conclude by arguing that in jazz the roles of technology are limited, especially when compared to improvising in other artistic traditions such as African American quiltmaking and suggest this may explain why the roles of technology have received little attention in the organizational literature.

2.3.1 The Roles of Technology in Organizational Improvising

There are four notable exceptions to the dearth of organizational research on the roles of technology in improvising: Ciborra, 1996; Miner et al., 2001; Orlikowski, 1996; and Weick, 1993.

Ciborra (1996: 369) offers the following definition of improvisation:

> Improvisation is situated performance where thinking and action seem to occur simultaneously and on the spur of the moment. It is purposeful human behavior which seems to be ruled at the same time by chance, intuition, competence and outright design. In improvising, features of a situation are "suddenly" framed and combined by the actor, so that they become resources at hand for invention.

From this definition, he focuses on four aspects of improvising and discusses how different kinds of information technology ("systems") may potentially be used to support a different aspect (Ciborra, 1996: 376):

> Systems "for the Here and Now" address the "situatedness" aspect of improvising by "capturing electronically, for future use (unspecified at the moment of collection), location and time of events in the life of a person, a document, an artefact (e.g., a picture), or a conversation."
>
> Systems that "access and retrieve experience" address "organizational memory" and "allow the actor to index, store and retrieve in a variety of ways (e.g., full text retrieval) distributed (over networks) fragments of past experiences (again, documents, e-mail messages, images, conversations).
>
> Systems that "constitute a shared context for interpretation" address the aspect of "communication and shared context" and "become a collective repository, where members can access vast collections of because-of motives on a shared basis."
>
> Systems that "support reflection-in-action and learning for smart improvisation" address the aspect of "reflection and learning" by establishing "precendents endowed with interpretation."

In general, Ciborra (1996) proposes the use of information technology as a tool for capturing and managing information about an event (including its context and rationale), for enabling communication, and for reflecting and learning. These general applications seem promising, although it is difficult to appreciate them without knowing more specific examples and how they relate to any activities that constitute improvising. As Ciborra (1996: 375) acknowledges:

> A theory of improvisation (still lacking today) would help establish a common framework among what at present may seem scattered experiments or peculiar applications

A goal of this dissertation is to heed Ciborra's observation and develop a framework from which to better appreciate the value of his four proposed applications.

Miner et al. (2001) do not focus on technology per se but, as I noted earlier, in their field study examining organizational improvisation and learning in the

area of new product development, note in each instance of improvisation "something was produced" (p.309) and that some of these "productions" included artifacts - "the teams we observed actually created new physical structures without prior design" (p.310). Miner et al. do not consider these artifacts any further, though, other than to note their existence and participation in the process of improvising. In the following chapter, I focus on these emergent artifacts as important technologies in improvising.[6]

Orlikowski (1996) proposes a situated change perspective to examine the history of changes resulting from improvisational work practices associated with the use of a new information technology tool within an organization. These improvisational work practices include unanticipated, unplanned adaptations. Orlikowski (1996) presents an important perspective for describing change associated with improvisational work practices as well as rich descriptions of these work practices but does not focus explicitly on what is actually done during improvisation or how technology is involved in improvising.

Finally, although Weick (1993) also does not focus on technology per se, in his examination of organizational design as improvising, he notes that a key factor for successful bricolage is the ability of the bricoleur to consider artifacts as unrestricted by any single use. To the bricoleur, the materials at hand are not associated with any specific purpose or intention (e.g., a hammer is for driving nails into wood), but instead, are associated with all the ways in which the materials were used before (e.g., I used a hammer once to prop a door, another time to crack open a coconut, etc.). As Weick (1993: 352) explains:

> The materials, in other words, mean whatever they have been used for in the past. The more diverse these uses, and the more fully the materials themselves are understood, the more innovative will the bricoleur be in improvising new designs from his stock of materials.

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[6] In the context of new product development, there is a growing body of literature that turns out to be relevant to understanding the roles of technology in improvising: the literature on boundary objects (e.g., Henderson 1996, Carlile 2002). I discuss this literature in Chapter 6, when it becomes particularly relevant.

Levis-Strauss (1996: 9) notes that to a bricoleur, "[a]nimals and plants are not known as a result of their usefulness; they are deemed to be useful or interesting because they are first of all known." What makes a bricoleur successful is that, rather than categorize objects as useful or not based on a specific use of that object, a bricoleur assumes that there are many potential uses of an object. Considering materials as unconstrained to any particular use and open to a number of different, unanticipated, spontaneous uses enables a bricoleaur to develop the skills to make do with whatever is at hand.

2.3.2 The Roles of Technology to Bridge Boundaries

Research on metaphors, boundary objects (Bechky, 2003; Carlile, 2001; Henderson, 1995, 1998; Levina, 2001) and single-text strategy explores the role of objects to bridge boundaries and enable collaboration across them, overcoming and maintaining differences by creating new commonalities.

Metaphors

Metaphors are another type of object that is used to relate and bridge boundaries. A metaphor is a simplified articulation or representation of a mental model that relates one element in terms of another (Hill and Levenhagen, 1995; Morgan, 1980; Morgan, 1986). It frames the understanding of an element by simultaneously emphasizing aspects that are related to another element (either negatively or positively) while de-emphasizing aspects that are unrelated to the other element (Morgan, 1986). Entrepreneurs in ambiguous and uncertain environments create and use metaphors to cope with large amounts of data, interpret events, and develop a common language (Hill and Levenhagen, 1995). They "provide a clear sense of intended direction but allow sufficient flexibility for effective implementation" Hill and Levenhagen (1995: 1069). Donnellon et al. (1985: 52) found that metaphors were an important communication practice for developing equifinal meanings and enable collective actions despite differences in understanding:

> Metaphors are particularly effective in such situations because they create new ways of experiencing reality. They redefine reality ambiguously by leaving the specific details of similarity and dissimilarity between two entities undefined and thus open to individual interpretation.

Boundary objects

Boundary objects are artifacts that are either created or shared across boundaries. Henderson (1995, 1998), for example, describes in rich detail the various ways that artifacts (e.g., design drawings and prototypes) are engaged in the work practices of design engineers as they develop surgical tools (1995) and customer service representatives at a call center (1998). Henderson (1998: 146) finds prototypes are used for eliciting and capturing ("conscripting") tacit knowledge, garnering support or project buy-in ("support networks"), and as reference points for negotiations. For example, Henderson (1998: 143) describes visual documents used as:

> [T]hinking and note-taking tools... sketches help to capture concepts in a tangible and communicable form which then facilitates individual and communal critical analysis... collaboration over sketches is one of the best methods for accessing and sharing tacit knowledge.

In addition, prototypes serve "gatekeeping roles" when used to control "who is permitted to have input into the new design process" (1998: 146).[7]

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[7] It may be worth noting at this moment that Henderson's use of "role" is different from my use of "role." Henderson's work is grounded in the perspectives of the social construction of technology (e.g., Bijker, Hughes, and Pinch, 1987) and actor network theory (e.g., Latour, 1987). The social construction of technology views technology "as a social process, simultaneously socially shaped and society shaping" (Henderson, 1995: 275; Henderson 1998: 140). Building on research from the social construction of technology, Latour (1987) developed the Actor Network Theory to emphasize the role technology as a "co-producer" in the social construction process. Actor Network Theory essentially arguing that both humans and objects ought to be treated as actors. Whether this lack of distinction between humans and non-humans as actors is simply methodological and not ontological (Preda, 2000: 286), is unclear (e.g., Shapin, 1995: 312-3). Regardless, I use "role" to describe the general kinds of structured ways that people use technology. Thus, in my view, a "role" does not describe what a technology does but rather, how it is used. Finally, although I find Actor Network Theory problematic because of the lack of clarity regarding what is meant by "role" (and consequently, the risk of anthropomorphizing technology), Henderson's findings are quite valuable.

In situations that are uncertain and non-routine, actors may create new objects to experiment and reflect - i.e., "to think with" (Levina, 2001). Levina (2001) examines the role of boundary objects as participants in a multi-party cross-disciplinary IS development project attempt to collaborate across a variety of boundaries. Drawing on the work of Donald Schön, Levina (2001: 3) describes the collaborative process as a "collective reflection-in-action spiral, which involves iteratively reflecting on objects produced by others and either adding to or challenging past experiments in future actions." Levina (2001: 222) uses "object" to refer to "what has been made explicit (outside the body)" (Levina 2001: 181):

> Collective reflection, unlike individual reflection, requires that agents make their thoughts explicit (tangibly or orally) in the form of *explicit objects* (henceforth, referred to as just "objects"). Such objects include verbal expressions, gestures, tangible artifacts, virtual artifacts, etc. - any form of expression that makes an agent's appreciative system visible to another agent.

The IS product that results from the collaborative process is shaped by the creation and use of boundary objects throughout the process. Levina (2001) notes that participants produce objects with the intention of having other participants reflect on them. Both the practical and symbolic aspects of objects influence their role in this process. For an object to be shareable, for example, it must be both materially and symbolically accessible to the recipient (i.e., the technical properties of the objects need to be such that it can be perceived by the recipient's senses and what is perceived must make sense to the recipient in the manner intended by the producer). Factors that influence the material accessibility of an object include its durability ("the degree to which an object created in a given medium remains unchanged in time outside agents' actions"), portability ("the degree to which an object created in a given medium can be moved around in space without being changed"), and reproducibility ("the degree to which an object created in a given medium can be reproduced through technology in another or same medium without being changed") (Levina, 2001: 190-191). The last feature is especially salient, given an object may pass through an intermediary medium or agent that potentially alters the object and its intended

representation. Situational factors also play an influential role in the material accessibility of an object.

Symbolic accessibility requires "competence" and interest on the part of the recipient to engage in the reflective practices necessary to reflect on the object as intended by the producer. Assuming the recipient was competent and interested, the recipient could ignore the object or engage it in practice and in the process, adding to or challenging the producer's message (Levina, 2001).

Effective boundary objects are objects that are used to overcome significant boundaries.[8] Specifically, Carlile (2001) finds that effective boundary objects establish "a shared syntax or language for individuals to represent their knowledge" (p.29), they enable individuals to learn about each other's values, differences, and dependencies, and they "facilitate a process for individuals to transform knowledge" (p. 32).

The Use of Text Documents to Develop Consensus

The use of objects to develop consensus is similar to the single-text strategy pioneered by President Jimmy Carter at the Camp David negotiations between the Egypt, Israel, and the United States (at the recommendation of Roger Fisher of Harvard Law School) (Raiffa, 1982). Accounts of this strategy illustrate the use of text documents as structuring devices that help keep multiple parties focused

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[8] Both Henderson (1995, 1998) and Carlile (2001) share similar assumptions about the nature of knowledge, and these are central to their research on the role of artifacts in multi-party problem-solving. Carlile (2001), for example, argues that one of the challenges to cross-boundary problem-solving is the nature of knowledge itself. Essentially, knowledge is inseparable from the situated practices that generate it and draw on it. Consequently, as Carlile (2001:12-13) argues, knowledge is "localized" (it is dependent on particular kinds of problems and thus the knowledge developed from one kind of problem is not necessarily useful to solve a different kind of problem), "embedded" (it is dependent on and difficult to separate from the particulars of the practice - the situation in which it occurred, the structures that were enacted, the artifacts that were involved, etc. - and consequently is fundamentally tacit), and "invested" (it is dependent on what is valued since valued knowledge is more likely to be developed than knowledge of no value). Given these assumptions about knowledge, boundaries may develop between people working together to solve a problem. Because knowledge is invested, it can be problematic when people trying to work together "are invested in and less able and willing to change their knowledge in order to accommodate the knowledge developed by another group that they are dependent on."(Carlile 2001:13).

on a common point.[9] The single-text strategy, also known as the "one-text procedure" (Fisher and Ury, 1991) and "single negotiation text" (Raiffa, 1982; Fisher, 1978), involves each party working off a shared document. It is a technique that "literally puts negotiators on the same page" (Thompson, 2001: 156). As a general approach to building consensus, the single-text strategy "provides a clear structure for discussions and a focal point for identifying areas of agreement and disagreement" (Carpenter, 1999: 78). The single-text strategy is recommended for mitigating human biases (e.g., the tendency for people to view themselves and their actions more favorably than others view them, think that they have more control over events than they really do, and feel overconfident that what they know is correct) that may complicate consensus building (Thompson, 2001: 155). It is also recommended as a process for translating oral understanding into written agreements and for producing written agreements in general (Susskind and Cruikshank, 1987).[10] It is particularly recommended "when technical, regulatory, or statutory language is required and in situations in which large numbers of parties are involved" (Carpenter, 1999: 78). Fisher and Ury (1991) advocate the "one-text procedure" as a mediation process that a third party can engage in to help a set of parties shift from positional bargaining to interest-based bargaining ("principled negotiation") when those parties are unable to do so themselves.

The general idea is that a trusted party (either a person participating in the negotiation, a very small group of participants, or a third party) first collects the interests and needs of each party (rather than their positions) into a list and asks each party to criticize the list and make improvements on it. Then, based on that list, the person drafts a single rough proposal and again, emphasizing that it is a working draft open to improvements, asks the parties to consider it tentatively

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[9] Although there is an extensive body of research on negotiations, there is a dearth of research on the roles of artifacts in the negotiation process. One exception to this is the small body of work on the single-text strategy for consensus building.

[10] With respect to producing written agreements, Susskind and Cruikshank (1987: 147) also regard the single-text strategy as "more likely to produce agreement than a process in which each party

and provide constructive feedback on it. This continues for several iterations until the person is no longer able to improve the proposal (i.e., the person is unable to reconcile the various interests any better). At this point, the person offers the proposal to the other parties and recommends that they accept it. The parties can then decide whether or not to accept it and under what conditions (e.g., one party will accepts it only if the other party does).

A challenge of getting parties to participate in a single-text strategy is fear of commitment to the resulting proposal. This is why an important aspect of the single-text strategy is the option at the end for a party to not agree with the result. The alternative to going back to negotiating as before is always available. A party may also resist the strategy because it does not want to make explicit a tacit or vague aspect of the negotiation (e.g, it may not want to make explicit a conflicting or destructive interest or it may want to avoid discussing what will be done in the worst case scenario) (Susskind and Cruuikshank, 1987: 124).

When a negotiation involves multiple parties, a single-text strategy is effective for the structure it adds to the negotiation. As Raiffa (1982: 254) has noted:

> I have talked extensively to professional negotiators, who have reinforced my conclusion based on personal observation: many-party negotiations are often too diffuse to be effective unless they focus on a single negotiating text.

In summary, the few articles that begin to explore the roles of technology in improvising, together with the a growing body of related research on the roles of objects in cross-boundary collaboration suggest there is great value in further exploring the nature, uses, and influences of technological artifacts in improvising. In Chapter 3, I draw on these insights, show how they complement Orlikowski's (2000) distinction between technology-as-artifact and technology-in-practice, and use them to draw out two essential activities of improvising: assessing the situation and creating resourcefully.

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drafts its own version of the final agreement and those versions are later integrated" because the

2.3.3 The Roles of Technology in Jazz Improvising

Of the two artistic disciplines that organizational theorists draw on most as models of improvising (jazz and theater), jazz offers a greater variety of examples of how technology may be involved in improvising. Whereas in theater improvisation, technologies are simply used as props, in jazz, technologies are used for musical expression (e.g., instruments) and to capture and reflect on what has been performed (e.g., recording and playback technologies).

The primary role of technology in jazz improvising is that of a musical instrument, where the technology is used as a tool to help artists perform and express themselves musically. Traditionally, musical instruments were non-electronic, consisting of such types of instruments as found in any traditional jazz band: metal wind or horn instruments (e.g., trumpet, tuba), reed instruments (e.g., clarinet, saxophone), string instruments (e.g., bass, guitar), and drums (e.g., cymbals, congas). Midway through the 20th Century, some musical instruments became electrical (e.g., electric piano or synthesizer, electric guitar), enabling musicians to amplify their playing and develop new sounds. Since the 90's, computers have become more prevalent and used during performances, enabling artists to use pre-recorded musical segments during their performance.

Another important role of technology in jazz improvising has been the use of recording and editing technology to capture and assess what has been performed. Traditionally, such use only had an indirect influence on a particular performance, in that the performance of each player was in part influenced by recordings that the player had heard before. The literature does not provide any examples where recording or playback technology had a direct effect on a performance - i.e., where jazz musicians used a recording as an accompaniment or where they listened to a recording during their performance.

Below, I elaborate on both of these roles.[11]

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later process is vulnerable to the biases discussed before and to gaming.

[11] My primary resource is Paul F. Berliner's 1994 encyclopedic volume on improvising in jazz, "Thinking in Jazz: The Infinite Art of Improvisation" (it contains over 500 pages, not including over 200 pages of music texts). Berliner's work has been extensively praised by musicians as being the

Musical Instruments

In jazz, the ability or inability of a musical instrument to produce particular sounds is not discussed as solely determined by fixed characteristics of the instrument. Instead, they are discussed as resulting from the interaction between the characteristics of the instrument, the abilities and actions of the musician, and the properties of the performance situation - all of which may change over time. There are features of an instrument that enable and limit the kinds and ranges of sounds that an artist can produce. But those features alone do not determine the sounds that can be produced with an instrument and the playing skills of the musician. The performance situation also influences what sounds can be produced using a particular instrument. And because all three are capable of changing over time, the uses of the instrument are as well. For example, it is not uncommon for artists to develop new uses that help expand the possibilities of sounds that the instrument can make.

The Instrument

There at least three physical aspects of an instrument that influence the kinds of sounds that can be produced with the it (Berliner, 1994: 190): its acoustical properties (e.g., the piano produces a wide range of sounds but it is difficult for it to sound like a violin), its physical layout (e.g., to play a particular set of notes on a piano may require the pianist to move her fingers in a particular way, whereas to play the same set of notes on a saxophone would require different movements), and its performance demands (e.g., to play the piano requires using a set of muscles different from those required to play the violin). Berliner (1994: 190-191) provides three illustrative examples worth quoting at length:

> Whereas the piano's arrangement of keys and the mechanical nature of its sound production enable competent improvisers to sustain musical invention in any register, Chuck Israels considers that "it's hardest to

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most complete, inclusive, and informative on improvising in jazz, and it has been a key resource for researchers studying improvising in organizations.

> achieve a keyboard kind of freedom in the low register of the bass or trombone." If the intention is to "improvise in subtle and quickly changing ways," the performer must "move into the highest register of the instruments, because that's where the notes are physically closest together." In contrast, the demands of high-note playing for trumpeters may temporarily erode endurance. Unless they possess exceptional strength, these artists typically venture into their highest register only for short excursions, for instance, to provide peaks to melodic phrases or to create musical climaxes. Other distinctions also come into play. Wide leaps with the trumpet involve demanding embouchere changes, whereas saxophonists can exploit an octave key and bass players can play such large intervals as fourths with the ease of movement over their instrument's open strings.

With experience playing the same instrument, a musician learns how the acoustical properties, physical layout, and performance demands relate to his or her self and the situation(s) in which the he or she plays.

The Human Body

Jazz is not so much about how well one plays a particular instrument as much as how well one expresses oneself using a particular instrument. To use an instrument requires that one physically interact with it. One's technical and physical "command over instruments - commonly described as chops" is greatly valued by jazz enthusiasts because having chops enables one to overcome "the constraints that musical instruments potentially place upon the expression of feelings and ideas" and thus one is able to "manipulate instruments as if they were toys" (Berliner, 1994: 259-60). Bass players, for example, often have to work with the bass that is available at the venue - one that is often of a different size and made of different strings than the one the bass player practices with (this is also common for drummers and pianists). The better bass players - the ones with "chops" - are able to adapt to each new bass they play with. Berliner (1994: 455) tells an entertaining story of legendary pianist Bud Powell's ability to make the best of any piano, no matter how "damaged" it was:

> ... one measure of the prowess of great improvisers is their masterful exploitation of the idiosyncracies of instruments. In a legendary confrontation with a club owner, several musicians refused to begin their performance until he had tuned his piano. Bud Powell arrived at the club in

> the heat of the dispute and ran his fingers up and down the keyboard to identify the offending keys. He then proceeded to give a virtuoso performance in which he treated "the bad notes" as dissonances or special effects - like blue notes - integrating them perfectly with his solo. Dazzled by Powell's improvisation, the club owner refused to believe that there was anything wrong with the instrument, and the protesters lost their argument.

Although one's technical mastery of an instrument is related with one's physical mastery of it, the two skills are distinct. One can develop both through practice, but one's physical body provides some real limits (e.g., the length of one's arms or size of one's hands, etc.) that require more than practice to overcome. Being able to use an instrument to express oneself depends on the physical aspects of the instrument, one's technical ability to play the instrument, and one's physical ability to do so.

In music, similar to sports, the human body may vary during a performance, let alone over several performances. For example, it may take a few songs before a musician's muscles stretch and "warm up" enabling the musician to play well. After several physically intense songs during the concert, though, the musician's body may become exhausted and make it more difficult to play well. Similarly, the same musician who at age twenty was able to play well throughout the entire two hours of a concert, may find it more difficult to do so 30 years later because of wear and tear of critical muscles.

The Situation

Finally, the performance situation is another critical factor in determining what sounds a musician can produce using a particular instrument. Good musicians accommodate themselves to the acoustics of the building. As Berliner (1994: 450) notes:

> Like an extension of the improviser's instrument itself, the physical characteristics of the venue have the capacity to mold and shape an artist's sounds.

The temperature of the room, the room design, the size and seating of the audience - these factors and many others all influence how one plays and consequently what kinds of sounds one produces.

In summary, in jazz improvising, the musical instrument is discussed with regards to how a particular musician used it, and not as separable from the musician or the situation in which it was used; the instrument, the musician's body, and the performance situation are all integral constraints and facilities that any musician contends with when playing an instrument and developing his or her own musical vocabulary.

Recording and Playback Technologies

One of the most common ways for a jazz musician to develop his or her own musical vocabulary is by imitating the work of others. Technologies that represent music, such as sheet music, recordings and devices used to play recordings, are extremely valuable resources for learning by imitation.

Recordings of improvisations are valuable sources of ideas for artists learning from how others played. Recordings (and the devices used to play them) enable musicians to study an artist's recorded repertoire - enabling them to listen to all the songs over and over again (and transcribe them, if they are so motivated) - and learn the artist's "musical vocabulary." Indeed, this is the reason why some artists refuse to have their performances recorded; they do not want to be copied). Recordings are used to learn compositions, distinguish and name chords, melodies, bass line counterpoints to melodies, and solos. Some playback devices (e.g., tape players and record players with variable playback speed) enabled musicians to slow down a recording to learn compositions. In general, musicians use recordings and playback devices to learn to build their own musical vocabulary.

Recordings are not without limitations. For example, during the early years of jazz, their quality was not always very good and so it was sometimes difficult for some musicians to decipher the vocabulary from them. Many creative performances were not available on recordings because the producers of

recordings were often more interested in traditional performances (that would sell to a wider audience) than in innovative performances. Finally, because part of the skill in playing well is about how one uses one's body to play the instruments, students could only learn so much from a recording before needing to see how a musician played his or her instrument (Berliner, 1994: 107).

However, what may be limiting for one person may be (intentionally or not) an opportunity for another. Berliner (1994: 106) describes an interesting example:

> ...learning from recordings sometimes has serendipitous effects. In Greorge Duvivier's endeavor to master a recorded bass solo distinguished by its extraordinary rhythmic complexity, he developed a special complex fingering technique that allowed him to play most of it. Later, Duvaviver attended the band's performance of the piece, "The Big Noise from Winnetka," and discovered that the solo was actually a duet: drummer Raymond Bauduc performed rhythmically with drumsticks upon the bass strings near the instrument's bridge, while bassist Bob Haggart fingered different pitches on the neck of the base. With great amusement, Duviver recalls how his own misunderstanding led to his unique version of the solo. It also gave him a new technique, involving light finger action across the strings, that increased his facility on his instruments.

Especially talented musicians, in their never-ending search for new ways to express themselves, observe and imitate not only artists who play the same instrument but also artists who use different instruments and artists from different artistic disciplines. For example, Berliner (1994: 139-140) describes how some drummers, like Max Roach, developed rhythmic patterns from the footwork of tap dancers they accompanied, and tap dancers, like Baby Lawrence, developed routines from pianists. There are also several examples of musicians who switched instruments and developed unique playing styles by appropriating a playing style on their new instrument with one traditionally associated with their former instrument. For example, pianist Earl Hines had a "trumpet style of piano performance" that he had developed "from his earlier training as a cornetist and his admiration for other great players like Louis Smith and Louis Armstrong" (Berliner, 1994: 140). The translation isn't always initially successful, due to the limitations of the instrument. For example, one cornetist tried

several flute solos on the trumpet but found he was unable to recreate the "full-bodied" sound of the flute (Berliner, 1994: 140).

In summary, technologies are involved in jazz improvising in two general ways: they are used as instruments to produce music and they are used to record and playback performances to reflect and learn in preparation for future performances.

2.3.4 Commentary on Literature on the Roles of Technology in Improvising

A clear conclusion from examining the few articles from organizational literature on the roles of technology in improvising is that a theoretical framework of technology in improvising is needed to better understand and explore the potential roles of technology in improvising. For example, Ciborra (1996) notes that a theory of improvisation is lacking with which one can better understand how technology can be used to support improvising. In addition to a theory on improvising, I also believe a framework on the roles of technology would contribute to the same purpose.

The literature on technology in jazz offers several important insights. For example, the use of technology is influenced, in part, by its physical layout and design because the layout and design influence the physical effort that a musician must exhort in order to produce particular sounds. In addition, to fully understand their role in jazz, one needs to also consider person using it, as well as the situation in which it is used. Finally, technology can be used to create a representation of an improvisation and learn from it (even if the representation is considered limited), as examples of uses of recording and playback technologies illustrate. In the next chapter (Chapter 3), I present a framework of the roles of technology that builds on these insights, turning to other types of improvising (i.e., improvising in African American quiltmaking) to expand the role of technology.

2.4 Summary

With regards to the two broad questions I have set out to answer in my dissertation, the growing body of organizational literature on improvising provides numerous insights into the process of improvising but only a few on the roles of technology in improvising.

Taken as a whole, the organizational literature covers many different aspects of improvising. For example, structures serve a critical role in improvising, providing enough constraints to guide and coordinate creative activities of participants but not so many as to stifle them. The process of improvising involves creating new things from unpredictable situations, such as new ways of doing things, new products, and new ways of interpreting things. There are also degrees of improvising depending on how new are the things that are created (i.e., how much the improvisation departs from the standard). Other aspects covered in the literature pertain to the participants in improvising. Actors feel most creative when they experience transcendence. Group and individual characteristics that improve improvising include a general will for success, good relations between participants, and confidence in risk taking. The best way to learn improvising and to develop one's intuition for improvising is from experience.

Few of those who define improvising integrate more than a couple of these aspects in their definitions. This is in part because several of the aforementioned aspects seem to pertain to improvising well, rather than distinguishing improvising from other practices. In the following chapter, I draw on numerous insights from organizational literature on improvising, as well as accounts of improvising in African American quiltmaking, to develop an integrative framework of improvising that explicitly addresses what core activities constitute improvising.

Finally, notwithstanding four studies (Ciborra, 1996; Miner et al., 2001; Orlikowski, 1996; Weick, 1993), a theoretical examination of the roles of technology in improvising is still lacking in the organizational literature. In

Chapter 3, I address this issue and again by drawing on African American quiltmaking to develop a framework on the roles of technology in improvising.

Chapter 3: A Proposed Framework

3.1 Introduction

In this chapter, I present two theoretical frameworks that I have developed: one on improvising and the other on the roles of technology in improvising. Unlike other treatments of improvising which draw predominantly from the artistic disciplines of jazz and theater, I draw predominantly from accounts of improvising in African American quiltmaking as my inspiration. As I discuss in the following sections, the history of quiltmaking, particularly that of African American quiltmaking, challenges any notions of quiltmaking as simply an artistic hobby. Quiltmaking was an important process of creating practical and valuable artifacts, as well as resisting and changing oppressive conditions. African American quiltmaking, in particular, is an example of quiltmaking where improvising has a long tradition of being practiced, admired, valued, and celebrated. In addition, unlike jazz or theater, it is an example of improvising where artifacts are involved in several different ways and where the improvising does not occur in a single situation during a single continuous block of time, but rather, across several situations and over several blocks of time.

Drawing on historical accounts of quiltmaking, I describe how quilts were improvised and where technologies played a significant role. I draw principally from the history of African American quiltmaking, but to help illustrate particular points, I also draw on examples of quiltmaking that are not necessarily associated with African Americans.[1] In addition, although artifacts are

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[1] I found it necessary to draw on historical accounts of quiltmaking that were not necessarily associated with African American quiltmakers because the early history of African American quiltmaking has been especially difficult to develop, due to the marginality of the actors during that period and subsequent scarcity of documentation of either the quiltmakers, the quiltmaking process, or quilts. For example, only a small number of improvised quilts from before the mid 1900's exist today because improvised quilts were made from scrap material and heavily used, and old quilts tended to be recycled as batting for new quilts. In the 1970's, several scholars began taking on the especially difficult task of assembling a history of African American quiltmaking. It is these accounts that I draw on to describe improvising in African American quiltmaking. To complement

prominent in the accounts described in the literature, no literature on quiltmaking explicitly explores the roles of artifacts in the process of improvising quilts. Thus, my descriptions of the roles of artifacts in quiltmaking are based on my own reading of the literature.

It is important to emphasize from the outset that improvising in quiltmaking is not limited to African American quiltmaking, nor is all African American quiltmaking improvised. The history of African American-made quilts is extremely diverse and includes not only improvised quilts but traditional quilts and original designs as well (Freeman, 1996; Benberry, 2000). In addition, although the majority of quiltmakers are female, there are several examples where men also quilted or helped out with the quiltmaking process.

In what follows, I first provide an overview of the early history of African American quiltmaking. I then describe the quiltmaking process, describing how improvising quilts is distinct from the traditional process of quiltmaking. From these examples, I offer a theoretical framework of improvising. Finally, I describe how artifacts were significant to the quiltmaking process and develop a theoretical framework of the roles of technology in improvising.

3.2 African American Quiltmaking

3.2.1 Background

As part of the national quilt revival triggered by the American Bicentennial celebrations in 1976, an unprecedented interest in African American-made quilts and their histories emerged (Benberry, 2000). During the late 1980's and into the early 1990's, Eli Leon produced and toured with an influential exhibition entitled "Who'd A Thought It: Improvisation in African American Quiltmaking." The exhibition, consisting of 28 quilts that were made by African American women, inspired an even greater wave of interest and research into African American quiltmaking. In several reviews of the exhibit, one quilt is highlighted: an

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them, I also draw on historical accounts of quiltmaking in the United States that are not necessarily about African American quiltmakers.

anonymously-made double-sided quilt with one side "perfectly regular and symmetrical, exquisitely sewn with every stitch in place," and the other side, a "fanciful, equally deft improvisation of the strip motif" (Knight, 1991). A critic from the *Los Angeles Times* remarked (Mason, 1993):

> An anonymous 19th-Century quilt hangs from the ceiling in the center of the exhibition so the viewer may see both sides. On one side is the easily recognizable 'flying geese' European pattern of repetition. On the other side is an exuberant splash of design, which, as gallery curator Sally Perisho explains, was thought to be more beautiful than the perfect symmetry of the European pattern. 'The artist maintains a generous attitude toward the accidental, embracing innovations that originate beyond the conscious domain,' says Perisho, 'They allow for diversity, using approximate measurements and dealing creatively with resulting piecing predicaments. So, the design is conceived as an invitation to variation, similar to a jazz musician's approach to music.'

Although quite capable of making quilts with perfectly rendered patterns, African American women (as I describe later) improvised quilts for several reasons, including, for example, aesthetics, lack of resources, and creating secret signals.

More recently, the Whitney Museum of American exhibited to much praise "The Quilts of Gee's Bend," an collection of 60 improvised quilts from the community of women at Gee's Bend, Alabama, which had been put together by Museum of Fine Arts in Houston (e.g., the New York Times called the show "the most ebullient exhibition of the New York art season" (Kimmelman, 2002: B33). In the foreword to the exhibition's catalog, the Director of the Museum of Fine Arts, Houston, included the following remarks (Marzio, 2002:6-7):

> [The quilts from Gee's Bend] are products of the brilliant originality that lived through the dark eras of slavery and Reconstruction. All the quiltamkers in this exhibition are black women. The women are descended from generations of slaves who worked the Pettway plantation at Gee's Bend [...] These artists are religious, patriotic citizens who for as long as anyone can remember have made the most beautiful quilts in the world. Their masterworks are the products of both tradition and innovation: older women teaching younger women the styles and standards of beauty, a pedagogical process similar to that practiced in academic salons of formal art schools. Working with "useless" bits of cloth, these artists seem to follow linear patterns - a classical path to beauty. But they also show a profound

> color sense that is as refined as any professional artist. The women know one another's styles as confidently as Jackson Pollock knew his compared to Willem de Kooning. These women learn from one another but strive to be themselves. Their quilts are both the signatures of individuals and the banners of a community.

Improvising in African American quiltmaking is a tradition practiced primarily by women, starting in the early days of slavery and passed on from generation to generation. Larger plantations and other wealthy households had "sewing slaves" - African American slave women who did the spinning, weaving, sewing, and quilting (Johnson 1998). For their mistresses, slave women had available all the necessary material and equipment to make intricate traditional quilts. For themselves, though, slave women lacked the same wealth of resources and instead had to create quilts from whatever scraps they could get a hold of. They were not constrained to patterns preferred by their mistresses, though, and thus were able to design quilts based on their own rhythmic and color schemes. Describing the history of African American quiltmaking, Hindman (1995:103) explains:

> In their capacity as seamstresses for their mistresses, slaves stitched traditional quilts in the same intricate, exacting, repetitive patterns and techniques cherished by white quilters. For their own beds, slaves also did patch-work, but these quilts required greater ingenuity, dexterity, and resourcefulness given the economy of means, time, good that restricted their construction. Left only with stolen or gift scraps of the fabric from the "good quilts" that slaves made for their mistresses or with the strips or squares they cut from their own worn out clothes or breeches, slave quilters were forced to improvise; 'the ingenuity with which slaves used 'throw away' or discarded goods is astonishing' (Fry, 43). Creating original patterns for their personal quilts, slave quilters developed quiltmaking techniques that allowed for broken patterns, multiple rhythms and color schemes, large stitches that facilitated quick completion of a project, and spontaneous piecing of often unique color combinations. African traditions and folklore likewise accounted for some distinctive techniques in slaves' personal quilts.

In the United States, quilts were, amongst other things, the most effective way to keep family members warm during times when home heating was difficult or too expensive or, even if a family had invested in heating, too rudimentary to effectively heat the entire house. Mamie Lee Bryan, from Sparta,

North Carolina, during an interview conducted in 1978, described the difficult circumstances in which she had to raise her family as well as the importance of quilts for keeping her family warm (Bryan, 1978):

> I had to stay here and keep the house and keep the children and raise the kids, to get what we've got. It come hard. I had to save everything and piece everything that I could get to make, to keep us warm. Sort of hard living back yonder. So most of the folks don't even realize what it's been, way back yonder. See, I'm seventy-nine years old. That's how old I am, seventy-nine. I been here a long time. And worked hard. If I wasn't out in the field working, doing something like that, I was doing something like [quilting]. So I never had no time for fooling.

Thus up until the early to mid 1900's quilts were a household necessity and an integral part of life for most rural and low-income families (Benberry, 2000; Finley 1992).

Quiltmaking was also a way to resist and change oppressive conditions faced by African Americans, particularly women, from within. African American women took advantage of their marginalized status and the fact that they were considered less capable than men to make quilts and secretly participate in the Underground Railroad. Quilts were made with specific patterns and knots (essentially, secret maps) and were hung outside on porches to help prepare and guide participants of the Underground Railroad from the South all the way to Canada (Tobin and Doddard 1999). For example, participants knew to begin gathering the tools necessary for their trip when a quilt with the "monkey wrench" symbol was hung out on a porch (for "airing out"). Quilts also included grids of stitches, where the space between stitches was believed to correlate with the distance between safe houses up North. Other symbols offered practical advice for the journey (e.g., a "bear's paw" pattern was believed to suggest that to find food and water, follow real bear-paw prints) which, combined with the singing of specific rituals (e.g., "Wade in the Water" to avoid hounds), provided a complete audiovisual system (Tobin and Doddard, 1999). A different quilt was hung out with each next step in the preparation process, and each was memorized by the would-be escapees, until a quilt with five knots was hung out, signaling it was time to escape. Participants learned the code from small sampler

quilts.[2] Because enforcement authorities overlooked and took for granted both women and quilts, they never suspected that women were successfully using quilts to raise money for abolitionists and to secretly signal the location of safe houses and escape routes to participants of the Underground Railroad (Tobin and Doddard, 1999).[3]

Quilts were also an important source of income, and were one of the few available to women. For example, Cash (1995) describes how, in the late 1800's, Lizzie Hobbs Keckley, with the money earned from selling her elaborately embroidered quilts, fed seventeen persons, including her master, for over two years and eventually purchased her own and her son's freedom.[4]

In summary, the early history of improvising in African American quiltmaking is also the history of marginalized people acting resourcefully with what little was available, developing tactics to maintain and preserve their humanity, and actively shaping those conditions for the better. In improvising quilts, black women not only produced decorative, utilitarian bed coverings, but they also generated communal identity (Cash, 1995; Hindman, 1995; Davis 1998), a link between generations (Davis, 1998; Benberry, 2000), income (Cash, 1995), and a "form of resistance to structures of dominance and control" (Davis, 1998:67).

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[2] Sampler quilts were a common type of quilt and consisted of a collection of blocks, each of a different design. They were a common way for quilters to learn of different designs

[3] The assumption that quiltmaking was essentially insignificant also dominated academia until the late 1960's, when female academics began to take note of the practice as empowering and effectively subversive. One notable exception was the pioneering work of Finley (1992), discussed later on in this chapter.

[4] This was also true during the Civil Rights movement when, in 1966, several African American women from Gee's Bend, Alabama, with the help of Francis X Walter, an Episcopal priest and civil rights worker, formed the Freedom Quilting Bee. They made and sold quilts to high-end department stores in the Northeast, including Bloomingdale's and Saks, to supplement income (several quilters had lost their jobs and some even their land, after registering to vote) and to raise awareness of the Civil Rights movement. Freedom Quilting Bee is now Alberta's largest employer and is regarded an outstanding example of a women's cooperative and of community-based economic development.

3.2.2 The Quiltmaking Process

There are three general stages to making a quilt: *piecing the quilt*, which involves collecting, cutting, and arranging scraps of cloth into a particular pattern, or block, and then sewing together the blocks; *putting the batting* or quilt filling in; and finally *doing the quilting*, that is, stitching or tying together the top, the filling and the base.[5] Once a top is constructed, it is stretched onto a quilting frame, along with the back. The back is the base of the quilt and often consists of breadths of yard cloth sewn together. Using the quilting frame, the batting or filling is put in and then the three layers quilted. Each stage can be accomplished individually or, as is more often the case, with a group of individuals (e.g., quilting bees).

The key distinction between improvised and non-improvised quilts is in *how* the three stages are accomplished. Specifically, the key distinction is whether or not creative decisions throughout the quiltmaking process are made with regard to the situation at hand (rather than with regard to a pre-determined plan). Creative choices are abundant throughout the quiltmaking process: what pattern to choose, how to recycle scraps of cloth and other materials, how to arrange them, what thread(s) to use, what to use for batting, what to use for backing, what needles to use, what stitches to make, etc. Improvised quilts emerge from extemporaneous adaptation - from adapting patterns in response to unanticipated situational conditions that arise during the process. This distinction is clearer if one first understands how standard traditional quilts were made.

Standard traditional quilts were made by determining the pattern and fabric to be used, cutting the pieces precisely, and then piecing them together so that the pattern was replicated exactly. Finley (1992:45-6), in her historical account of how

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[5] Patching and piecing are often used interchangeably, although technically, there are two kinds of patchwork: pieced and appliquéd. Piecing involves sewing patches of cloth together on a seam. Appliquéing involves layering a smaller patch of cloth on a larger patch and then hemming or felling it down.

quiltmaking was commonly practiced by women of European descent,[6] describes the typical planning-then-executing approach to quiltmaking:

> There is only one way to make a quilt, and that is the way our grandmothers and their grandmothers did it [...] After a color scheme and pattern have been chosen, the finished size of the piece must be decided and whether there is to be a border. Use of a border reduces either the number or size of the blocks. Having determined the blocks, one must then cut the individual patches, being careful to allow three-sixteenths of an inch on all sides for seaming. The next step is to 'piece the quilt'. This is done, first, by sewing the patches together to form the blocks and then setting the blocks together, by whatever type of set has been selected. The border being added, the "top" is now done save for pressing.

Pressing was "important" because otherwise, the top would "ripple" and that made "for difficult and uneven quilting" (Finley, 1992:46). Cutting the pieces was the most critical step, though, for replicating the pattern exactly, given the complexity of the geometrical design and inter-relation of all the pieces. Quilters devised work arounds for cutting complex geometric pieces precisely, without the use of mathematics. As Finley (1992:55) describes:

> The women of the eighteenth and nineteenth centuries made up for their deficiencies in mathematics by devising a substitute accurate enough for the purposes of quilt-making. A piece of cloth carefully folded, a pair of scissors, and snip or two, and the trick was done! Not that it was all as easy as it sounds, for there was a knack to mastered [sic], and the result had to be perfect. There was required, not only exactness of proportion in the individual patch, but also a correct relation of each patch to all others composing the block.

Women invented clever methods for achieving such precision quickly and without the need of mathematics, using a method similar to that employed in cut-out designs: taking a perfect paper square, folding it into a particular shape, and cutting out pieces such that when unfolded, one had, for example, an eight-

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[6] A feminist who strongly believed that women's folk art illuminated women's history, Ruth E. Finley authored *Old Patchwork Quilts* in 1929, then only the second book ever written on the subject. Her interviews with women born in the 1840's and 1850's are "amongst the best records of the quilt lore from the generation" and her book is still considered a "primer on American quilts" (Brackman 1992). The history presented, though, does not seem to include accounts from African American women, and reflects principally on the assumptions and beliefs of white American women of that period.

pointed star or an equilateral triangle. The practice of cutting geometrical patterns using folded paper (rather than explicitly using theories of geometry) is a nice example of the quilters' repertoire of "practical thinking" (Scribner, 1984). In describing how one would cut a precise eight-pointed star, for example, Finley (1992:57) notes:

> To sit down with paper and pencil and try to figure out how to cut a square of cloth into eight diamonds which, when joined together, will form a perfectly matched star of a definitely desired size, is a task that the modern girl just out of college may well hesitate to undertake. But great-great-grandmother did not waste time bothering her head over such any such problem. Many years before the kindergarten was dreamed of, she employed one of its elementary practices, with the aid of scrap bag and scissors.

Throughout the process of designing and constructing a standard traditional quilt, quilters strove for precision, accuracy, exactness, replication, and evenness.

The African American tradition of improvising in quiltmaking was distinct from the standard traditional process of making a quilt in that, rather than execute as precisely as possible according to a predetermined design, it involved modifying patterns by incorporating elements of the situation throughout the process. The resulting quilts often consisted of large shapes, strong colors, and asymmetrical designs. And although they required skill, they did not exhibit precision, accuracy, exactness, replication, and evenness.

As noted before, African American women improvised quilts for several reasons, including aesthetics and lack of resources. Rarely could families afford to purchase fabric for quilts. Instead, fabrics for quiltmaking came from sewing remnants, old clothing, and feed, flour, and sugar sacks. When there were not enough pieces to complete a top, one could either piece as much as possible and then wait until more pieces were collected, or simply wait until one had collected enough pieces. Even when enough resources were available to plan a design and then execute it accordingly, African American quiltmakers subscribed to an aesthetic where unintentional change was anticipated and considered a "creative offering"(Leon, 1987:24). Specifically, Leon (1987:28) argues:

> If the standard-traditional American quilt is properly executed, its final appearance is largely predetermined by the choice of pattern and fabric. The quiltmaker has only to cut and sew the pieces correctly and they will fit together to make consistent blocks and relatively predictable quilts. This emphasis on precision piecing and exact pattern replication, often yielding splendid textiles, is not conducive to improvisation. The Afro-American quilter, on the other hand, when she is not measuring pieces precisely, must make adjustments as she puts the pieces together if they are to fit, since each block may be different in size and/or shape. As she deals with irregularities, drawing on a body of Afro-traditional techniques, she has the opportunity to explore and excel in improvisational possibilities not open to the standard-traditional quilter.

While improvising a quilt, the quiltmaker continually reassess the emerging quilt and the situation in which the quilting is taking place, while drawing on and adapting to the particulars of the moment. To do otherwise (e.g., to execute a plan without regard for the situation), they believed, produces a quilt that is "less alive" than an improvised one.[7] Sherry Byrd, for example, preferred to piece quilt tops without measuring the individual pieces. As Leon (1987:29-30) described it:

> Sherry Byrd sometimes measures but she feels that measuring has its price: "I really don't like to sit down and do all the measurin'. It just takes the heart outa things."
>
> She often chooses not to measure: "I just kinda eye things. Just see *how* I want it to go together and then put it together."
>
> These cutting practices, of course, have to be backed by the skills to deal with pieces that do not fit together.

Similarly, Catherine Hall, rather than replicate standard quilt patterns, preferred to "play with her fabric" (Benberry, 2000:26).

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[7] Leon and others have noted that African American quiltmakers share the aesthetics of West African textile makers and argue that these quiltmakers have an "inner design sense" attributable to their African roots. I subscribe instead to the views of Freeman (1996) and Benberry (2000): rather than assume African American quilts represent "a single aesthetic orientation based on unconscious cultural memories of their African homeland" (Benberry 2000, x), I believe African American made quilts represent a diverse set of aesthetics, including aesthetics handed down from one generation to another.

The quiltmaking process is filled with unpredictable "accidentals" (regarded as creative opportunities) and adapting to them often has surprising results. As Will Ette Graham (Leon, 1987:34) explains:

> When I get it together, well I'm surprised at the quilt that I've made. It's so much different to what it's supposed to have been. It's a new pattern.

When improvising, the quiltmaker seems to follow a situated change process (Orlikowski 1996); rather than design a pattern and execute it accordingly, regardless of the situations in which the constructing takes place. The quiltmaker who improvises starts with a pattern but throughout the process, adapts it to the situation as the situation evolves. The result is emergent, unpredictable, and continuously changing.

The history of improvising in African American quiltmaking is a rich source from which to develop a framework on improvising and the roles of technology in improvising. Examining examples of improvising in African American quiltmaking - especially alongside examples of improvising in other artistic disciplines, such as jazz or theater - has been helpful for understanding what key activities constitute improvising. For example, I was able to understand that the primary factor that distinguishes improvising from other quiltmaking processes is that the emerging improvisation is influenced unpredictably by the situation as it is being created. In the following sections, I draw on this rich history to develop and illustrate theoretical frameworks on improvising and the roles of technology in improvising.

3.3 Theoretical Framework of Improvising

3.3.1 Definition of Improvising

Based on several literatures, including the literature on improvising in African American quiltmaking and improvising in organizations, I propose the following definition of improvising:

> *Improvising is a structured process of innovation that involves responding to changing situation(s) with resources at hand by creating a production and adapting it continuously.*

Improvising consists of *enacting structures* that guide *assessing continuously, creating resourcefully,* and *adapting extemporaneously.* These activities are treated as distinct for the purposes of describing the framework but in practice they are inter-related and difficult to consider separately. In the process of improvising, individuals create one or more productions. Productions may be conceptual, such as a song or theater performance, or tangible, such as a quilt.

Although in jazz and theater, performers intend to improvise, in African American quiltmaking, there are several other motivations for improvising, including scarcity of resources (e.g., materials, time, money, etc.), a situation that is changing unpredictably, expectations, and desire to innovate.[8] For example, for their mistresses, African American slave women were able to construct quilts that consisted of perfectly rendered patterns because they were given all the resources necessary to accomplish the task. Many of these same women, though, did not have the same resources to construct quilts for themselves (including time and materials) and so they improvised quilts. Even when they did have the necessary resources, though, many chose to improvise their quilts. Thus, intent is not a defining characteristic of improvising.

In what follows, I describe each core activity and then consider some dimensions along which improvising may be seen to vary.

Enacting Structures

Improvising is a structured process; it involves enacting structures that guide (but do not determine) the creative activities of actors (Bastien and Hostager, 1988; Hatch, 1998; Miner et al., 2001; Weick, 1998). For example, improvised quilts are structured around recognizable patterns, such as Log Cabin, Double Wedding Ring, Pinwheel, Brick, and Jacob's Ladder. Improvised quilts illustrate that improvising is not guessing or randomly piecing together resources but rather, it consists of creatively integrating features of the evolving situation in

[8] As I show later on, these factors also account for the degree of improvising that one engages in.

relation to structures common to the actors and audience. Improvisation in jazz and theater is lauded for the enactment of structures that guide and coordinate improvising in a manner that is flexible to the surprises of the situation (Barrett, 1998; Crossan, 1998; Peplowski, 1998). Structure also enables musicians to communicate with the audience (Peplowski, 1998). Without structure, an audience would only hear noise or simply see a random collection of scraps of fabric. Structures, explains Hatch (1998: 565), are 'historical referents' which are reinterpreted every time they are enacted:

> [M]ost jazz musicians start playing a tune from a point of reference to the past, work forward through interpreting some things that have gone before, and then get into the improvisational element.

When enacted, structures connect past experience and memory with present situation, and in the process of enactment, they may be changed, even if such change is unintentional and unacknowledged (Orlikowski, 1996).

The reinforcing and transforming power of structure is well captured by structuration theory (Giddens, 1984). Structures here are both the (enabling and constraining) medium and outcome of reflexive human action. As Giddens (1984:17) explains, structure refers to:

> [T]he properties which make it possible for discernibly similar social practices to exist across varying spans of time and space and which lend them 'systematic' form [...] Social systems, as reproduced social practices, do not have 'structures' but rather exhibit 'structural properties' [...] structure exists, as time-space presence, only in its instantiations in such practices and as memory traces orienting the conduct of knowledgeable human beings.

Structures are evident in recurrent social practices that exhibit a certain (though not necessarily exact) consistency across time and space. They are enacted to guide action, and in their use, they become an outcome of action. In their situated enactment, structures may be reinforced or changed. Structures can be used both to facilitate and to limit action, depending on the situation.

Improvising consists of enacting structures that serve as templates for assessing continuously, creating resourcefully, and adapting extemporaneously. These three activities are described in the following three sections, respectively.

Assessing Continuously

In a 1974 interview Mary White, a West Texan farmer and quilter described her approach to piecing, or making quilts (Cooper and Buferd, 1977:20):

> You can't always change things. Sometimes you don't have no control over the way things go. Hail ruins the crops, or fire burns you out. And then you're just given so much to work with in life and you have to do the best you can with what you got. That's what piecing is. The materials [sic] is passed on to you or is all you can afford to buy ... that's just what's given to you. Your fate. But the way you put them together is your business. You can put them together in any order you like. Piecing is orderly. First you cut the pieces, then you arrange your pieces just like you want them. I build up the blocks and then put the blocks together and arrange them, then I strip and post to hold them together ... and finally I bind them all around and you got the whole thing made up. Finished.

Although White's description of the quiltmaking process is similar to Finley's (1992) description of the (traditional) quiltmaking process (see page 7 of this chapter), there is one significant difference: White's belief in and embrace of the fundamentally unpredictable nature of the situation. As others have noted before (e.g., Crossan, 1998; Eisenberg, 1990; Hatch, 1998; Weick, 1993), unpredictability is integral to improvising. Improvisers not only surrender control to the unpredictability of the situation but they try to make the best of it. In fact, in jazz, incorporating the unexpected is essential to great improvising (Hatch, 1998:80); good improvisers are continuously assessing the situation, actively listening to fellow improvisers and the reactions of audience members, as well as looking out for any unexpected circumstances that could be integrated into the improvisation (Crossan, 1998).

During the process of improvising, improvisers rely principally on features of the situation, their motivations and intentions, and their memories to develop their innovations. The features of the situation include the institutional and cultural environment, audience (e.g., who is assessing the process and outcome), other actors, the improviser's body, artifacts, and particulars unique to the moment (e.g., interruptions, sudden technical failures or physical slips, changes in the natural environment). During the creative

process, the situation also includes the history of the process itself as well as any artifacts that may have been generated.

Situation assessment is an important part of decision making models developed by researchers studying naturalistic decision making (NDM) models (Klein, 1993, 1998). Situation awareness involved both intuitive matching of features and mental simulations (Klein, 1998). Mental simulation is used to assess the situation and to evaluate a course of action. If there is time the decision maker will conduct a mental simulation of the "dominant response option" to see if it will work. The decision will be implemented if it works, otherwise, it will be modified (if it can be) or rejected (if it can't be) and another option considered (Klein, 1993). Klein (1998:89) explains:

> Mental simulation is one way to make sense of events and form explanation [...] it weaves together events into a story that shows how the causes led to the effects.

My use of situation assessment is in line with its use in NDM. Assessing the situation continuously refers to creating narratives and engaging in sensemaking (Weick, 1993) throughout the process. When improvising, whether by choice or not, African American quiltmakers continuously assessed the situation they were quilting in, looking for "creative offerings" and inspirations. To improvise is to respond to the unpredictable circumstances of the situation and be prepared to take advantage of any "windows of opportunity" (Tyre and Orlikowski, 1994) that may arise during this process.

Creating Resourcefully

The innovation that emerges from the process of improvising (e.g., the quilt) is an assemblage of material and social elements drawn from the situation(s) within which the improvising takes place. Consequently, an improvisation will always be unique and result in something new.[9] Barrett (1998:616) notes:

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[9] In the innovation literature, significance is used to distinguish innovations from other creative results (e.g., Von Hippel 1988). Whether or not animprovised result is "significantly new" is

> Jazz players, junkyard collectors and technical reps find themselves in the middle of messes, having to solve problems in situ, creating interpretations out of potentially incoherent materials, piecing together other musicians' playing, their own memories of musical patterns, interweaving general concepts with the particulars of the current situation, creating coherent, composite stories.

As Texan quiltmaker White notes, "you're just given so much to work with in life and you have to do the best you can with what you got" (Cooper and Buferd, 1977:20).

Weick (1993) has noted that improvisation could be considered as a kind of *bricolage* and the improviser as a kind of *bricoleur*. Bricolage, according to the anthropologist Levi-Strauss (1966), refers to the process of drawing on the materials at hand to create a response to a task on the spot. To the bricoleur, the materials at hand are not associated with any single specific use, but instead, are open to a variety of anticipated and unanticipated uses. By always being open to and trying out new ways to use an object, a bricoleur develops a richer understanding of the object and consequently is more able to develop innovative uses for the object (Weick 1993, p.353).

A bricoleur is successful at bricolage in part because of his/her ability to distinguish between what Orlikowski (2000) labels technology-as-artifact and technology-in-practice. Technology-as-artifact refers to "the material properties of technology that transcend the experience of individuals and particular settings," whereas technology-in-practice refers to "the specific structure routinely enacted as we use the specific machine, technique, appliance or gadget in recurrent ways in our everyday situated activities" (Orlikowski, 2000:408). Traditionally, research on the interaction between technology and social systems has treated technology either as deterministic material properties or as socially constructed (Orlikowski, 2000; Orlikowski and Barley, 2001). Making the distinction between technology-as-artifact (subsequently referred to as

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unpredictable and subject to the subjective criteria for assessing "significantly." To consider improvising as a process of innovation is problematic from the point of view of traditional researchers of the innovation process because improvising does not necessarily lead to significantly new results. Because of its situated nature, novelty is inevitable in improvising.

simply "technology") and technology-in-practice avoids assuming technologies embody particular structures and instead, can explain how the use of a technological artifact may vary and how, during use, the artifact itself may change.

Creative recycling was an essential activity for many early quiltmakers - especially for the large number of quiltmakers living in economically difficult conditions. When important resources were lacking, these women created clever workarounds by either taking whatever artifacts were available and putting them to a new use or by taking them apart into their components/pieces and putting those to new uses. For example, cotton and feed sacks were used for backing, the string in the feed and flour baskets was often unraveled to use for quilting, and scrap cotton, burlap sacks, old sheets and old quilts were recycled as batting.[10] Mary Holmes, as quoted in MacDowell (1997:37) recalled gathering and processing scrap cotton for quilt batting:

> They would use lint cotton. This would be the cotton that you could go to the gin [and get] and it wasn't any good you know they would throw it over here in the corner. The person who carried cotton to the gin could pick up a bundle of this and it was kind of trashy. But my father and his brothers would always go out in the woods and cut cane for more than one thing - fishing, canning chairs, and whipping the cotton for quilts. And we'd - that was one of the things children had to do - take a pole and you'd beat that cotton until it becomes fluffy and light. We'd whip this and get most of the trash out of it. Then we'd get down and spread that cotton out on linings so it would be nice.

Throughout the quiltmaking process - from piecing the quilt top, to putting the batting, to doing the quilting - quiltmakers found creative ways to be resourceful, convert discards into resources, and make the most of what was available. As Teressie May, as quoted in MacDowell (1997:43), explained that they would "take nothing and make something out of it."

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[10] Old quilts were considered especially valuable because incorporating them was a way to preserve and integrate family history.

Adapting Extemporaneously

Adapting extemporaneously refers to *how* structures are enacted: throughout improvising, actors enact structures with regard to the particulars of the situation at hand. Improvising is not simply structured bricolage but involves playing with structure as well (Eisenberg, 1990; Hatch, 1998; Hatch, 1999). In *The First Book of Jazz*, Langston Hughes explained (1982:40): "[Jazz] was not just playing music. It was playing—like a game—playing with music, for fun."

The goal of improvising is not to produce exact renderings of structures but to make the most of the situation at hand, in a structured manner - even if it means tailoring structures to the specific circumstances of the situation. Extemporaneity in improvising is not about acting quickly but about acting in the moment - responding to a situation as it changes.

Adapting extemporaneously is the activity that distinguishes improvising from other creative practices. This aspect is clearest when one contrasts standard quiltmaking with improvising in African American quiltmaking. Standard traditional quiltmaking involves enacting structures (e.g., a quiltmaker determines the pattern and fabric to be used, cuts the pieces precisely, and then pieces them together so that the pattern is replicated exactly), assessing continuously (e.g., a quiltmaker makes sure that she is not deviating from the intended pattern) and creating resourcefully (e.g., a quiltmaker often uses scraps of cloth) but not adapting extemporaneously (e.g., the quiltmaker will not incorporate "mistakes" in her quilt and instead, will "correct them).

Although adapting extemporaneously may be the activity that distinguishes improvising from other practices, improvising is not simply adapting extemporaneously. As noted before, improvising consists of enacting structures that serve as templates for assessing the situation, creating resourcefully, and adapting extemporaneously.

3.3.2 Degrees of Improvising

At a general level, people are constantly improvising to deal with unpredictable changes or things not going as planned, even during apparently routine tasks (Scribner, 1984). Out of the improvising, one notices different degrees of improvising (Moorman and Miner, 1998; Weick, 1998; Zack, 2000). I suggest one way to characterize degrees of improvising is by the difference between the instantiation of a structure and its referent (i.e., "structural referent"). The degree of improvising is a way to describe and compare *how* structures are enacted. In cases where the structure is enacted by drawing on the structural referent as expected by the audience, the degree of improvising may be influenced by the specificity of the structural referent.

An instantiation of a structure is the enactment of a structure in a particular situation. One develops a knowledge base about how the structure has been enacted (including implicit and explicit expectations about the structure) from past instantiations - either from enacting the structure in the past or from stories about others enacting the structure. When one draws on that knowledge base, it becomes a template for enacting the structure. A structural referent is a representation one develops about a structure, and may be a story, artifact, collection of memory traces, or a combination of any of these representations. The structural referent of a genre, for example, includes the form of the genre and associated expectations. The structural referent serves as a template for enacting the corresponding structure and for making sense of an instantiation of that structure.[11]

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[11] Miner et al. (2001, pp. 316) discuss "improvisational referents" as important factors that shaped the improvisations they observed:

> The referent both infuses meaning into improvisational action and provides constraint within which novel action unfolds. In our firms, unexpected problems, temporal gaps, and unanticipated opportunities provided crucial referents that anchored and constrained the improvisational episodes.

An improvisational activity often included more than one referent, including, in addition to those listed above, "a preexisting behavioral routine, product, or interpretive framework." An improvisational referent is any factor that shapes the improvising process. A "structural referent" is more specific; it refers to any reference or representation of a structure.

Figure 3.1 (following page) consists of four quilts, which represent a range of improvising in African American made quilts. The degree of improvising decreases as one proceeds from Figure 3.1a to Figure 3.1d. The first three quilts (Figures 3.1a, 3.1b, and 3.1c) were made around the 1940's by the same quilter, Dorothy Lambert White. The first quilt (Figure 3.1a) is a strip quilt. Strip quilts were common utilitarian quilts made quickly with whatever materials were at hand. Made from six different cotton fabrics, the quilt consists of randomly cut pieces, organized only in uneven strips (Benberry, 2000). Uniformity of blocks or of set was clearly not a high-priority goal. The second quilt (Figure 3.1b) consists of two distinct and unrelated patterns, Fly Foot (also known as Whirligig or Pinwheel) and Nine Patch, arranged in such a manner that they are connected with diagonals. As Benberry (2000:38) notes:

> Theses paths or connections are so noticeable, it is difficult to assume Dorothy's arrangement of Fly Foot and Nine Patch was accidental or mere happenstance, or that she was unaware of what she was doing [...] We are compelled to believe Dorothy's organizing of this quilt top was intentional because the arrangement of the dark path's is consistent throughout the quilt's surface. Other examples of her work indicate each quilt is different in construction and concept, and so she apparently was open to new ideas and wanted to try them out.

The third quilt (Figure 3.1c) is the Friendship Star quilt, with an eight-pointed star design with a circular open center. The design was a traditional design (part of the custom was to have friends write their names in each of the center circles, although this quilt has no signatures). The pieces are cut uniformly, the blocks are identical in size and are arranged symmetrically. The only variation is in the arrangement of colors and fabric. Figure 3.1d is a quilt made in 1924 by Beulah Smith, an African American quilter from Paragould, Arkansas, and an example of an intricate pattern rendered precisely. The quilt was a wedding gift for her employer. Beulah Smith created the design and named it "Rising Sun." The Rising Sun Quilt was clearly planned in great detail and executed meticulously with a special attention to symmetry, preciseness, and uniformity in shape, size, and arrangement of pieces, colors, and blocks. The

Figure 3.1: Four Different Examples of African-American Made Quilts

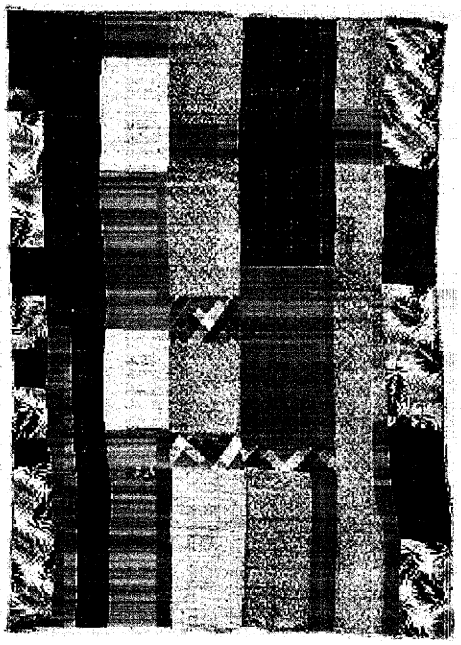

Figure 3.1a: *Strip Quilt*, made by Dorothy Lambert White, Conway, Arkansas, circa 1940, 86 x 60 inches, cotton, pieced.

Figure 3.1b: *Fly Foot and Nine Patch Quilt*, made by Dorothy Lambert White, Conway, Arkansas, circa 1940, 76.5 x 63.5 inches, cotton, pieced.

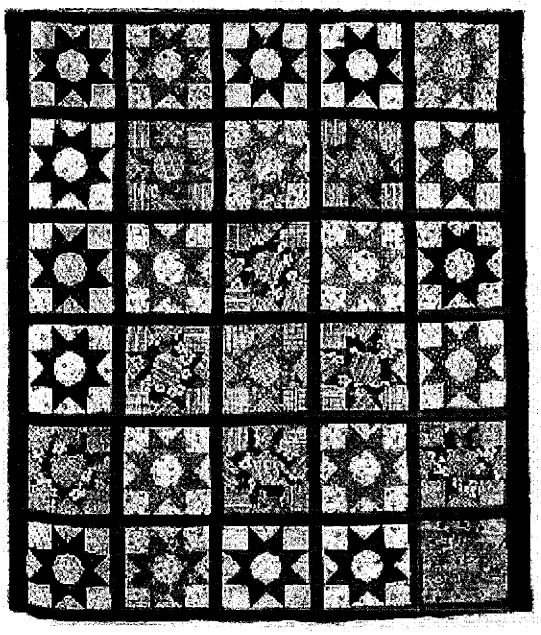

Figure 3.1c: *Friendship Star Quilt*, made by Dorothy Lambert White, Conway, Arkansas, circa 1940, 89 x 60 inches, cotton, pieced.

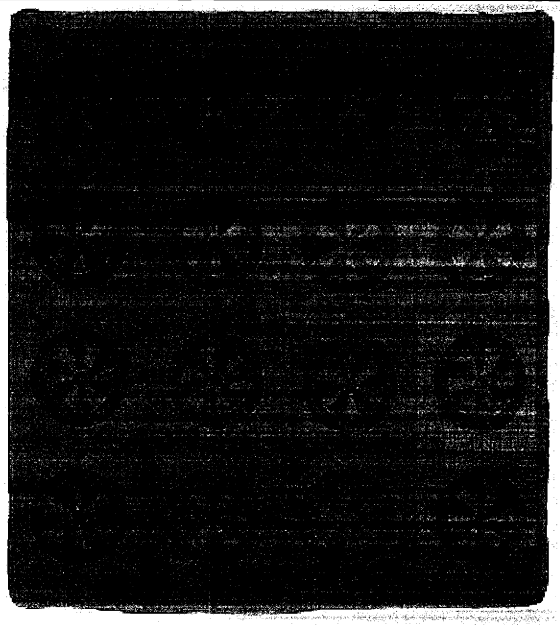

Figure 3.1d: *Rising Sun Quilt*, made by Beulah Smith, Paragould, Arkansas, 1924, 80 x 70 inches, cotton, pieced.

Source: Benberry, C. (2000). *A Piece of My Soul: Quilts by Black Arkansans.* The University of Arkansas Press: Fayetteville, Arkansas.

Rising Sun Quilt is an example of a quilt that was planned with great specificity and executed accordingly; it does not seem to have been improvised.

Structural referents can be explicit or tacit. Explicit structural referents can be shared by a group of individuals (e.g., a story or a recipe), whereas tacit structural referents are personal and not necessarily articulated (e.g., experience developed while creating formulas). As my findings show, an important role of artifacts is their use as representations of structural referents.

Assuming one enacts a structure as socially expected, the degree of improvising depends on the specificity of the structural referent: the more specific the structural referent, the less room there is for adapting to the situation at hand.[12] The strip quilt (Figure 3.2a) and brick pattern are both examples of patterns with relatively low specificity. To make a quilt with a brick pattern, one simply sets rectangular patches in rows, each row staggered from the next, like brick masonry (Benberry 2000, p.17). One can choose the size of each patch, whether or not all patches or rows are uniform, the color arrangement of each patch, and still reproduce the brick pattern. The expectations associated with making both quilts contributed to the low specificity of the structural referent: the quiltmaking norms encouraged the quiltmaker to extemporaneously adapt the pattern to the situation at hand. In contrast, an example of a pattern with a relatively high degree of specificity would be the eight-pointed star design in Figure 3.2c or the Rising Sun quilt in Figure 3.2d. These quilt design patterns are more specific about shape, dimensions, arrangement and colors of the pieces. With such patterns, there is very little room to improvise if one tries to follow the pattern. Particularly the fourth quilt, which was made for a white American family, and was thus made respectful of their expectations (e.g., there was no extemporaneous adapting, unless it was necessary to maintain precision). The more specific the structural referent, the less apparent room there is to

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[12] Of course, one could imagine a structure that is situationally prescriptive - that is, it anticipates specific situations and states what one can or can not do in those circumstances (e.g., rules of games). Rarely is the situation at hand totally anticipated, though, and thus one often finds room for adapting even more to the situation at hand, if one decides to.

improvise, assuming one enact the structure as expected. More specific structural referents tend to be more detailed, intricate, and inter-dependent than less specific structural referents.

The specificity of the structural referent does not determine the degree of improvising, however. For example, one may take a very specific recipe and "follow it exactly" or one may take the same recipe and use it as a guide to make something quite different. There would be a higher amount of variation between the structural referent and the enacted structure in the latter case than in the former. The degree of improvising could be due to several factors, including the scarcity of resources (e.g., materials, time, money, etc.), the unpredictability and dynamics of a evolving situation, and/or simply because one want to improvise. Figure 3.2 shows a representation of the structural referent "Log Cabin pattern" and two examples of quilts designed using that pattern. In addition to differences between how the Log Cabin blocks are arranged, there are differences between the two quilts regarding the degree of variation between the structural referent and the two instantiations of the Log Cabin pattern. Specifically, in the second quilt, there is clearly greater variation between the structural referent and the various ways it was instantiated than in the first quilt.

Others have noted that there are degrees of improvising (e.g., Berliner, 1996; Weick, 1998; Zack, 2001). Yet, none describe explicitly along which dimension(s) improvising varies. I propose to define the degree of improvising by the amount of variation between the structural referent and the instantiation of the structure.

Having developed a framework to better understand the activities that constitute improvising, I develop next a framework to examine the roles of technology in improvising.

3.4 Theoretical Framework of the Roles of Technology in Improvising

3.4.1 Introduction

Throughout the quiltmaking process, quiltmakers engage with different kinds of artifacts in a number of different ways. For example, scraps of cloth (frequently from old garments and left over homespun cloth) are used to make-up the quilt top. Old blankets or old quilts are used as batting (the "stuffing" material). To do the quilting, a large frame made of wood, called the quilt frame, is used to keep the top, filling and base taught and in place, and thus facilitate the stitching of the three. The uses of quilts are also varied (e.g., providing warmth, representing talent, recording family history, and communicating secret messages) and may influence the quiltmaking process if the quiltmaker considers them as potential uses of the quilt that is under construction. I draw on this rich variety of artifacts and uses to develop a framework on the roles of technology in improvising.

I define "technology" quite broadly: technology refers to any artifact that is involved in the improvising process. Consequently, throughout this dissertation, I use "technology," "technological artifact," and "artifact" interchangeably. This definition is grounded in Orlikowski's (2000) distinction between technology-as-artifact and technology-in-practice. The distinction avoids assuming artifacts embody particular structures and instead, can explain how the use of an artifact may vary and how, during use, the artifact itself may change. Consider, for example, a quilt. This artifact is a collection of pieces of cloth held together by string. A practice most commonly associated with a quilt artifact is the recurrent use of the artifact as decorative bedding. There are other practices, though, that involve the same artifact: it can, for example, be used as insulation for newer quilts and it can be used to communicate secretly (e.g., Underground Railroad). The distinction between artifact and use is quite simple but critical to help us recognize that some artifacts are typically associated with a stable set of uses, and consider other ways in which the artifact can be engaged in

practice. By not making such a distinction, we risk associating artifacts with a stable set of uses and it becomes very difficult to talk about the same artifact as engaged in unexpected and emergent uses. As noted earlier, the ability to separate the habitual uses of an artifact (and associated expectations) from the artifact itself and consider alternative uses of the same artifact is a critical skill of bricolage. Similarly, recognizing the habitual enactments of structures may enable one to "play" with those structures and adapt them creatively to the situation at hand. The use of quilts to secretly communicate in the Underground Railroad is an example of the benefit of being able to creatively imagine ways of playing with structural expectations.

To consider "technology" solely as an artifact is to ignore that one makes sense of a technological artifact via its participation in structural enactments. For example, a quilt is not simply an assemblage of scraps of cloth, thread and filling, but has simultaneously any number of potential identities, depending on how it is imagined and used (e.g., the quilt as something that keeps one warm, the quilt as a way to communicate secretly, the quilt as a source of income, etc.). To consider "technology" solely as the result of human activity, on the other hand, is to assume technology may be used in any manner, within the social condition (e.g., political, cultural, etc.) of the situation, and ignore the material properties that enable and constrain enactments. For example, in the North of England, closely worked stitching designs evolved for Durham quilting because the filling that was used was such that if the designs weren't closely worked, the filling would separate and bunch up into hard lumps when the quilt was washed, rendering the quilt impractical and unattractive (Banks, 1999).

Table 3.1 (following page) offers a number of examples of different kinds of artifacts and the different ways those artifacts are significant throughout the quiltmaking process. From these examples and many others mentioned in the quiltmaking literature, I have developed a categorical framework identifying two kinds of artifacts and three generic ways in which their use is significant.

Table 3.1: Examples of Technologies Associated with Quiltmaking

Technology	Technology-in-Practice (Specific)	Role of Technology	Predominant Aspect of Technology
A completed quilt	Quilts were used to provide warmth	product	practical
A completed quilt	Quilts were hung outside houses to signal to travelers on the Underground Railroad a variety of messages. For example, if the quilt had a "Jacob's Ladder" pattern, hanging it on a porch signaled that the home was a safe haven.	product	symbolic
A completed quilt	Old quilts were recycled as batting for newer quilts.	component	practical
An old blanket and an old bath towel	Used as batting by Emma Perkins Wilbourn, sometime between 1900-1925, in Virginia. The old blanket was not quite large enough to use as batting for the quilt so an old bath towel was folded in half and attached to the old blanket; together they served as batting for a newly pieced quilt.	component	practical
Linsey Cloth	Salves often made Linsey because it was all they could afford. During the Civil War, most Southern women had to make Linsey to clothe themselves, families, and soldiers. The rough cloth was used to make pants, coats, dresses and skirts. Remnants and scraps of Linsey from old garments were pieced together to make warm bedding quickly during the Civil War.	component	practical
Pieces of fabric from significant other's clothes	Used for a quilt top, commemorating the significant other.	component	practical and symbolic
Sewing Machine	Quilts with sewing machine stitching were a status symbol in the late 1800's because the sewing machine was very expensive and required a great deal of dexterity to "control the three layers of top, batt, and lining while treadling the machine, for the working space was small, and the thread often broke." (Meyer 1994, p.1117)	tool	practical and symbolic
Quilting Frames	Used to stretch out top and back, add filling, and quilt the three layers together	tool	practical
Emergent Quilt	Used to assess the process thus far and what to do next.	product	symbolic
Emergent Quilt	Used to extend the quiltmaking process across different times and places.	tool	practical
Emergent Quilt	Used as part of the final product.	component	practical

What follows is a more detailed explanation of my framework on the roles of technological artifacts in improvising. For a technology to have a role is for a technology to be recurrently used in the innovation process (i.e., technology-in-practice). In describing technologies as having particular roles, I do not want to anthropomorphize technology and suggest that, like actors in a play, they take on certain dispositions or behaviors. The recurrent engagement of technology is similar to the notion of genre (e.g., Orlikowski and Yates, 1994; Yates and Orlikowski, 2002). A role has a socially recognized purpose and form, where the form is represented not only by past uses but by the artifact as well.

The roles of artifacts can be analyzed along three dimensions. There are two kinds of technological artifacts: stable and emergent. Both kinds are involved in at least three different structured ways: technology as tool, technology as component, and technology as product. Each role involves at least one of two aspects of artifacts: their practical aspect and their symbolic aspect. I will present examples from African American quiltmaking to illustrate different aspects of different kinds of technological artifacts involved in different roles. These examples and others I will present also highlight that the roles of technology are neither inherent in the technological artifact nor completely socially determined, but rather, emerge from the interaction between the constraints and abilities of the material artifacts, the social context of the activities (including the motivations and intents of the actors) and other particulars of the situation.

3.4.2 Two Kinds, Three Uses, and Two Aspects of Artifacts

During the process of improvising a quilt, there are at least two general kinds of technologies: *stable artifacts,* which do not significantly change during the improvisation (e.g., the quilt frame, needles) and *emergent artifacts,* which are created and adapted during the improvisation (e.g. the quilt-in-progress).

Examples of stable artifacts include the quilt frame, the needles, scissors, and sewing machine (assuming all were used during the quiltmaking process). Traditionally, in the organizational literature, technology is assumed to remain stable while in use during a performance. That is, the technological artifact is

assumed not to change significantly as one uses it for whatever purpose. There is research on how the *use* of technology may evolve, or how, over many different uses, the technological artifact is adapted (e.g., Bjiker et al., 1987) but within a single use, the prevalent assumption is that the technology will not change significantly (a notable exception is the literature on boundary objects). During the quiltmaking process, however, artifacts are created and adapted. The quilt-in-progress is a clear case of an emergent artifact; it is created and changed during the process. In other areas, emergent artifacts, such as prototypes and other boundary objects are critical to the process of innovation involving different communities of practice (Carlile, 2002; Henderson, 1995, 1998).[13]

There are other ways to categorize different kinds of artifacts. For example, the literature on the uses of technology in jazz improvising describes how the acoustical properties, physical layout, and performance demands influence the sounds that can be produced with an instrument (Berliner 1996). One could categorize artifacts by any of these features. Another category that may be worth considering is whether or not the artifact can be shared during a particular use. For example, it may be significant that three musicians can simultaneously read off the same sheet of music but not play the same instrument. For the moment, though, I will simply consider two kinds of artifacts: stable and emergent.

Both kinds of artifacts may be involved in one of at least three generic ways: as tool, as component, and as product. Technology as tool refers to how technology is involved in the process of constructing the outcome (e.g., the use of a quilt frame to hold the top, filling, and backing of a quilt together during quilting); technology as component refers to how technology is involved as an element of the outcome (e.g., the use of scraps of cloth to make a quilt top); and technology as product refers to the role of technology as an outcome of the improvising (e.g., the use of a finished quilt to keep warm).

Each role involves at least one of two aspects of an artifact: practical and symbolic. Involving an artifact for its practical aspect refers to using the

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[13] Boundary objects are artifacts that are used to bridge boundaries. I discuss this literature in

functional properties of an artifact (e.g., using a quilt for warmth). Involving an artifact for its symbolic aspect refers to using the representational properties of an artifact, without necessarily depending on an artifact's functional capabilities (e.g., using a quilt to secretly signal a safe route on the Underground Railroad regardless of whether or not it keeps one warm).

3.4.3 Examples of Artifacts in Improvising

Table 3.2 (following page) describes different examples of the roles of artifacts in African American quiltmaking. Examples of technology as tool include thimbles, needles, scissors, the quilting frame, and the sewing machine. Of particular interest are the quilting frame and sewing machine. The quilting frame consisted of four wood beams, typically placed on the backs of straight-back chairs and held together with large screw clamps. The large size of the quilt frame often limited the quiltmaking to the largest room of the house - usually the kitchen. To store it, at night, the frame was either hung from the ceiling or rolled up and placed standing in a corner (Benberry, 2000).

The sewing machine is an example of a technology used as a tool in the quiltmaking process that at had both practical and symbolic value. When they were first introduced in the mid-1800's, sewing machines were very expensive (about a fourth of the average annual family income of the time). Quilts with sewing machine stitching were a status symbol in the late 1800's because the sewing machine was very expensive and required a great deal of dexterity to "control the three layers of top, batt, and lining while treadling the machine, for the working space was small, and the thread often broke." (Meyer, 1994: 117). By the turn of the century, the price of sewing machines was more financially available and most families had them in their homes.[14] The sewing machine

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Chapter 6, when I present my field data on the Internet start-up.

[14] This was due, in part, because sewing machine manufacturers introduced the concept of installment plans - where a family makes a down payment and then pays the rest in monthly installments - to make sewing machines seem more financially accessible; the installment plan is now a common financial strategy for many consumer goods (Meyer 1994).

Table 3.2: Analyzing the Roles of Artifacts Along Three Dimensions

The roles of artifacts can be analyzed along three dimensions:

- Two kinds of artifacts: stable and emergent
- Three uses of artifacts: tool, component, and product
- Two aspects of artifacts: symbolic and practical

The following two tables provide examples of each:

Stable Artifacts

	symbolic	practical
tool	The use of sewing machine as status symbol.	The use of sewing machine to stitch the top, filling and back together. The use of a quilt frame to hold the top, filling, and back together.
component	The use of a significant other's old clothing to put together a memorial quilt.	The use of Linsey cloth to piece a quilt top.
product	The use of the quilt to secretly signal safe routes on the Underground Railroad.	The use of a quilt to keep one warm.

Emergent Artifacts

	symbolic	practical
tool	The use of emerging quilt to assess the process thus far.	The use of the emerging quilt to stop process and continue at a different time and place.
component	The use of the emerging quilt pattern to design remaining quilt.	The use of the emerging quilt as the key part of the remaining quilt.
product	The use of the emerging quilt to represent the process thus far.	The use of the emerging quilt to stop process and continue at a different time and place.

lost its status symbol and handwork became most valued. As Meyer (1994: 121) explains:

> With the passing of time, the machine turned into simply that - a machine. When the time came that women took the machine for granted, they - and the magazines they read - once again valued handwork for its own sake. By the end of the nineteenth century, handwork, not machine work, was the status symbol, for the handwork stitch spoke of leisure time and experience with the needle.

The sewing machine had practical value because when the user of a sewing machine developed a particular level of comfort using it, she was able to stitch fabric together more quickly than by hand and consequently, save a great deal of time. It had symbolic value because the stitches produced by a sewing machine were distinguishable from hand sewn stitches, thus many people admiring a quilt could tell whether a quilt was sewn by machine or by hand; this distinction gave the quilt a particular status, although that status changed over time.

Examples of technology as component include the use of thread for piecing and quilting, scrap cotton and old quilts for batting, and flour sacks for the backing. The most visible examples of technologies as component are the scraps of cloth pieced together into a patterned mosaic. In the eighteenth and nineteenth centuries, for example, poor families often had to make do with a home-spun cloth, called linsey cloth, that was relatively quick, easy and inexpensive to make (Waldvogel, 1994). Linsey cloth consisted of a wool weft and a cotton warp and was used to make cold-weather cloths such as pants, skirts, and peticoats. It was coarse and stiff, however, and it unraveled easily, thus women adapted their quiltmaking practices in ways that in ways that respected the material qualities of linsey cloth. Waldvogel (1994:125) explains:

> The raveling problem limited the size and type of quilt blocks one could make from linsey. The quilt pieces are rarely curved and never appliqued. The coarseness and thickness of the cloth limited the quilting stitch length and the quilting design [...] The quilting designs are limited to fans, diamonds, or straight diagonal lines, with four to six stitches per inch.

Linsey cloth enabled women to make much needed quilts to keep their families warm but the use of linsey cloth as a component also structured the way

the women designed their quilts (specifically, their designs consisted of larger blocks and longer stitches than traditional non-utilitarian quilts of the time).

The history of quiltmaking includes examples of artifacts used as components, both because of their practical aspects (e.g., thread is used to hold together the pieces of cloth, cotton batting is used to insulate the quilt, linsey cloth to piece the top, etc.) and symbolic or aesthetic aspects (e.g., a cloth of a certain color is used to bring out a particular pattern, the tattered clothing of a significant other is used for a memorial quilt, etc.).

Finally, examples of technology as product include the final quilt ("quilt"), and during the process, the emergent quilt. Quilts are the clearest example of artifacts that were used not simply for practical reasons (e.g., as a tool, component, or product) but for symbolic reasons as well. As I've noted before, the symbolic function of a quilt often went beyond simply decoration. Made from scraps of cloth significant to family or community members, quilts were given as gifts on such occasions as births, weddings and graduations and used in a manner similar to photograph albums: they were documents of family stories that triggered the telling of those and other family stories. An improvised design was visually different from the precise patterns preferred by white women and a link to African and African American identities (MacDowell, 1997); it was a symbol of pride in one's heritage. Quilts were also used to secretly signal safe houses and routes along the Underground Railroad.

Although completed quilts are rarely used during the quiltmaking process (with the notable exception of using old quilts for batting), the various ways that completed quilts are used are significant to the quiltmaking process because they are part of the history that quiltmakers reflect on when making creative decisions. The greater the diversity of uses of quilts that a quiltmaker is exposed to, the greater the quiltmaker's awareness of possible uses of the quilt she is currently working on. This is similar to how experience with a variety of uses of the same artifact improves the abilities of a bricoleur to use that artifact creatively (Weick, 1993). This greater awareness is significant to the *projective* dimension

of human agency (Emirbayer and Mische, 1998).[15] Thus, a significant role of technology during the quiltmaking process is the role of technology as product - i.e., imagined potential uses of the product of the improvisation, based on past uses of similar products.

During an improvisation, the emerging quilt is used in several different ways. As a tool, it enables quiltmakers to start the process in one location, take a break (sometimes for as long as a week or two), and continue the process later on in a different location. As a component, it becomes the core part of the ensuing product. As a product of what has been improvised thus far, it is used as a representation of what has occurred and an inspiration for what will happen next. The emergent quilt is an example of how an artifact may be involved in several different roles at once.

Improvising involves extemporaneously adapting, throughout the creative process, shared structures using resources at hand. It is therefore grounded in the performance situation. Technology is integral to the situation, both as an artifact and as part of the rules and resources that are drawn upon when actors enact structures. Unlike other structures such as authority systems, technologies-in-practice are predicated on the use of technological artifacts, which serve to represent expectations and whose material properties enable and constrain.

These examples illustrate that a technology does not have a role like an actor has a role in play. A technology's role emerges from how it is used. The use of technology, though, is neither inherent in the technology nor completely socially constructed (unlike, say, the name for a technology), but rather, is the result of several social and situational factors. The recurrent ways that artifacts are used in the process of improvising are influenced by several factors, including the performance situation (e.g., economic and social conditions and the particulars of the moment(s) it was created in), the individual tastes of the quiltmaker(s), and

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[15] The projective dimension of human agency refers to an actor's "imaginative engagement of the future" (Emirbayer and Mische 1998, p.984). Actors compose new possibilities ("projects") from reflecting on past experiences and the situation at hand. As Mische (1997) explains: "Projects are the means by which actors imaginatively formulate purposive actions, but these are always composed from the cultural narratives and repertoires at hand"

the material properties of the artifacts. The size of the quilt, for example, was mostly practical: it depended on the size of the bed that it was going to cover. For example, pre-Revolutionary War quilts typically measured about ten feet square to cover the common large beds of the time, where a husband and wife and their several children could all sleep together. By 1812, though, the most popular bed was a smaller, "three-quarters" bed," and the size of quilts were reduced accordingly. As Finley (1992:26) noted in her classic 1929 study of the history of quilts:

> One wonders how [the three-quarters bed], wider than necessary for the comfort of one sleeper and far too narrow for two, could have remained the standard size so long. But it did, well past the Civil War - which accounts for the odd size of many of the quilts of the eighteen-hundreds. Now fallen into modern hands, they present the problem of being too narrow for today's double bed while too wide for a twin bed.

The material properties of the artifact also occupy space and persist over time - thus artifacts are involved in work practices in ways that influence how work is conducted spatially and temporally. For example, using a sewing machine shortens the amount of time required for stitching together the quilt top. Because the quiltmaking process involves tangible artifacts that persist over time, the entire process can take place over several sessions in different places (rather than in a single sitting).

In general, though, these examples illustrate how the practical and symbolic aspects of stable and emergent artifacts are engaged in three general roles: tool, component, and product.

3.5 Summary

Drawing on the historical accounts of improvising in African American quiltmaking, as well as the organizational literature reviewed in Chapter 2, I have developed a theoretical framework on improvising and the roles of technology in improvising. According to this framework, improvising is a creative process that involves extemporaneously adapting shared structures to changing situation(s) using whatever is at hand. Improvising consists of

enacting structures that serve as templates for assessing the situation, creating resourcefully, and adapting extemporaneously. What distinguishes improvising from other creative processes is that the emerging improvisation is influenced unpredictably by the situation as it is being created.

There are two kinds of artifacts: stable and emergent. There are three kinds of roles: technology as tool, component, and product. Stable artifacts are artifacts that do not significantly change during the improvisation. Emergent artifacts are artifacts that are created and adapted during the improvisation. Technology as tool refers to how technology is involved in the process of constructing the outcome, technology as component refers to how technology is involved as an element of the outcome, and technology as product refers to how technology is used as an outcome of the improvising. All three roles may involve at least one of two general aspects of artifacts: practical (i.e., using the functional properties of the artifact) and symbolic (i.e., using the representational properties of the artifact).

As I describe in the following chapters, I have found these frameworks helpful for making sense of improvising and the roles of technology in improvising.

Chapter 4: Research Methods

4.1 Introduction

My dissertation is an exploratory study into the practices that constitute improvising in the workplace and the roles of technology in such improvising. I used ethnographic methods to developed a theoretical framework that addresses two questions:

1. What does it mean to improvise?
2. What are the roles of technology in improvising?

In Chapter 2, I presented an overview of relevant literature and in Chapter 3, I presented a theoretical framework addressing the aforementioned questions. Next, I want to explore the theoretical framework empirically, drawing on findings from two field studies I conducted. Before doing so I describe, in this chapter, how I developed my theoretical frameworks, collected data in my field studies and analyzed them.

It is appropriate that I discuss my methods after I described my theoretical framework on improvising because the process by which I developed my dissertation is an example of improvising. To illustrate this point, it may help to contrast what I did with what I did *not* do. My research is not deductive research. I did not first develop a hypothesis, design a set of experiments to test the hypothesis, execute those experiments as planned, and analyze my results to confirm or reject my hypothesis (Judd, Smith and Kidder, 1991). Instead, my research is inductive. I "assessed the situation" and derived several theoretical concepts from my observations. My research is also contextual and focuses on processes. As such, it is an example of interpretive research, with "an aim of generating a descriptive and explanatory theory" of the roles of technology in improvising (Orlikowski, 1993: 311).

Overall, the process of developing my dissertation was iterative, moving between collecting data; analyzing, comparing, and reflecting on them; developing and adapting my theoretical concepts; and discussing my theoretical

insights and empirical findings with others. For example, after I completed my ethnographic field study of the nonprofit startup, DotOrg, I started to put together detailed accounts describing the activities that constituted several projects I had witnessed. While piecing together those accounts, I was also developing a framework to describe the roles of technological artifacts, based on accounts of improvising in African American quiltmaking. As I developed my framework based on improvising in African American quiltmaking, I was also beginning to examine how it applied (or did not apply) to my findings from the startup. In African American quiltmaking, for example, the significance of the symbolic aspect of technological artifacts was apparent in several ways, most strikingly in the use of quilts to signal safe passages in the Underground Railroad. The importance of the symbolic aspect of technological artifacts (i.e., technological artifacts are useful not simply because of their functional capabilities) helped me "see" (i.e., it highlighted for me) the important role of technological artifacts at DotOrg as structural referents, particularly as representations of collective efforts (discussed in Chapter 7). As I realized the salience of the symbolic aspect of technological artifacts at the startup, I returned to African American quiltmaking to explore this aspect in greater detail. I also discussed my ideas with others (e.g., colleagues, advisors) and read academic journals to see what had been written on the subject. These discussions and readings influenced my dissertation work, including how I developed my theoretical frameworks (e.g., I related my concepts to those of others), pieced together my accounts of what happened at the field sites (e.g., I made sure to include information pertaining to the symbolic aspects of technological artifacts), and presented my ideas and findings to others (e.g., I would continue to use examples that were clear to others in presentations and either clarify or drop those that were not).

As I iterated among activities - collecting data, reflecting on everything I was gathering, writing up my findings, developing theoretical concepts, and discussing my findings with others, I produced and edited multiple drafts of tables, graphs, accounts, and chapters until, eventually, I pieced together this dissertation. In this regard, the process of developing my dissertation on the

roles of technology in improvising was an improvisation itself that also involved technological artifacts, including emergent artifacts, such as the dissertation.

Although the overall process of creating my dissertation was iterative, what follows is a linear presentation of general aspects of the process. First, I discuss how I conducted my two ethnographic field studies. I discuss each separately and describe how I gained access to the sites, what I collected, and how I collected it. Finally, I discuss how I analyzed my field data, developed my theoretical concepts, and examined them empirically.

4.2 Conducting Two Ethnographic Field Studies

Practice-based theories, such as structuration theory (Giddens, 1984) and the technologies-in-practice lens (Orlikowski, 2000), argue that to understand a phenomenon (e.g., structure, knowledge, learning, innovation, creativity), one must examine the practices that constitute that phenomenon. Consequently, to understand the roles of technology in improvising, I collected data on the practices that groups of individuals engaged in as they improvised. I accomplished this by conducting two ethnographic field studies using principles and strategies of participant observation (Jorgensen, 1989). Participant observation, explains Jorgensen (1989:23):

> focuses on human interaction and meaning viewed from the insiders' viewpoint in everyday life situations and settings. It aims to generate practical and theoretical truths formulated as interpretive theories. The methodology of participant observation involves a flexible, open-ended, opportunistic process and logic of inquiry through which what is studied is subject to redefinition based on field experience and observation.

In this regard, participant observation is a process that follows an improvisational model of change (Orlikowski, 1996; Orlikowski and Hoffman, 1997), which "recognizes that change is typically an ongoing process made up of opportunities and challenges that are not necessarily predictable from the start" (Orlikowski and Hoffman, 1997: 20).

In both field studies, I set out to understand the everyday practices of individuals as they worked together to accomplish a project. In the case of the chemical manufacturer, Blockasun, employees worked together to manufacture and sell Blockasun products. In my fieldwork, I studied the work practices of most Blockasun employees (e.g., the formulating team, the sales team, the CEO, the accountant, the administrative staff). For the dissertation, however, I focused on the work practices of the formulating team because of their extensive use of a variety of artifacts. In the case of the nonprofit startup, DotOrg, participants worked together to help launch the startup from a winning business plan to a viable nonprofit startup.

4.2.1 Choosing Sites

For my dissertation, I chose the two field settings because they both involved ample opportunities to observe groups of individuals using technology to work together on a variety of projects in different organizational settings. Both field settings included projects (and the activities associated with accomplishing them) that were significantly different from each other, both within sites and across sites (e.g., the activities that constituted developing formulas, making up formulations and testing them were significantly different from each other and from the activities that constituted developing a funding pitch and creating a web prototype). They also differed in the kinds of technological artifacts that were used during improvising. At Blockasun, for example, the formulating team did not use information technology extensively while improvising a formula (e.g., their only use of information technology was the use of computers to format a formula), whereas at DotOrg, the team working on developing a funding pitch used multiple kinds of information technologies (e.g., instant messaging, walkie-talkies, cell phones, computers) for a variety of uses (e.g., communicating, coordinating, presenting ideas, etc.).

After I conducted my fieldwork at Blockasun, I started going through the data I collected, piecing together what I had observed, and noticing that a significant role of technology in the improvising of the formulators was the emergent

prototype. Excited to learn more about the role of the emergent artifact, I decided that I should find another site to study - ideally one in which the improvising was around a tangible, Internet-based product. I was specifically interested in an Internet-based product to explore differences between IT artifacts and non-IT artifacts. In addition, although I had collected a rich and interesting set of data describing in detail the work practices of a group of individuals using artifacts to improvise at Blockasun, I wanted to complement this with a set of data describing the work practices of a group of individuals improvising in a more dynamic environment. I wanted to increase the variety of settings to better understand how improvising was different and similar within and across settings, and how the use of technology in improvising was different and similar within and across settings. This also enabled me to better understand the limits of my theoretical framework (e.g., what was not improvising).

4.2.2 Gaining Access

Blockasun

As I mentioned in Chapter 1, I gained access to Blockasun because its parent company - a multinational chemical manufacturing firm named Alchema Industries (pseudonym) - had invited my advisor and I to conduct a large exploratory study on the use of the groupware product Notes (from Lotus Development Corporation) in several business groups owned by Alchema. The larger study focused on the implementation and adaptation of the Notes technology, examining the interactions between the organization and the technology, and considering the resulting changes (intended and unintended) in work practices for the users of Notes. My field study of Blockasun was the most extensive of five that I conducted at Alchema.

DotOrg

Getting access to an Internet startup proved to be especially challenging, even though it was during the time of the Internet boom. I was looking to gain access to a startup beginning in March of 2000, when the Nasdaq was around 5000 (a

year later, it would be below 2000). The Internet boom was in full swing: real-estate prices were sky-rocketing, the business press was filled with success stories of startups getting rewarded immense amounts of money from enthusiastic investors, and new forms of business development were starting to emerge, most notable incubators. Through the alumni network at my university, I was able to talk to some key decision makers at several startups.

The working environment at most startups tends to be very chaotic. Employees - especially those involved in developing the product - tend to spent long hours working on many different tasks. In addition, everyone takes on many roles at once (e.g., the person in charge of technology development may need to help a team at one moment prepare a presentation, attend a company strategy meeting in the following moment, talk to a potential new hire in the next, and at some point, help work on code for the prototype). It is never easy to know what task to prioritize next - they all seem essential and due yesterday. The most common approach is to tackle what is immediate.

The first thing I was asked was "What can you do for us?" The increase in amount and access to potential funding resulting from the "Internet boom" did not seem to decrease the amount of work that employees at startups seemed to face; there was always a lot of work on employees' plates and the only reason they would want to accommodate a graduate student interested in researching them was if that student could be of use to them. I was not able to find any startup that was willing to have me simply be an observer. The only way they would even begin to consider having me study their work practices was if I was available to help get things done.

Fortunately, I was introduced to the Founders of DotOrg via the head of the incubator (Greenhouse) that sponsored the non-profit business plan competition that they had won. The Founders welcomed my participation because they hoped my presence would help legitimize their startup from the point of view of potential clients and investors (e.g., "We have a researcher from the MIT Sloan School learning from us") and wanted to have the process of developing their startup documented so that they could reflect on the process and learn from it.

They also understood that I was constrained in the extent to which I could participate. Observing the participants of DotOrg seemed an excellent opportunity to observe not only the work practices of one startup, but also of the work practices of other startups - all located within a larger startup - i.e., an incubator.

I went into DotOrg to explore the use of IT in improvising because I assumed that there would be a lot of improvising that involved technology in such a new and entrepreneurial setting. I was right. There were numerous examples of improvising, as well as example of not improvising (which I will discuss later on, in Chapter 6). DotOrg thus proved to be an excellent site for further exploring and elaborating my framework.

4.2.3 Collecting Data

Data collection focused on the work activities of participants, particularly as they strove to collaborate and accomplish joint projects, and the contexts in which they worked. In both field studies, I sought to triangulate my findings by collecting multiple sources for data. In general, I accomplished this by complementing my personal observations in the field (in the form of either field notes, audio-tape recordings, or both) with documentation (paper and electronic) and interviews of participants. Overall, I collected detailed data from four sources: observation of daily work practices; transcripts of taped meetings and activities; unstructured interviews with key participants; and archival sources (paper and electronic documentation).

In the field, I always carried a notepad, pen, tape recorder, and a few extra tapes. When I first met a new participant, I was introduced either by the person I was already shadowing or by the key person who had agreed to have me observe at the site. I would explain that I was a doctoral student from MIT conducting research on how individuals use technology to get their work done. I also explained that any data that I reported would be reported anonymously and that I would respect confidentiality (e.g., in both settings, I signed non-disclosure agreements stating that I would respect confidential information and, in my

introductions, would let participants know that I had already done so). I also stressed that I was *not* evaluating participants. I would explain "there are no right answers" in what I was studying, given my research was exploratory, and that I was there to learn from the participants.

Periodically, in my field studies and when appropriate, I reassured participants that actions that they seemed embarrassed about were sensible, given the particular circumstances. For example, when I first started observing a traveling sales representative, he forgot to follow-up with his boss about a particular customer at the end of an exhausting day visiting customers, in part because he had been distracted by a tense call from his wife. He seemed embarrassed by what I had witnessed and stumbled through an explanation regarding what had happened. I kept my notebook closed and put it away (to indicate clearly that I was not going to note the incident in my notebook) and replied that I too was exhausted and that, in similar conditions, I also tend to forget to do things. I then changed the subject. Days later, he confided several things to me (both personal and professional) and I was flattered that he trusted me enough to do so.

In some cases, when I introduced myself to participants, I would also explain that I was studying how people improvise at work. Typically, upon hearing that I was studying improvisation in the workplace, the participant would jokingly say something to the effect of, "Well, you picked the right place to study that. We improvise all the time!" In some cases, I sensed that people were not sure whether I considered improvising problematic or not. I wanted to assure them that I did not consider it problematic. During my field study at Blockasun, I would often reply that, as in jazz or theater, to improvise well requires a great deal of skill, and that is why I was studying improvising at Blockasun. During my field study at DotOrg, I would reply in a similar reassuring manner, remarking that improvising seems to be a critical skill to the success of startups and I was interested in developing a better understanding of what that actually entailed. At both sites, my intent was to emphasize that I believed the people I was observing were doing something valuable, that improvising seemed to be a

helpful way for me to begin to make sense of what they did, and that I was not evaluating any of the people I was observing. I wanted to make the people I was observing feel as comfortable as possible to do what they would normally do, when they did not have a stranger observing them. My responses seemed to help put most participants at ease.

In their field study on improvising, Miner et al. (2001) made a conscious effort not to mention the word "improvisation" to avoid bias due to demand characteristics (i.e., to avoid having participants act in a manner that they believe to be consistent with what the observers wanted to see). Although I did mention to some participants that I was studying improvising, I believe I avoided demand effects by not specifying what exactly I meant by "improvising" (e.g., I never explained what activities constitute improvising). In addition, the data I gathered consisted of observations of work practices over time, rather than measures that were easily influenced by any participants' desires to help me (e.g., attitude scales).

Although I attempted to avoid demand effects, I do not pretend that my presence had no effect on how participants behaved. I believe that my presence had an effect on the work practices of the people I observed, although it is difficult for me to know in most cases exactly how and to what extent. At the very minimum, for example, in both settings, I believe that when I first started to observe participants, my presence made them more self-aware of what they were doing. In addition, another clear influence was when I interrupted the work of participants to ask them to explain and reflect on what they had just done (in most cases they obliged, but not always). Although it is difficult to know how exactly my presence influenced what I observed participants do, I believe that what I observed was representative of improvising in each setting. Stated differently, I do not believe that my presence influenced whether or not participants improvised. I define improvising as a specific collection of general set of activities that occur over time and I believe that participants would have engaged in those general sets of activities, whether or not I had been observing them. In the case of the formulating team at Blockasun, I could compare the

general activities that I observed with observations from previous visits and with other data documenting how the team had created new formulas in the past (e.g., lab books, training manuals). I found that the formulating team had a history of developing new formulas in a manner similar to that which I had observed - i.e., they developed new formulas in a routine manner. At DotOrg, the participants did not have any history of interacting together which I could compare my observations with. The participants at DotOrg, however, seemed so focused on accomplishing numerous projects simultaneously and trying to make sense of multiple uncertainties (e.g., who are our competitors? who are our customers? who are our funders? what are each looking for? what is our service?) that I often felt my presence had little significance relative to all the other interruptions participants had to contend with. Indeed, at DotOrg, in contrast to Blockasun, I had to make a significantly greater effort to get participants to reflect and explain what had just happened.

Over the course of both field studies, I felt I was able to develop a certain level of trust with each participant, although that level varied with each person. At Blockasun, I felt that I developed similarly high levels of trust with all the participants. I felt this, in part, because I became a confidant to several participants and was included in gossip, jokes, and other banter during food breaks. In general, I felt that they wanted me to succeed in my study and made every effort to make sure I was "kept in the loop." I never sensed that I was a threat to their way of working. To the contrary, unlike their parent company, which was threatening to break Blockasun apart (e.g., move the formulating team to a different plant) and in general seemed not to value the Blockasun community, I saw great value in it and was interested in learning as much as possible about it. Because the parent company had also complicated my research (however unwittingly), I had an implicit common bond with Blockasun employees: we both simply wanted the parent company to stop disrupting our work and let us get on with it. Although most participants at Blockasun were equally enthusiastic and helpful in my research, my key informants became the

formulating team, particularly the two apprentices, because I spent the most time with them.

At DotOrg, participants also went out of their way to help me accomplish my research. I felt that I was able to develop high levels of trust with all but four of the twenty key participants. These four remained quite reserved in what they shared with me throughout my field study. They seemed to be skeptical of my role as a neutral observer and seemed concerned about maintaining a certain image. In general, participants at DotOrg seemed much more aware about image - both of themselves and the organizations they were associated with - than participants at Blockasun. This made sense, given many of the activities that participants at DotOrg engaged in involved promoting themselves, their organizations, and DotOrg (whereas at Blocksun, such activities were less frequently practiced during the process of developing a new formula). Partially as a result of having limited access to all participants at DotOrg, my findings privilege the perspective of the Founders. The Founders were my key informants since shadowing them gave me access to the greatest number of projects.

At both sites, I wrote down in my notebooks what I observed people to do and say. I also noted whether or not artifacts were involved and if so, what kinds and how. I wanted to be able to describe as richly as possible what participants did and (if they used artifacts) how they involved artifacts in what they did. In addition to writing down descriptions of what people were doing and saying, I wrote down my own general observations and thoughts regarding uses of technology in improvising. I took advantage of relatively calm periods (e.g., when participants were checking their electronic mail or going to the bathroom) to write down more detailed summaries and thoughts about what I had witnessed. At the end of each day, I reviewed my notes to make sure I could understand what I had written throughout the day, and write down additional thoughts and concepts that were beginning to emerge and which, if the right opportunity arose, I could re-examine in the field at a later date.

In addition to my hand-written field notes, I was able to audiotape several important interactions at both sites. For example, at Blockasun, after observing for several days each member of the formulating team work in their role, I asked each to "think out loud" as he/she went through his/her activities and audiotaped them doing so. At DotOrg, I was able to audiotape almost all of the large meetings in which several key participants were involved. At both sites, before audio taping, I first asked the participant(s) whether or not they minded if I taped them. I would also explain that if, at a later date, they decided they would rather I not have a tape of the interaction, they could tell me and I would destroy the tape (I was never asked to). At DotOrg, it soon became a joke that I always had a tape recorder and always asked at the start of meetings if anyone minded me taping them. After several meetings with participants who were already familiar with me, a few would good-naturedly interrupt my speech soliciting consent to audiotape with "Yes, you can tape us!" These tapes proved invaluable, as they captured the overlapping dynamics and uncertainties of the moment in a significantly richer manner than my field notes did.

In addition to my field notes of observations of daily work practices and audiotapes, I conducted several unstructured interviews with key participants. At Blockasun, conducting interviews proved much easier to do than at DotOrg because at DotOrg, participants rarely had time to talk with me for more than 20 minutes. The consequence of this was that at Blockasun, I was able to interview all key participants, whereas at DotOrg, I was unable to interview the principal consultants or the two co-founders of DotOrg's first customer organization. This proved to be a limitation as I could not report on the perspective of those I did not interview (e.g., I am limited in what I can report regarding the thoughts of the co-founders of DotOrg's first customer organization after they saw the first web prototype of DotOrg). In developing my findings from Blocksun, I drew on interviews with ten people (i.e., the formulating team (3 people), other formulators (2 people), sales representatives outside of Blockasun (3 people) and other Blockasun employees (2 people)). In developing my findings from DotOrg,

I drew on interviews with twelve people (i.e., Founders (2), Incubator Employees (7), Fellows (2), and Intern (1)).

Finally, at each site, I collected a variety of paper and electronic documentation. At Blockasun, for example, I collected print-outs of formulas, faxes sent and received by the formulating team, copies of laboratory book entries recording tests of formulations, test sheets, print-outs of electronic mail, brochures of Blockasun, and trade magazines. At DotOrg, I collected, amongst other documents, print-outs of electronic mail, hand-outs used at meetings, copies of rough drafts of funding pitches, press articles, publicity from the incubator and DotOrg, and print-outs of emerging web prototypes.

Overall, my observation period at Blocksun consisted of two five-week long visits, six months apart, for a total of two months of day-to-day observations. This period proved sufficient to observe several iterations of the practices that constituted the process of developing a new formula. In addition to observing the day-to-day work practices of the formulating team, I was able to participate in the largest cosmetics trade conference in Europe (Incosmetics) and the United Kingdom (SCS Formulate). Also, as important background, I collected data on the practices of others at Blockasun, including, most notably, the work of sales representatives, who helped get information to the formulating team, interacted with customers, and promoted Blocksun's products. At DotOrg, I followed the founders of DotOrg from May 2000, when they were announced as winners, until December 2000, when I participated in the first special event supported by DotOrg. During that time period I spent about four months shadowing the founders every weekday, and spent the remaining time visiting them about twice a week. Because so little of what I observed at DotOrg was routine, I decided to end my observation period at the conclusion of the first special event supported by DotOrg. Since then, I have maintained contact with the Founders to learn how DotOrg continues to evolve.

4.3 Analyzing Data and Developing Findings

My method for developing my framework and concepts and analyzing my field data drew broadly on the principles of grounded theory (Glazer and Strauss, 1967). I conducted several iterative readings of the data until I identified potential themes regarding similarities and differences across the sets of data. I then re-read the data to examine the relevance and prevalence of each theme, trying to better understand why it was or wasn't relevant or prevalent, and adjusting my emerging theoretical concepts accordingly.

I began by examining existing relevant literature on improvising in organizations for common themes, developing an emergent set of categories, and then re-reading the literature to see how it fit with the categories. Then building on this analysis, I drew on accounts of improvising from artistic disciplines, in particular, accounts of improvising in African American quiltmaking, to develop my own framework on the roles of technology in improvising.

In collecting and analyzing data from my fieldwork, I focused on examples of improvising, or what I refer to as *improvisation events*. An improvisation event is the collection of actions and artifacts that are involved when actors innovate extemporaneously by enacting and adapting structures to make do with the situation at hand and to develop an improvised outcome. I identified improvised outcomes and then examined the actions and artifacts that were associated with the history of that outcome. For example, in the case of the formulators, I focused on completed formulas (formulas that were developed for customers to the point that the formulating team no longer changed the formula) as examples of improvised outcomes. In the field, I observed the work practices associated with the development of a new formula. In analyzing my field notes, I began with a completed formula and traced back its history, identifying the actions and artifacts that were involved during the process. In the case of the startup, I focused on the development of a mock web site that was

going to be used to demonstrate the services offered by the startup to potential customers and funders. There were several other improvisation events associated with the one I focused on, including some that were part of the event I focused on.

My analysis of the data I collected from my field studies was both within-field study and across-field study. With both field studies, I started by constructing chronological accounts of the various projects I observed. I also constructed accounts of each setting, the participants, and their activities "outside" of those involved with getting projects done. I then re-read these accounts using my theoretical framework on the roles of technology in improvising. I was interested in what activities fit both within and outside the sets of activities that constitute improvising (i.e., enacting structures in the process of assessing continuously, creating resourcefully, and adapting extemporaneously) and within and outside the categories describing different kinds of technological artifacts, different uses of both kinds, and the use of different aspects of technological artifacts. I examined those activities that fit within the framework to see if I could develop any finer categories or concepts. I did the same for those activities that did not fit within the framework. The use of my framework helped me identify sets of activities that did not constitute improvising (as I had defined it), activities that were integral but not essential to the process (e.g., negotiating), and important differences between improvisations events. I also used the framework to analyze the data and try to develop more specific relations between the activities that constitute improvising and the different kinds, uses and aspects of technological artifacts. As I conducted these analyses I began to define and specify more precisely what it meant, for example, to "assess continuously," and, as another example, the significance of re-using emergent artifacts as components and "creating resourcefully."

Overall, in addition to relevant literature, I drew on three cases on improvising - improvising by African American quiltmakers, improvising by formulators, and improvising my entrepreneurs - to develop my theoretical concepts related to the roles of technology in improvising. This enabled me to

corroborate concepts ("replication") and develop more elaborate concepts ("extension") (Eisenhardt, 1991).[1] To check the accuracy of my interpretations, I triangulated my findings. Where I was unable to triangulate a finding, I noted the ambiguity or removed it altogether.

4.4 Summary

In summary, the process by which I developed my dissertation on technology and improvising was itself an improvisation that involved technology. It was an iterative, exploratory process that was structured throughout by the lenses of structuration theory (Giddens, 1984) and technologies-in-practice (Orlikowski, 2000). As I progressed through the process, my activities became increasingly structured by the history of the process. One of my first activities, for example, was to develop a theoretical framework on the roles of technology in improvising based on existing literature on improvising in organizational studies and on accounts of improvising in artistic disciplines, most notably African American quiltmaking. I also conducted two ethnographic field studies. Using methods of participant observation (Jorgensen, 1989), I collected data on a team of chemists developing formulas for personal care products and on a team of entrepreneurs launching a non-profit Internet startup. I then used this framework to analyze my field data.

[1] Eisenhardt (1991:620) notes: "[Replication] helps researchers to perceive patterns more easily and to eliminate chance associations. Different cases often emphasize complementary aspects of a phenomenon. By piecing together the individual patterns, the researcher can draw a more complete theoretical picture."

Chapter 5: Field Study 1 - The Formulators

5.1 Introduction and Overview

Formulators of personal care products are chemists who create recipes (i.e., "formulas") for products such as shaving creams, shampoos, skin lotions, and toothpastes. They translate relatively vague requests (e.g., "we would like a sunscreen that feels light, smooth, and non-greasy, and has an SPF of 18") into precise formulas involving over a dozen different chemicals. What follows is a detailed account of the work practices of one particular team of formulators as it created formulas for sunscreens. The three-member formulating team belonged to Blockasun, a small manufacturer of Titanium Dioxide-based dispersions based in England.[1] These dispersions were used as sun-blocking ingredients in a number of popular suncare products available in Europe, the United States, South Africa, and Australia.[2] Without charging for their services, the formulating team consulted and worked with actual and potential customers (manufacturers of sunscreens) to modify and develop new sunscreen formulas according to the effects the customers desired (e.g., SPF 30, waterproof, affordable, transparent, spray, etc.). The resulting formulas included dispersions supplied by Blockasun and its parent company, a large multi-national chemical company. Consequently, while serving as free consultants and developers of formulas to sunscreen manufacturers, the formulators also helped promote and sell Blockasun's dispersions. In this chapter, I explore the process of developing formulas as an example of improvising in an organizational environment where improvising, while not labeled as such, was an accepted and valued work practice and where organizational structures had been created to support and improve it.

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[1] Blockasun and all other names in this chapter are pseudonyms.

[2] With an increased public awareness of the harmful effects of ultra-violet rays on the skin, the demand for suncare products has experienced steady growth worldwide over the last five years. In the United Kingdom, for example, demand in 2001 for suncare products increased by 9 percent (from $234M to $255M) and represented 19 percent of the entire $1367M skin care market.

From the perspective of improvising developed in Chapter 3, the overall process of creating a formula was an example of improvising. The process involved enacting a wide variety of structures, including implicit rules for combining and organizing chemicals into 'elegant' formulas, explicit specific procedures for creating and testing samples, and clear roles for each of the team members. Throughout the process, the formulating team assessed the formula-in-progress by creating and testing numerous samples of the formula-in-progress, to see whether or not it was close to meeting the needs of the customer. Resourcefulness was central to at least two aspects of the process: developing formulas that were inexpensive for customers to produce and developing as many uses as possible for Blockasun's dispersions (for example, formulators explored different ways to involve chemicals that were easily available to the customer, particularly Blockasun dispersions and chemicals manufactured by Blockasun's parent company). Finally, as the formulators made changes to the formula-in-progress and explored potential uses of preferred chemicals, they used results from tests on samples to decide whether or not more changes needed to be made (and if so, what kinds) and they adapted the formula-in-progress according to the emerging situation, as represented by the results of the sample tests.

Although the overall process of creating a formula was an example of improvising, it is interesting to note that it consisted of several practices that involved little or no creativity and a minimal amount of extemporaneous adaptation. Nevertheless, these relatively routine work practices were critical for continuously assessing the situation and informing extemporaneous adaptation. In addition, as in improvising in African American quiltmaking (discussed in Chapter 2), artifacts - particularly emergent artifacts - were central to the process of creating new formulas. Throughout the process, for example, formulators used chemicals and lab equipment to create samples of formulas-in-progress and to test them. Emergent artifacts were an essential part of the routines practiced to compare the formula-in-progress with the requirements of the customer and with past projects.

In what follows, I begin with a description of formulators and more specifically, of the range of activities practiced by the formulating team at Blockasun. Next, I explore in detail two representative cases of how formulas were created, modified, and better understood. I focus first on how, in both cases, the formula itself evolved from numerous iterations between adapting a formula and testing it (the "macro-level" process). I then describe the routine practices that each iteration involved (the "micro-level" process). The macro-level process focuses on the sequence of changes that occurred during the evolution of the formula, while the micro-level process focuses on the routine procedures involved in making up and testing samples of the latest iteration of the formula to see if subsequent changes were necessary. I conclude the chapter with a more detailed discussion of the nature of improvising practiced by the formulating and of how various kinds, uses, and aspects of technological artifacts were involved in the process.

5.2 Background

5.2.1 Formulas at Blockasun

Figure 1 (following page) is a representative example of the kind of formulas that the formulating team at Blockasun created. Once the team finished developing a formula, it sent the customer a fax with a formula in the same form as Figure 1, along with instructions regarding procedures for preparation.

All sunscreen formulations are emulsions.[3] An *emulsion* is a mixture of two or more ingredients that don't normally mix with each other. For example oil and water mixed together will separate out - the oil will go to the top and the water to the bottom. An emulsion is a system that takes oil and water and mixes them together in such a way that they remain in a single phase (i.e., they don't separate). All sunscreen formulations are emulsions in order to give the formulation the desired properties for the skin: if all ingredients were water

based, the sunscreen would probably feel quite dry; if all ingredients were oil based, the sunscreen would probably feel quite greasy. A formulator will try to maximize water as that reduces the greasiness of the product and the cost of producing it. There are two kinds of emulsions: *water in oil (w/o)* or *oil in water (o/w)*.

Figure 1: Formula for a sunscreen emulsion (o/w) based on a lamellar gel network and an oil-soluble, film-forming polymer

A. Polyglyceryl-10 pentastearate/ behenyl alcohol/ sodium stearoyl lactylate	2.50 % w/w
Mineral Oil (*paraffinum liquidum*)	4.50
2-Ethylhexyl palmitate	6.00
Jojoba (*Buxus chinensis*) oil	2.50
Myristyl myristate	2.00
Dimethicone copolyol	0.50
Tricontanyl PVP	3.00
Titanium dioxide, C_{12-15} alkyl benzonate, phenyl trimethicone, alumina, polyhdroxystearic acid, silica (Titanium Dioxide Oil Dispersion)	5.00
B. Water (aqua), demineralized	61.50
Xanthan gum	0.20
Magnesium aluminum silicate	0.80
Propylene glyc ol	4.00
Water (aqua), titanium dioxide, alumina, silica and sodium polyacrylate (Titanium Dioxide Aqueous Dispersion)	7.50
C. Preservative	qs

(Source: Hewitt, J. (1999). "Formulating Water-Resistant TiO2 Sunscreens" *Allured's Cosmetics & Toiletries Magazine*. Vo. 114 (9). September 1999. p63)

To have the oil and water stay in a single phase, one has to include an *emulsifier* - an ingredient that will hold one phase within the other in the form of droplets. Most formulations will have more than one emulsifier. The combination of different emulsifiers is called the *emulsification system*. Because this system is what stabilizes the emulsion, it is considered the critical part of any personal care formula. Surfactants, for example, are common emulsifiers and work by increasing the viscosity of the system (making it more difficult for the

[3] Throughout this chapter, the term "formula" refers to a recipe and the term "formulation" to the product that results from following a recipe. Thus, one uses a formula to make up a formulation. Please also note that I use "recipe" and "formula" interchangeably.

droplets to come together) and stabilizing the system (in shampoos, for example, two common surfactants are Sodium Laureth Sulfate and TEA Lauryl Sulfate).

A cosmetics formulation consists of different phases. In Figure 1, Phase A is the oil phase; Phase B is the water phase; and Phase C is the preservative phase. Within each phase, materials are first mixed together. Then, when each phase is made-up, the phases are mixed together.

Experienced formulators are capable of developing *systems* or *guide formulas*. A system is a basic framework that is adaptable to a variety of circumstances, depending on the preferences of the customer; it is a general formula that can be modified simply by changing the concentration of the key ingredients or by substituting or adding marginal complementary ingredients. At one point during my field work, Edward Bond, the head of Blockasun's formulation team, explained:

> What I would call the system is the basic outline of the formula that you need - you always need water, you'll always need some oil phase, so that's probably your emuliant oils, and a surfactant and an emulsifier so the two phases are stable... and I normally call that the system... the basic outline of what you need.

Later on, he described a system in greater detail:

> [A system is] a particular combination of ingredients which you can vary within certain parameters. So the basic combination that you use in terms of the emulsifiers - thickeners that you put into a formulation - remains the same but you can vary the amount of the emulsifiers that you use, you can vary the oils that you put in, you can vary the actives that you use, and so you've got a slightly different formulation every time but in terms of the basic system - the basic framework of the formulation - it's the same. It's very good to have a system like that that you can work with because it allows you to do a lot of different things. You can create different viscosities, you can create different SPFs, without having to change the ingredients that you're using all the time.

Expert formulators tend to create systems that resemble each other. Over time, these similarities become known as a formulator's signature or style with the result that other formulators are able to identify the creator of a particular formula by the characteristics of the formula's system. Bond explained:

You'll find that any given formulator will have his own favorite systems. I can sometimes look through the journals, for example - and you'll see example formulas printed in *Cosmetics and Toiletries*, and what have you - and I can look at a formula and say: 'Yeah, Gert Damz formulated that,' or, 'That one's come from John Woodruff.' ... There are certain systems that people tend to use a lot. For example - and we've done a lot of work with some of these consultants - so I know that Gert Damz likes to use a combination of mineral oil ... and sunflower oil, in his oil phases. So you spot those in a certain proportion and you can tell its a Gert Damz formula. Also, he bases a lot of his formulations on what we call liquid-crystal-gel network system, which involves certain combinations of ingredients - and you can spot that. I can spot formulations that have come from John Woodruff because, again, we've done a lot of work with him - I know the sort of systems that he tends to go to as a first attempt. But also, sometimes you can look at some of the phraseology that's used in the mixing instructions and people have their own way of wording things. So you can spot that. Individual formulators have their own favorite systems, and they tend to be quite a limited group of systems.

5.2.2 Formulators at Blockasun

The formulating team at Blockasun was headed by Edward Bond, an expert within the skin care community on formulating with Titanium Dioxide (TiO2), particularly the TiO2 dispersions manufactured by Blockasun. Because of his expertise, Bond spent as much time creating new formulas as he did consulting with existing and potential customers, attending trade shows to promote the dispersions, and training new sales teams.

Bond first began working with TiO2 after he graduated from university as a chemist. For three years he worked in the lab exploring different ways in which TiO2 could be used as a white pigment to provide opacity and whiteness to products such as coatings, plastics, and paper. Then, when Blockasun was formed as an off-shoot of the company that Bond worked for (over 10 years ago), he was invited to help the start-up develop formulas for suncare products, using TiO2. Before joining Blockasun, Bond had never done any formulation work, let alone work in cosmetic products. Although he had a background in chemistry, it was difficult for him to look at a formula and understand the purpose of each chemical. To develop his formulating skills, Bond attended

intense training workshops, mostly one-on-one, with a well-known, recently retired formulator based in Germany. Initially, as Bond explained, the workshops covered "the basics":

> [They were] teaching me what a cosmetic formulation is. What goes into it. What types of ingredients you use in a formulation. And that's the sort of ground level you have to start at because initially, when you come to it with no experience, you look at a formulation and basically all it is is a list of chemicals. You have no idea what each one is there for. So that's what they had to teach me to start with: what are the different components that go into a formulation.

About three to four times a year, Bond would go to Germany for a week to work with the German formulator in his lab.

Back at Blockasun, there was also a lot of self-teaching involved; reading and going into the lab to try things out. When questions came up, he would call on two experienced formulators (one in Germany, the other in Belgium). Working with experienced formulators, Bond was able to develop a sense for the potential functions of various chemicals in formulas for skin care products. It took Bond about a year of training before "I could actually take a blank piece of paper and start to put together a formula by myself and then start working on it in the lab and from there work out what I needed to do to get it right." After ten years, Bond had become a noted expert in formulating suncare products with TiO2, and had published several articles in industry journals.

Over those years, Bond also developed a few reference guides to help aspiring formulators and sales representatives understand how the characteristics of a product desired by either a consumer or manufacturer related to potential formulas. When sales representatives discussed Blockasun formulations with customers, for example, they focused on a different set of features, depending on whether they were discussing the use of formulations by suncare products consumers (e.g., people who used sunblock at the beach) or the manufacturing of formulations by suncare product manufacturers. For example, one set of features - known as "consumer features" - was considered particularly salient to consumers and included "safety on skin" (a product was considered

safe on the skin if it did not irritate the skin after being left on for long periods of time), "higher SPF's" (a product with a higher SPF was considered more protective), "aesthetic" (a product was considered aesthetic if it had the right feel - smooth, non-greasy, light - and look - transparency - on the skin), and "applicability" (a product had good applicability if it was easy to spread on the skin). The reference guides explained how each of these features related to particular ingredients and combinations of ingredients. For example, safety of the skin was influenced in part by a formula's design; higher SPF's were influenced by inorganics; aesthetics (e.g., transparency) were influenced by mixing organics and inorganics; and applicability was influenced by viscocity and greasiness. Another set of features - "processing features" - described characteristics of the formulation that were particularly relevant to manufacturers (e.g., the customers of Blockasun) and included "ease of handling," "safety," and "consistent quality." Table 1 (following page) lists in greater detail these and other features, why they were considered important, and how they related to the formula. Although each feature of the formulation was associated with a set of features of the formula, the association remained quite general. In addition, it was not uncommon to have to forgo one feature to improve another. The challenge for Bond and his team was to develop formulas for products that would improve as many features as possible.

Although much of the process of translating customer requests into specific chemical recipes was formalized, several people I interviewed, including Bond, described formulating as a combination of art and science. They noted that, in addition to dealing with subjective metrics such as 'silky,' 'smooth,' and 'creamy,' formulators mix chemicals based more on experience with how the chemicals interact than on any explicit scientific logic predicting how the chemicals will interact. In this regard, formulating is very similar to cooking: science is involved but it is experience with *doing* formulating that counts most when developing a successful product. At a national conference of formulators, I interviewed a rheologist (one who studies the deformation and flow of matter)

Table 1: Important "Properties of the Application" For Consumers and Manufacturers.

Features	*Importance*	*Influenced By*
CONSUMER FEATURES		
Safety on skin	Non-irritant on skin, when being left on for long periods of time.	Formulation design and ingredients used.
Higher SPF's	Demands, driven by marketing, for higher protection.	Inorganics more cost-effective at higher SPF's.
Cost-effective	General consumer wants low-cost options for protection.	Current scrutiny from government intervention (health requirements, not luxury goods).
Anti-ageing	Provides longer-term protection.	UVA protection as well as UVB.
Aesthetics	Feel (smooth, non-greasy, light) Look (transparency) on skin.	Organics naturally transparent. Inorganics contain solids which are more difficult to make transparent.
Applicability	Ease of coverage onto the skin.	Viscosity, greasiness.
Photostability	Duration before needing re-application.	Formulation design and actives used.
PROCESSING FEATURES		
Ease of handling	Reduces cost/effort for manufacturer.	Powder vs. Dispersion.
Ease of use	Reduces cost/effort for manufacturer, and consistency of application quality.	Stability of dispersion.
Ease of formulation	Reduces cost/effort for brandhouse formulations expertise.	Chemical qualities of active.
Safety	Reduces safety risks for manufacturer.	Form e.g., Powder - dust hazard.
Cost effective	Competition.	Price cuts always passed onto active supplier as highest cost additive.
Consistent quality	Increases quality consistency of application product.	Powder can give agglomeration. Dispersion is more consistent.

with over 12 years experience working with formulators and she explained the following:

> I'm a rheologist by training. So I know I can put a material on a rheometer and I can measure its resistance and behavior under low sheer and under high sheer. And I can give it numbers. But I can't talk to a formulator. A formulator knows their language. They know the feel. And its experience that's important... you can say that however you want... So a formulator, really, is a creative artist. They have to rely on the scientist to give them some model in their mind as to what's happening but at the end of the day its what they've learned - it's their experience [that's important]. I mean, there's one expression I heard: it's when magic meets science. And I thought 'In a way it is.'... The food technologists and the creative cosmetic chemists are very similar because they are playing with materials that are far too complicated to really be able to characterize. That's the problem. You can characterize elements of it or you can describe its behaviors in certain windows of situations but you can't describe its behavior in the whole window of situations of what's going to happen.

A materials provider at the conference offered his perspective on how the work of a formulator is creative.

> It's creative because the materials that you're working with are not that well defined. So I'm a materials supplier. So I can tell people how my raw material will behave in certain situations but I haven't got a clue what they will make. So I suppose if you use the artist analogy with a painting, I'm selling the red pigment or the blue pigment or the white pigment - I've got an idea of what some of those combinations are gonna be but if my artist is somebody off the wall who is going to start putting in flowers and egg shells to give it texture, I don't know - I don't know what they're going to do. It's even more so in cosmetics. I don't know if they are trying to make a deodorant, I don't know what the other ingredients are going to do later. It's their experience that gives them an educated guess. Trial and error - they try it, if it fails, they try something else.

Finally, Bond explained:

> The phrase 'cosmetics science' is regarded by cynics as a contradiction in terms because there is often not a lot of science going on when it comes to formulating cosmetic products ... I consider myself as one of the kind of new breed of cosmetic formulators who are trying to put some science behind it and sort of work more from the first principles, and decide on what to use based on a knowledge on what's supposed to happen chemically.

> But going back into the history of cosmetic formulation, it's pretty much a black art. It's something that people have done based on their experience and they'll put together a given formula system and when you ask them 'why?' they'll say 'well, because it works.' You'll say 'why does it work?' 'Well, we don't know that.' ... I'm reminded of a scene from a comedy series on TV that we had in this country a few years ago - it was starring Rowan Atkinson - I don't know if you've ever seen him - Mr. Bean ... he did a series called Black Adder ... and there's one line from him in there - he was talking about somebody who had just invented a new machine for spinning cotton and the guy he was talking to said 'What for?' And he says: 'That I don't know sir, I'm one of those people who are quite happy to work on it but I have no idea how it works.' And it's the same idea with cosmetic formulators, you know - they'll put together systems because they know what works well together, but without really knowing why. And I'm trying to get a bit more into the science that's behind it, but the fact is that there are so many materials, so many interactions between the materials, that it just wouldn't be feasible - at the moment, anyway - to put it all into a computer program and get the computer to suggest what to use and to achieve a given result.

The ingredients that formulators play with can be described using particular scientific metrics, but the value of a formulator lies in how creatively he/she is able to combine the ingredients to produce the effects desired by the customer. This skill is one that can only be developed through experience in playing with ingredients because the interactions between the chemicals are so numerous and varied that it is impossible to describe or predict them all; only the results of the creative mixing can be described and even then generally. It is no surprise then that all those I spoke with from the personal care market described the work of the formulator with great admiration for the creative talent and the years of practice required to do the job well.

At the time of my field study, Bond worked with two assistants, Alex Brown and Sharon Selene. Brown and Selene were in the middle of a lengthy process of learning to become formulators (they had been at it for three and two years, respectively, and it typically took about four years of training before one started developing formulas). They spent most of their time in the lab at Blockasun, making up and testing formulas, and rarely interacted with customers. With a degree in chemistry, and 3 years of training, Brown was the more experienced of the two. He was also participating in a distance-learning program sponsored by

the Society of Cosmetic Scientists. In addition to making up and testing formulas, Brown was learning how to use a new rheometer - a machine that is used to test the viscosity of formulations. Selene was going to night school to earn her qualifications for a degree in chemistry.

The formulators worked in a lab at Blockasun that was located off a major highway, in an industrial "estate" that had been recently set up by the local community in an attempt to revive an economy depressed from the decline of the mining industry. From the outside, Blockasun's five-year old building looked like one of the many large, simple, nondescript metallic warehouses that were scattered about the industrial estate. Inside, about a third of the building was dedicated to three office spaces, in which some dozen people worked. Most of the remaining two-thirds of the interior was taken up by the manufacturing facilities, where about 20 employees worked. A dining room and lab were located in between the office spaces and the manufacturing facilities. The dining room consisted of a kitchen, with two refrigerators and a microwave oven, and a large table where at least eight people could sit comfortably. The space filled up with employees three times a day; first, at around 10:30, during the morning break; next, at around 12:30, during lunch break; and finally, at around 3:00, during the afternoon tea break. Brown and Selene often participated in these breaks and in the collegial discussions that ensued during them.

The lab in which they worked was a relatively large space consisting of four long waist-high lab counters, placed in two rows and split by a middle walkway. Standing at any point in the lab, one could easily scan the entire space. The formulating team shared the lab space with chemists working with the production team of Blockasun emulsions, so was not unusual to find four people working in the lab at any one time (the space could have easily accommodated twice as many). Before entering the lab, visitors and lab workers had to don a white lab coat and, if they weren't wearing eyeglasses, clear plastic protective eye wear. Florescent light bathed the space and a single radio, always tuned to BBC1, filled the air with commercial-free pop music and banter from DJs.

Although Bond, Brown, and Selene worked as a team, they handled different aspects of the creative process. Bond focused on the broader, macro task of translating the request of a customer into a formula for a formulation. Often, the request was vague and required further clarification and negotiation. For example, a customer might request "a very smooth cream that has a silky feel." Although there was no way to scientifically measure or test characteristics such as "smooth" or "silky," Bond could eventually take that ambiguous request and create a set of instructions for how to combine a specific collection of ingredients to produce the customer's desired product. Brown and Selene, on the other hand, focused more on the relatively micro tasks associated with assembling samples and testing them, each time the formula was changed significantly so as to see whether further modifications were necessary. For example, making-up a sample formulation involved printing out the basic formula, finding the risks associated with manufacturing it, retrieving the ingredients and equipment, weighing out the chemicals, mixing them according to the formula, storing the sample, and cleaning the equipment. In addition, they conducted several tests on each sample (e.g., the SPF Test, the Whitening Test, and the Stability Test) to assess whether or not further modifications to the formula were necessary.

In what follows, I present two representative cases of how formulas were created, modified, and better understood - adopting a macro-view on how the formula itself evolves through numerous iterations. The first case describes the development of a formulation in response to a client's request for a series of inexpensive waterproof formulas. The second case describes how the formulating team goes about better understanding the "flexibility" of a particular formula.

5.3 Developing a New Formula - A Macro-View

5.3.1 Case 1

When I asked Bond to share a representative case of how a formula is created by the team, he took me to the lab, pulled out several lab books filled with data

from past experiments, and while flipping through them as if they were a photo album, recounted the case of a formula that had recently been completed and which, by coincidence, I had observed in development during my first visit to Blockasun. This case involves Blockasun working with Norayz, a toll manufacturer of suncare products. A toll manufacturer manufactures a product for a client company that will then market that product under their own brand. Norayz (pronounced "no rays") manufactured suncare products for two "client companies" owned by the same parent company and together making up about 70 percent of the national suncare market in a country located in the Southern hemisphere. Norayz was also located in this country.

One of the dispersions manufactured by Blockasun, Tioblock, used to be in the formulas of the products manufactured by Norayz but was eliminated a few years ago when a formulator at Norayz, with no experience working with Tioblock, redesigned the formulas and replaced Tioblock with a powder version of TiO2.[4] After this redesign, both Norayz and its client companies began to experience problems with their products, both in manufacturing the products and in consumer returns because the products had become unstable. At the time these problems were emerging, Norayz was still using Tioblock for another brand of suncare products they were manufacturing, and thus, were still in contact with Blockasun. In November of 1998, they approached Blockasun and as Bond recalled, said: "We want to be able to go to [the clients' parent company] and suggest to them some new formulations which will be better than these current formulations. Can you help us?" Recognizing that this was a valuable opportunity to get back into that regional market, Bond "jumped at the chance."

Norayz was mainly concerned with improving the stability and skin feel of the "oil-free" products. Norayz sent Bond and his team one of the formulas that they were currently using with the powder TiO2, as well as a few samples, and asked for comments and suggestions for changing and improving the

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[4] Tioblock comes in a dispersion form. The powder form of TiO2 is supplied by a competitor of Blockasun.

formulation using Tioblock. The samples were sent to help Bond and his team understand the look and feel of the current products. As Bond explained:

> They also sent us samples of the product to look at. So we just had to look at that in terms of what's the general consistency of the product and make a qualitative assessment as to what we were aiming at - in terms of viscosity and feel and that kind of thing.

Norayz wanted the new formulas to maintain the viscosity of the current products so as to avoid having to change any packaging. They sent a formula that included a viscosity level measurement but that did not specify the method of measurement. Because scales of viscosity level measurements vary with method of measurement, Bond and his team could not tell what the given viscosity level measurements meant (since they had no scale to compare the values against). Instead, Bond used the samples to get an idea of the viscosity that Norayz was aiming for, using Blockasun's rheometer and their own metrics.

After looking through the formula and examining the samples, Bond faxed back a reply with three general questions: "What is the target SPF for this formula? (do you want suggestions for both the 16 and the 30?); What exactly does 'oil-free' mean?"; and How much freedom do I have? The formula was headed "SPF 16/30" and it was not clear to Bond what that meant. Looking at the actives in the formula, he could imagine it would give an SPF 16 but he found it very hard to believe they could give an SPF 30. If Norayz wanted an SPF 30, it would need to increase the amounts of actives in the formula. In addition, Bond noticed that the current formula included a few "features" that he wanted to change. Specifically, he noticed at least two ingredients - one used as a thickening agent, the other as an emulsifier - that were essentially ineffective when used with any form of TiO2. Finally, there was no regulation anywhere in the world defining "oil-free." Bond knew of about five different definitions of "oil-free." As he explained:

> 'Oil-free' is a movable beast ... So I needed to know exactly what definition they were working to [...] The most rigorous definition of oil-free is to have a product which contains no oils or organic components at all - nothing in it that's not water or water-soluble. But that's very rarely used. The most

> liberal definition of the other end of the spectrum is simply avoid using ingredients which have the word 'oil' in their name. So people will tend to avoid using mineral oil, or sunflower oil, or anything like that, but they will still use esters, which are oils, they just don't have the word 'oil' in their name. Then there are definitions in between. For example, one that's very commonly used is to have a system where the only oils present are silicone-based oils and therefore somewhat different from the more conventional organic oils or esters.

Before changing these ingredients and making suggestions for improving the formula, Bond wanted to know how much "flexibility" he had in changing things or whether he had to stay as close as possible to the original formula. As he explained:

> But before I start making suggestions or doing any lab work to change this formula, I need to know what are my limits in terms of changing this formula? Do they want to stick as close as possible to this? Or do I have a wide degree of freedom to change the emulsifier system and fundamentally change the formula?

A few weeks later, Norayz replied to Bond's fax with one addressing his questions. Regarding the SPF, the formula that had been sent to Blockasun was indeed for an SPF 16. The SPF 30 version was based on the same formula but with more actives. On the issue of how much flexibility Bond had to change the formula, Norayz was comfortable with Bond changing some of the ingredients, as long as they were commonly used or easily available in the country of manufacture. As Norayz explained in the fax:

> If you change any of the materials with commonly used alternatives I'm sure it won't be a problem as the work for a contract manufacturer who will hold a large range of different raw materials... Please use what would give us the best and most stable product. All I ask is that you explain your changes so that the manufacturer understands why.

Finally, Norayz explained it was working with the definition of "oil-free" that meant none of the ingredients had the word "oil" in their listing. Thus, Bond couldn't use any mineral or vegetable oils but he could use organic esters and other ingredients generally considered by chemists to be oils. With this reply, Bond had a clearer sense of the parameters he had to work with.

The process of changing and creating a formula was an iterative process, where Bond continuously imagined how the customer would manufacture the formula and how the resulting product would end up looking and feeling. Bond examined the original formula and asked himself: "How can I stick reasonably close to this so I'm not forcing them to make too many changes in raw materials but give them something that's going to work better?" He then continued:

> So then I work out the formula that I think is going to work better and [I] go through that mental iterative process where I go through it and make sure 'Is this going to work? Are we going to see any incompatibilities between any of these materials? Do I need to change something?' Because I might look at it and think 'Yeah, the emulsifier system is too hydrophobic' or 'I need to make a change there,' 'I've gone a little bit too far in making this change there, we need to just pull back a bit on that.' And I will look through that before I actually send it out to the customer. But if it's something that we haven't actually made in the lab I will always add that cautionary note to the end that you know 'We haven't made this. It's a theoretical formula and it needs to be tried out in a lab.'[5]

In this particular case, Bond almost completely changed the emulsifier system so that it was much more suitable for use with Blockasun's TiO2 dispersion. He also incorporated some bees wax to boost the SPF and increased the oil phase accordingly. Finally, he eliminated a redundant active (and increased the remaining one) to simplify the formula and make it more elegant. Bond noted that the iterative process of checking over a formula "all comes down to experience and knowing the ingredients and knowing what sort of effect they're going to have on the formula."

Bond faxed the new formula to Norayz but did not hear back from them for several months because at the time Norayz received the new formula it was going into production for their summer (Blockasun's winter) and had no time to change their current formulas. At the end of the summer production (late March 1999), Norayz was apparently impressed with Bond's improvements and asked him to look at a range of products (e.g., oil-free range with SPFs 5 and 15,

UV blocker oil-free SPFs 16 and 30, etc.) that were currently in production, and figure out how to change them so that they could offer their client a whole range of new products.

Norayz sent Bond a fax that did not list all the formulas for the range of products, but listed the actives that were present in the various formulas and asked him to "guestimate" the expected SPFs for each. This was an "awkward" exercise for Bond because a formula's SPF relied very much on how the actives interacted with the rest of the formula, something he did not know. Regardless, he was able to offer some rough estimates, as he understood that Norayz wanted to first establish whether the actives that they were using had any chance of reaching the SPFs that they were supposed to be reaching. He explained:

> There's certain sort of benchmark levels of activity or efficacy that you can expect from different actives, if they're formulated correctly. [...] If you put these into good formulations, these are the sort of SPFs that you can expect. The actual SPF could be a bit higher or it could be a lot lower, depending on other factors in the formulations.

Assuming the actives were in good formulas, Bond estimated the SPFs that they would support and found that in some cases Norayz was reaching the SPFs they wanted but in others they weren't. He faxed his findings to Norayz.

After receiving Bond's estimates, Norayz asked: "What do we need to do to change the formulation systems that we're working with?" Based in part on his experience with the first formula from Norayz, Bond replied: "You need to start from scratch. You need to completely change the formula system from what you've been working with before, if you're going to do this properly." Norayz then asked him to show them some suggested formulas. Bond looked at the requirements for the different ranges - the sort of skin feel and viscosity that was required and the SPFs that were required - and sent them a couple of suggested formulations based on work that his team had already done on other projects, to

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[5] The formulating team at Blockasun did not always have time to make up and test a sample of a formula before sending it to a customer. Consequently, they often sent out formulas to customers which they believed worked, but which they had not yet actually tested.

see if those could meet their requirements with existing formulas. Norayz looked at those and decided the suggested formulas were too expensive.

Cost is typically a significant parameter in developing formulas - especially with clients as price-sensitive as Norayz was known to be. All clients want to have formulas that achieve a high SPF, are waterproof, have excellent skin feel, have superb transparency, and are inexpensive. But there does not exist a single formula that optimizes all those characteristics at the same time. Formulators must always make a compromise. Explained Bond:

> If there was a certain type of formula that's fulfilled everybody's requirements which is SPF 30, plus waterproof, minimum cost, excellent skin feel, superb transparency, you know - all the requirements that everybody always asks for. If there was one formula that did all that, I'd be out of a job. Because we could just give the same formula to everyone. But, you know, it never works like that. There's always something you have to compromise on. You have to make a judgment on what are the most important factors for this customer.

Norayz wanted their costs to be particularly low and were willing to have the cosmetic elegance of the product "take a little of a back seat." According to Bond:

> If it had been a more sophisticated market or a more sophisticated customer, they may have put in a few more expensive types of oils - but the more sophisticated the system, the more expensive it will be, but it's going to have a nicer skin feel.

At this stage, Bond also decided with Norayz that, rather than try to come up with the formulations for the complete list of products, Bond and his team would focus on a single product. They decided to look at one of the most difficult products in a particular product line - the one with the highest SPF (SPF 30) - and design a system for it. The logic was if they could develop a good SPF 30 formula, they could use it to develop all the other SPF formulas. As Bond explained: "If we could crack that one we could then use basically the same system to do all the other SPFs, just with some changes in emollients and levels of actives." They chose a waterproof product with an SPF 30.

The first step in creating a system formula was to develop a *concept formula* - a formula "that's been worked out from theory." To accomplish this, Bond "pretty much started from scratch... using a whole different system to what [Norayz] used before but trying to use fairly basic straightforward ingredients that wouldn't be too expensive." He first thought of systems that he knew worked well with Tioblock and used them to generate the base emulsifier system. From there, he could consider what cheap, "relatively straight forward" oils to include to make sure he had a solvent system for the organics, and then finally, consider what thickener system would "give the best results." This was going to be a *combination formula* - one where two actives are used, instead of one - because he knew he would be unable to achieve an SPF of 30 and stay within the cost constraints if he just used Tioblock. He would need to add an organic sunscreen.

At the end of April, Bond faxed his new formula to Norayz. At the same time, Brown made up a sample of it in the lab. There, he discovered the formula was a "disaster." As Bond explained, while examining the lab book entry for that sample:

> Everybody gets it wrong from time to time and I got it spectacularly wrong on this occasion, because it seemed to go together okay to start with but then, the observation that Brown's put down here is 'emulsion collapsed on cooling.'

Bond immediately called Norayz and told them to ignore the formula. He and Brown re-examined the formula and decided that the emulsifier system did not mix sufficiently well with water (i.e., it was too hydrophobic). They needed to add something more hydrophilic.

Bond went "back to the drawing board" and came up with two alternative systems: one was a modification of the "disaster" formula ("modified system"); the other a completely different one - one with a completely different emulsifier system ("Steadee 20 system").

In the "disaster" formula, Bond had used a single emulsifier. In the modified system, he decided to add two other emulsifiers. Bond had only his experience to draw on to decide which two emulsifiers to use and how much of each to add in. Although there existed a method to help one calculate the

amounts of the emulsifiers to use (the HLV system), that system only worked for very particular kinds of formulas, and the formula Bond was working on did not qualify (because it included Tioblock, amongst other things). Consequently, Bond was able to rely only on experience to substitute the suspect emulsifier with a different, more successful system. Bond admitted: "Its a matter - to be honest - of educated guess work as to how much to put in. And you just experiment with it. Try different concentrations, if you don't know, to try to find what's the right amount to use."

In addition to modifying the "disaster" formula, Bond - inspired by other research his team was conducting at the time - decided to develop a completely new formula using a new emulsifier, Steadee 20. Once this new formula was completed, Bond sent both the modified formula and the Steadee 20 formula to Norayz so that they could examine and test them. In the meantime, Brown made and tested samples of both formulas in the lab. The samples from the modified system turned out to be "quite nice" overall, with the exception of low viscosity. As Bond remarked:

> [The modified system] was looking pretty good. Because when [Brown] did the SPF measurements, we got an average estimate of 29.8 - almost exactly what we're looking for. Under the microscope - fine homogeneous emulsion and stability results - we did some brief stability testing - basically ones or ones-stroke-twos. So it was all looking good with the exception of one thing: and that was the viscosity. The viscosity was a little bit low compared to what we were really aiming for the product. Everything else was nice. The viscosity was a little low.

When Brown made up the Steadee 20 system, though, the results were not as "rosy." Bond explained:

> ... the microscope assessment was good. The SPF was a bit down from what we were aiming for. We were just getting an SPF of 24. And here the viscosity is extremely low. And that could actually be related as to why the SPF wasn't so good. Because there's not enough structure in the system to give a good even film and give it a good SPF - so those two issues could be related.

Both systems, then (especially the Steadee 20 system) had low viscosities.

Bond explained that when everything but the viscosity is working, that signals that one has a good basic system, and that only the viscosity needs to be tweaked. There are various ways to do this, including adding a thickener. Bond sent a note to Norayz and explained to them that both formulas were thin - especially the Steadee 20 one - but that they shouldn't be too difficult to thicken.

Bond re-examined the modified formula to see how he could increase the viscosity. He knew of a "standard trick" to examine the fatty alcohol content and either change its percentage or change the fatty alcohol.

> So, looking at the system, I thought, okay, we can bump [the alcohol percentage] up a bit, it's not going to affect the emulsifier system a great deal, it should give us the extra viscosity that we need. So, I changed that from 1 percent to 1.5 percent. And it did increase the viscosity - it went from 4000 up to 7000 - which is more like the sort of area we were looking for. And the SPF was essentially unchanged. Within the experimental error of the technique, that's no change. And then when we did stabilities, the stabilities were all good still. So we'd succeeded in increasing the viscosity without adversely affecting anything else.

After improving the modified formula, Bond and his team went to work on the Steadee 20 system. They tried to increase the viscosity of the system by increasing the amount of Steadee 20 but only managed to increase the SPF (which wasn't necessarily bad but it wasn't the improvement they were seeking).

Any change in the formula involved developing it and testing it out in the lab - a process which often took at least two days. If the time required to conduct the stability tests was accounted for, the process would take about 5 days. By the time Bond and his team had attained the desired results from their changes to the Steadee 20 system, Norayz had replied. Norayz had looked at both formulas and liked very much the modified formula because it used materials that they were used to working with and the viscosity was reasonable enough and easy enough to improve. They were not as enthusiastic about the Steadee 20 system because it was more expensive, too thin, and involved ingredients that they had not worked with before. Bond agreed - if Norayz was developing new formulas in a hurry and had no experience working with Steadee 20, then it should go for

the modified system because to work with Steadee 20 required technique and experience which it had no time to develop.

After deciding which system to focus on, Norayz no longer involved Bond's team in the final stages of the development process and instead, worked on the last changes themselves. Thus, at that point, Bond and his team stopped work on both systems. As Bond explained:

> As far as this project was concerned it was dead. But, you know, obviously, we keep a record of what results we've obtained and in future, if we're looking at formulations with similar type of requirements that might come back to us and we'll say 'Let's look at that system again. [...]
>
> We didn't do anything further because Norayz said, okay, we now need to work on this ourselves. Get ourselves fully familiar with it and the final sort of tweaks to the product we'll do here. So [Norayz' principle formulator] took that away and started working on it herself. She made a few small changes to get it exactly as they wanted it. She did say 'Can you suggest starting formulations for some of the other SPFs in the product ranges?' So I then sent a further fax... a nine page fax with suggestions for the other SPFs that they were wanting. And I was really changing very little [from the modified system] in doing this. So we still were working with basically the same system - we've got the GMS there, we've got the sterile alcohol, we got the Ambisol K, and the Tween 20's still in there, and I'm changing the levels of actives slightly. So the SPF 30, for example, we had 8 percent Tioblock. I've now dropped that to 7 percent because here we're only aiming for an SPF of 25. I think I changed the level of this material slightly as well. And then they wanted an SPF 16 so I dropped the Tioblock down another notch. [...] So all based on basically the same system but just playing with the levels of actives to get the SPF as they wanted.... So I sent them those suggested formulations for the lower SPF products just to start them down that road as well. And then pretty much Norayz have taken it and run with it themselves from there on and have developed the formulations on further.

Having developed a basic system for Norayz, Bond was able to adjust it slightly and provide them with formulas for similar products with different SPFs. After receiving the system and formulas from Bond, the formulator at Norayz modified each a little and then started to get herself "fully familiar" with them, by making them up and testing them in her lab.

Clients typically do not share their final formulations with Bond. When they do, it is with the understanding that the information will be kept confidential. In this case, Bond was shown the final formulation because Norayz was experiencing problems in achieving their lab results during manufacturing and they sought Bond's advice in resolving the problem.

Bond described Norayz as an ideal customer because they were completely open about the information they provided. They trusted Blockasun to keep it confidential and they gave Bond everything he needed to help them.

From this experience, Bond and his team learned what emulsifier systems work well with Tioblock, since he and his team were still in their "relative infancy" in terms of formulating with the ingredient. They learned it was "more flexible" than the first generation of formulations. In addition, though the Steadee 20 system was not appropriated by the client, Bond and his team still considered it a valuable exercise because the system could potentially be useful to a different customer with different interests and under different circumstances. Bond explained:

> [The experience] showed us how far you can and can't go in terms of how hydrophobic the emulsifying system with the Tioblock is. So that's useful information that we can carry forward to further work.
>
> Obviously, the actual formula system that Norayz had finally ended up working with, I wouldn't share that with anybody else because, although there was never a confidentiality agreement between us, I regard that as being their formula now. But some of the general learning we can take out of it and use in other projects. And we've got the Steadee 20 formula, which was starting to show some promise. But they didn't want it. So we are now free to do with that whatever we please for other projects. So if we get another project with similar types of objectives, that's kind of given us a head start into that. And also, of course, we get to sell them some product. You know, we've helped them develop a series of formulas and they're buying Tioblock again.

In summary, the process of developing a new formula for Norayz involved Bond, with the help of his team, going through several iterations of modifying the formula-in-progress (based primarily on past experience), making-up and

testing samples of it to see if it worked, and receiving feedback from the customer.

5.3.2 Case 2

In addition to independently developing new formula systems for customers, the formulating team at Blockasun conducted joint development work with some of its larger customers. In these cases, they were able to conduct more detailed exploratory work on a formula. Rather than simply develop a formula and hand it off to the customer, they would run a series of experiments to better understand "how flexible the formula is." For example, they would attempt to develop a formula that had a range of different oils to see if the oils were compatible and whether or not they changed the viscosity or skin feel of the product. From these experiments, they were able to better understand how sensitive the formula was to changes in either quantity or ingredient, as well as the effects of those changes on the formula. During the time I observed one of Bond's assistants, Brown, he worked on several projects that involved testing the flexibility of a formula. What follows is a brief description of one of these projects, which is representative of the others he was working on.

An international manufacturer of personal care products approached Blockasun and asked them to help them develop an "oil-free," silicone and water sunscreen. The first thing Bond wanted to do was develop a *frame formula* - essentially a basic system formula. Usually, Bond was the one who developed the frame formula but at this point, Bond was involving Brown more in the process. Before Bond left for two weeks of business travel, he and Brown discussed what the formula might look like. Their principal goal was to get as much Tioblock into the formula as possible, but they were also interested in reducing the greasy feel that's commonly associated with silicone-based formulations. With the general goal of the frame formula clarified, Brown began to develop a system.

The basic components of a system - the water phase, the oil phase, the surfactant and emulsifier systems - were rarely re-invented from scratch but

taken from older familiar formulations. The resulting frame system was an arrangement of older pieces. As Brown explained:

> All the ideas are there from before - they've all been developed. So the water phase used in this system has probably been used quite a few times by Bond in the past. Some oil phases are quite well known... it's got an emulsifier, surfactants, Steadee 20 which is [a product from Blockasun's parent company] ... [...] it's quite a standard system that we're using at the moment... I mean, [Blockasun's parent company] might have developed this type of thing when they were evaluating their own product so that's quite standard, really...

Because of Bond's greater experience with formulations, he was often the one to choose the pieces of the formulation, after he and Brown discussed what they were seeking.

Bond used a software program called *Generecipe* to help him think of new possible ingredients to formulate with. Generecipe was developed by a well-regarded formulator who worked as an independent consultant. He wanted to develop a tool that would facilitate the process of creating a new formula, by structuring the process and making it easy to look up ingredients. The formulation team used Generecipe to store and organize their formulas, look-up the chemical composition of commercial brands, and brainstorm other possible ingredients for formulas. Bond explained in greater detail the use of Generecipe to trigger the consideration of new ingredients:

> The purpose of [Generecipe is] to widen the scope - widen the field of what you look at - because without it, you would tend to look at an even more limited group of materials. [...]
>
> What [Generecipe] does, is it gives me the option of looking at a wider range of materials because I may be looking at a brand new system - this has already been formulated, but say I wanted to add a co-emulsifier to this system and I wasn't sure what to add. What I can do is ... if I click on that materials button there - this goes into a search engine which searches through the materials database ... and it searches based on key words - so if I am looking for 'oil and water emulsifier' [types it in and enters search] ... now that's given me all the materials which are on the main trade-names database, which are classified as oil and water emulsifier - there's 146 of them. Now, I may have in my mind 4 or 5 of those ... whereas going through this, I may go down the list and think: 'Oh yeah, [names a chemical] - let's give that a shot.' It just maybe helps to foster more innovation...

If one wanted more information on a particular ingredient, one could simply double-click on the ingredient's name, and Generecipe would display information regarding the supplier, as well as any notes that lab technicians had written about using the ingredient. If one decided to use that ingredient, one could then use Generecipe to add it to the formula.

Because of the vast number of ways in which ingredients could be combined and the fact that the interactions between them were not well understood, it was not feasible to develop a computer program to figure out an optimal formula based on a set of requirements. How much of each ingredient to add and how to combine it with other ingredients were competencies achieved through experience and not computable by any computer program. As Bond explained:

> Now, [Generecipe] is an invaluable aid to compiling formulations. But still the basis of each individual formulation really comes from experience and from your own individual knowledge because this is the database of tradenames of ingredients that you can use to formulate - and there are currently 13,295 records on that database - so obviously it's impossible for one person to have a knowledge of all of them... and you can only be experienced with a small fraction of them... Even if I just go into the database of materials that either we have in the lab or that we've used in formulations in the past, that comes to 650 serials - so, there's a huge range of different materials that you can use in formulations. So deciding on what to put together to formulate an individual system is really largely based on experience.

Besides serving as a triggering mechanism, Generecipe was also periodically used to organize the various formulations and store comments about which formulations worked or not. Although the lab books were used as the primary record of results from experiments, the entries were arranged in chronological order. Generecipe was periodically used to group all the experiments related to a particular project, enabling Bond and his team to print out "project summaries."

Brown also used Generecipe to get a better idea of the material properties of each ingredient in a formula. The commercial name of the ingredient rarely indicated its chemical name or composition. Generecipe listed all the ingredients by their chemical names, enabling Brown to find out quickly the chemical composition of each ingredient, its molecular structure, and its potential reaction in a particular formula.

Returning to the second example, Brown and Bond developed a frame formula after developing a better understanding of each ingredient in a formula. As Brown described it, it was a "simple system":

> Well basically it's a quite simple idea and a quite simple system. Water and a couple of thickeners and an ICI surfactant and dispersant, some skin conditioning agent, preservative, in the oil phase, and methacone/silicone oil to give like a nice skin feel, we needed something in there to give it some kind of structure on the skin so we added some of this - various silicone actives to try and do this - most of them, if they were compatible, didn't give any benefit for SPF apart from this which is Dow Corning 2502 which is like an alkile.

With this basic framework, Bond and Brown explored and "played with it," adding different ingredients to it to test its "flexibility." The process of playing around with the formula consisted of a series of explorations in the lab and on paper - each making a set of similar changes to a new aspect of the formula to see what kind of products were created from the changes. For example, one day, Brown was making up samples of formulas that incorporated different oils to understand what oils worked well with the system. The following lengthy quotes from Brown, provided as I observed him conducting various experiments, describe and emphasize the structured, exploratory and iterative nature of his process:

> [A]ll I'm doing with this is putting in different oils - different emollient oils so that's the oil variable in these... [...] so that's all I'm changing here just to see if they are at all compatible and if they are, what effects they have because some might change viscosity, some might change skin feel, some might not work, some might improve SPF... so we are trying a wide range to see how flexible the formulation is as well. Some might be cheaper than others so depending on what the customer wants, you can advise them what to use. Imagine things like smooth, simple sort of oils - mineral oil would probably be a lot cheaper than some of those sophisticated Mona oils but they might not have as nice a skin feel to them...

Brown also described the process of "playing" with a formula:

> [Bond] had a list of ideas and we just talked through them really ... and it was just a standard development thing... [Brown is now just playing around with the formulation]... that is what I'm doing with this formulation now. I did do a little bit on my own and development work on another formula...

[Brown flips through a lab book to show me]... we're developing a similar formula ... the water [phase] is very very similar - the oil phase [was] different... it was basically an oil phase - silicone oils really didn't come into it - and it was using a waterproofing agent - so it'd be a lot more waterproof... basically we had an idea of the formulation we wanted to use - or Bond did - we just tried different ingredients at different levels and we found out - I found a system which I thought worked quite well and then we included things like waterproofing agents and changed the Tioblock content from about - most of the development was done at 12.5 percent Tioblock ABC so I think it went from something like 5 to 25. Then we combined Tioblock AB with an oil grade and that gave us a few problems so then - tried a few ideas and then left a few ingredients out and included an extra one ... an isostearic acid which seemed to be not working as part of the oil phase so I neutralized it with a base called triethonolmine and the formula worked - it's the best one we'd found - but [it] isn't compatible with Tioblock AB so I may not be able to use it...

Although Bond and Brown described the exploratory process as "playing around," it consisted mostly of well-planned evaluations. As Brown noted:

First experiment, I wanted to evaluate the effect of using different levels of Steadee 20. So the oil phase in each case was the same, 20 stepped from 2.5, 3.5, 4.5, 5.5 percent- this is sort of the top end of what you would use of 20. And the effect we saw was: SPF was the same, similar; viscosity was... started out at base level, viscosity increased little bit, came down, came even more - which we didn't expect it to step change... so that proves something... proves that it's not a straight line relationship...

This one, of the next ... next three experiments, certainly, what I wanted to do was determine the effect of the sterile alcohol. What this does is it gives it a little more body. It helps form a film on the skin as well. Sterile alcohol. So, I wanted to determine the effect of that. So, no sterile alcohol. All these are done with the same 20 because if you start changing the 20 with the sterile alcohol, you don't know what the parameters - you don't know what the change is caused by. So I kept this at a low level- at 2.5 percent each time and just increased the sterile alcohol. Went from none, to 2 percent, to 3 percent. The one percent is in this experiment here [one he did during the first set of experiments]. I didn't redo the one percent. So that's at 2.5. 3.5, the same thing. 4.5 the same thing. 5.5 the same thing. So you just got a complete picture through that.

In summary, this second case describes the process of developing a frame formula and then playing with it to understand its flexibility. It highlights that rather than simply develop a single recipe to meet the specific set of

requirements, an important project for the formulating team was to be more resourceful and develop general recipes that could be adapted later to more specific circumstances. Creating frame formulas was an important way to learn about the effects of new chemical interactions and to prepare to respond to more specific requests.

Although the two cases describe how formulas were created at Blockasun, they do not provide details of how samples were developed and tested. Developing and testing the formulas well requires a great deal of practice and expertise. I now offer a detailed account of what this involves.

5.4 Developing a New Formula - A Micro-View

Throughout the process of creating a formula, representations of the emerging formula were developed (i.e., print-outs of formulas) and used to create samples. The samples were then tested and the results used to determine whether or not the formulators should modify the current formula, start from scratch, or conduct a few separate but complementary experiments. Although the formula evolved in a manner that was unpredictable and extemporaneous, it was made up of routine iterations that enabled formulators to assess the situation and relate it to past improvisations. What follows is a description of the process of developing a sample or formulation from a formula ("Making up the formulation") and then testing it ("Testing the formulation"). For the purpose of simplicity, I have assumed that Selene is the formulator throughout, although I observed both Brown and Selene making up and testing formulations.

5.4.1 Making Up the Formulation

Making up a formulation involved the following routine steps: printing out the formula and finding out the risks associated with each chemical; getting the chemicals and equipment; weighing out the chemicals; mixing them all together according to the formula; and finally, storing the formulation and cleaning the equipment. What follows is a more detailed account of each step.

Printing Out the Formula and Finding Out the Risks Associated with Each Chemical

Bond used the software Generecipe to write-out and store formulas on his computer. Whenever he wanted to see how the formula worked in practice, he would print it out and give it to Selene to make up, along with verbal instructions on how to modify particular ingredients.

Selene was required by Blockasun to go through the list of chemical ingredients in the formula and find out the risks associated with each. The risks of each chemical were associated with the product of its hazard and its exposure. Both factors were categorized as either high, medium or low (depending, respectively, on the type of chemical and the amount that was used). For example, most preservatives tended to be classified as low hazard. If a formula called for less than 100 grams of the preservative, then exposure was considered "low" (anything between 100-1000 grams was considered "medium," and anything greater than 1000 grams, "high"). There was a table in the lab that explained how to multiply the value of hazard with exposure. As Selene explained:

> If you got two lows, it's a one, if you've got a medium and low it's a one, if you've got two mediums it's a two... and things like that... but we never get a two because everything we use either medium or low... and if it's a "medium hazard," it's always the lowest exposure... the only thing that has a "medium exposure" is the water, and that's only because its over 100 grams - anything else is not.

Once Selene calculated the risk of each chemical, she wrote it down on a special printout of the formula, filed it away, and then proceeded to collect the chemicals that she would need to make up the formulation.

Getting the Chemicals and Equipment

The chemicals were all stored alphabetically in several cabinets located under the counter tops of the lab benches. Some were sorted under their trade names while others under their chemical name. Over time, Selene had learned whether a chemical was stored under its trade name or chemical name, and what

it looked like, so she now was able to find any chemical quickly. As Selene removed chemicals from their storage place, she placed them in groups, according to what phase of the formula they belonged to, so that by the time Selene finished taking out all the chemicals, she had created two or three (depending on how many phases the formula had) groups of chemical containers next to the area on the bench where she would be mixing them.

Selene used different glassware (e.g., different sized Pyrex beakers) to mix the ingredients together, depending on the formula. To make sure the glassware was the appropriate size, she would look at the formula and imagine going through the development process using the glassware. A significant characteristic of the formula was whether it was an oil-in-water or water-in-oil formula because that determined what size beaker was needed for each phase. As Selene explained, while making up a formulation with water and silicone:

> You've got to think ahead and think which beaker is the formulation going to end up in because a lot of the time we put the oil phase in there...[shows me a 100ml glass container] and you're not going to fit a 200 mg emulsion in one of them... So you tend to think: when it's water in oil... when it's water in oil, you're going to end up with... the oil phase wants to be in a large beaker because you're going to add the water to the oil. Accordingly, the other way around, when you are doing the oil in water, you're going to add the oil to the water phase so your water phase wants to be in a large beaker. This one is water and silicone, so your silicone is like the oil phase (they just don't like to call it the oil phase) so the oil phase wants to be in there because you're going to add the water into there.

Examining a formula and seeing whether or not it was oil-in-water or water-in-oil, helped Selene quickly imagine the process of making up the formula and determine the most appropriate glassware for the oil and water phases.

Weighing Out the Chemicals

Each chemical (whether liquid or solid) had its own pouring behavior, due to its particular consistency and subsequent viscosity. Some chemicals poured more quickly than others, and consequently were more difficult to control and pour out in precise quantities. With practice making up formulations, Selene developed techniques for controlling and adapting to the flow behavior of the

chemicals so that she could extract precise amounts for a formulation. For example, with ingredients that required especially precise measurement or were used at the end of the particular phase, she used glass pipettes to extract more precise quantities.

When an experiment called for several variations on the same basic formula - for example, playing with a particular ingredient (adding it in at 2 percent and then at 4 percent, or adding in instead a similar but different ingredient at 2 percent and 4 percent) - Selene prepared the small batches in parallel. This technique was considered the most efficient because, as Selene explained:

> When you get used to doing them, you can do - say you've got a set of six you got to do - you can do a set of six - well, not at once because you've only got four stirrers but - but you can do four at the same time... sometimes it's easier, with two or three to do... it's just as easy [...] to do four as it is to do three. I've got to do it anyways so I may as well do the other one. And sometimes when you're not changing your water phase. If you're making six you can make big batches and just divide out into six individual things...

Whenever Selene made several batches in parallel, she would weigh out the chemicals in parallel as well. Once, for example, when Selene made four separate but similar batches, she weighed out the first ingredient for batch 1, then batch 2, and so on. Because each batch of chemical had its own pouring behavior, it was easier for Selene to manage each ingredient at the same time, across the four batches, rather than develop each batch individually and revisit each ingredient (and recall how the ingredient behaved).

Mixing It All Together

Water in oil formulations were considered easier to make than oil in water because the former simply involved mixing the ingredients together and homogenizing them ("homogenizing" means to stir the two phases until they are mixed evenly throughout). The mixing was done with an electric mixer, similar to a kitchen mixer for mixing bread dough or whipping cream, that used long blades. Oil in water formulations, on the other hand, involved extra steps

such as adding a dispersant thickener which had to be stirred for about half an hour before it dispersed.

In both cases, the oil phase must be homogenized before it gets mixed with the water phase. A particular blade is used for the homogenization of oil. That blade is smaller than the blade used for water and oil phases together. To mix the two phases together, Selene could chose from five mixing blades which looked like drills. The mixing blade was quite important in achieving the right levels of homogenization. At one time, for example, Blockasun had been experiencing problems with variation between samples of the same formulation. This variation stopped when they started using blades that were sent over from Belgium.

How the two phases are combined also depended on whether the formulation was an oil-in-water mixture or a water-in-oil mixture. As Selene explained:

> For water and oil, it's always added slowly because you need a lot of energy, I think, to get the water like into the oil because I think they really don't want to do it because oil and water don't mix – so this oil formulation then needs a lot of energy to get them to emulsify together so you add them slowly so it's taking its time to get in... The other way around, you just add it as fast as you can ... You need to move it around because sometimes these will go thick, just like that, and if you don't move it around then you'll get like an air bubble inside and it'll not be mixing anything...

The formula was stirred for about an hour at room temperature.

Before mixing, Selene thought through the mixing process to determine the most efficient and practical way to assemble the formulas. Factors she considered included: the time of day, what other tasks were on hand, and whether or not anyone else was making up formulas. Brown went through a similar thought process. What follows is an example of Brown thinking out loud as he figured out how to mix, at the end of the day, a series of formulas in which essentially he was changing one ingredient:

> So what I'm thinking of doing because this is quite a long process to dissolve this Steadee 20 - it's about half an hour - so what I'm thinking of doing, actually, calculating how much I need for the full experiment - water and 20,

for all eleven - so I'll probably just times it by 11.5 - so I've got a little to play with. And I just make a bulk solution today, just ready for tomorrow - so I can get them all done for tomorrow... it's easy enough to do when you're just changing one variable. If I wanted to I could probably make up the full thing... in fact I might just do that... [make all of Phase B] ... What'll happen, when these cool, I'll do two bulks... this will form about ... when these are hot, they'll be nice and fluid. On cooling, it'll go quite thick - it'll form quite thick and lumpy - like a paste, really - it'll be quite difficult to get that re-dispersed as a bulk - so I'll split them while they're hot into eleven smaller ones for the experiments and then it should be a lot easier to re-disperse eleven smaller ones... Accuracy improves as you scale up because you make small errors over a larger scale ... rather than small errors over a small scale...

Putting the Batches into Containers and Cleaning the Equipment

While the ingredients were being mixed, Selene would begin to put the ingredients back to where they were stored. After the ingredients were mixed together, each mixture was transferred into a plastic jar and labeled. The equipment was then cleaned with soap in an adjoining sink and the counter area wiped down.

5.4.2 Testing the Formulation

Once the formulation was made-up, Selene would run it through various tests, including one to examine its SPF (The SPF Test), one to make sure it was stable and had the correct texture (The Stability Test), and one to examine how it would look on the skin (The Whitening Test). All formulations were tested in the same manner, enabling them to be compared to each other consistently.

The SPF Test

SPF testing involved measuring the sun protection factor (SPF) of a sunscreen product. The SPF of a sunscreen product defines the level of protection that a product provides against UV-induced erythema (sunburn) for all skin types and intensities of sunlight. If a product has an SPF of 15, for example, and it normally takes 20 minutes for a person with a particular skin type to redden under a given intensity of sunlight, then use of the SPF 15 sunscreen product will increase the time of exposure to 300 (15x20) minutes.

There are two general methods for measuring SPF: *in-vivo* methods, which use human volunteers to measure the SPF according to strict protocols, but are expensive and time-consuming; and *in-vitro* methods, which are cheaper and quicker because they rely on spectrometric measurements of the UV light attenuated by the test product. The formulation team at Blockasun only conducted in-vitro SPF testing using the "Diffey method."

At Blockasun, SPF testing was conducted on samples sent in by customers and samples that were prepared by the formulators. Blockasun provided free SPF testing to suncare manufacturers, as a way to help promote Blockasun as a respectable company with high standards. Because Blockasun had developed a good method of SPF testing, suncare manufacturers sent samples to Blockasun to take advantage of the free service and receive reliable third-party estimates of the SPFs of their products. What follows is a more detailed description of how SPF testing was conducted at Blockasun.

The general method for in-vitro SPF testing at Blockasun included applying the sample to be tested onto a substrate which mimics skin, and then placing that substrate into a machine which measures how much UV light passes through the sample. More specifically, the method consisted of several steps, which for the sake of clarity, I have numebered:

1. Selene cuts three pieces of tape from a roll and stretches each across either a glass plate or a metal slide, depending on how precise the test needs to be (if the test is a customer's sample, then they use glass, which is more precise; if the test is for a rough SPF measurement, then they use a metal slide, which is cheaper). Medical tape is used because it is cheap, readily available, UV transparent, and its texture mimics the uneven surface of the skin well.

2. She places a blank slide (a slide with tape but no sample) into the machine, which measures transmissions of light through the blank tape to get a reference scan and to calibrate the following measurements.

3. She takes a plastic syringe and fills it with the sample to be tested.

4. With each slide, Selene applies the same amount of the sample onto the tape. How she initially applies the sample onto the tape depends on the consistency of the sample: if the sample is especially thick, then she applies

small evenly spaced dots of the sample onto the tape; if the sample is more viscous and easier to spread, Selene will apply a series of parallel lines on the sample. She only prepares one slide at a time (rather than all three at once).

5. Using a gloved finger, she gently spreads the sample around the tape, to try to have the tape covered as evenly as possible with the sample.

6. With the sample as evenly spread as possible, Selene places a slide in the machine and runs the machine so that it will measure the sample and present its findings. A computer controls the testing machine, collects the data from the machine, and performs the calculations for the results.

7. As Selene waits for the machine to run the test, she either applies the sample on to the next slide (if there are any remaining slides) or she begins to prepare a new set of blank slides.

8. When the machine is finished, Selene writes the results down in the lab book.

This seemingly straight forward procedure was susceptible to variance by a number of factors which could have significantly affected the results, including the syringe, the tape, and the sample itself.

A Blockasun publication describing its method for SPF testing explained some variables that may affect the quality and consistency of results:

The key to success with this method is product application onto the tape [...]

A number of variables can affect the results, and lead to errors in the measured SPF. A key variable is the quality of the tape. The tape has microscopic pores in it, and these have been seen to vary significantly in size. These variations in topography affect the spreading of the product over the tape. If the pores are too large and the tape too 'rough', the product does not spread evenly and the SPF is decreased. If the surface is too 'smooth', allowing very even spreading, an artificially high SPF result is obtained. [...]

Operator technique also influences the result. Different operators use different pressures when spreading the sample, leading to variations in the distribution of the product over the tape.

At Blockasun, we have attempted to control these systematic errors by use of a standard test product, with a known in-vivo SPF, to select batches of tape suitable for use by each operator.

Recognizing the variables in the process, Bond had developed techniques for controlling them and achieving in-vitro results that correlated with in-vivo results.

Even with these controls, there was variation due to the sample, the equipment, and the formulator conducting the test. As Selene was conducting an SPF Test, she explained some of these in her own words:

> When [the samples are] really watery, they'll seep straight into the tape, into the pores. And once they're into the pores, you can't get them back out and spread it around... [so that's what makes it so difficult to spread around]... especially thin ones... but thick ones have the same effect - when they get into the pores, it's difficult to spread them around - they just stay there. So you may have parts of the tape where there's a lot of cream and other parts where there isn't, so it's easy to get high SDs and wide variation in that - there's something wrong when I get the third one off, it'll tell us either closer to 10 or 26 and I'll see from the other which it is [so by finding a pair she approximates what the SPF should be]... looks like it's going to be high... so that 10.6... sometimes you can get air bubbles in the syringes when you pull the formulation - if there's air in the formulation or I don't know how else you can get it in but you do get air bubbles - if I'm pushing out and there's an air bubble, I'm not going to have the same - the right amount of cream on the surface...[...]

I remarked to Selene that when I tried to make up an SPF sample myself, I realized that pushing the sample out from the syringe consistently was very difficult because of the disposable syringe. I pushed the syringe a little, but nothing came out. I then pushed it a little more and suddenly a ton came out. Syringes were unpredictably quirky. She replied:

> Yeah, some of them are tighter than others. There are so many different things - so many outside things that can affect the SPF, that it's a hard test to do and it takes a lot - sometimes it takes months of practice to get it right. I mean, I've been doing it for two and half years and I wouldn't - it's not easy for me to do. I mean, you've seen me this morning I hadn't gotten what I wanted... so I don't like doing it.

With the controls developed by Bond and with practice, Selene and Brown were able to conduct the SPF test so as to produce reliable results. That is, they were able to produce relatively consistent results from a method that included

several sources of variability, including the equipment used to conduct the test and the person performing the test.

The Stability Test

The Stability Test made sure that the physical characteristics of a formulation would remain the same over a particular period of time, under particular temperature conditions (i.e., that a formulation would remain stable over time). It simulated a long period of time by placing the samples at higher than normal temperatures, to accelerate any destabilizing qualities that may evolve under normal conditions. Selene explained the concept of *accelerated stability*:

> In cosmetics, everything we make is for three years... [but]we can't wait three years, so the law of chemistry says: for every ten degrees you increase the temperature, you've doubled the shelf life. So if you put something at 50 degrees for two months, more or less you know that it's going to be okay for three years. [...] So everything they make they put into stability. Keep looking at it. There's no machine that looks at it yet that's very successful. And then, if it starts changing color or changing its feel or behavior, then we have to go back and start again.

The Stability Test was only conducted on samples made in-house and the results were not shared outside of Blockasun.

There were three stability tests: short stability, intermediate stability, and full stability. Each was conducted in the same manner and varied only by the length of time being simulated. After samples of a formula were made up, Bond would specify which stability test he wanted done on each. For the short stability, for example, a jar of the sample went through the following three stages: it was first placed in a small oven at 25 degrees (Celsius) for four weeks, then at 40 degrees for two weeks, and then finally through two freeze-thaw cycles. A freeze-thaw cycle is where the jars are placed in a freezer overnight, taken out the next day, incubated, then tested the following day. When two freeze-thaw cycles were conducted, they were done one after the other.

At each stage, each sample was visually inspected. This was done by taking a small metal spatula, dipping it into the sample, scooping some of the sample out with it, and, against the artificial light of the lab, examining it to see if its

consistency has changed at all. The sample was graded on a scale from one to five, where a "five" is when the sample has totally separated (i.e., it was unstable) and a "one" is when the sample has a perfectly smooth consistency. Separation of the oil phase from the water phase was a common instability. Sometimes Selene didn't even open the jar because she could see right away that the sample had separated. Other times, it was not until she stuck the spatula into the sample that she discovered a layer of much lower viscosity on top of a much thicker, creamier level. In the lab book, Selene described one such sample as "low viscosity with a layer of high viscosity gel on top."

Two other kinds of instabilities that occurred were agglomeration and graininess. When a sample became unevenly lumpy, like curdled milk, it was described in the lab book as "AGG" referring to agglomeration. When a sample became lumpy and those lumps were equal in size, it was described in the lab book as "GR" - in reference to "grainy."

During my field work, there was a sample that at first glance appeared to be perfectly smooth, but when Selene scooped up a little of it with her spatula and held it against the light, she could see roughness around the edges. Selene described this sample as "one-stroke-two" and wrote down in the lab book "1/2." In the following quote, Selene describes this sample, before showing me another one that qualifies as a "four":

> Ideally, you want it to be smooth in every way. So that would just be a one-stroke-two. Because it's alright but it's not 100 percent. Something like these ones... I mean, it looks fine but when you ... [takes some out] you can see the lumps in this one... so that one goes down as being a four...

The difference between a "two" and "three" was very ambiguous to a novice's eye, but over time Selene, Brown and Bond had developed a common understanding of what distinguished a two from a three. Even so, within a certain range it was quite subjective. They would agree whether it was a four or not but disagree among one and one-and-a-half, and two. As Selene elaborated:

> Sometimes, I've been off on holiday or I've been off sick and I've put something down as maybe being a two and then when I came back and Brown's done them, he's changed them and said "Oh, it's not a two, I only

> think it's a one and a half." When I come back it's gone, two, two, two, and then one-and-a-half, and then I come back and say "No, it's not. It's a two." So I put two down. Everybody has a different opinion ... For me, for it to be a one, it would have to be flawless. Whereas with Brown, it doesn't have to be flawless to be a one.

The stability test was one way to describe how a sample changed over time. Many samples started off being a one or two but because of a variety of reasons, including the oil and water phases separating and coagulation, they quickly degenerated into a four or five. The lab books were filled with the various histories of all samples developed in the lab. "Full stability" tests represented a longer history of a sample and, as Selene noted, this was also reflected in the books:

> You can tell when it's a full stability because the whole chart's used up - four weeks, six months, four weeks, one week, and five freeze-thaw cycles - I hate doing them... everybody hates doing them... but they have to be done.

Finally, at any one point, there were numerous samples being tested, each at a different stage. Selene and Brown kept a diary to keep track of what stage each sample had already gone through and to see which samples needed to go through which stage.

The Whitening Test

The Whitening Test was a "straight-forward test" which, at the time of my field work, the formulators had been conducting for only a year. The results of the test were not shared with anyone; it was conducted only for the benefit of the formulation team.

The purpose of the whitening test was to get a sense for how white a formula appeared on the skin; it gave one a sense of the formulation's "transparency and how people see it." Unlike the SPF test, the "skin" in this test was not considered representative of any particular human skin type. Instead, the skin factor was normalized using a black paper surface that reflected very little light. A small fixed amount of the sample was applied to the surface, and after ten minutes (when it had dried), a hand-held device was used to measure how much light

was reflected from the surface (after it had been calibrated against a white tile). The whiter the surface, the more light was reflected, and the higher the reading. In addition to testing the sample, a test was conducted using a standard - a product whose whitening was used as a benchmark against which to compare the formulation sample. Thus the whitening test was essentially a way to compare a sample with a commercial product. As Bond explained:

> The purpose of this is to see how white something is on the skin... but we can't use skin so we use black ... so it's more of a comparison. [...] Of course, you can't compare the skins... for example, like these ones I've done - I've done seven, and they all have different powder Zn - so I've done the whitening of them all and then I've done whitening for [the] standard and then they'll all be compared to the standard. So it's more of a comparison than an independent test of its own, like the SPF...

The Whitening Test consisted of the following steps:

- gathering the sample to be tested;
- gathering the reference standard;
- applying the sample to black paper and let it dry for ten minutes;
- calibrating the hand-held reflected-light measuring device with white paper;
- taking measurements in three areas of the sample; and
- subtracting the measurements from the calibrated measurement to get results.

As with the other tests conducted on samples, the Whitening Test was structured in a relatively specific manner and formulators enacted those structures as consistently as possible with past tests and with little, if any, extemporaneous adapting.

Having discussed in detail an example of the process of creating a new formula system, an example of testing a system's flexibility, and the process of making up and testing samples, I will now examine these practices from the point of view of improvising.

5.5 Improvising by Formulators

In this section, I first propose that formulating is an example of improvising by briefly discussing how the four activities that constitute improvising are practiced in formulating. I then examine the various roles of technological artifacts in the process and focus in particular on emergent artifacts (e.g., the formula-in-progress and samples).

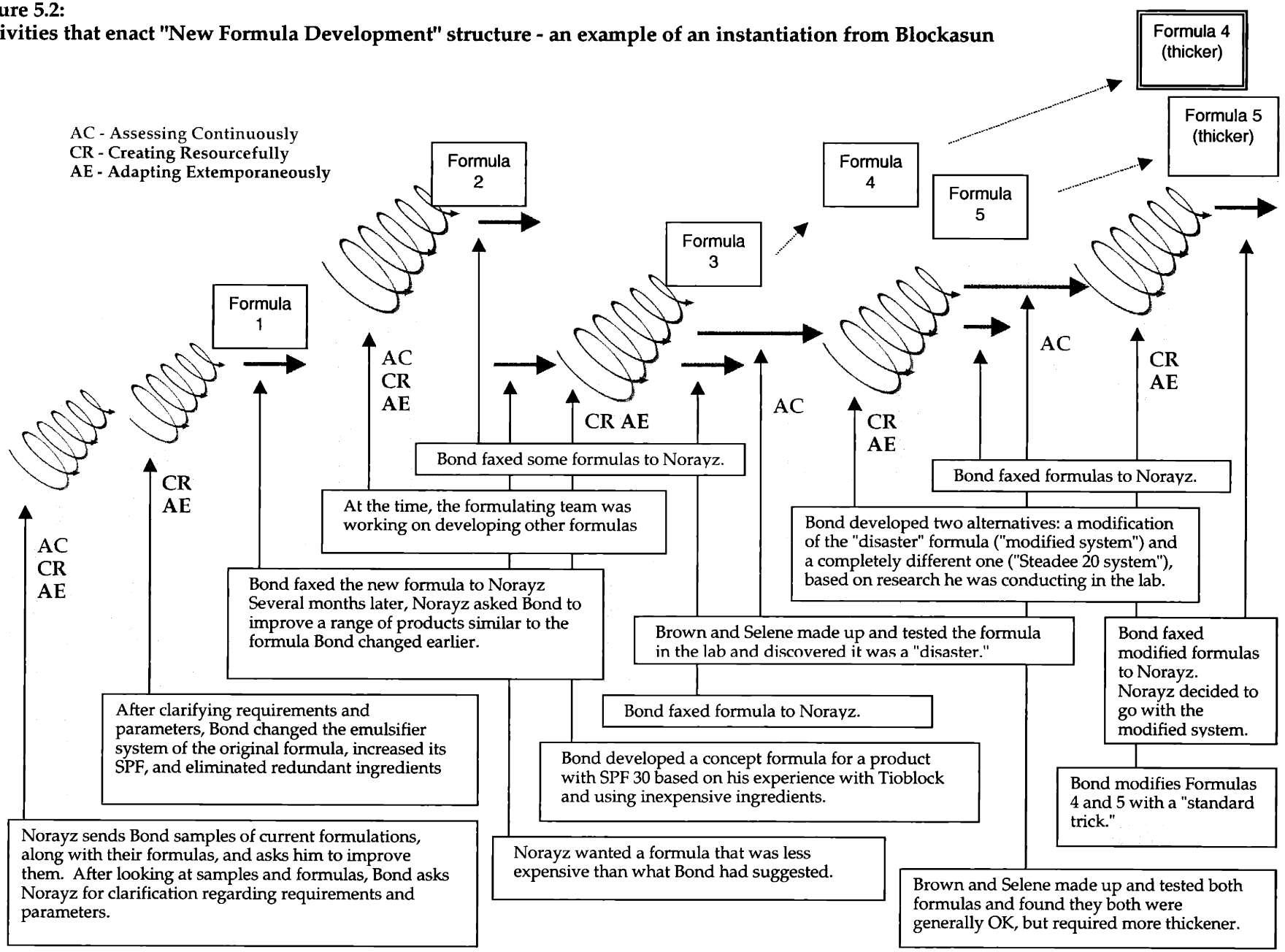
5.5.1 Formulating and Improvising

Of all the practices associated with formulating, the overall process of developing a new formula was the clearest example of improvising as it also exhibited the greatest degree of improvising. The framework I developed in Chapter 3 proposes that improvising is consists of enacting structures in the process of assessing continuously, creating resourcefully, and adapting extemporaneously.

Each time the formulating team at Blockasun went about developing a formula for a customer, they enacted (i.e., their activities shaped and were shaped by) the same structure, what I call the "New Formula Development" structure. Figure 5.2 depicts the clusters of activities that constituted the process by which the formulating team developed a new recipe for Norayz (Case 1). In doing so, it also depicts the clusters of activities that enacted the "New Formula Development" structure - i.e., it depicts the clusters of activities that constituted a specific instantiation of the "New Formula Development" structure.

I use two different symbols to represent and distinguish two general clusters of activities. I use a spiral to represent a cluster of iterative activities that typically involve creativity and extemporaneous adaptation. For example, the first spiral represents the cluster of activities that were involved in creating a better understanding of the desired formula. These activities included developing a set of desired characteristics from examining samples to get an idea of the desired "look

Figure 5.2:
Activities that enact "New Formula Development" structure - an example of an instantiation from Blockasun



and feel" and clarifying terms and parameters (e.g., what is meant by "oil-free"?).[6] I use a straight arrow to represent a cluster of activities that typically involve a minimal amount of extemporaneous adaptation. For example, the processes of making up and testing formulations are depicted as straight arrows. Although improvising may occur during these relatively "straightforward" activities, I want to distinguish them from clusters of activities that typically do involve adapting in the moment.

In addition to distinguishing two different kinds of clusters of activities, I have labeled each cluster as either an example of assessing continuously (AC), creating resourcefully (CR), and/or adapting extemporaneously (AE). The purpose of this is to relate the core activities of improvising (according to my improvising framework) to the activities that constitute this specific example of improvising. For example, in the first spiral, representing the process of getting a better understanding on the identity of the desired formula, examining samples and clarifying terms and parameters are examples of Bond assessing the situation (AS) to get a better understanding of what he had to work with. The general activity of creating a set of desired characteristics is an example of creating resourcefully (CR) (i.e., Bond was piecing together a set of desired characteristics based from whatever was available). Finally, as he clarified parameters, he adapted the set of desired characteristics - i.e., he adapted in the moment (AE).

In my improvising framework, improvising involves enacting structures. Several different structures were enacted during the process. Tables 5.2 and 5.3 (following page) list examples of structures that were enacted throughout the process of developing a new formula. Each structure is described by its general purpose, typical pattern of activities (i.e., the general activities that typically constitute an instantiation of the structure), and structural referents that serve to

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[6] It is worth noting that the third spiral from the left represents the formulating team developing a different set of formulas. Thus, if I were to represent the entire process depicted in this figure with a single graphic, I would use a spiral.

Table 5.2: Examples of structures enacted throughout process of developing a new formula, including structural referents associated with the structure

Structure	General purpose	Typical pattern of activities (i.e., general activities that typically constitute an instantiation of the structure)	Structural referents (artifacts are underlined)
New Formula Development Structure	To develop a new formula	Typically constituted by the following iteration of activities: 1. Gather customer requirements/feedback 2. Construct a new formula/Adapt current formula/Adapt other formula (if confident about formula, share with customer) 3. Make up a formulation of the formula 4. Test the formulation 5. Reflect on results of test and decide what to do next (if formula good to send, then go to Step 6, otherwise, return to Step 1). 6. Share formula with customer and solicit feedback	stories about 'how a new formula typically gets developed' (idealistic stories), stories about specific examples (case studies), emerging systems/frame formulas, print-outs of formulas, formulations (and corresponding test results), lab book (provides a history of all the formulations made up and tested for each project), samples of comparable formulations, training guide
Formulating Role: Principal formulator (e.g., Bond)	To lead formulating team	Leads the formulating team; acts as the principal point of contact with customers; makes final decisions, constructs and adapts formulas, and does not make up or test formulations; shares office with other senior scientists, outside of lab; gives presentations at conferences.	lab coats, protective eyewear, faxes (used to communicate formulas to customers)
Formulating Role: Assistant formulators (e.g., Brown and Selene)	To assist formulating team	Make up and test formulations; train to create formulas; conduct SPF Tests for customers; share office in lab.	lab coats, protective eyewear, SPF Tests results (sent back to customers)
Bond's signature form	To develop an elegant formula	(difficult for me to describe) Bond, like some other formulators, tended to develop formulas that had a form that distinguished his formulas from others' and was recognized by other formulators.	old formulas of Bond (published in trade journals)

Table 5.3: Examples of structures enacted during specific stages of the process of developing a new formula, including structural referents associated with the structure

Structure	General purpose	Typical pattern of activities (i.e., general activities that typically constitute an instantiation of the structure)	Structural referents (artifacts are underlined)
"Making Up a Formulation"	To make up a formulation of a formula	Typically constituted by the following series of activities: Print out formula and find out the risk associated with each chemical Get the chemicals and equipment Weigh out the chemicals Mix chemicals together Put batches of formulation into containers Clean equipment	print-out of formula, training guide
"Testing a Formulation"	To lead formulating team	Typically constituted by the following series of activities: Conduct the SPF Test Conduct the Stability Test Conduct the Whitening Test	lab book (provides the results of each test for each formulation), training guide
"SPF Test"	To test the SPF of a sample	Typically constituted by the following series of activities: Apply sample onto substrate Place substrate into machine Record results	lab book (provides the results of each test for each formulation), training guide

represent the structure and guide instantiations of the structure. I have underlined structural referents that are artifacts, to highlight the role of artifacts as explicit representations of structures.

The process of creating a new formula involved enacting several different kinds of structures, including, for example, customer requirements, team roles and implicit and explicit guidelines for composing a formula and making up and testing samples. When a customer came to Bond to request a new formula, Bond typically engaged in a discussion to clarify the requirements of the customer (e.g., what exactly does a customer mean by 'oil free'?). These requirements were used throughout the process to assess whether or not a formula-in-progress was satisfactory. Team members enacted clear roles around conducting the creative work involved with developing the formula and making up and testing samples. Although Bond encouraged his assistants, Brown and Selene, to provide input and to suggest next steps in the development process of a formula, Bond was the one who made most of the key creative decisions. These roles also reflected the level of formulating experience of each team member; as each team member developed experience formulating, they were able to participate more in the creative decision making process.[7]

The practices of assessing the situation continuously, creating resourcefully, and adapting extemporaneously were also structured. In an effort to bring "more science" into the artistic discipline of cosmetic science, Bond structured the general process of composing a formula so that the team could better understand not simply what chemicals worked well together but also why they worked well

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[7] Two years after I conducted my fieldwork, I caught-up with Bond and Brown. Blockasun had moved their lab facilities to the headquarters of their parent company and the formulating team had merged with formulators from other small companies in the personal care business. Bond was now serving as an internal consultant to all the formulators. Brown was now not only formulating on his own but was a key member of the larger formulating team and was learning to formulate personal care products other than just suncare products. Selene had left to have a child and did not return because the commute to the new location was too long. Bond was in the process of finding a replacement for Selene. As he explained, he was looking for "somebody who can come in young and fresh and can sort of pick things up. The ability to learn is probably the key requirement, above anything else."

together. Every time a significant change was made to a formula-in-progress, a sample was made up and tested, and the results of the test were recorded in a lab book. Structuring the general process in this manner enabled the team to continuously assess the situation. The documentation practices enabled them to develop an understanding for what and why certain chemicals worked well or did not work well with each other.

The notion of creating resourcefully was apparent both during the process of creating a new formula and in preparation for it. A noted aspect of the artistry of formulators was their ability to find new unexpected ways to use ingredients. This aspect was apparent, for example, in the comments of the materials provider, quoted earlier, who exclaimed:

> [I] can tell people how my raw material will behave in certain situations but I haven't got a clue what they will make. So I suppose if you use the artist analogy with a painting, I'm selling the red pigment or the blue pigment or the white pigment - I've got an idea of what some of those combinations are gonna be but if my artist is somebody off the wall who is going to start putting in flowers and egg shells to give it texture, I don't know - I don't know what they're going to do. It's even more so in cosmetics.

Rather than develop a single formula that specifically addressed a particular set of requirements, Bond often tried to develop a system or frame formula. A system formula was "flexible" enough to be adapted to different conditions (e.g., different SPF factors). The team also conducted several experiments exploring either the flexibility of a formula system or the compatibility of an ingredient to different systems, in preparation for developing a new formula (e.g., the second case). In examining what chemicals a system could use (and still work), the team was essentially examining how resourceful they could be with a single formula system.

The final version of any formula that was passed on to a customer was the result of several adaptations of (an often significantly) different original concept. These adaptations occurred throughout the process, in the moment, in response to either customer feedback, the memory of past experience, or the results of sample tests. Interestingly, although extemporaneous, these adaptations tended

to lead to structured results, particularly with experienced formulators. Bond, for example, was able to tell who the author of a formula was simply by looking at either the ingredients that were used together or the wording of the mixing instructions. These formulaic signatures made more explicit some of the meta-structures enacted by experienced formulators as they adapted extemporaneously.

During the process of creating a new formula, then, several different structures were enacted to assess continuously, create resourcefully, and adapt extemporaneously. Some structures, such as those enacted to guide the overall creative process, were more tacit than explicit and did not specify what to do during many parts of the process (e.g., there were no explicit guidelines for what to do next, if a formula-in-progress proved disastrous). Thus the overall process involved a lot of extemporaneous adaptation. In contrast, the processes of making up and testing samples involved enacting as consistently as possible structures that were more explicit and specific about what to do during a greater part of the processes.

5.5.2 Using and Creating Artifacts

As with improvising in African American quiltmaking (discussed in Chapter 2), artifacts were significant to the process of creating new formulas. Throughout the process, formulators used chemicals and various lab equipment to create samples of various formulas-in-progress and test the samples to see whether or not the formula-in-progress, if followed as directed, would produce a sunscreen with the desired effects. The framework for the potential roles of artifacts in improvising, developed in Chapter 3, is helpful for highlighting and organizing the various kinds and uses of artifacts in the process. Two kinds of artifacts are significant to creating a new formula: stable artifacts (e.g., glass beakers, testing equipment, mixing machines) and emergent artifacts (e.g., the samples). In addition, the various uses of artifacts can be described as examples of three general uses: as tool (e.g., the use of lab equipment to create and test samples), as component (e.g., the use of dispersions - manufactured in-house - as ingredients in the samples), and as product (e.g., the use of a sample as a

representation of the formula). Finally, these uses tend to involve two aspects of artifacts: practical (e.g., the use of samples to test the respective formula-in-progress) and symbolic (e.g., the use of a print-out of a formula-in-progress to guide the process of making up a sample).

Throughout the process of creating a new formula, different kinds of artifacts were used in a variety of ways. Table 2 includes a variety of examples of how artifacts were significant to the process of innovation at Blockasun, similar to the range of examples of how artifacts were significant to the process of African American quiltmaking.

Table 2: Examples of artifacts and associated uses during the process of creating a formula

Artifact	Artifact-in-use	Kind of artifact	Primary role of artifact	Primary aspect of artifact used
glass beakers	The use of glass beakers to contain ingredients for mixing, as part of making up a sample.	Stable	Tool	Practical
testing equipment	The use of lab equipment to conduct tests on sample	Stable	Tool	Practical
formulating software	The use of Generecipe to brainstorm potential ingredients.	Stable	Tool	Symbolic
dispersions	The use of dispersions as ingredients of samples.	Stable	Component	Practical
printout of formula faxed to customer	The use of the formula to assist a customer and promote Blockasun dispersions.	Stable	Product	Symbolic
printout of formula-in-progress	The use of a printout of a formula to guide the process of making up a sample.	Emergent	Tool	Symbolic
representation of formula-in-progress (either on paper or from computer)	The use of the formula-in-progress to derive a new formula	Emergent	Component	Symbolic
sample	The use of a sample to assess the formula-in-progress.	Emergent	Tool	Practical
sample	The use of a sample as a representation of the formula-in-progress	Emergent	Product	Symbolic

Several of the artifacts that were used did not change in any significant way during their use. For example, glass beakers were used to hold ingredients during the process of making up a sample and other lab equipment was used to mix the ingredients together, heat them up, as well as perform several different tests on samples. These artifacts remained stable during their use.

Although there were many examples throughout the process of innovating a new formula where technological artifacts were used to perform critical tasks (e.g., measuring and mixing chemicals, testing samples), there were only a few examples where IT was used and even fewer to perform a critical task. An example of how IT was used to perform a critical task was the use of the SPF testing machine. The machine consisted of a computer with software that collected data generated from the test, performed calculations with the collected data, displayed the data and results of the calculations in a graph form, and printed them out. Examples of the use of IT to perform less critical tasks included various uses of the software Generecipe. The formulators used the software program Generecipe to enter, store and modify formulas, view the formulas from different perspectives (e.g., by mixing order, by chemical name, etc.) and print them out accordingly. Brown would also occasionally use Generecipe to explore alternative chemicals suggested by the software. In this regard, Generecipe was software that was used primarily for storing and organizing new formulas and periodically for brainstorming alternative ingredients. In summary, from the point of view of improvising new formulas IT was used to facilitate the process of assessing the situation (by using it to test samples), enact structures (by using it to store and organize formulas in particular forms), and create resourcefully (by using it to generate new possibilities for using available ingredients).

In addition to stable artifacts, there were also several emergent artifacts - artifacts that were created or were altered significantly during the process of improvising. Emergent artifacts included printouts of the formula-in-progress and any samples that were made up.

In African American quiltmaking, emergent artifacts (specifically, the emergent quilt and, depending on the particular process, any emergent quilt blocks) are critical to the innovation process because, among other reasons, they are used as key components of the final product, they represent the process thus far, and they enable the process of innovation to occur over different periods of time and different places. Emergent artifacts are also critical to formulators in the process of creating new formulas, although not necessarily for the same reasons as in African American quiltmaking. The most salient examples of emergent artifacts, during the process of improvising a formula, are the samples created by the formulators. Although these emergent artifacts do not become part of the final product, as they do in African American quiltmaking, they serve as important representations of where the formulators are with regards to completing the process of innovation. They also serve to compare the current situation with past situations.

The first case discussed in this chapter illustrated how the process of creating a single new formula may involve "branching out" - working on and exploring several different possibilities in parallel. Anytime a significant change was made to one of the formulas-in-progress (assuming there were several related formulas being worked on in parallel), a sample of the formula-in-progress was created. During the course of creating a new formula, over a dozen samples were generated, and each sample tested, and the results of each test recorded in lab books in such a manner that the formulators could compare the results of all samples ever created in the lab. In contrast to improvising in jazz or theater, improvising in quiltmaking involved creating an artifact that served as a tangible representation of the history of the process. In contrast to improvising in quiltmaking, improvising in formulating involved creating several artifacts (e.g., samples, formulas-in-progress) and these artifacts were used collectively to create a more detailed representation of the entire process - including those "branches" that proved be irrelevant or "mistakes." This detailed representation offered formulators an opportunity to learn from "mistakes" or "rejects" that would not have been apparent if, as in the case of quilts, only the process of the

final formula had been recorded. For example, although Norayz rejected the Steadee 20 system formula, Bond anticipated using that system to meet the needs of a different future customer. As he explained to me:

> Well we just put [the Steadee 20 system formula] to one side. As far as this project was concerned it was dead. But, you know, obviously, we keep a record of what results we've obtained and in future, if we're looking at formulations with similar type of requirements that might come back to us and we'll say 'Let's look at that system again.'

Emergent artifacts, then, were essential for increasing the opportunities for learning from past experiences.

Both kinds of artifacts were involved in at least one of three generic ways; that is, there are at least three generic roles of artifacts: tool, component, and product. Artifact as tool refers to how an artifact is used to construct the outcome (e.g., the use of glass beakers to hold ingredients during the process of making up a sample); technology as component refers to how an artifact is used as an element of the outcome (e.g., the use of dispersions manufactured at Blockasun as ingredients of samples); and artifact as product refers to how an artifact is used as an outcome of the improvising (e.g., the imagined use of a formula by a manufacturer).

Each role involved at least one of two aspects of an artifact: practical and symbolic. Involving an artifact for its practical aspect refers to using the functional properties of an artifact (e.g., using a sample to test whether or not a formula works). Involving an artifact for its symbolic aspect refers to using the representational properties of an artifact, without necessarily depending on an artifact's functional capabilities (e.g., using the printout of a formula to guide the process of making up a sample).[8]

The work practices involved in improvising a new formula begin to suggest relations between the improvising framework and uses of technology

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[8] The material properties of the printout were significant in that they enabled Brown and Selene to take the formula to the lab. Had they been unable to print out the formula, for example, they would have had to either copy it down on paper by hand or install a networked computer in the lab.

framework described in Chapter 3. That samples were created throughout the process of creating a formula to assess the situation, for example, suggests that emergent artifacts were critical tools for continuously assessing the situation, a core activity of improvising. Rather than assess the situation from examining the formula-in-progress (which would be the equivalent of what quiltmakers do when they use the emergent quilt to assess the situation), formulators created a representational artifact of the formula-in-progress (i.e., the sample) and examined it from the perspective of several different "lenses" (i.e., tests) to see what they showed. The formulators then used the information from the tests on the sample to make assumptions about the formula it represented. Thus, both the practical and symbolic aspects of the emergent artifact were involved when the artifact was used as an assessment tool.[9]

5.6 Summary

Similar to the artistic disciplines of theater and in jazz, there is a tradition of improvising in the discipline of formulating. The process of creating a new formula at Blockasun, for example, was part of that tradition and consisted of enacting structures in the process of assessing continuously, creating resourcefully, and adapting extemporaneously. Bond, the head of the formulating team at Blockasun, introduced several new structures into the process to bring "more of the science into the art" of formulating. In this case, being more scientific did not refer to increasing the predictability of the process in order to plan and execute optimally, but rather, it referred to increasing the

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Regardless of the medium, what was most significant to the creative process was what the printout represented (i.e., the formula-in-progress).

[9] The distinction between practical aspects and symbolic aspects of artifacts becomes confused when using the example of samples of sun block formulas because part of their practicality involves their appearance: the sample not only has to block sun-rays but it has to look attractive. The results of tests of a sample of a formula-in-progress may indicate the sample has a high SPF but if the consistency of the sample is comparable to cottage cheese, it will not be considered attractive. Using a sample to test its attractiveness is an example of using the practical aspects of a sample. On the other hand, because the sample is used as a representation the formula-in-progress, the use of a sample in the test also involves the symbolic aspects of the sample. Thus, as a tangible representation, samples are emergent artifacts that are used both for the practical and symbolic aspects.

consistency of the assessment process for the purposes of more detailed comparing and learning from unpredictable results. Emergent artifacts were created to assess the formula-in-progress and, in this role, were essential to the process of improvising. The formulating team at Blockasun is an example of a team that managed to introduce new structures to formalize improvising without stifling the creativity of the process.

In Chapter 7, I will revisit the improvisational work practices of the formulating team at Blockasun, together with the improvisational work practices of the management team of SSCo, the nonprofit Internet-based startup I studied and discuss in the following chapter (Chapter 6). Using the findings from both field studies, I will examine several aspects of improvising, including, for example, degrees of improvising, routine versus non-routine improvising, and the variety of roles of emergent artifacts. Before doing so, I will present the findings from my field study of SSCo in the following chapter.

Chapter 6: Field Study 2 - DotOrg

6.1 Introduction and Overview

In Chapter 5, I examined the process by which a team of three chemists at Blockasun ("formulators") created and engaged various artifacts and worked together to develop new sunscreen recipes ("formulas") as an example of improvising. In several respects, improvising a new formula was similar to improvising in the arts: the formulators enacted a consistent set of structures each time they improvised, including consistent roles (e.g., Bond was the leader) and processes (e.g., making-up and testing samples in particular ways). Across improvisations, improvisers enacted a relatively stable set of structures. In contrast, in this chapter, I present my findings from a field study of a startup where participants were improvising in a highly ambiguous and dynamic environment and were constantly piecing together and re-negotiating structures to guide the collaborative process they were already engaged in.

The startup I studied was called DotOrg.[1] DotOrg was a nonprofit startup founded by two sisters, Margaret and Natasha, and the winner of a nonprofit business plan competition held by an incubator. DotOrg's mission was to work with nonprofit organizations that held special events, such as walkathons and bikeathons, and use the Internet to streamline those organizations' fundraising efforts and extend their community outreach. Part of DotOrg's service included bringing the solicitation of sponsors and collection of money online. DotOrg claimed that using their service, a nonprofit could collect more money, advocate its cause to a broader audience, interact more directly with participants, and in the process, develop a stronger community around its interests. I followed the founders of DotOrg from May 2000, when they were announced as winners of the competition, until December 2000, when I participated in the first special

[1] DotOrg and all other names used in this chapter are pseudonyms. In addition, although at this time DotOrg still exists as an active organization, I describe my findings regarding it in the past tense because I am reporting on things as they were.

event "powered by" DotOrg. During that time period I spent the first four months shadowing the founders almost every weekday, and the remaining three months visiting them two to three times a week.

The initial months of DotOrg were rife with numerous interrelated projects that had to be undertaken simultaneously and immediately. Participants were engaged in multiple urgent interconnected projects including, for example: building the basic structure of DotOrg and addressing fundamental questions of identity (e.g., who are we? what is our service/product? what is our strategy?); signing on customers; developing a funding pitch; assembling a board; and obtaining legal status. What follows is a detailed account of the work practices that constituted the two most significant projects: developing a funding pitch and developing a web prototype (which was used to acquire their first client). These projects were the most significant because they consumed most of the Founders' time, involved the largest number of participants and were critical for establishing the viability of DotOrg. Participants in these projects also engaged a wide variety of artifacts in the process.

From the perspective of improvising developed in Chapter 3, the examples of developing a funding pitch and developing a web prototype were examples of improvising. In both cases, participants (eventually) coordinated their activities and were able to collaborate in a structured manner. For example, in developing a funding pitch, those responsible for developing it used a "ghost-sliding" process to develop funding-pitch prototypes and solicit feedback. In developing a web prototype, participants first agreed on a "look and feel" for the prototype and this influenced the subsequent layout and design of the web pages that constituted the web prototype. Given the unfamiliar and dynamic aspects of the situation, participants constantly assessed the situation, adapted their work accordingly, and developed greater consensus among participants. Both projects were also essentially about piecing together products from whatever was available (including products that had been pieced together during earlier moments of the project). Piecing together involved recycling and discovering new uses of products. Resourcefulness was a persistent aspect in the work

practices of the Founders and several other participants. The pervasive lack of financial resources and pressure to accomplish projects quickly inspired participants to recycle as much as possible, rather than "re-invent the wheel." The improvising framework I developed in Chapter 3 helped me organize the key practices enacted in developing a funding pitch and a web prototype.

My findings - particularly from the funding pitch project - illustrate several challenges associated with a group of individuals improvising together for the first time without any shared guidelines or rules to structure their collaboration. Developing a funding pitch was the first significant project at DotOrg. To the frustration of all involved, the project proved to be a great deal more difficult than anticipated. Those involved with developing a funding pitch were only able to work successfully as a team during the last three weeks of the twelve-week project after spending the previous nine weeks struggling to develop consensus on DotOrg's strategic focus. Reaching consensus on DotOrg's strategic focus was critical because the strategic focus was a core structural element of the funding pitch (it was a key driver of the funding pitch story). The process of developing a common understanding was thus essential to the successful development of a funding pitch. It also contributed to the success of the development of a web prototype. Building on the experience of developing a funding pitch, represented, in part, in the funding pitch itself, the process of developing a web prototype was relatively successful. The web developers and Founders worked well together to develop a presentable web prototype and, later on, to modify it to meet the interests of a potential customer which eventually became DotOrg's first. Together, the findings I offer in the chapter provide an account of how participants at DotOrg first developed a minimum shared understanding which enabled them to improvise a funding pitch and then, later on, a web prototype.

In what follows, I will first introduce several of the key players and present some background on how DotOrg was initially conceived, before describing in detail two stories of innovations that occurred at DotOrg: the development of a funding pitch and the development of a web prototype. These stories illustrate

how participants innovated in situations that were confusing, unpredictable and dynamic.[2] These stories provide "thick descriptions" of the various practices that constituted the funding pitch and web prototype projects. After describing my findings, I examine these practices using the improvising framework I developed in Chapter 3. Finally, I examine the integral role of artifacts in both projects. Throughout both processes, participants engaged both stable and emergent artifacts for different purposes, and used both practical and symbolic aspects of the artifacts. By focusing on practices and the role of artifacts, my findings on improvising in a startup environment contribute to the growing body of field-based research on small-group collaboration.

6.2 Background

I first met Margaret and Natasha at "Liquid Launch Party," a party celebrating the grand-opening of the new office space of the incubator, Greenhouse. Liquid Launch Party was also where Greenhouse publicly announced that Margaret and Natasha's business plan for DotOrg had won Greenhouse's nonprofit business plan contest. The inaugural party was called "Liquid Launch Party" because, as the invitation explained:

> In this transforming world of technology and the Internet, successful ebusinesses need to be adaptable and flexible: FLUID. Greenhouse and its member companies are launching an environment ideal for the accelerated growth of new business ideas. Join us for a celebration as we liquefy the launch of our new workspace.

Upon arriving to the new facilities, guests were handed a brochure with a map of the space. The cover of the brochure further explained the theme of the party:

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[2] Stories are always simplified accounts of what is experienced directly or indirectly. The stories I present here seem all the more so, given the multiplicity of interrelated and seemingly critical activities and concerns that were occurring simultaneously at any given moment during my field study. Nevertheless, I have done my best to convey the "messiness" of what I witnessed, while attempting to maintain enough cohesiveness in the narrative so it is comprehensible.

> As we inaugurate our new workspace, LIQUID and its various forms symbolize the nature and vision of Greenhouse. Flowing, moving, nourishing, evolving, adapting, - as LIQUID is, so is Greenhouse.

Liquid Launch Party was in line with other publicized Internet startup parties of the time: it was filled mostly with people in their 20's and early 30's who were associated with the Internet boom (e.g., web designers, publicists, entrepreneurs, and investors); there was a generous offering of various trendy foods; and there were several open bars scattered about the premises, including one with a "martini luge" (consisting of a large block of ice, supported on a table, tilted at an angle, and engraved with a few grooves or "slides," such that a martini, poured from the top, would flow down the slide, into a waiting glass or, as I witnessed several times, a person's mouth pressed against the block of ice). In each of the offices, there was information about either a member company or a business unit of the incubator, as well as numerous gadgets that one could play with, including computer games and prototypes, fluorescent sticks, a large-scale game of Operation (in the bay of a startup involved with the medical industry), and contraptions with different colored liquids that seemed derived from lava lamps. There were also free massages available and an area for dancing. Each guest leaving the party was given a hand-blown glass paperweight, which at a handcrafts store would have cost at least $25. More than 400 people attended the event.

6.2.1 Initial Key Players

Several key players were involved in the development of DotOrg. Most important were the founders, Margaret and Natasha, who were sisters and were often affectionately referred to as "The Sisters," by many at the incubator. Throughout my field study, they were the central figures in all activities concerning the nonprofit startup. In addition to the two founders ("Founders"), there were several other individuals involved with DotOrg. First, a few employees of the incubator advised the founders, including a dedicated advisor ("Incubator Advisor") and a team from new product development ("Web

Developers"). Second, as part of the winning package, DotOrg had the advice of two students from a prestigious MBA school who spent the summer at DotOrg ("Fellows"). These MBAs were supported by a leading management consulting firm and two professional consultants from this firm were also quite involved with advising DotOrg ("Consultants"). Finally, two undergraduates had volunteered to work with DotOrg for the summer. Table 6.1 summarizes these and other key actors. Most of the key actors were women and were either in their late 20's or early 30's. In what follows, I describe in greater detail the Founders, the Incubator, and the Consultants.

Table 6.1: Some Key Players in DotOrg

Reference Name	Description
The Founders (a.k.a. Margaret and Natasha)	Two sisters who founded DotOrg.
The Incubator (a.k.a. Greenhouse)	Hosted the nonprofit business plan competition won by DotOrg. DotOrg spent its first eight months working in Greenhouse's offices interacting with the community there.
Incubator Advisor	The Incubator Advisor was the principle liason between DotOrg and Greenhouse. She was also a board member of DotOrg.
The MBAs (a.k.a. Rachel and Sophia)	Two MBAs from a prestigious business school, who had been awarded fellowships to spend the summer working with DotOrg, under the guidance of a consulting firm.
The Consultants (including Project Manager)	Two senior consultants from a leading management consulting firm who supported the Fellows during their summer projects for DotOrg.
Web Developers (a.k.a. Beth, Cynthia, and Debbie)	Beth and Cynthia were the principle people involved in creating the web prototype. Debbie was the key person responsible for developing DotOrg's web-based service for the first customer.
Good Cause Foundation (GCF) (a.k.a. Ed and Frank)	DotOrg's first customer. GCF managed the Good Cause Run. Ed and Frank ran a sporting goods store associated with GCF.

The Founders

Margaret came up with the idea for DotOrg while working as a manager at a cancer research institute. Each year, the research institute organized a 10K walk to raise public awareness of cancer treatments and funds for their research. While participating in the walk, Margaret met a gentleman who had spearheaded a team to walk the 10K event in memory of his wife, whom he had lost to cancer. Margaret found his enthusiasm and commitment to organizing the team and getting sponsors admirable. Yet Margaret was very concerned that much of the money that this gentleman was raising was being lost in overhead costs and not going directly towards cancer research. At around May 1999, Margaret started to keep a journal of the things that were bothering her regarding the fund-raising process at the research institute. Margaret wanted to use the Internet to help this gentleman and those like him organize teams and ensure that more of the money raised went to the causes they wished to help.

On New Year's Eve 1999, while at a Philippine restaurant in San Francisco, Margaret told her boyfriend, Dino, an entrepreneur with experience starting several small Internet-based and non-Internet-based businesses, "I have this idea about these walks." She proceeded to outline some of her ideas regarding the use of the Internet to improve the management and participation of special events. Margaret wanted to further develop these ideas and present them to an existing organization that was involved with online donations. Dino thought her ideas were "fantastic" and encouraged her to start her own organization, rather than offer them to an existing company. Together, they brainstormed about several different ideas related to DotOrg and started to write them down on the back of one of two paper placemats (which also served as menus) that were at their table. Some of what was written down included a rough diagram that used boxes and arrows with labels to show how DotOrg would relate sponsors, volunteers, and the nonprofits organizing the special events; as well as a list of the beneficial aspects of DotOrg's service, such as "cost saving value for nonprofit," "walker

feedback to nonprofit," and "e-mail notification from walker to sponsor (value to walker (time effort $) + for nonprofit (bring in more $)."[3]

An entrepreneur with a particular interest in "guerilla marketing," Dino asked almost immediately "What are we going to call your business?" That night they came up with the name DotOrg and on January 3, 2000, they registered it as a domain name (specifically, they registered www.DotOrg.org, www.DotOrg.com, and www.DotOrg.net).

When Margaret and Dino returned to the East Coast from their trip to San Francisco, Margaret continued to develop her ideas into business proposals. Dino supported her efforts, explaining the concept of a "value proposition," getting her a special issue of the Internet startup magazine *The Industry Standard* on charity portals, and, sometime around mid-January, e-mailing her information on a nonprofit business plan contest that was being held by a local emerging incubator called Greenhouse. Margaret examined the information on the contest and decided this was a valuable opportunity to launch her idea. The deadline for the business plan competition was February 29, 2002.

At around the same time, Natasha, Margaret's younger sister, was taking a web master class to develop her computer graphics skills. Natasha had left her job at a bank six months earlier to pursue a career in web development. In late January, Natasha agreed to help her sister develop a business plan for the competition. Margaret and Natasha were 20 something second generation Filipinos who grew up in rural Pennsylvania, and whose parents expected them to take on careers in medicine, just like their father. The fact that they might both be leaving secure jobs to pursue more entrepreneurial careers was quite stressful for their parents and heavily discouraged. Even so, both Margaret and Natasha felt quite strongly about having greater responsibility in their careers and decided to take a chance.

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[3] In the following months, Margaret would periodically refer back to this placemat to remind herself of the original ideas that had generated so much initial enthusiasm. When I first interviewed Margaret in May, she pulled out the paper placemat to show me the original ideas she had jotted down. Later on, during some tumultuous times in the summer, Margaret again pulled out the placemat a number of times to recalibrate their activities.

Although determined, both Margaret and Natasha thought their chances of winning the nonprofit business plan contest were slim. They assumed they would be competing with well-established, credible nonprofits with more experience writing grants and proposals (established nonprofits could participate in the contest). On February 4, 2000, Margaret quit her job at the cancer research institute to dedicate herself to developing DotOrg. As she explained:

> I knew I needed to make the change. And I needed to do something positive. Because I couldn't - I tried my best to do as much as I could internally and I realized, you know, I may better serve, in terms of my calling, in nonprofit. I may better serve externally.

Margaret's back-up plan was to develop her ideas at a business school, so during January, in addition to developing the business plan, she applied to several business schools specializing in nonprofit management.

Neither Margaret nor Natasha had ever developed a business plan before. To guide them through the process, they relied on advice from Dino (Dino had a quite a bit of experience with startups: his father had launched several successful businesses, he had attended Babson College, and had launched several of his own companies), samples of business plans, and magazine and newspaper clippings which Dino had collected over the years. They also relied on questions they had to answer for the application, although these questions (posted on the incubator's web site) kept changing as they prepared the application. For example, one question asked them to develop a walk-through of the service, but then it was removed from the set of questions. Natasha also drew on her work experience in banking, where she had conducted financial modeling of companies and read through numerous business models. She had collected two boxes full of information from the bank, including pitch books, business plans, and material on how to conduct financial analysis of companies. Drawing on all this information, Margaret and Natasha put together a business plan for DotOrg and submitted it on February 29.

After submitting the business plan, Margaret and Natasha continued to brainstorm ideas about DotOrg. In mid-March, they decided to take a break and

spend four days in Montreal. When they returned, there was an e-mail from Greenhouse: to the delighted surprise of Margaret and Natasha, they had made it to the semi-finals. One hundred and forty business plans had been submitted and their plan was one of a handful to be selected. As semi-finalists, they had to go into the incubator for an interview the following week. Initially, they were going to have to prepare written answers to a list of new questions, which would be sent out 24 hours before the interview. That requirement changed, however, from detailed answers to brief answers, plus a presentation. Then, a few days later, the presentation changed from an hour and a half presentation to simply a short presentation with open discussion format. In the end, Margaret and Natasha gave a 45 minute presentation and after much discussion, were given three questions to answer within the next 24 hours. They did so and within a couple of days, they learned that they had become finalists.

Margaret and Natasha had two weeks before they had to present their business plan once again - this time, in front of a nine-member panel of judges. During this time they reached out to all their contacts to interview as many potential users as possible (including fundraisers and participants of special events) to learn about what kind of service would best suit their needs. In this process, they started sharing their business plan with several other people to get feedback on how to improve it. The feedback was extremely encouraging and positive and it energized Margaret and Natasha for their presentation. Finally, in May 2000, they made their presentation to the incubator panel.

Two weeks later, Margaret and Natasha learned that they had won the competition and had become the Greenhouse's fifth member company.[4]

The Incubator

Greenhouse was founded during the summer of 1999, during the height of the dot-com bull market, and was the first incubator in its geographical region of the United States. An *incubator* is a business that tries to help entrepreneurs

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[4] A few months after winning the business plan contest, Margaret was accepted at Yale, considered one of the leading business schools in the U.S. for nonprofits. She deferred for a year.

accelerate their "speed to market" - the time it takes for entrepreneurs to go through the initial stages of development of their business, as they transform their business plan into a company publicly traded on the stock market. An incubator typically houses several startups within its space (referred to as "member companies" at Greenhouse), and helps them with a number of different aspects of starting a company, including, for example, acquiring funding, developing strategies, attaining customers, hiring employees, and obtaining space to work in. In exchange, the incubator receives a percentage of the member company's stock. On BusinessWeek.com, the CEO of Greenhouse explained the difference between Greenhouse and a venture capital firm:

> It's a different model from venture capital. We enter the business at an earlier stage, which allows it to grow more quickly. A venture capitalist is about writing checks. We do active incubation. We buy 50% of each company, whereas a traditional venture capitalist might buy 33%. But we become the co-founders of the company. It's like starting a business with a friend. If you started a business with a friend, you'd probably split it 50-50. We're like that friend - but a rich friend.

The general incubator model - to take substantial equity in a startup in return for providing capital, services and advice to the startup so that it would not have to spend time finding them on its own - seemed extremely attractive to investors in 1999. By April 2000, just before the stock market declined, there were over 300 incubators in the United States.[5] According to researchers at Harvard Business School, the average incubator had about 36 employees, and 9 member companies. Incubators took an average of 35 percent of a member company's stock. Of the few who had member companies that went on to becoming free

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[5] Examining incubators more specifically, Chinsomboom (2000) notes that there were four general types of incubator models during the time period I was at Greenhouse, depending on the range of services provided to a member startup: some incubators provided everything a startup would need, such as infrastructure, contacts, human resources, and access to capital ("Venture Incubator"); some would focus their efforts on helping startups develop business strategy and acquire funding to launch the startup as fast as possible ("Venture Accelerators"); some would focus on using the web to create a network of entrepreneurs, advisors, and investors ("Venture Portals"); and some would focus on financial investment in startups and building synergies between their portfolio companies ("Venture Networks"). Greenhouse was an incubator that subscribed to a "Venture Incubator" model and provided a relatively broad range of services to its member startups.

standing companies, the average "incubation time" was 9 months. In addition, over half of the incubators (58 percent) were startups themselves, facing cash-flow, growth, and strategy issues similar to those of their member companies. Almost all new incubators (92 percent) focused on Internet specific markets, with 46 percent of those specializing in a single sector (e.g., Content, Telecom, Internet backbone/software, B-to-B, B-to-C) (Mowrey, 2000).

The incubator model was not without its critics or skeptics. Seth Goldstein, for example, a principal at the New York venture capital firm Flatiron Partners, was critical of startups joining incubators and taking an "easier route" to becoming publicly traded companies. From his point of view, the challenges of the market were important filters of weak startups; incubators enabled startups that otherwise would have failed to succeed. As he explained to the New York Times (Kilgannon 2000), the idea of accelerating a startup was akin to:

> bringing a high school athlete into the big leagues too soon [...] You rush ideas to launch to take advantage of the bullish stock market, and the incubator just jumps to the next project. In the long run, the entrepreneurs suffer from being protected so long [...] Incubators are the safe route. I call it entrepreneurship lite. Real entrepreneurs take risks. In giving you less chance to fail, incubators also give you less chance to succeed. You tell an entrepreneur, 'We'll take care of everything, including the coffee cups,' and he misses out on the very culture of his own company.

As I discuss later on, the economic landscape changed for the worse during my field study, and as it did, more and more people at the Incubator started to share Goldstein's skepticism, particularly with regards to how the incubator spent its money. But when I started my field study, Greenhouse was described by most at the incubator as an "extremely exciting place to be."

While in an early interview published in a popular business journal the CEO of Greenhouse claimed to be able to launch a company in 120 days, by the time DotOrg arrived to Greenhouse in May 2000, the incubation time of 120 days was no longer promoted. Greenhouse was itself a startup and as such, its business model was continuously changing. The two founders of Greenhouse were MBA classmates who had never founded a company before, although they had extensive experience as consultants to entrepreneurs. Greenhouse was focused

on Internet-based startups, although not on any particular market. DotOrg was the fifth member company at Greenhouse. The other member companies included a B-2-B company that enabled online product registration, a company that was building a communications infrastructure to enable individuals and businesses to stay in touch as they moved to different locations or jobs, a medical web site that facilitated the management of information during clinical trails, and a B-2-B business that provided customized information to people traveling. Greenhouse had a 50 percent stake in each company.

As part of being a member company of Greenhouse, startups had to pay for basic facility and support services (e.g., rental of space, furniture, office equipment and supplies, concierge services, office management and bookkeeping), network operations (e.g., support for telephones, LAN, email, development servers, computers), finance and accounting (e.g., set up accounting books, insurance, cash management coaching, forecasts and budgeting, auditing), and "people strategy" (e.g., team building, vision and values, "wellness programs," "conscious culture development"). In addition to these required services, Greenhouse offered services in Internet product development (e.g., product conceptualization, prototyping and requirements definition, project management and planning, user interface design, web development, quality assurance and testing, vendor management), marketing (e.g., identity design, temporary web site, market research, positioning/messaging, events planning, public relations), and recruiting. Each of these services was considered a "business area" at Greenhouse.

In its earlier press releases, Greenhouse described itself as an incubator skilled at moving startups from idea to market, in part, thanks to its office environment - an environment considered so special that it was given its own name and trademarked.[6] For example, a press release from April, 2000, explains:

> Greenhouse has pioneered *Acceleration*, a revolutionary new business model that creates successful e-businesses in record time, by bringing

[6] The practice of claiming every new practice and product with a new name and either a copyright or a trademark symbol was prevalent at Greenhouse and other Internet startups.

> together an unprecedented level of expert collaboration, applied industry experience and capital. Through its unique *Enterprise Campus*™ environment, Greenhouse helps emerging e-businesses develop and execute winning strategies to rapidly navigate the course from idea inception to market success.

Greenhouse was located on one of the top floors of an 18-floor hi-rise concrete building, constructed in the 1960's. As soon as I stepped off the elevator and onto Greenhouse's floor, though, it was clear that I was in a very modern place: the hallway space was re-shaped with polished sheet metal and blue neon lights and two touch-screen monitors greeted anyone exiting the elevator with Greenhouse's web site. To reach the receptionist sitting behind a collection of sharp-angled polished metal sheets, one walked through two glass doors that, at night, could only be opened with a security card. Beyond the elevator hallway and receptionist's space, the rest of the office space consisted of relatively minimal industrial decor. Modularity and flexibility were the dominating themes of the space. All office equipment was set on wheels; the chairs, desks, whiteboards, and file cabinets could all be rolled from one space to another.

The overall shape of the 18,000 square foot office space was a rectangle, with each side having full-length windows looking out over the surrounding neighborhood. Support staff members were placed in desks along the windows offering the best views ("prime space") to underscore their importance at Greenhouse. Corner spaces were reserved for conference rooms, available to all for meetings. Member companies and business units were housed in the "bays" - spaces where five to six desks could be placed to form a mini-office. There were a total of 14 bays; 10 were located on one of the long sides of the rectangle, and 4 on the opposite side. Translucent walls divided each bay from the outside hallway. These walls were also designed such that one could write on them (although very few actually did). Each bay was separated from its neighboring bays by sliding plastic walls, so that if two bays needed to be combined into a larger space, one could simply slide the partitioning wall back. There was one member company, for example, that was spread across three bays, and another across two. DotOrg was given one bay.

The computer servers that supported all the Internet technology, the elevators, the bathrooms, the kitchen, and the common meeting space were all located in the center of the rectangular office space. The kitchen and common room were the areas where most people at Greenhouse congregated. Together, they were generally referred to as 'The Cafetorium." There was a heavy cloth curtain that could be pulled across to separate the common meeting space from the kitchen and enable people to hold large meetings without significant interference from the kitchen. In the common meeting space was a small stage, slightly raised off the ground, where speakers would give presentations. There were also two couches, several chairs, and ping-pong and foosball tables. Greenhouse-wide meetings, attended by over 60 people, were held in this space.

The kitchen had two large, metal-clad, industrial refrigerators, stocked with a variety of free food and drinks, including sodas, fruit juices, beer, yogurt, string cheese, and fruit. The kitchen cabinets were stocked with chips, Smartfood popcorn, apple sauce, Pepperidge Farms Goldfish, and pretzels. Coffee and tea were also available, and anyone who brought their lunch or dinner could re-heat it in a microwave. The kitchen was the most common place to run into someone from a different bay and start an informal conversation. It was also where weekly Friday evening pizza and beer get-togethers ("Friday soirees") were held.

Overall, people dressed in business casual attire, although a few employees, particularly the interns and several from technical support dressed even more casually (e.g., t-shirt and shorts). Rarely did anyone wear a tie or sports jacket. The business casual attire was the norm for the Internet startup environment in general and was so strong a norm that several traditional financial and consulting firms adapted their dress codes from formal to business casual when dealing with the Internet industry.

When I entered the Incubator, the atmosphere was filled with enthusiasm, confidence, and optimism that everyone was part of a promising future. A month after DotOrg had entered Greenhouse, there were a total of six member companies and a hundred people working in Greenhouse (including employees

of the member companies). During my field study, however, the atmosphere became increasingly filled with insecurity, skepticism, and doubt. By mid-summer, it became painfully clear that the funding situation at Greenhouse had become extremely difficult. During a Greenhouse "Town Meeting," the CEO of Greenhouse reported that in developing their latest round of funding, they talked to a dozen serious investors and got "no real bites." As he explained:

> The bull market changed last month. Then, it was too early to tell what impact it would have. Today it is clearer that people with money are treating the market as a bear market. Many companies have suffered.

Consequently, the incubator would have to start cutting back on its spending.[7]

The Fellows and Consultants

As part of its winning package, DotOrg received help from a program set up by a prestigious business school and a leading management consulting firm to help local nonprofits during the summer. Each summer, five MBA students were awarded fellowships to participate in the program. Two MBA students ("Fellows") were assigned to work with DotOrg for 12 weeks to "provide strategic consulting." The Fellows were supported by two dedicated engagement managers - senior consultants who advised both the students and DotOrg. Each engagement manager allocated a day a week of their consulting time to help the Fellows. Engagement managers spent most of their time at the consulting firm,[8] although they would periodically arrive at Greenhouse for large meetings (discussed in greater detail below). As one consultant explained, the value of the Fellows and Consultants was to provide an "outside-in perspective."

Before working with DotOrg, the Fellows went through several days of training at the consulting firm. During the training, the Fellows were

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[7] Greenhouse was not alone in struggling with a difficult funding environment. By the end of the summer of 2000, most incubators were suffering as much as all other Internet-based startups. The stock value of three publicly traded and well-regarded incubators (CMGI, ICG, and Safeguard), for example, had dropped by 80 percent in a period of 6 months.

introduced to a process model representing the six stages of an "analytic-intensive study" (see Figure 6.1). Each stage was described by key objectives, activities, "end products," and the expected role of the Fellows during each stage.

Figure 6.1 - "Common Phases" in a Consulting Project

This figure is compiled from two charts used during the training of the Fellows and included in their training packet. Because of confidentiality, I am unable show the actual charts, but the language and structure I have used in this figure are representative. The principle purpose of this figure is to show the role of Consultants and Fellows in planning change.

Problem-solving phase (an iterative process between Phases 2, 3, and 4)						
	Phase 1: Initiating	**Phase 2: Defining**	**Phase 3: Gathering and Analyzing Data**	**Phase 4: Developing Recommendations**	**Phase 5: Developing Action Plan**	**Phase 6: Implementing**
Objectives	Identify client needs; agree on study parameters	Refine problems and key issues	Collect and analyze information; test hypotheses	Develop alternative actions; make recommendations	Communicate findings; gain acceptance	Launch change
Key Activities	Discussions with key executives Staffing	Preliminary client interviews Hypothesis generation Issue identification Work planning task assignment and scheduling	In-depth client interviews In-depth customer interviews Client workshops Quantitative analysis	Team brainstorming sessions Working sessions with clients	Report writing Presentations Client discussions	Work planning Task assignment Monitoring of process Modification of recommendations
Role of Fellows	Little or none	Identification of issues, hypotheses, analyses, and data sources	Interviewing Data gathering Data analysis	Active participation in team problem solving	Assistance in report writing, management of report production	Staying in touch
End Product	Letter of Proposal	Issue analysis and project planning	Progress reviews	Final Presentation	Action plan	

For example, the process as a whole consisted of identifying client needs and agreeing on study parameters; refining problems and key issues; collecting and analyzing information and testing hypotheses; developing alternative actions and making recommendations; communicating findings and gaining acceptance; and finally, launching change. One of the Fellows was for the first time working with a consulting firm, while the other Fellow had worked at a different

[8] As one engagement manager explained to the Founders, "[the consulting firm] is in the background, asking the right questions."

prominent consulting firm before. Although the firm she had worked for previously had a noticeably different organizational culture than the current firm, both consulting firms conceived of consulting projects as involving clear, distinct stages whose end-goal was to produce an "action plan" for change. The role of consultants, consequently, was to help the client develop a plan for change and execute it accordingly.

The combinations of Fellows, Consultants, and Incubator members ensured that the Founders of DotOrg had a wealth of talent available to help them through the first three months of developing their winning business plan into a viable organization.

6.2.2 Initial Challenges

The initial stages of any organization are rife with numerous inter-related projects that must be undertaken simultaneously and as soon as possible. With DotOrg, these projects included building the basic structure of DotOrg (and addressing such interrelated questions as Who are we?, What is our service/product?, and What is our strategy?), signing on customers, acquiring funding, assembling a board, and obtaining legal status. As the Founders struggled to manage all the projects, they received a lot of advice, both solicited and unsolicited.

At any given moment, during the time I was with DotOrg, there were dozens of projects that demanded attention. Several of these projects lacked clarity and all were interrelated, so that to pursue one - even just to make sense of it - inevitably meant pursuing several others as well. There were several projects that were constantly worrying the Founders but which received little attention including, for example, the legal status of DotOrg as a nonprofit organization, developing the board of DotOrg, and figuring out the costs incurred by DotOrg by being at Greenhouse. Consequently, although the following examples of projects are presented in a coherent fashion for analytic purposes, it is important to keep in mind that all of these projects and all decisions associated with these projects were made within a stressful, confusing and overwhelming context.

To help them make sense of what was going on and what needed to be done, Margaret and Natasha would often write (either on static sheets or the white board) lists outlines of the situations they were trying to better understand.[9] For example, on the day they moved into their bay at the incubator, they wrote out the following four lists on a large white board and three static sheets: "Issues" (e.g., legal, defining relationship with Greenhouse, and staffing); a continuation of "Issues" (General Road Mapping, Board Development, Mission, Preparation for [Fellows], etc.), a list of activities to do throughout the week, and "Cast of Characters" (listing the name of everyone they have met, along with a title or brief description).

The work week typically included an average of eight meetings, either with the Fellows, the Incubator Advisor, other Greenhouse employees, or all of the above. Often, particularly during the first two months, the Founders left meetings more overwhelmed and confused than when they started them because during the meetings, new questions, concerns, alternatives, and options would be presented and few answers or resolutions generated. After a venture board meeting, one of the Founders exclaimed, exasperated: "Every time we talk, [DotOrg's strategy] changes so much!"

As I describe in greater detail later on, team members from Greenhouse and the Consulting firm liked to organize and present their ideas in the form of hypotheses that need to be tested. DotOrg's Incubator Advisor recommended that the Founders structure their communication with other team members accordingly. For example, during one meeting, she advised:

> The fear is that advice is cheap. It's free. But at some point you need to ask: What is my hypothesis of what our value proposition is? What is our competition? and How do we go about testing them?

The Founders found it very difficult to subscribe to this form of structuring and, as I explain later on, only began doing so about nine weeks into the project.

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[9] Static sheets were large thin plastic sheets, about 2 feet by 4 feet, that could be written on with marker and then placed on the plastic walls without tape, since they adhered to them with static

Given the working environment at Greenhouse, it was a challenge to remain focused on a single task without getting interrupted by someone dropping by, calling, e-mailing, or instant messaging with either a question or greeting. To deal with this, people would sometimes work off-site. The Fellows, for example, worked both "on-site" at DotOrg and "off-site" at the Consulting firm. Rarely would more than two consecutive days go by without one of the Fellows spending time at DotOrg. The Fellows were in contact with the Founders practically every day, either by e-mail, phone, or instant messaging. Working at the Consulting firm enabled the Fellows to focus on their tasks and not get interrupted by someone dropping by to say 'hello' and inquire how everything was going, or get caught up in any of the other issues that were relevant to DotOrg. The need to take a break from the business of the incubator was shared by many at Greenhouse. Located in the first floor of the office building was a cafe where, at any time of day, one typically found one or two groups from the incubator holding a private meeting around one of the small tables. Sometimes the cafe became so full of people from the incubator that it no longer served as an escape location. After working a few weeks at the downstairs cafe, one of the Founders ended up going to a cafe that was located about a block away because fewer people from the incubator went there and this gave her more privacy and enabled her to focus on her work.

The Founders preferred to always have someone present in the incubator office, in case someone who could help them dropped by. Thus, there were several times when one of the Founders would go to a cafe to work, while the other stayed in the office. To maintain communication, the Founders used walkie-talkies. The walkie-talkies they used were relatively inexpensive (compared to using cell phones) and had a range of five miles. Before one of the Founders left the office to work at a cafe, she would "synch up" her walkie-talkie with her sister's to make sure they were using the same frequency, and to make sure that frequency was not being used by someone else (for example, they discovered that one of the frequencies available to them was the same frequency that the window cleaners used to communicate on their walkie-talkies). Many of

the staff at Greenhouse loved the Founders' idea of using walkie-talkies to communicate with each other. In fact, the New Product Development (NPD) team ended up purchasing two sets so that they could communicate and find each other around the office. Before NPD purchased the walkie-talkies, for example, it was not uncommon that someone from NPD would end up spending about ten minutes walking all around the office space, looking for a colleague, when the colleague was doing the same or had stepped out for a break downstairs. With the walkie-talkies, anyone who left the NPD bay could take a walkie-talkie and be easily paged. In addition, the person with the walkie-talkie could avoid having to return to the NPD or use a member company's phone to ask a question by simply using the walkie-talkie.

Another important form of communication was Instant Messaging (IM). When the Fellows went "off-site" to work at the Consulting firm, for example, they would stay in touch with the Founders, using IM. Natasha also used IM to talk with people who were only a few bays away. This enabled her to send technical questions to members of the new product development team and to record those interactions.[10] Natasha would use the logs later on and refer to them to make sense of technical aspects of DotOrg.

Of the various projects that the Founders were engaged in, the two most significant and encompassing (in terms of number of people involved) were developing a funding pitch and developing a web prototype. What follows is a detailed account of each.

6.3 Developing a Funding Pitch

Although the first several weeks at DotOrg were filled with confusion and lack of consensus regarding what exactly DotOrg should try to achieve and what was the best way to achieve it, there was early consensus around one endeavor: using the expertise of the Fellows and Consultants to develop a funding pitch.

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[10] Recording IM "conversations" was not a common practice at Greenhouse but one that Natasha practiced frequently when using IM to converse with the new product development team.

As I describe in greater detail below, the process by which the funding pitch was developed consisted of two general stages. During the first stage, the three parties involved struggled to make sense of the specifics regarding DotOrg's mission (e.g., Who exactly was DotOrg's target customer? What services would DotOrg offer? How would DotOrg generate revenues?). While researching potential customers and competitors, the Fellows began to have reservations about the viability of DotOrg's original mission and, consequently, developed alternative strategies. In the process, it became clear that there was a lack of consensus regarding how exactly DotOrg should help nonprofits. By the eighth week of the 12-week project, a funding pitch had yet to be developed and most participants had become so frustrated with the way the project had evolved that tensions boiled over. After a few heated days, Margaret and Natasha insisted on pursuing their original mission statement, precisely because of the research findings that had cast doubt on it. By the end of Week 9, a common understanding regarding how DotOrg intended to help nonprofits was finally achieved. This understanding proved to be an essential structuring device for developing the funding pitch. During the remaining three weeks that made up the second stage, the Fellows were able to piece together a funding pitch from the market and competitive research they had developed earlier. And, guided both by a clearer understanding of and stronger belief in what the Founders wanted and by the consulting firm's expertise and guidelines on developing presentations, the Fellows developed eight slides representing the core arguments of DotOrg's funding pitch.

My findings on the process of developing a funding pitch describe the work practices that constitute the collaborative process of a group of individuals who have never worked together. The following two-part account of how the funding pitch was developed is an example of how a group of people from different communities-of-practice needed to develop a new common understanding before they were able to collaborate creatively.

6.3.1 Part I: Creating a Shared Understanding

Beginning the Sensemaking Process

On the first day the Fellows and Consultants officially started to work with DotOrg, a large meeting involving the Founders, Fellows, Consultants, and Incubator Advisor was held to develop a strategy for how to make the best of the Fellows during the summer. I will discuss this meeting in greater detail than others because it was representative of most subsequent meetings.

Although all participants had read DotOrg's winning business plan, Margaret and Natasha started the meeting by articulating DotOrg's mission and then giving their winning presentation again. Afterwards, the participants discussed as best they could the competitive landscape, potential firms that DotOrg could partner with, the relationship between Greenhouse and DotOrg, and DotOrg's external board. These discussions seemed to generate more questions than answers given many of these issues were unclear and evolving (for example, the Founders at that point still did not know how much cash they would actually receive - and consequently be able to rely on - from having won the contest).

At the meeting, Margaret and Natasha handed out a list of tasks that needed to be accomplished over the next few months. This list reflected the variety of issues that were already overwhelming the Founders. The items were organized into three columns, each representing part of a broader task: "Beta Test Partner," "Product Development," and "Business Development." "Beta Test Partner" referred to the general task of finding a nonprofit organization that would be willing to work with DotOrg as their first customer. "Product Development" referred to the general task of developing the actual service - this service was what DotOrg would be offering to nonprofit organizations that organized special events. Finally, "Business Development" referred to the need to develop DotOrg as a self-sustaining business. The Consultants recommended the Founders add a few other items to the list, including developing a list of potential beta organizations.

The Founders recognized that these tasks would need to be accomplished in stages and asked those at the meeting to help them organize the items into "short-term goals" and "long-term goals." Even with a clearer prioritization of the list of items, there were still a large number of high-priority tasks that needed to be accomplished immediately. The Founders had to choose which items to focus on first and there were no clear selection criteria, given the urgency of all the projects and their inter-relatedness. Part of the confusion emerged from the different audiences that they were struggling to address simultaneously. For example, they discussed whether they should be tackling those items which were most attractive to investors (What did investors consider attractive? Which investors?) or those items that were most attractive to NPOs (What did NPOs consider 'attractive'? Which NPOs?) and in the process, realized they needed to first address more fundamental questions regarding the identity of DotOrg (e.g., What is DotOrg's core technology? Who will make up DotOrg? What is DotOrg's strategy?). During the rest of the meeting, the participants iterated between making sense of DotOrg's mission and the environment it intended to work in (e.g., competitive landscape, potential customers) and structuring the work schedule of the Fellows (directly) and the Founders (indirectly).

The meeting was marked by three general types of interrelated sensemaking activities: translating, clarifying, and prescribing. Translating involved one participant reiterating out loud what another participants said and translating that into a language that was more familiar. For example, in an attempt to better understand DotOrg's value proposition, one of the Consultants went up to the white board and drew a bar graph to illustrate how various components of the DotOrg service contributed to the cause. The Incubator Advisor noted that at a previous meeting between Greenhouse and DotOrg, the CEO of Greenhouse, an ex-consultant, had drawn the same graph for himself. She joked that it must be a way that consultants think and everyone laughed. This representation of DotOrg's value proposition resonated with all participants, was subsequently referred to as "the waterfall chart," and a few weeks after it was first introduced, a

static sheet of it was created and placed prominently inside the DotOrg office, next to the door.

Clarifying was a similar sensemaking activity that involved one participant asking other participants to clarify concepts or issues. During the meeting, for example, one of the Fellows asked the Greenhouse advisor "What is the meaning of success from the standpoint of Greenhouse? Is it the number of customers? Is it to be self-sustaining?" The Greenhouse advisor responded that the goal was to have DotOrg "in business a year from now." From this conversation it became clear that DotOrg needed to get some money to support it. The Consultants asked how much money was available. They were told that DotOrg had won about $250K in cash and services. More specifically, DotOrg had about $115K-$145K in cash and the rest in services, although these were not guaranteed. One consultant concluded: "This really describes social enterprise well [...] the ability to garnish resources." Another example of clarifying occurred when one of the consultants asked the Founders "Why are you a '.org' and not a '.com'?"[11] Their reply was that as a '.org,' they would use all their revenue to make their service more affordable to nonprofits - both large and small. One consultant realized out loud "it's not a go-public kind of scheme." To which the other commented: "The trick will be to maintain the '.com' atmosphere in a '.org'."

As participants tried to make sense of a variety of aspects of DotOrg, they typically prescribed roles and activities to structure the process. For example, one of the consultants explained how consultants generally work:

> We ask a lot of questions. Some clients aren't used to that [...] We are hypothesis driven. We'll throw one out, even if it will change. It helps us organize us as efficiently as possible. If the story changes, we change the story.

[11] This question turned out to be the most frequently asked question to the Founders, whenever they discussed DotOrg with anyone working in for-profit businesses.

This statement seemed to define the role of the consultant during the project. These prescriptions seemed to serve as reference points from which those giving them made sense of an issue at hand.

The consultants determined that many of the items on the list were not items that they should be tackling, given their strategic consulting expertise and the fact that they only had three months "to deliver." Thus, they decided to develop two items: "a solid pitch" (a funding pitch that would help DotOrg acquire financial support) and "a prospect list" (a list of people potentially willing to support DotOrg financially).

By the conclusion of the meeting, the Consultants decided to focus on the long term goal "to have money or be on the path to money," although one of them admitted:

> It's a constant chicken-egg problem. What does come first? Funding seems first. What do the funders need? What do I need to do to attract investors most quickly?

They decided to focus on funding and, consequently, develop a pitch focused initially on funders but which, eventually, "will be the basis of all your conversations, as you develop different pitches for different segments." One Consultant suggested making the pitch "an efficiency pitch" - specifically, argue that by funding the nonprofit DotOrg, a funder will actually be helping out many nonprofits. They decided to first develop a "quick scan of investment universe" and then create a "ghost funding document."

The way the Fellows would help DotOrg attain this goal was to accomplish two projects: 1) develop a list of potential investors, including several whom the Fellows could interview (to make sense of what investors are looking for, what does a solicitor need to show them, whether or not having a beta customer signed on is necessary, etc.); and 2) develop a "very professional story" about the value of DotOrg that could be used to solicit money from investors. The Consultants emphasized several times during the meeting that developing each of these items is an iterative process between drafting a result and testing it.

The Consultants originally wanted to plan a more detailed working schedule for the Fellows but realized during the meeting that, given the iterative nature of the process they subscribed to and given the dynamic and unpredictable nature of DotOrg's strategy, it didn't make sense to make a detailed plan for more than the following two weeks.[12] Thus, in the short term, for the next two weeks, the Fellows would work on two general projects: 1) investor approach and contacts; and 2) detail the investor "pitch" strategy. Regarding the investor pitch strategy, one of the Consultants noted that "we shouldn't re-create the wheel" and instead, they should be sure to draw on "business plan templates" developed at the consulting firm. One of the Fellows also volunteered to bring in several business plans and articles discussed during a social enterprise course she took during her first year as an MBA, explaining: "none of this is going to [be] built from scratch," but, rather, "combined" from various "cookbooks."

In addition to developing a list of tasks to be completed by the Fellows over the following two weeks, one of the Consultants developed a list of what the investor pitch should include. There were seven main items, each representing a slide on a future PowerPoint presentation:

1. Needs/opportunity summary statement
2. Value proposition to each stakeholder
3. Market sizing and detailing of target customers & strategy for approaching customer
4. Competitive landscape and DotOrg differentiation
5. DotOrg's distinctive ability to deliver on defined value proposition
    a. [Greenhouse] tie
    b. Technical delivery
    c. Key business partners
    d. Mngmt team/staff
6. Financial Projections
    a. Liquidity events scenario - proving sustainability of model
    b. Requests for funds - details on way for investors to participate
7. Key risks/potential stumbling blocks and plans to address them

[12] The Consultants and Fellows had been forewarned by the Incubator Advisor that such changes may be necessary due to the dynamic nature of startups.

Although it was clear from the conclusion of the meeting what the Fellows would focus on (i.e., developing a list of investors and developing a pitch to investors), it was still not clear what kinds of investors to interview or what content to include in the pitch because it was still not clear what exactly DotOrg should be. The sense was that without a specific understanding of DotOrg's identity, it was very difficult to develop a list of investors. On the following day, the Fellows met with the Founders to clarify DotOrg's specific strategy for accomplishing its mission and to develop a plan for accomplishing their projects. During the meeting, one of the Fellows noted:

> There are two ways of approaching this: Figure out who we are and then identify key funders or figure out the funders and then tailor the business model. We don't want the seed funding to dictate the business model so the later seems kind of backwards.

Earlier that same day, the Founders had had a meeting with several of the top advisors at the Incubator. That earlier meeting was scheduled to last at least an hour but it was cut short after 30 minutes when the Founders were unable to satisfactorily answer the question "What is the angle of differentiation that is preventing others from adding [your existing service and competing with you]?" Basically, what is DotOrg's competitive point of differentiation.

The meeting with the Consultants lasted over three hours, during which the participants discussed, explored and tried to develop a common understanding of DotOrg's short-term and long-term goals, potential strategies for achieving those goals, and which tasks were most critical. This kick-off meeting proved to be representative of numerous meetings that followed during the first nine weeks of the project, both in content (all of the themes discussed in this meeting continued to emerge in the subsequent meetings) and process (loosely structured, more questions generated than answers, and several participants generally feeling overwhelmed or confused by the end).

In the following twelve weeks, there would be eight more large face-to-face meetings of the Consultants, Fellows, Founders, and Greenhouse Advisors.

These meetings were used as significant milestones for developing a common understanding among participants about the short-term and long-term goals of DotOrg, and how it was going to accomplish them. In addition to these large meetings, there were over six additional meetings between the Fellows and the Founders. The meetings were used to clarify issues and questions related to DotOrg's general strategy.

Making Sense of the Competitive Landscape, Potential Markets, and Technology

The initial meeting among all the team members was indicative of the first couple of months at DotOrg. For example, during this period, it was difficult to focus on and make sense of any single task before getting side-tracked by a related and seemingly equally important task. People soon felt overwhelmed by the number of vague tasks they wanted to accomplish.

Table 6.2 (following page) is a timetable that highlights some of the key activities that took place during each week of the project. A few days after the initial meeting the Fellows developed an interview guide to interview the Founders. To develop the guide, they had drawn on business literature (e.g., case studies and articles) and business models from the consulting company and their MBA classes. They wanted to better understand DotOrg and identify what research needed to be accomplished. After their interview, the Fellows met with the Consultants at the Consulting office and decided on a 3-stage research project: investigate the competitive landscape, investigate customer needs and then merge the two.

The following week (Week 2), as the Fellows tried to segment competitors and customers, they met with the Margaret and Natasha to understand "what exactly is a 'special event'" (e.g., Is selling Girl Scout cookies a special event? What about benefit auctions?). Although the Fellows were able to get a clearer idea of what a 'special event' was ("special events are 'athons,' like bikeathons,

Table 6.2: General Timeline Highlighting a Few Events During the Development of Funding Pitch

Week 1	First Meeting With Fellows and Consultants. The Fellows develop an interview guide and plan a 3-stage research project (competitive landscape, customer needs, merging the two)
Week 2	Fellows still trying to better understand how they can be most helpful to DotOrg Fellows set a deadline for June 12 to have a complete assessment of the competitive landscape. Fellows and the Founders agree to meet every Friday AM
Week 3	The Fellows present their Market Research Findings. The two key conclusions of the report were that: 1) the national NPO market appears modest in size and in opportunity; and 2) competitors have linked up with large NPO event sponsors. Consultants decide to help DotOrg define and develop their "value proposition" based on their research on the competitive landscape and customer needs.
Week 4	Fellows discuss with Founders who exactly is DotOrg's target market. The Founders request Fellows to explore the smaller nonprofits.
Week 5	Fellows working on developing customer market segmentations and conducting interviews. Several meetings between Consultants, Fellows and Founders to get a clearer understanding of what DotOrg wants to achieve and whether they realistically think they would.
Week 6	At large-scale meeting, Consultants continue to express concerns that original idea not viable. They seek greater clarification regarding target customers. In addition Fellows seek more guidance from Founders regarding what to do.
Week 7	Fellows continue to conduct research on competitors and with Consultants develop ten alternative business models for DotOrg.
Week 8	Ten alternative options are presented to the Founders. The Founders develop three options from the ten. Tensions between participants peak. E-mail from Greenhouse Advisor sent out to entire team proposing new communication structure to avoid future "tangles." Founders present the three options and solicit feedback and advice from all participants of a large-scale meeting. Over the next few days, all but Founders focus on a new option: working with a well-known local NPO to help them develop volunteer management tools.
Week 9	Founders decide to stick with what they feel most passionate about - their original mission - and announce their decision to all participants. Everyone is supportive and it is suddenly much clearer what needs to be done next. Consultants help develop a detailed work plan for the remaining three weeks that the Fellows will be around.
Week 10	Over the week, Rachel develops a total of three sets of ghost slides. The final version has 22 slides.
Week 11	Together with the Project Manager, Rachel presents the 22-slide version to the Founders. From the meeting, a new set of 20 hand-written slides emerges. The following day, after another large meeting, Rachel further modifies the 20-slide version into an 8-slide version. Rachel spends the rest of week developing in greater detail the 8-slide version.
Week 12	Rachel presents the 8-slide funding pitch to entire team at final meeting.

walkathons, and danceathons"), the concept still seemed vague. They worked out a plan to develop a list of potential interviewees and an interview guide by the following week, so that by June 12, they would have a complete assessment of the competitive landscape. In addition, because everything regarding DotOrg

seemed to change and evolve so quickly, the Fellows also agreed to meet with the Founders every Friday morning.

While conducting their preliminary research, the Fellows grew concerned at what they were discovering and met with the founders to discuss their findings: there were already several for-profit companies pursuing strategies similar to DotOrg's and those for-profits were already pursuing the most attractive customers. According to the Fellows, the Founders needed to begin considering alternative business strategies.

A few days later, the Founders had a meeting with their principal Incubator Advisor to discuss the work of the Fellows. The Incubator Advisor wanted to be sure that the Founders were giving "clear directions" to the Fellows and knew what to expect from them. It quickly became apparent to the Advisor, that it was not clear to the Founders what exactly the Fellows were going to deliver by the end of the week. The Founders explained to their Advisor that the Fellows were concerned that the market appeared small and already filled with competitors. The Founders were not convinced that the "market" that the Fellows were examining was the correct market. There still seemed to be confusion between what a nonprofit was and what a "special event" was. Sensing this confusion, the Advisor suggested:

> What would probably be very helpful for you guys [the Founders] is that you should literally take a blank piece of paper and sketch out what you want the [Fellows to develop for you]. So think long and hard about what the most important pieces of information are for you to them make your argument and then you'll know exactly what you'll get. Because the glory and downfall of research - particularly online research - [is that] it can go on forever. And you want to make sure that people are actually giving you stuff that is actionable and helpful because that's good for you and that's good for them [...] I would really encourage you guys to please draw blank sliding in consulting [...] Remember in one of our road-mapping sessions when we drew the blank slide of the waterfall? That's the kind of stuff that you should do with the Fellows. Because that way you are saying I want this slide, now go get the real data. This is exactly what I want my company profile to look like. I want it in PowerPoint. I want this chart over here with the revenues. I want expected money saved using [DotOrg] over here.

> [...] I think it is really important when working with consultants that you blank slide out exactly what you expect. What's your hypothesis? What's your hypothesis about the competitive landscape? What do you want to know about those people? I think it's really important as much as possible to kind of blank it out and then basically what you're asking the consultants to do is fill in this data. And if it turns out I'm wrong, then change the plan. It gives them a really easy way to manage their time, manage their research. Because it can just get totally out of hand.
>
> [Blank sliding] makes their job easier and it makes your relationship easier. And that way you can plan for the information that you are looking for.

The Advisor recommended that the Founders structure their arguments as hypotheses and then sketch data-less slides onto pieces of paper representing the general arguments and indicating what kind of data needed to be collected to support them (i.e., "blank slides"). In the end, though, to the frustration of those who were familiar with blank-sliding, the Founders did not develop any blank slides nor did they communicate their concerns regarding the Fellows looking at the wrong markets. Consequently, when the Fellows presented their market research at the end of the week, the market they examined was not exactly what the Founders had in mind.

In addition to making sense of DotOrg's business strategy (including its "value proposition"), the Founders were grappling with making sense of a different but related issue: the technological component of DotOrg. Questions and discussions regarding the technological component of DotOrg included: Can DotOrg really build the technology that will support its service without partnering with an established technology firm? If DotOrg cannot build the technology and needs to partner, what does it have to offer that could not simply be copied by another organization? What does DotOrg bring to the table that is unique? In addition to these questions, it was extremely difficult for the Founders to get a clear understanding of what exactly was involved in developing "the technology" (i.e., DotOrg's Internet-based service). Whenever the Founders asked someone about the technology, they would typically receive a vague answer such as "Oh, the technology is out there, it's not that complicated." Natasha, the Founder in charge of technology, explained to the

Advisor: "We don't fully understand how complicated or simple [developing the technology] is and what the time and cost would be."

On Week 3, the Fellows presented their "Market Research Findings" at a meeting attended by the Founders, Incubator Advisor, and Consultants. The Fellows had developed these findings from looking through a database on nonprofits, searching the web for competitors, and interviewing customers. The report was developed and organized using a template from the Consulting firm. The two key conclusions of the report were that: 1) "the national NPO market appears modest in size and in opportunity;" and 2) "competitors have linked up with large NPO event sponsors." Given these findings, the Fellows believed that the best next task for them was to interview nonprofits to better understand how DotOrg could be valuable and to "broaden their market opportunity." They also decided to help DotOrg define and develop their "value proposition." As one of the Fellows explained:

> We need to quantify and spell-out the value proposition (including both financial and social return). [One of the Consultants] has done a lot of value proposition work. Once you figure the value proposition, then you are better prepared to go to the NPOs and seek money. I think you are trying to articulate the value proposition so let us see how to best represent this. Let's not re-invent the wheel. If someone at [the Consulting firm] has done this then we'll just copy!

The Founders agreed that it would be a good idea to have the Fellows work on re-articulating their value proposition in terms that would make better sense to investors.

During this meeting, the Fellows explained to the Founders that, although they "felt bad" showing the Founders the charts depicting the small market and large number of competitors already in it, "they were trying to help." The Founders replied explaining that they "weren't taken aback" since they were already aware of the competitors. The Founders believed that their nonprofit status gave them a competitive advantage over all the competitors, who were for-profit. Specifically, their nonprofit status signaled to other nonprofits that, unlike the for-profits, DotOrg was not interested in profiting from the special

events but rather, was interested in helping the nonprofits accomplish their missions more effectively and efficiently. This point seemed particularly difficult for the Founders to articulate in a manner that was convincing to the Consultants, the Fellows, and the Incubator advisors.

During the following week (Week 4), members of the DotOrgteam continued to struggle communicating with each other and, more specifically, relating the interests and concerns of the Founders with those of the rest of the team. The Fellows met with the Founders to develop a better understanding of who exactly DotOrg wanted to help. At this meeting, one of the Founders suggested out loud: "Maybe the way we can help is to get the bottom folks, not the top." The Fellows asked what kind of information they would need to determine that. They then struggled with several other issues regarding how DotOrg was going to develop a competitive differentiation or at least distinguish itself from other organizations in a manner that was attractive enough to earn funding. After more discussions, the other Founder said the following regarding DotOrg's mission:

> Our blue sky goal is to help everyone. Nonprofits tend to enter areas that for profits can't make a profit in. Maybe that's our differentiation! Even though it may not be a huge market. Just so they have this service is good. So that could be our differentiation.

In response, one of the Fellows looked through her work plan and noted:

> I'm looking at the work plan and am not sure that this will help. A lot of this stuff we didn't talk about [during the large meeting held the week before].

She then went up to a white board and created a "parking lot," where she wrote "revisit discussion on the boundaries of the value prop work." Returning to the table where everyone was, she then explained that the Consulting firm defines a value proposition as "statements that you own in the minds of your customer" and that at the core are points of differentiation. The conversation soon turned towards discussing once again DotOrg's target customers and different ways of segmenting the market (e.g., by revenue size or by the number of people participating in the event).

During the rest of Week 4, and during Week 5, the Fellows examined web sites and databases as they worked on developing customer market segmentations and developed a detailed interview guide to interview exemplary customers. Upon completing the guide, they began to conduct interviews, although they rarely referred to the guide and instead, listened and let the interviewee guide the interview.

In Week 5, another meeting was held between the Consultants, Fellows and Founders to get a clearer understanding of what DotOrg wanted to achieve, whether its goals were realistic or not, and what was the best way to "take advantage" of the Consultants and Fellows. The team agreed that the Fellows would focus on answering the following four questions:

1. Who is DotOrg's target customer?
2. Are there enough potential target customers? (list of NPOs)
3. Can DotOrg achieve sufficient market penetration? (Competitors)
4. Can [DotOrg] gain enough share to achieve financial sustainability? (Financial Modeling)

Four days later, the Fellows meet with the Consultants at the Consulting firm to agree on a more detailed work plan for each of the Fellows for the next three weeks. The work plan included two meetings with the Founders to keep them updated on the most recent findings from the Fellows' research.

By this time (Week 5), tensions between the Fellows, Consultants and Founders were becoming more apparent. Despite efforts to develop detailed work strategies, the team members felt they were making little progress. In addition, the Fellows and Consultants believed DotOrg needed to develop a new business strategy (specifically, one that was more viable than the original idea). The Founders, on the other hand, were not convinced by the Consultants' argument that they needed to do that.

During a meeting in Week 5 between the Consultants and the Fellows, held at the consulting office, the Consultants and Fellows expressed their frustrations more clearly. One of the Consultants, countered:

> [The Founders] are not letting go of their original vision. The only thing we can potentially do now is to answer them in a fact based way [...] We have to

> think more creatively of how we can get them to hear things more directly ... How are we going to be most effective with the facts that we uncover?

At this meeting, the Consultants agreed that one strategy for convincing the Founders to "let go of their original vision" was to "include [the Founders] more in the fact gathering process." One of the Fellows noted: "[The Founders] don't care if the market is not big enough. They say if there's one person we can help, that's enough." In response, one of the Consultants suggested that maybe, if they focus on the economic viability and "show if you do this, you die," the Founders would understand that they have to change their business strategy. They eventually discussed the difference between consulting and startups. One consultant observed that the key difference was one of language. One of the Fellows who had worked with startups, commented that startups are very "instinct" and "emotion based" and "not so fact based":

> We [as consultants] may come up with a great fact based job for an MBA but what I'm hearing from [the Incubator Advisor] is that we need to understand their biggest fears and emotions. [Startups] are much more emotion based. So we need to figure out where we can strike the deepest emotionally.

The Fellows and Consultants agreed that to be more convincing, it was important to communicate their findings to as many people as possible ("the more people we can get to see things our way the less we have to worry about any one person") and to "stop analysis a few days early and focus on how to spin [the findings]."[13]

In Week 6, the team held its first "progress meeting," during which the Fellows presented more detailed data on the competitive landscape. From the point of view of the Fellows, Consultants, and Incubator Advisors, the data confirmed more precisely what they had been fearing for the past month: the landscape was so saturated with well-funded competitors that it would be impossible for DotOrg to compete. As they reported in the paper they handed out:

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[13] In Chapter 7, I discuss in greater detail the significance of the distinction between what constitutes the identity of a nonprofit and a for-profit.

> There are several current competitors in the E-Philanthropy ASP market, many of whom are funded in the scale of $1,000,000-$6,000,000; There are several (even more) potential competitors in related markets, such as traditional donor management software or E-Philanthropy portals; and Partnerships within the market are forming rapidly, especially between competitors and customers and between firms in complimentary markets.

From the point of view of the Fellows, Consultants, and Incubator Advisors, this progress report only added to the uncertainty regarding the viability of DotOrg and increased the time pressure to develop a viable alternative quickly. Given these dire circumstances, the Fellows proposed narrowing their list of about 85 potential competitors down to 15 key competitors and focusing on learning as much as possible about these competitors' business models.

The following day, the Fellows began to conduct their research on the top 15 competitors. As they did, tension between the participants grew. From the point of view of some of the Fellows, Consultants and Incubator Advisors, there was more and more data highlighting that the original idea of DotOrg was not viable and would have to change; they felt the data was "telling the honest facts" and had to be taken more seriously than the Founders were doing. Other participants placed more faith in the Founders and felt the other participants needed to be more supportive.

Arriving to a Shared Understanding

Weeks 8 and 9 proved to be the climax of the project. Tensions between the participants boiled over, the Founders asserted their original mission, and eventually, everyone arrived at a sufficient common understanding of the mission that it could serve as the project's central guiding theme.

Week 8 began with a large-scale meeting between the Fellows, the Founders, the Consultants, and the Incubator advisors. At the meeting, the Fellows and Consultants presented to the Founders a list of ten possible options of how to change DotOrg current "ineffective" business model into a viable one. Each option was listed (with "pros" and "cons") in a paper document titled "[DotOrg] Has Reached a Critical Decision Point." The list reflected the Consultants'

general belief that the best way for DotOrg to attain enough money to become viable and deal with the small market space and large number of competitors was to partner with an existing, well-funded competitor. The Founders were to choose the three most attractive options from the list of ten and discuss them during another large-scale meeting at the end of the week. The Fellows and Consultants wanted the Founders to pick a strategic direction for DotOrg so that they could develop an appropriate funding pitch based on all the research they had conducted already. As one of the Fellows explained, re-iterating a concern that they had discussed with the Founders several times before:

> [I]t is important for you guys to direct and tell us how you want to use us [...] You're the heart of this and you need to help guide us. You guys are the coordinators [...] You need to tell us how we can support you.

Everyone was frustrated that more had not been accomplished by this point in the project and that there was still not a clear strategic direction for DotOrg. Thus the pressure to decide on a new strategic direction for DotOrg was extremely high.

The following day, the Founders developed three options of potential alternative business models from the list provided by the Consultants. In developing these three options, the Founders tried to preserve as much of their original mission as possible and drew on the market research developed by the Fellows. Like the other participants, the Founders started to subscribe to a more specific categorization of the potential customers. For example, based on the market segments defined by the Fellows (based on revenue generated from event, size of organization, and whether or not they are web-enabled), the Founders had developed their financial projections and figured out they would need about 55 customers a year to break even - a number much larger than they had originally anticipated. With these kinds of insights, the Founders chose three options from the original list of ten.

With the three options at hand, the Founders and Fellows discussed how to best use the next two days to help the Founders decide amongst them and prepare for the large-scale meeting. They agreed that the Fellows would conduct

a few interviews of potential customers to see which of the three options seemed most attractive, conduct a "quick scan of the players in that space" to better understand if there were any competitors associated with any of the three options, and determine the cost of each option. Soon after the Founders and Fellows developed their work plan, the Consultants came over to the incubator space to meet privately with the Fellows. The privacy of the meeting raised concerns that the Consultants would complicate the work plan. The concerns proved correct: at the meeting, the Consultants expressed frustration that they were being left out of the loop in key decisions. The Consultants had a fourth option they wanted considered - one that would take greater advantage of all the research conducted so far by the Fellows. At the conclusion of the meeting, the Consultants left the Incubator without talking to any of the Founders and the Fellows returned to the DotOrg bay to explain what had just been discussed. The Fellows, at this point, were feeling overwhelmed with negotiating between so many different interests.

While the Fellows had been meeting with the Consultants, the Founders received a bill from the Incubator that was twice what they expected. Suddenly, their "burn-rate" - which already seemed high to the Founders - was extremely high. Everyone involved with DotOrg had already been feeling the pressure that DotOrg needed to raise funds quickly. Receiving the latest bill from Greenhouse only exasperated the situation.

By the end of the day, tensions had boiled over between all participants and the Incubator Advisor was compelled to send out an e-mail to all team members to help improve the situation. The e-mail included the following opening paragraph:

> [DotOrg] team,
>
> Well, it appears that we are right on schedule for our monthly communication tangle. From the outset we knew the [DotOrg] engagement was new ground for all parties and would require open channels of communication to optimally support the [Founders] and make this a good experience for the [MBA Consultants]. We are all on new ground here: new entrps, new incubator, first time incubating a non profit, [...] the landscape is

> littered with potential hazards and we have hit a couple of potholes. I take full responsibility for not structuring more routine meetings that could have smoothed the bumpy communication between all parties and prevented the current confusion.
>
> To that end, I would like to suggest some communication structure and clarify the present issue of the much ballyhooed "DECISION" facing [the Founders]...

Acknowledging the tensions between the team members and taking responsibility for them seemed to improve the situation tremendously. The Founders, Fellows and Consultants spent the next few days interviewing members of Greenhouse and NPOs to determine the costs and attractiveness of the three options.

At the end of Week 8, the second large-scale meeting of the week was held. After the three options were presented, several participants began discussing a new, fourth option, called "Volunteer Management Provider," that took advantage of all the research conducted by the Fellows and that involved partnering with a well-regarded technology service provider. The new option, quite different from the original mission, generated so much enthusiasm that the rest of the meeting was spent developing it in greater detail. The enthusiasm was so great that those participating in the discussion did not realize that the only two in the room who did not share in the enthusiasm were the Founders. The Volunteer Management Provider option ended up being developed without much input from the Founders, and by the end of the meeting, with the exception of the Founders, everyone seemed to be in agreement that it was the future of DotOrg. The Founders felt completely overwhelmed and confused. Later on, after everyone had left, the Founders broke down into tears because they felt they had lost the essence of DotOrg.

The Founders spent the weekend at Greenhouse searching the web to learn more about what exactly it meant to develop volunteer management tools and who their potential well-regarded technology service partner was. They also spent time talking with some of the incubator employees who had been supportive of the DotOrg's original vision but who had not participated in the

large-scale meeting. As they searched the web and talked things over with others, the Founders realized that they were not interested in this new option and that their passion was with their original mission. The Founders spent the next days thinking over what they wanted to do.

On Wednesday of Week 9, the Founders announced to their Incubator Advisor that, rather than go with any of the options that were being considered over the past weeks, they were going to stick with their original idea. The Incubator Advisor said she would support the Founders' decision, but she still needed to be convinced that there was a real need for DotOrg as a nonprofit. The Founders agreed to develop their case. They also decided to develop a "beta" of their service, specifically, "an html prototype" rather than a collection of "screen shots."

Later that day, the three of them informed the Fellows and Consultants of the Founders' decision to stay with the original idea. The role of the Consultants would be to help them develop a funding pitch for the original idea. The Founders drew on the ideas that had been developed over the past weeks to re-iterate their original idea. The Consultants agreed to help as requested. The principal Consultant observed: "it sounds like the bulk of what you'd like to work from is what [the Fellows] have done [...]. The team's got a lot of facts but you guys have to craft the story."

The following week, one of the Fellows, a Consultant, and the Founders sat together and began to develop key messages for the funding pitch. Using the white board, the Consultant wrote out several key points of the pitch that supported the Founders' original mission statement. This time, the phrases on the board made sense to all the participants and were compatible with the analytical process practiced by the Consultants (e.g., develop a well defined hypothesis, gather the relevant data, review the hypothesis in light of the data, etc.). Although some participants were still not convinced that the original mission was viable, they were much more enthusiastic about participating and helping DotOrg because they felt their findings would be listened to (e.g., if in the next couple of weeks they were not able to prove a market need, then the

Founders would consider addressing a different market need - one identified from the interviews).

Part of the success of this meeting was that there seemed to be a greater sense of clarity and shared understanding among all the participants regarding the value proposition of DotOrg. As one of the Fellows explained:

> [W]e got it originally in our minds that competition was SO intense that there was no space for [DotOrg]. And I think if you have that mental data point in your mind, it's very hard to progress. And so it was almost like I forced myself to say "OK. Let's just relax that a little bit and try to figure out if there were going to be a way through the forest, what would it be?" And then see if then we can cater the data to justify that statement. Because I almost think that you can look at data more than one way. [...] Because we keep on going back to data as if it is this god that's going to absolutely dictate what the story is. But I truly think you can make up 3-4 different stories based on the exact same data set [...] [Now that the Founders] have said "Look we're making the decision based on gut a little bit. So figure out a story that's going to work." We need to do that without being academically dishonest.

With greater clarity and shared understanding, the Fellows were more motivated to work on the funding pitch.

6.3.2 Part II: Creating a Funding Pitch

There were two general parts to the funding pitch that the Fellows focused on: an outline of what the Founders would say during a presentation and a set of slides to represent the pitch. To develop the set of slides, the Fellows relied on "ghost sliding" - a process practiced by the Consultants for developing the packet of slides for a presentation. Ghost Sliding was essentially the same as "blank sliding," referred to earlier by the Incubator Advisor. It involved sketching a rough outline of the key slides that one wanted to include in the presentation. Each slide represented one or more hypotheses and data that either supported or disproved them. With an idea of what one was striving for, one could be more efficient about what kind of data to look for. Ghost Sliding was an iterative process where quick, rough representations of each slide were drawn up and discussed with the client to develop consensus on what statements were going to be included in the presentation and what data needed to be collected to support

those statements. After each discussion, more data were collected and more detail and specificity added to the slides. Then, after a significant number of changes had been made to the presentation-in-progress, the next version was discussed with the clients.

The ghost sliding process for the funding pitch document was lead by one of the Fellows, Rachel.[14] Rachel first started developing a rough sketch of the funding pitch at the beginning of Week 8, as the (later discarded) option of DotOrg becoming a developer of volunteer management tools for nonprofits was gaining momentum and generating enthusiasm from most participants. Rachel had never developed a funding pitch for a startup, let alone a nonprofit startup. She began the process by interviewing a fund manager at the incubator, who had extensive fundraising experience, to learn about what made a convincing funding pitch. From her discussions with the fund manager, she developed a set of notes, including a list of the main themes ("main buckets of topics") that needed to be considered (e.g., detailed description of business opportunity, market analysis and customer feedback, competitive landscape, competitive advantages of DotOrg, projected financials, etc.). Using these notes, she wrote out by hand a four-page document titled "Outline of [DotOrg] Funding Pitch." This document was laid-out in a "landscape" fashion, as was recommended and practiced at the Consulting firm and common in PowerPoint presentations (rather than in a "portrait" lay-out, as most documents at the startup were formatted).

Once Rachel completed this draft, she faxed it to an assistant at the consulting firm whose job it was to translate handwritten drafts into Word documents that were polished enough to be presented to a client. A few hours later, when the assistant finished translating the document, she e-mailed it back to Rachel, who then printed the Word document out on one of the common printers in the Incubator (there were about four printers located around the floor that were

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[14] The other Fellow, Sophia, was available to help this process, if necessary, but otherwise she was to focus her energies on strategic partnerships between technology providers and potential beta customers.

shared by all the bays). Rachel read the printout and, using a pen, changed some of the copy and added two more points. She faxed the edited version back to the assistant (recycling the same cover letter as before but with new comments), who e-mailed the updated Word document an hour later.

Rachel printed out the updated Word document and went to the consulting firm offices, where she discussed the first draft with her Project Manager and her co-Fellow, Sophia (who had more experience in developing such presentations). After going through it, they explained to her that she was "looking at [the funding pitch] the wrong way" and that instead, she should be "looking at it more as a story and that the buckets would just fall into place as [she] was telling the story." They recommended she "focus more on the need." Merging their ideas with those of the fund manager, Rachel asked herself "Well, what do we know and where is that taking us?" and from there, "started to try and put together this story."

Using pen and paper, Rachel re-developed her story based on the research that she and Sophia had spent most of the summer collecting. The first part of the new draft was "lifted straight out" of the work that she and Sophia had already done, but the second part was "pulled out of thin air." As Rachel explained:

> I was just trying to tell a story. So the first premise of my story, we've been through a million times: that there's a compelling cause out there, there's a compelling need in the marketplace, but there's a million competitors that are already kind of there. But there still may be room for us somewhere. And I can't recall that there's anything that made me go to the next step, other than it just seemed like the next part of the story should be that we were the right ones to fill the gap.
>
> [I] almost had to step away from the data and just say 'OK, what's the story that would make sense?' And then test it and see whether or not we had the data that could justify it.

Rachel developed a new "DotOrg Funding Pitch" and, alongside each key statement, marked as a bullet point, she placed two columns: one titled "necessary analysis," where she described what kind of data was necessary to

prove the statement; and the other column titled "responsibility," to assign who (she or Sophia) would be responsible for finding that data.

Rachel was on vacation when she completed the latest version by hand, so she faxed it to her Project Manager and Sophia. Upon returning from her vacation, she spent time at the Incubator and consulting office, discussing the new version with the Incubator Advisor and with her Consulting colleagues. In general, there was skepticism regarding whether there existed 'enough data to justify the story.' At the Incubator, for example, the Advisor remarked that it was important to make sure that there existed compelling data to prove there existed a need that was not being addressed by any for-profits, and consequently, prove why DotOrg should be a nonprofit.

At the consulting firm, there were also debates regarding which hypotheses were supportable and which were not, but eventually the Fellows and the Project Manager arrived at a compromise story that they were all comfortable with. Once they had the funding pitch outlined, the Project Manager, using pen and three sheets of paper, sketched a very rough set of sixteen ghost slides. Each "slide" (represented as a boxed area on the piece of paper) included a single phrase or idea and a graphic or image to illustrate the data that supported that idea.

The following morning, with the rough set of 16 ghost slides and the latest version of the funding pitch, Rachel created her own set of ghost slides, consisting of 22 slides. Each slide was represented by a single piece of paper on which she wrote by hand the key messages and drew the general graphics. These slides were a great deal more detailed than the rough sketches drawn by the Project Manager. Although Ghost Sliding was a new practice to Rachel, it was a common practice at the consulting firm. When I asked Rachel what the value of Ghost Sliding was, she explained:

> [I] think the value [of Ghost Sliding] is a couple of things. One is you find out by actually drawing the charts but not putting in the data, you find out where the holes are in your data, where you need to find the data to support your story. And I think secondly you start to figure out exactly what your story is. And so as that becomes clearer in your mind, it's kind of complementary.

> There's a kind of battle at play between what the data dictates the story is, and what the story dictates the data needs to be. And I really think this has proven to be a remarkably helpful exercise in playing out that battle. Because you're going from story to data and then back to story and back to data until you find a compromise.

Ghost Sliding was also a process that involved soliciting feedback and incorporating that feedback into the evolving product.

When she finished drawing them out, Rachel, together with her Project Manager, presented all 22 slides (stapled together in a single packet) to the Founders to get their input. Initially, the Founders were not clear what the exact story was, so they unstapled the packet and laid out all the slides across one of the bay's walls. The Project Manager took out a purple pen and began to draw linkages between the different slides, tighten the story and make it clearer to the Founders. By the end of the meeting, the Founders were very enthusiastic about the ghost slides, as were Rachel and her Project Manager. In fact, the Project Manager considered it the best meeting he had had all summer. As Rachel explained:

> [B]y diagramming it out, we were able to... I hadn't realized that linkage until we were able to really visualize it and find out how this parallels this. And by expressing right here, when we got to the point where we expressed what the five barriers were that we hypothesized are preventing nonprofits from accessing the technology. And then we went to this step of starting out 5 unique features that DotOrg would offer to address these 5 barriers. We realized that this is a value proposition, these 5 unique features. And that was like "Wow, we finally went from need to our answer." And that's how we differentiate ourselves and that's the value proposition.

On a separate white board, the Project Manager wrote out in one color the original five themes that seemed to run throughout the slides. With a second color, he then edited each theme and added more information, to include concerns and interests of all those at the meeting. The Project Manager, together with Rachel and the Founders, edited the slides and developed on the white board a new summary of the key messages that would be communicated in the funding pitch.

From this meeting and the new summary that had emerged and been captured on the whiteboard, Rachel developed a new set of ghost slides and a five-page outline of the funding pitch. Two days later, she presented a new, modified set of hand-written slides to a large-scale meeting, where the Founders, Fellows, Consultants, and others attended. This set consisted of 20 handwritten slides. This set served as the principle source of information from which the participants discussed different ways of presenting the information. There was discussion, for example, regarding how much data should be presented on the actual slides, given that some audiences would be more interested in the emotional aspects of the pitch and would want to focus on the Founders rather than details of the slides, whereas other audiences would be more quantitative and want to see some figures backing up the pitch. From this discussion emerged an option to have the slides free of detailed data but then at the end, offer the audience a handout that included more of the detailed data.

During the meeting, a few participants inquired about particular aspects of DotOrg that did not seem to be explicitly covered in the packet of slides. For example, the "waterfall chart" was no longer in the slide packet, although several participants thought it should belong in it.

In general, as with large meetings in the past, this meeting was an opportunity for participants to give advice on ways to improve the funding pitch. This advice typically included the statement of a "fact" or trend and how to best address that fact. For example, early on in the meeting, an executive advisor from the consulting firm shared the following piece of advice:

> In general we try and do presentations to folks that are no more than like 12 pages maximum. I would recommend probably staying within 15 pages. So when you're thinking about pulling this together... We also really encourage folks to put data on the slide. That's hard to explain but put as few words as possible. One is because when you put words in front of people, they tend to read them and they don't look at you. And your ability to get money from somebody is directly based on eye-to-eye contact and their ability to believe in you. It's much better if you're giving all the information and the slides are sort of a prop.

The following day, the Incubator Advisor met with a colleague of hers at the incubator, the Founders, and the Fellows to go over in detail the ghost slides and try to reduce the packet of 20 down to 12 key slides. For this meeting, Rachel prepared a one-page document with a table that highlighted how five "business components" of DotOrg (target customer, business development/customer acquisition, pricing, product, and people/organization) related to a set of nonprofit needs, in addition to specific potential "value propositions" (e.g., regarding the target customer, the associated value proposition was "we target nonprofits who rely on special events but who for-profit tech providers have overlooked. Long term we will expand our market to include other nonprofits who do not yet take advantage of the special event vehicle."). As Rachel explained to the participants of the meeting:

> I thought maybe this was a good starting point and I just wanted to make sure that the principles of your story, the principles of who you are, don't get lost as we think about what execution stuff are possible. Because we spent a lot of time working on just the logic of who you are! And we need to make sure that's preserved going forward now as we start out to firm up the nuts and bolts of how you execute that vision. Or, if it turns out that after we start with the nuts and bolts, we have to re-visit who you are, which I anticipate, but we have to just really be aware that like so far we have a lot of data and logic that support this type of an articulation of what DotOrg is all about. And we need to make sure we remain true to this, or else consciously choose to drift away from it.

As had been done in a previous meeting, the participants decided to de-staple the packet slides and spread them out to look over as they discussed what were the key slides that were needed and what slides could be either eliminated or combined into another slide. The Incubator Advisor, who was essentially leading the meeting, also grabbed a pile of scrap paper to draw new slides on. The discussion was often around how to represent as concisely and clearly as possible the key messages summarized in Rachel's document. For example, they considered several different ways to illustrate the point early on that DotOrg increases the amount of money that goes to the cause. One visual they considered was to have two pie charts next to each other: a smaller one, representing the total amount of money going to the cause using the traditional

method, and a much larger one, representing the amount of money going to the cause using the DotOrg method. They debated whether numbers should be included in the visuals and if so, whether there was statistical data available or whether they would have to develop numbers assuming a "typical scenario." In the end, they decided to re-develop the waterfall slide chart that had been developed earlier during the summer and which the Founders had missed in the latest packet of slides.

By the end of the meeting, a new list of slides was developed, which included a few slides that would represent a prototype of the product (a "walkthrough"). The prototype slides were to be prepared by the marketing division of Greenhouse, but the remaining 8 slides were to be prepared by the Fellows. That evening the two Fellows took responsibility for developing four slides each.

During Week 11, Rachel further developed the eight slides and had them translated into Word (again, with the help of an assistant at the consulting office, dedicated to translating hand-written documents into Word documents). By the final meeting, during Week 12, the Fellows had completed their work on the funding pitch. They had helped develop several key slides that would be used as part of a visual presentation, and they helped develop the key arguments that would be articulated during the pitch.

6.3.3 Summary of Developing a Funding Pitch

The process of developing a funding pitch ultimately took up all of the Fellows' twelve-week consultation with DotOrg. It proved to be a frustrating process for all involved because it took about nine weeks for all participants (including the Founders) to create a shared understanding that DotOrg's original business model was viable. There were two factors that seemed to be especially significant in contributing to the difficulty of developing a consensus around the funding needs of DotOrg. One was that the challenge of developing a funding pitch for a nonprofit Internet startup was new to all three parties - particularly the Founders, who, consequently, found it very difficult to lead the process. A second was the different expertise and interests - what could be referred to as

invested knowledge (Carlile 2001) - that each party brought to the table. Specifically, the Consultants were experts in planning change for large for-profit organizations; the Incubator Advisors were experts in launching for-profit startups, and the Founders of DotOrg were interested in developing a nonprofit startup. Although the situation was new to all participants and among them there were significant differences in expertise and interests, they finally managed to develop enough consensus to create a funding pitch. And although frustrating, the process of creating a shared understanding of DotOrg was essential to the process of creating a funding pitch. As I describe in the next section, it also facilitated the process of creating a web prototype.

Improvising a funding pitch proved extremely challenging because it was the first time participants had developed a funding pitch for a nonprofit startup, there were few guidelines to coordinate their efforts so participants had to develop their own, and there were conflicting assumptions regarding what was a viable DotOrg. In contrast, the process of improvising a web prototype proved to be less problematic. It was more similar to the final three weeks of the funding pitch project. There was greater consensus among participants regarding the collaborative endeavor, and participants were able to draw on guidelines to coordinate their efforts.

6.4 Developing a web prototype

One of most successful innovations at DotOrg during my field study was a web prototype that was developed to acquire DotOrg's first customer.[15] The principle purpose of the prototype was to graphically illustrate DotOrg's services to potential customers and funders. The process of developing a web prototype overlapped with the process of developing a funding pitch, described in the previous section. In fact, the process of developing a common understanding

[15] At DotOrg, participants referred to the web prototype as a "web prototype" because it was initially intended to prototypenstrate DotOrg's services. Eventually, however, the prototype became a prototype for DotOrg's services. I use the term "web prototype" to emphasize the use of the product not simply to represent DotOrg, but to structure and constitute it as well.

that occurred between those developing the funding pitch contributed to the success of the development of the web prototype.

In what follows, I describe the process by which the prototype was developed in three general parts. The first part describes how the Founders spent the months of June and July making sense of the technical aspects of DotOrg so that they could better define what services they intended to offer. The second part describes how, during the month of August, two web developers at the Incubator - Beth and Cynthia - worked together with the Founders to construct a general prototype. Finally, the third part describes how the general prototype was used and adapted to help DotOrg attain their first customer.

6.4.1 Part I: Making sense of the technical aspects of DotOrg

The idea of developing a prototype was discussed from the very first days that the Founders were at the Incubator. In this section, I will describe the process by which the Founders (particularly, Natasha) made sense of the technical aspects of DotOrg.

Learning from Others

Natasha was in charge of managing the technical aspects of DotOrg, including the construction of DotOrg's web-based services and the development of a prototype. This was the first time she had attempted to design a complete web service. Her "web master" classes had covered web-page design but not "back-end" design. Before actually developing a prototype, Natasha wanted to get a better idea of the technical aspects of DotOrg (e.g., how to go about building each feature; what was required technically to deliver the services that she and her sister envisioned; how much time each would take to build; how much money it would cost, etc.).

Natasha spend the first month at the Incubator looking at various web sites and talking to people at the Incubator. Natasha acquired media kits from potential competitors and companies similar to DotOrg and examined them to learn what services they offered. She used one in particular "as a basic guide,

basic framework" to start developing DotOrg's own technology as its range of offerings seemed especially relevant to DotOrg's mission.

Two other important sources of information were a pair of web sites that offered "tutorials" (either as PDF or HTML files): Webproforums and Webmonkey. Webproforums provided Natasha with the "big picture" of technology-enabled businesses, that is, information that was particularly useful for information technology managers. She had used this service in her previous job at the bank where Webproforums had provided several useful telecom tutorials. She now downloaded a tutorial on the "basic functions of electronic commerce systems," which provided a helpful overview of electronic commerce systems and asked "Are you a commerce enabler or a commerce service provider?" She found the distinction helpful to understand what DotOrg was "aiming to be" (a commerce service provider). The tutorial also detailed the different components needed to fulfill the range of services offered by a commerce service provider. The Webmonkey website also provided tutorials on issues more relevant to technology developers (e.g., graphics programs, building e-commerce systems, marketing web sites, tracking).

As Natasha would read through the material, she would write down important points in different sections of a small notebook she kept labeled "technology." These sections included titles such as "things I should keep in mind" and "questions I should ask when I talk to people around [the Incubator]"). She eventually developed a specific note-taking system, using different colored pens and symbols to highlight particularly important points and questions. She wrote down items to clarify at a latter point - for example, the difference between web-based applications and traditional client-server applications, and between single-server and distributed system.

Natasha and Margaret had excellent relationships with most of the staff at the Incubator. They were genuinely respectful of the staff's skills and the staff, in turn, genuinely wanted to help out Natasha and Margaret - even if it meant relaxing a few of the rules at the Incubator (e.g., not billing DotOrg for time spent helping them). Natasha found several very helpful technology developers who

wanted to help her out with developing the technological aspects of DotOrg. Help typically emerged from unplanned, informal, chance interactions. For example, one night while Natasha was working late in the DotOrg office and most people at the Incubator had left for the day, one of the most knowledgeable and respected technology developers from a neighboring startup dropped by to say "hello" and chat during his break. During the chat he invited Natasha to check-out the prototype he was working on. While Natasha was getting his preview, she asked the developer a few technical questions. He was happy to help and together, they ended up spending an hour discussing various aspects of IT architecture that could support DotOrg (e.g., "Who would provide server maintenance?"). He even drew several sketches for her with various components and ways they could be linked with each other, and alongside each component, he listed the names of potential providers. These simple sketches helped Natasha understand what different components did, how they related to each other, and what brand names related to which components (for example, afterwards, she was able to explain to me that ColdFusion was "a cool way to maintain the same template but to automatically have things changing"). Using these sketches, Natasha was able to go back to several articles and have a clearer understanding of what they were talking about (because many articles simply mentioned a brand name and assumed the reader knew what the product did). It became clearer for her, for example, what an article meant when it referred to Apache, PHP, and MySequel as being opensource, copy left products. She also learned that the "business logic portion" was the portion of the system that handled credit card transactions.

Throughout the process of learning about the various options regarding technology, Natasha also collected a range of estimates regarding the costs associated with building DotOrg's technological infrastructure. Although the member company that was technically most similar to DotOrg had closed down a few weeks before DotOrg joined the Incubator, several ex-employees had transferred to other member companies and were available to help Natasha. She learned that this startup had gone to one "chop shop" (a company that built IT

architecture relatively cheaply using refurbished second-hand technology) and was told it would cost $1.5M to build their technology. Another chop shop quoted the startup $700K for the same project. Natasha also learned that a good strategy for reducing costs even further was to approach a chop-shop with as much of the technology planned out as possible, so that the chop-shop spends its time focused on building, rather than on designing. This information was useful to Natasha because it gave her a better sense of the costs associated with building out DotOrg's technology. During the first meetings between the Founders and the Incubator, advisors from the Incubator had claimed that it would costs $1.5M to build the technological infrastructure for DotOrg and thus they should develop their funding, business, and technology development strategies accordingly. For about a month, this figure influenced the work of everyone associated with DotOrg (e.g., Founders, Fellows, Consultants, etc.). That changed when Natasha realized the $1.5M figure was extremely high. Subsequently, she and her sister felt less constrained regarding what strategies to pursue (e.g., they felt more comfortable pursuing their original strategy).

Developing a Detailed List of Features (WebStrategy)

After being at the Incubator for about two months, Natasha was better able to discuss technical aspects of DotOrg with others and but had not yet found enough time to develop even a rough prototype. She and Margaret had wanted to develop one because they had grown frustrated at their inability to understand or communicate well with the Consultants and Fellows and felt that a prototype could help articulate their mission. Natasha wanted to take a week off to develop a quick prototype herself ("I was just going to take a week and knock out something and try to do storyboards"). With Margaret, she developed a quick walkthrough on paper, based on other web-sites and the user experiences they wanted to highlight most. Natasha was unable to complete the prototype herself because other demands consumed her time. As she explained:

> So before we wanted to do [a prototype] and I was looking at other sites and thinking "Oh, this could be a good format." And then we were thinking

some of the slides that should be in on that process. And it was also kind of complicated because we're not doing one walk through from one user's point of view. Participant, donor, nonprofit - which path do you take? And so in the end we started out with a participant walkthrough. Then they got to the sponsor-me e-mail out and the donor was involved at that point. So it was a mix of those two. And then we just had a single shot with the NPO Administrator. But figuring out the correct path and the correct point of view was another component. And then it seemed that we were advised to put that off until the WebStrategy sessions.

As part of the winning package from the nonprofit business plan contest, DotOrg won a small consulting engagement with a technology and strategy development company called WebStrategy. The engagement occurred in late July and consisted of a preparatory meeting with several WebStrategy consultants, the Founders, and advisors from the Incubator (including the Incubator's Chief Web Development Advisor and the head of Internet Product Development) and then, a week later, two full intensive days of working together to explore various potential features. The Founders took the opportunity to have consultants at WebStrategy help them develop detailed feature definitions of two potential technology models (an ASP model and a Portal model). By the end of the engagement, the Founders had explored again in detail various potential technical features (e.g., chat rooms, online registration, creating, editing, and sending e-mails, electronic payment systems, etc.), learned more about what issues were important to address when considering any of those features, and developed a detailed list of features that seemed most important to DotOrg. With an even more detailed understanding of the technical aspects of the system, the Founders developed a ten-page outline of what they wanted included in the prototype, including the features to be illustrated on each web page.

6.3.2 Part II: Constructing the Prototype

Developing a Common Definition of the Prototype

A few days after completing the technically detailed ten-page outline of the prototype they wanted, the Founders gave it to Beth, the manager at Greenhouse designated to lead the development of the prototype. The outline essentially illustrated what using "an DotOrg enabled website" would be like, from the point of view of a participant of a special event. It included, for example, a registration page, where one could register to participate in a special event, and a confirmation page, letting one know that they were now registered as a participant. After Beth had time to look over the outline on her own, she became concerned that the story was too focused on technical features and "not compelling" to a venture philanthropist or special events organizer. As Beth later recounted:

> [T]hey had organized ten screens or eight screens that were causal and which told the story but the story wasn't a compelling story. It was a story of somebody registering for something and that happens everyday on the Internet and we all see it and we all do it. Tell me something I don't know.

Beth discussed this with her boss, the head of Internet Product Development (IPD) at the Incubator, and he agreed with her concerns. He recommended that Beth and Cynthia (a recent hire who was learning web design) have the Founders go through the latest version of their funding pitch, distill the key points of the pitch, and "make sure that whatever the prototype is, it speaks to those features and those values." Later that afternoon, Beth walked over to DotOrg's bay and talked with the Founders to set up a meeting the following morning. To help the Founders prepare for the meeting, Beth also asked them to develop a detailed "story" of someone using DotOrg's services (also referred to as a "walkthough") that the prototype would illustrate. She asked them to describe a specific user ("actor"), including his/her background and goals and, in

about one page of bullet points, his/her key activities as she/he navigated through the site.

Beth had developed this structure for storytelling from her studies and experience in theater, as well as her experience with quality assurance and web development. By the time Beth had started working on DotOrg's prototype, she had already been working in web development and quality assurance for four years. As part of her work in quality assurance, Beth tested products to make sure they worked properly and satisfactorily from the perspective of potential users. It was during her training in quality assurance that Beth was first introduced to the notion of thinking of potential users of a web product as "actors." This notion was a particularly easy one to subscribe to for Beth because she had studied and worked in theater.

For the Founders, the particular storytelling structure suggested by Beth also made a lot of sense. Rather than deciding first on a set of features that they wanted to show in a prototype and then developing a story around the prototype, they would first develop a story that captured the mission of the nonprofit and then develop the prototype around that story. As the Founders recalled:

> Natasha: It was just so much easier when we heard: tells us a story. I mean think of some things that are important that you want to show from [DotOrg]. Like, these are core features that signify [DotOrg] to us. And think of a story around it or a story that melds with it. And then from there we'll build the [prototype] out.
>
> Margaret: [T]elling the narrative or a story is "OK, logically this is how it works."
>
> Natasha: Yeah. And I like the fact that it's the goals and then "OK this is what John does. First he logs in and then he sends team recruitment e-mails and ..." I like the way that was set up. And we were so happy finally. It was like, "Here we go. We can finally communicate."

The Founders had previously used stories to illustrate their goals and guide the development of DotOrg. The business plan they had submitted for the business plan contest, for example, included the real story of one of Margaret's colleagues, a gentleman who, as part of his participation in an annual special

event, organized a team of walkers in memory of his wife, who had passed away with cancer. Thus, when they were asked by Beth to develop a story for the prototype, the Founders reproduced the story that they had already been working with and simply restructured it in a manner useful for Beth.

The next day, on August 5, 2000, Beth and Cynthia met with the Founders to present the most recent version of the funding pitch and to discuss what should go into the prototype. Beth led the presentation. The Founders gave Beth and Cynthia a 5-page document with four sections: the first, titled "Meet John," consisted of two brief paragraphs describing who John was; the second, titled "John's Goals," described his four top goals; the third, titled "Walkthrough," described (in about a page) John using the site to conduct various activities related to the special event (e.g., recruiting team members, motivating them, and sending solicitations); and finally, the fourth, titled "Features/Content" was the outline of features from the original ten-page prototype. As Natasha recalled:

> When we gave that to [Beth] the next morning and she and [Cynthia] were sitting down, she was like "This is great. This is really specific. This is exactly what I want." We were like "Good!"

After the Founders presented the pitch, they discussed and clarified with Beth and Cynthia the key "selling points" that they wanted to emphasize. They came up with essentially three: increase revenue donations for special events; web-enable the process so that it is easier for organizers, participants, and donors; and help the organizing nonprofit create a more direct relationship with donors. With a clearer understanding of what the sisters were planning to present to venture philanthropists, Beth and Cynthia proposed a new set of pages for the prototype, in addition to an edited list of functions to better illustrate the key points.

The list that Beth and Cynthia developed was different from the list developed at WebStrategy. WebStrategy had focused on developing a comprehensive list of features that would enable DotOrg to deliver its services, whereas Beth and Cynthia focused only on those functions that best illustrated DotOrg's value propositions. For example, Beth and Cynthia reasoned that they

would not waste a screen shot of the prototype on showing the user what a DotOrg confirmation page would look like. As Beth explained: "Everybody knows what a confirmation page looks like. We're not going to spend time building that out." Beth explained the overall difference between WebStrategy's approach to developing a prototype and her and Cynthia's:

> The goal is really to facilitate a conversation that's not about "Well what would happen after I press this button?" or "Are you going to do this on the page?" but it's really to communicate all that stuff at once with a very information dense interface, so that the time spend conversing is conversing about quality information like "How much money do you need to get started?" and to talk about next steps rather than to gawk at the idea... the idea should just be conveyed really quickly and then the rest of the time spent should be talking about how [DotOrg] can get funding and how the people can help [...] It's like: This is what it is. Oh, I get it. What do you want to do with it? How are you going to do it? So you're not spending time talking about facts but rather strategy.

By the end of the meeting, Beth had written out by hand a one-page document outlining the eight pages of the prototype. It mostly consisted of bullet points, listing the title of each of the eight pages, and for a few of them, some features that definitely needed to be in each page (this outline was meant to complement the more detailed features outline developed by the Founders, and thus was more focused on general key ideas), and a single, small sketch of a section that was to be included in DotOrg's homepage (a section titled "Looking for an event?," which helped people interested in participating in a special event find one by either event name, event type, or zip code).

In addition to developing a clearer understanding of the key points that needed to be communicated via the prototype, and having a detailed story that would be illustrated by the prototype (and thus guide the development of the prototype), Beth and Cynthia talked to the Founders about the prototype's "look and feel." They quickly realized from their conversation that the Founders were not familiar with this concept. As Beth explained to me later on:

> I don't think [the Founders] understood what we meant by "look and feel." They [looked at] a lot of sites on their own and they said "We want this here and this here." And that's not really what look and feel is. Look and feel is

look and feel. It's like colors, images, how dense the information is. Not necessarily where it's laid out, but [the] style of how it's laid out.

Beth asked the Founders to drop by her desk later that day (located in the IPD bay, just down the hall from the DotOrg bay), so that she could show them a variety of web sites, representing "different looks." When the Founders dropped by later on, Beth showed them three distinct sites. She explained to them, "there are three different looks here and there are three different ways of conveying information, which do you like most?" One of the sites that Beth showed them to illustrate a particular look and feel and to illustrate a potential feature she had discussed earlier in the day was a site she had worked on at her previous employer. The site was for a new product that was still under development and technically only accessible to the client and those working on the project. She was able to access it because her password still worked. For each of the three sites, she walked the Founders through the pages to show and discuss potential features and layouts for the prototype. The Founders picked one to be used for principal "design direction." The site, www.iexplore.com, was described by Beth as "a really dense portal-like travel site" with a design layout that "was very rectangular, like a grid, with color blocks."

Putting Together the First Prototype

With their eight-page outline of the prototype, the Founders' detailed story and features list, and the desired look and feel of the site, Beth and Cynthia started to create the web pages. Over a period of a week, the two worked together in designing the eight pages of the prototype. Cynthia worked on two of the pages, while Beth worked on the others. Cynthia and Beth worked in the same bay with one or two other web designers, about 20 feet apart from each other. Periodically, they would go to each other's desks to see and discuss each other's work and make sure that significant new design changes were consistent across all eight pages.

With a common understanding of the general "look and feel" that the Founders wanted, both Beth and Cynthia knew what kind of general design

layout to apply to all pages ("block type style") as well as the kinds of colors to use (blue). In addition, because 5 of the 8 pages were "internal pages" (web pages belonging to the same web site - in this case, the special event's web site), they all had an even more specific common layout: the navigation bar was to be on the right hand side and the logo, along the top. With a general layout in mind, they started to design the graphical appearance of various features (e.g., the look of the "looking for an event?" section, the section displaying "recent news" items, the "fundraising center," etc.).

This was Cynthia's first time designing a web prototype. Cynthia became involved with the Incubator only a few months before, when she joined one of the Incubator's member companies right after college to work as a content developer (essentially writing copy for the member company's web site). Although the member company closed down after six months, she was able to witness during that time the development of the startup's prototype and the work practices of web developers. Thus, although Cynthia was "familiar" with how a prototype was put together, she "had never really sat down and looked at other web sites and thought about their design and stuff like that."

Before designing her pages, Cynthia looked through several web sites recommended by Beth and talked to Beth and another web developer in the bay about various ideas. Cynthia explained part of the process:

> Beth sent me to look at a whole bunch and I just sort of looked around and looked at stuff. I mean a lot of it was either just looking at other sites and sort of building off of their ideas or even like an exchange between talking with Beth and getting ideas or talking to [another colleague] and getting ideas from him. So I don't think if you sat in isolation you would be able to build a site like that. You need to talk to other people to get their feedback.

Cynthia also searched several online stock photography databases to find photographs that she could use for the prototype. During one of her searches, she found a series of photographs of hands that struck her as "perfect" for DotOrg's "homepage" (the second page of the prototype was DotOrg's homepage). She downloaded the images from the stock house ("image bank") and incorporated them into her design. When the prototype was previewed at

the Incubator, people reacted especially enthusiastically and emotionally to this page, and commented on how much they "loved those hands." A few weeks after designing the page, I asked Cynthia why she had chosen those hands and she commented:

> I was talking to [Beth] about this about why you pick whatever pictures you picked to put there. I guess they were probably like somewhere in the back of my head reading what I read about their company and knowing they wanted to be safe and secure, probably affected the types of pictures I chose but I am not sure how conscious that was. I mean I knew I wanted it to seem safe but I wasn't like 'Well in order for it to seem safe, I need to get hands that are doing this...' [...] I thought that I wanted to have somewhere like people holding hands maybe or something like that because that seemed like teamwork and safety, so I did a search action on a stock photo site for hands and I found one set of black and white hands that looked really nice. So I just kept searching through until I picked four that looked good and that's how those four hand pictures actually ended up on the site.

While working with the list of features that the Founders wanted in the prototype, Beth and Cynthia also included some additional features as they created the prototype and decided where and how all the features would relate to each other. Consequently, the site, including the final feature set, emerged as it was being designed. As Cynthia commented:

> I mean, a lot of the stuff that we decided to put on the [prototype] was sort of ... [Beth] and I would be there trying to decide well, where would you go from this page? We were sort of building out how this site would work just from while we were sitting there working on the [prototype].

For example, there was one page, in particular - the "NPO Administrator Page" - that initially was not clear to either Beth or Cynthia. As Cynthia explained:

> For some of the pages it was obvious from the beginning what would be on them. But then there was one, like the NPO administrator [...] where I don't think they knew for sure what they wanted and so it sort of became more of a dialogue between us and [DotOrg] and we'd suggest things and they would say 'Oh, that's a good idea' and just sort of throwing in a few more things for what they wanted on the page.

In designing the NPO administrator page so that it would seem attractive for the prototype, Beth and Cynthia essentially designed part of DotOrg's service.

Another example of this was the development of the "contact management center." One of the goals of DotOrg was to make it very easy for participants of special events to send e-mails to friends, family, co-workers, and other potential sponsors, and then to keep track of how much money the participant had helped bring in to the cause. Beth and Cynthia decided to group these features together in a single page, referred to as the "contact management center."

Putting Together the Second Prototype

On August 23rd, 2000, after working on the prototype for a few weeks, Beth and Cynthia presented to Margaret and Natasha their latest version of the prototype for review. This presentation was the first time that the sisters had seen a prototype of the web service. The prototype consisted of eight screen shots - web pages written in HTML and designed using the graphics program, Photoshop, to give the viewer the sensation of visiting an actual web site (e.g., the pages included "live links," which, when clicked, would take the user to a new web page). Beth and Cynthia walked Margaret and Natasha through each of the eight pages, organized in the order that they would be shown during a presentation - more specifically, they were organized around a fictitious story that Margaret and Natasha had supplied earlier of how a special events participant, "John Jackson," would use DotOrg's service.

As Beth showed the Founders the prototype, she would either take notes on changes she wanted to make or make the changes right away in front of the Founders. An example of the latter occurred when they were viewing the first page, the homepage of the Association for Breast Cancer Awareness (ABCA), a fictitious nonprofit created by Beth and Cynthia that was organizing the (also fictitious) special event, the Pink Ribbon 10K. Graphically, the first page was laid out in three horizontal rows. The top row took up the least amount of space and consisted of two logos or "buttons": in the left hand corner was the logo for ABCA; and in the right hand corner of the page was a "Run the Pink Ribbon

10K!" button, that, when pressed, would take one to the special event home page. The center row took up the most space and consisted of four large black and white images, each linked to sections targeted to particular audiences (e.g., "patients & family," "donors & sponsors," "public & press," and "researchers & professionals"). The bottom row consisted of a "News" section, with information on the nonprofit's mission statement, relevant news items, and a "find your local chapter" feature. The primary goal of the page was to highlight how the DotOrg-enabled aspect of a special event (the online presence of a special event) could be integrated with a nonprofit's website (e.g., The Pink Ribbon 10K home-page was graphically consistent with ABCA's homepage). During the preview, Beth asked the Founders: "So the goal of this page is to make the Pink Ribbon button stand out the most. Any thoughts or feedback on that?" The Founders felt that the Pink Ribbon button could stand out a bit more, so Beth highlighted the images of the middle row and lighted them slightly so that the Pink Ribbon button stood out more in contrast. Her first correction seemed too light (it became too difficult to see the images) so she darkened the section a bit more, until everyone thought it was well balanced with the Pink Ribbon button. She then explained that she would continue to "play with it" later on.

As they were looking through the homepage for the ABCA Pink Ribbon 10K, Beth asked the Founders whether there were too many or too few features present, particularly since she had transferred some of the features originally on the DotOrg homepage to other pages later on in the prototype. Beth realized that it was difficult for the Founders to answer such questions without having seen the entire prototype and having more time to think it through, so she told them that she would simply print out in color each of the prototype pages so that the Founders could look at them through in the evening and give her feedback the following day.

Throughout the preview, Beth would show the Founders where she needed more or different copy from them or guidance on what to add or eliminate. As the Founders were discussing these potential future changes with Beth and Cynthia, Beth suggested that at the conclusion of the project, she would give the

Founders the original files and graphics, so that the Founders could edit them as needed, as they learned about what was necessary and/or unnecessary to include in the prototype:

> Yeah. I think one of the things we can do is when we deliver this to you, we'll also give you the Photoshop files so that if you want to make changes to it as you further define what functions that you want to add, you can, you'll have the ability to do that, assuming you have Photoshop. So that way we're not just giving you this thing and be like "Good luck" and everything changes. Because it's so fluid. [Like] just in the past week, when we think of things. Oh yeah, I like that! So I'd like to give you the opportunity to change this if you want.

After viewing the prototype, making a few changes to it, and discussing future changes, the Founders were exuberant: this was the first time they had seen a concrete representation of their dream and seeing it in that format made it seem like they could really accomplish their mission. Natasha liked it because the pages that WebStrategy had developed seemed too "busy" to reflect on:

> The only previous impression that I had of what it would look like was from WebStrategy sessions where they had everything laid out all on a page [...] And even though every once in a while there would be a drop box, they had a lot of stuff going on. So in my mind, it was kind of busy. But [Beth and Cynthia] did a good job of making it simple and not intimidating the people and making important things stand out [...] [The prototype] captures a lot of the tools and it does it in a fun way so that you want to look around.

The prototype was shown to others in the Incubator and generated a great deal of enthusiasm and support. Beth remarked to me:

> I was really surprised by the response. [The prototype has] created a real visceral response from people seeing it. I think part of that is because people have been talking about it so much and I think for this specific client, they've been really struggling with defining what they were going to do all summer. It's been a real challenge for them. They've had a lot of people telling them what they think they should do. And I think finally they were able to pick a direction and really communicate that direction to people. And I think that it created a real visceral response. It was like "Finally we have something to show for this really frustrating process of trying to get on one path!"

Cynthia also shared her thoughts on why this was so:

> I think that until then, it's just an idea and it's hard to be believe that something like that could really exist. Because then once I actually see it and it looks pretty much like something that functions, even though I know it doesn't, I think that helps a lot. And just actually seeing it in front of you is a good way to generate more ideas about what you want.

The effect of having a concrete representation of one's efforts to reflect on what one had accomplished and what one could do next was significant during the development of the prototype.

6.4.3 Part III: Using and adapting the prototype

Once Beth and Cynthia completed the general web prototype, the Founders used it to explain to others what it was they were trying to accomplish. For example, they used it to pitch DotOrg to the head of web development of a well-known consulting firm and solicit from him recommendations for developing DotOrg's technological infrastructure. They also used the web prototype to acquire their first customer, and in the process, further develop DotOrg's technological infrastructure. This section describes that process.

A few days after Beth and Cynthia debuted the latest version of the prototype, the Founders of DotOrg met with the founders of the Good Cause Foundation to explore the possibility of having the nonprofit become DotOrg's first customer. The Good Cause Foundation (GCF) was a nonprofit well known within the local area. Its fame was due in large part to two factors: the organization was headed by a sports celebrity; and each year, it organized a festive 5K run, called the Good Cause Run, to raise money for several local charities. GCF was first identified as a promising "beta customer" (i.e., first customer) in mid-August. At the time, in an attempt to identify potential beta-test sites, Brenda, a student intern volunteering for DotOrg, had started compiling a list of local special events occurring in the Fall and Winter. I was asked to look at the list and see if any special events seemed especially promising beta customers. Looking through the list, I noticed that the GCF held The Good Cause Run in mid-December, and though they didn't discourage participant sponsorship, they did not encourage it either (instead, their application form simply requested that participants pay an

application fee). I pointed out to the Intern and Founders that the Good Cause Run would be an opportunity to illustrate how DotOrg could be used to enable NPOs to have participant sponsorship, rather than a way to illustrate the current pitch (i.e., that using DotOrg would increase the revenues of those special event that already had sponsored participants). There was some hesitation at the idea of approaching GCF because it wasn't clearly illustrating the current value proposition. The Intern was most enthusiastic about the idea, even though she too had initially overlooked the Good Cause Run because they didn't yet have sponsored participants.

A few weeks passed and soon the Good Cause Run seemed more and more attractive to those at DotOrg, given it was a well- known/high-profile run and that it was far enough away in the year to be feasible.[16] But given all the other things that the Founders were juggling (whether to pursue another prestigious nonprofit, funding, developing a prototype, etc.), they began to lose their focus on securing a beta customer. At this point, I was only at DotOrg two to three days a week. During one of my days at DotOrg, I asked the Intern about the progress in securing a beta customer. She expressed frustration that she had too many things to do before she felt she could call any of the nonprofits on the list and, in general, was hesitant to call GCF because she felt under-prepared and nervous. Before I left I suggested she call GCF and set-up and appointment to meet with them.[17] Within an hour, the Intern had called and set up a time when DotOrg could introduce itself to the GCF and explore whether or not The Good Cause Run would be a good beta site.

The following week, on September 1, Natasha, Margaret and Brenda went into town for a brief introductory meeting with the heads of GCF. Because the

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[16] One of the things that had been realized by then, for example, was that events in October and November were too early for DotOrg to realistically develop a beta for.

[17] Specifically, I said something to the effect: "GCF seems like it would be a promising beta customer. Why don't you give them a ring?" Although my very presence at DotOrg had a minor influence on the work practices of the participants I was observing, I did my best to avoid being too influential. In addition, although I believe the Intern would have eventually called GCF, I believe I accelerated her doing so. I highlight this exceptional influence of mine because to my knowledge, it was my most significant influence.

purpose of the meeting was simply to introduce DotOrg and learn more about GCF and the Good Cause Run, they decided not to bring the prototype. The GCF was located at an athletics store owned by the founder. It was there that the three women met and talked with GCF's founder and his brother, Ed, who was the key person in charge of managing the Good Cause Run. The brothers were quite interested in what DotOrg had to offer and welcomed the proposal that DotOrg return in a few days to discuss in greater detail the possibility of working together. The meeting was brief (as anticipated) and successful. Afterwards, the Founders felt the meeting went very well - in large part because the brothers were extremely friendly and their personalities and interests complemented those of the Founders. They liked Ed's eccentricity ("his beard and mustache [were] wild," because his mustache stuck out from the sides past his ears) and the fact that the brothers "didn't take themselves too seriously" (both had emphasized that first and foremost to the Good Cause Run was having fun). They were struck, however, by the fact that GCF was quite disorganized about the Good Cause Run: the brothers had shown them all of last year's registration forms, piled up in a box in a back corner of a cluttered office; they had nothing entered in any database; they still were trying to secure sponsors for this year's run; they had yet to design, print, and mail-out the registration forms; and they were trying to figure out where to hold the post-run party.

After the meeting with the GCF, the Founders met with several people from Incubator (including their Advisor and members from the IPD team responsible for building out DotOrg's Internet-based service) to prepare for their next meeting with GCF. Participants discussed strategies for convincing the GCF to become their first customer, among them, showing the web prototype. Although everyone thought the Founders should definitely show the web prototype (and that a representative from IPD should be at hand in order to answer any technical questions that could emerge), some warned the Founders that if they were to show the latest eight-page prototype, they could run into the problem of having the nonprofit want all of the features. As one explained:

> One thing that you'll probably encounter is that they're like "Oh, I love all of it!" So I think it's going to be really helpful for you to guide [GCF] and really come in and say "We're not ready to build out our entire product but we have some features that we'd like to build out and use with you and we're convinced that we'll make a difference. And here are the features." And you can talk again, like high level, like this feature will help people with registration process. You'll be able to take donations on line. There will be some personalization of this concept page, etc. And I would definitely use the [prototype] to kind of illustrate it. But I just would want to be real clear to [GCF] so that... because I want to maintain [their] expectations so that there's no "I thought I was going to get this blue page with all these buttons." Because there are people that, when they're not on the web all the time, they kind of take things literally. And so be as clear as you can.

By the conclusion of the meeting, the group decided that rather than simply show the prototype to GCF and ask them to choose the most attractive features in the prototype (an option that may have resulted in a collection of features that may be too costly and time consuming to develop[18]), the Founders would present the prototype to the GCF, highlight a pre-selected collection of features, and then see whether or not that set seemed attractive. As one advisor commented during the meeting:

> [I] think you do have an agenda here. And it's going to be a situation where instead of the client coming to you and asking for your help, you're going to say "Here are the things that we can provide you with. Help us understand which of these things are more valuable to you and which you would prefer to have."

The group now regarded the next meeting with GCF as both a "buy-in meeting," where they would try to secure GCF's participation, and a "fact finding mission," where the Founders would seek to develop a clearer understanding of which features would be more critical than others.

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[18] In part, because the exact cost of each feature was still unclear. One of the difficulties the Founders had was determining how much it would cost to build a basic service for a beta customer because they did not have a itemized list of how much a particular feature would cost. Natasha asked the technical advisors at the meeting whether or not there already existed components written in the programming language Cold Fusion that could be used in constructing the actual service. None of them knew whether or not any existed. By the end of the meeting, they agreed that the Founders had to develop a list of the features that were most important to DotOrg and from there, work with IPD to estimate the cost of building that.

A few days later, on September 7, Margaret, Natasha, and Debbie, the key person from the Internet Product Development Group (IPD) in charge of eventually building DotOrg's Internet-based service, went to the GCF to show the web prototype to Ed. Before arriving at the GCF, the three women had lunch near the GCF office to discuss their general approach to the meeting. Debbie once again explained that the team should emphasize that the prototype was simply a Utopian vision. She and others were concerned that in seeing the prototype, the GCF would want everything that was featured in the prototype, when in reality there was not enough money or time to develop a beta that included all those features. After lunch, the women met with Ed to show him the prototype. As Natasha took the lead in walking through the prototype, it became clear to the DotOrg team that Ed knew very little about the Internet or what it could do and that many of the web-based features that the Founders had discussed during the first meeting were only now beginning to make sense. As Debbie noted afterwards, Ed didn't seem to have any preconceived notions about what he needed from DotOrg because he didn't know much about what the Internet could do. The Founders noted that Ed and his brother seemed to be so informal and basic in how they executed the Good Cause Run that much of what was featured in the prototype was perceived as unfamiliar and not apparently relevant. DotOrg left the meeting unsure as to whether GCF was committed to working with DotOrg and whether DotOrg even wanted to work with GCF.

On the following day, the Founders met with the IPD team assigned to help DotOrg build its service and to figure out how to tailor the prototype such that it was more attractive to GCF and determine what services DotOrg could realistically offer, given the time and monetary constraints. Five days later, Cynthia had edited and customized the web prototype to GCF's Good Cause Run. She accomplished this in several ways, including creating a web page for the Good Cause Run, using images from a crude web page that was set-up for the previous year's Good Cause Run, and substituting the ABCA Pink Ribbon 10K homepage with it; and replacing the ABCA homepage with the GCF's homepage, also taken from the web.

On September 13, the Founders went to GCF for a third time to present to Ed the customized prototype. They were also hoping to meet John, the key person in charge of handling the logistics of the Good Cause Run as well as the person who had designed GCF's homepage and last year's Good Cause Run homepage, and have him become the key contact between DotOrg and GCF. As Natasha recounted to me a few days later:

> We had decided to keep expectations low, with the main goals being i) hear and then address Ed's concerns and ii) get connected with [John]. We also hoped to engage Ed in this project by showing him the revised [GCF] prototype. We set up the laptop and put together 3 press release packets containing info on [DotOrg], [Greenhouse], and other articles for Ed, Frank, and others at the store. They hadn't seen this information before, and we believed that it would lend to our credibility.

At the previous meeting, Ed had mentioned that before the Founders returned to show the customized prototype, they should call to make sure his brother would be there as well. The Founders "couldn't waste time waiting for a meeting with [the founder of GCF]" and so simply showed up after lunch at GCF with their laptop and press packets.

Ed was busy with a customer when the Founders arrived, so they looked over some of the running gear, commenting to each other on how they wished that they could get into running. At that point, John approached and asked how they were doing. They discussed running and Natasha's "problem feet" and Jason did an evaluation on them as Natasha took off her shoes and walked around. While Natasha was barefoot, Ed joined the group, having just finished with the customer. Margaret and Natasha explained that they wanted to start running so that they could participate in the Good Cause Run. Ed and John offered to show Natasha some shoes that would suit her feet. While she tried on four pairs of shoes, Ed and John shared memories of the Good Cause Run with the Founders. Ed also offered to give Natasha a good discount on a pair of shoes that she was obviously very fond of and showed her some proper stretching techniques.

The Founders checked the time periodically throughout the shoe discussion and found that they were still "on track" for a 4PM meeting at the Incubator. Anticipating a lengthy meeting at GCF, Margaret and Natasha had already canceled a 3pm meeting at the Incubator before arriving to GCF. As Natasha explained to me afterwards:

> We had learned from past meetings with these guys that 1) you can't rush them and 2) they need to trust you. So we didn't consider any conversation a waste of time, but rather part of the relationship building process or the hand holding that most of these small nonprofits will expect from us.

With her new pair of shoes in hand, Natasha walked into the back room of GCF with Margaret to show Ed the prototype. They had planned to show him the prototype and then share certain points with him in a certain order: express the benefits to both parties; state exactly what tools DotOrg would offer (i.e., online registration, online donation, e-mail solicitation, and simple reporting) and what DotOrg expected from GCF (liaison and official approval to process GCF funds); hear and then address Ed's concerns; and, finally, ask him specifically if DotOrg could help them with this year's Good Cause Run.

As with the past two meetings, there were several interruptions as the Founders went through the prototype and discussed the points they wanted to get through. For example, as they started on the first page, a salesman from an electronic payment company arrived to meet with Ed. Ed excused himself for a minute and then returned shortly because they needed to view a prototype via the Internet. Ed introduced him to the Founders as "this guy who wants to sell me something." Coincidentally, Margaret and Natasha had had a meeting earlier that same day with Debbie about online payment processing. As such, they were able to ask the salesman payment processing related questions with respect to GCF. Ed sat back in his chair and smiled, saying "I'm just amazed that she's able to ask you questions about all of this." As Natasha recounted:

> All of a sudden, we had become tech experts for GCF. Ed even pulled out a digital camera in a box and said "why don't you take this with you and see if you can figure it out."

After the salesman left, the Founders continued to show Ed the prototype. They used stories that GCF had shared about some of their past participants as talking points on how they could customize the content for the event page (e.g., spotlight on winners of the costume contest, letters from past participants, etc). Ed liked the flexibility of the customized content and the payment processing options (i.e., periodic transfers versus bulk transfer).

While they were on the events page, John came in briefly and said he liked the fact that information seekers could go straight to the Internet for answers on the Good Cause Run. He said that they receive so many repeat calls asking for this same info.

Ed's brother called during the meeting. While he was talking to Frank, he mentioned that Margaret and Natasha were meeting with him. They were described as "the ones who were helping with the website and the Good Cause Run." Margaret took this opportunity to call Debbie on Natasha's cell phone to reschedule their 4pm meeting with her.

When they arrived at the fourth and last page of the prototype the Founders stressed their interest in providing the services illustrated in the prototype for the Good Cause Run and asked if he had any concerns. Ed responded "No, not really," and proceeded to tell more stories about past Good Cause Runs and his family's history. Attempts by the Founders to steer the conversation back to DotOrg were only met with general comments about how DotOrg seemed like a good idea to him. As meeting seemed to come to an end, the Founders packed up their things and slowly headed for the checkout counter. At the counter, they asked Ed point blank, "Can DotOrg help you with this year's Good Cause Run?" He looked at them and replied, "Sure, I don't see why not. It seems like you're already helping us out. You should just talk to John." The Founders were relieved. Ed also became more enthusiastic about other possible collaborations with DotOrg regarding new races to benefit other local charities. He packed up the shoe box and digital camera into a bag for the Founders and said that they could take the shoes "on the house." They thanked him profusely and said their goodbyes.

The customized beta seemed to have significantly helped Ed understand what exactly DotOrg was doing for The Good Cause Run. After the meeting the Founders felt that if DotOrg could successfully implement its service with GCF, they could help any NPO, given that GCF seemed to be significantly lagging in the use of the Internet.

Several days later, the Founders returned to GCF to show the web prototype to John. The web prototype impressed him immensely. When the Founders returned to their offices at Greenhouse, they found an enthusiastic voicemail from him praising their work and volunteering to be the key contact person between DotOrg and GCF. With the key players from GCF on board, the Founders and IPD team focused their attention on building DotOrg's service. The customized web prototype was used as a representation of what they were trying to achieve and consequently, was used to guide the process of developing DotOrg's service.

It is clear that the prototype was critical in securing GCF's participation and it also served as reference point around which DotOrg's service could be discussed and developed.

6.4.4 Summary of Developing a Web Prototype

In August, the founders decided to develop a web prototype of the service they imagined providing to nonprofits. The prototype was essentially a collection of web pages, put together as a walkthrough of the service, from the point of view of different users. For example, it included screen shots illustrating what the service would look like from the point of view of someone participating in a special event, as well as screen shots illustrating what the service would look like from the point of view of an event manager. The overall process of creating and adapting the web prototype was structured in a manner similar to projects that Beth had worked on before and according to a "look and feel" that was defined collaboratively between Beth, Cynthia, and the Founders. To construct the first web prototype, Beth and Cynthia drew on, among other things, the funding pitch document created by the Fellows, stories

of imagined user experiences developed by the Founders, images downloaded from the web and an image stock house, and computers to communicate among the team members, write the html code, and in general, piece together the prototype. When the prototype was complete, the Founders used it during a meeting with a potential customer. The meeting seemed promising but no firm agreement was reached and it was clear that the potential customer was not very familiar with the Internet and did not seem convinced that DotOrg's service was valuable. The Founders and the web developer returned to the Incubator and worked together to adapt the prototype to include images and information about the customer's special event, thus tailoring the prototype to the customer. The Founders arranged another meeting with the potential customer. From this meeting, the customer agreed to use their service and the prototype became the basis for developing the real service. All of this occurred over the period of a month.

6.5 *Improvising at DotOrg*

During the first six months that DotOrg was at the Incubator, those involved with the nonprofit Internet startup were engaged in numerous inter-related creative projects, such as assembling a board of directors, developing a funding pitch, putting together an application for legal status as a nonprofit, constructing a web prototype, and building DotOrg's services for use in the Good Cause Run. The improvising framework I presented in Chapter 3 provides a helpful lens from which to examine what these people did as they innovated, particularly for highlighting core activities that constituted the process of innovation within each project (i.e., understanding what they did to accomplish various projects), comparing the process of innovation across different projects, and examining the roles of technology - particularly emergent artifacts - in the process of innovation.

Table 6.3 examines several of the innovations that I described in this chapter from the perspective of improvising. Two of the innovations I focused on - the funding pitch and the web prototype - involved several other innovations. For

example, the process of developing a funding pitch involved DotOrg's first business plan and required creating a shared understanding regarding DotOrg's viability. Integral to the process of developing the web prototype was the process by which Natasha made sense of the technical aspects of DotOrg, the process of constructing the first web prototype, and the process of adapting the first web prototype to the specific interests of GCF.

The examples listed in Table 6.3 could be regarded as examples of improvising because their core activities involved enacting structures while assessing continuously, creating resourcefully, and adapting extemporaneously. In what follows, I describe examples of each of these core practices.

6.5.1 Enacting Structures

Improvising is a structured process; it involves enacting structures that serve as templates that guide (but do not determine) the creative activities of actors. During the processes of developing a funding pitch and developing a web prototype, a wide range of different kinds of structures were enacted by participants to guide them through the processes.

For example, although the Founders had never created a business plan before, they structured the process of creating a business plan for the nonprofit business plan competition primarily according to the application for the competition, which listed a set of questions that required answering. In addition, they used business plans collected by Natasha, advice from Dino, and information garnered from the web to influence the course of their activities and the form and content of their business plan.

Throughout the process of developing a funding pitch, the Fellows and Consultants followed a "ghost-sliding process," as well as a set of guidelines for developing presentations. Part of the Consulting Firm's prestige, as with other well-regarded consulting firms at the time, was based on the fact that the reports and presentations that it produced - the key products of a consulting project - were extremely clear and well constructed. These reports and presentations were part of the Firm's identity which helped distinguish it from other consulting

firms. If one worked as a consultant for this Firm, one had to practice the Firm's particular method of presenting ideas. The Firm had an explicit and detailed process for developing presentations and reports, including a particular thought process that consultants had to follow to develop a presentation. The firm had invested a great deal of resources to ensure that anyone working on its behalf followed its guidelines for producing reports and presentations. These guidelines were spelled out in a 40-page document (titled "The Thought Process in [the Firm's] Reports and Presentations") that was similar to style-books designed to help the readers improve their writing. According to this document, reports and presentations were "conclusion-oriented communications that are essentially prescriptive." It described how to develop a "thought hierarchy" (where a governing thought is broken down into sub-governing thoughts and those are broken down even further, until all the important details are covered) and recommended, among other things, describing each idea in the form of a sentence (rather than, say, a key word) and as a dynamic assertion ("dynamic assertions are the secret of a tightly knit structure"). There were also specific guidelines regarding the development of introductions, conclusions, transitions, paragraphs, and sentences, as well as "pointers on style" regarding clarity, techniques for adding emphasis, and "the logic of Firm format" (i.e., guidelines for developing a proper outline).

The process by which the web developers created a new web prototype also involved enacting a variety of structures, including a collaboratively defined "look and feel" that would serve as a visual template for all the pages in the prototype; soliciting and developing a set of stories of how potential users would engage with the service; and finally, creating one or more series of pages that, together, made up a story of a fictional user. The process was structured such that the web developers co-defined with the Founders a set of more situation-specific sub-structures.

The defined "look and feel" structured the general layout of each web page and the stories structured the content of the web prototype, the development of features, and the arrangement of the web pages. The process was structured

primarily by Beth, in a manner similar to projects she had worked on within the Incubator and at her prior job. While developing the web prototype for DotOrg, Beth, at the request of her boss, was also developing explicit guidelines for developing web prototypes, so that others could see what the process involved.

The process of adapting the first web prototype into a prototype that better addressed the interests of GCF involved similar structures to those enacted during the process of constructing the first prototype. Specifically, in using the first web prototype to develop a prototype for GCF, the first web prototype served as an influential structural referent.

Participants also enacted structures of communication. Participants with backgrounds in consulting (e.g., the Incubator Advisor, Fellows, and Consultants) liked to structure their interests and concerns in the form of hypotheses. The Founders rarely subscribed to this form of structuring thoughts because they seemed to find it difficult to express themselves that way. The form of hypotheses seemed to complement the "fact-based" approach of the Consultants better than the "emotion-based" approach of the Founders. In contrast, the Founders found it much more natural to describe their interests and concerns in the form of a story. The Web Developers also subscribed to this form of communicating. Having a common form of communicating seemed to facilitate the interaction of the participants involved in the web prototype project.

In contrast to the processes of creating DotOrg's business plan, creating a funding pitch and constructing and adapting a web prototype, the process of creating a shared understanding or making sense of technical aspects of DotOrg did not draw on a set of explicit guidelines for how to go about. The way Natasha went about making sense of the technical aspects of DotOrg, for example, was similar to how she and Margaret went about collecting information for the business plan. She searched the web, went through tutorials, talked with others and observed their work practices. She also created representations of what she was learning (e.g., print outs, e-mails, a journal) and these served as tangible guideposts for navigating through unfamiliar waters. This process of learning

was one she had practiced before as she was learning about web authoring and as she was learning how to put together a business plan. It seemed that in making sense of the technical aspects of DotOrg, Natasha implicitly followed a similar process.

Finally, the findings in this chapter highlight the role of audience (i.e., for who was a group improvising?) as an important resource for enacting structures. Participants improvised for one or more audiences. Those audiences were sometimes imagined (e.g., a potential beta customer) and other times real (e.g., GCF) and the real ones sometimes witnessed the process and the results of the process (e.g., the Founders witnessing the work of the Fellows and the documents they produced) and other times simply the results of the process (e.g., GCF simply witnessing the prototype-in-progress). Each audience brought to the performance situation a particular set of expectations that influenced (whether implicitly or explicitly) what and how structures were enacted. In several regards, the role of audience during the process of improvising at DotOrg was similar to improvising in jazz, theater, and African American quiltmaking: the expectations of an audience influenced the process, whether there was an audience to the process (e.g., in jazz and theater improvising, where an audience pays to witness the performers in action) or whether there was an audience for the product of the process (e.g., a group of jazz musicians improvising for a recording for a CD, or a quiltmaker improvising a quilt to be used to keep a family member warm and as a mnemonic device for storytelling). Improvising at DotOrg shared an additional similarity with African American quiltmaking that was not apparent in jazz or theater improvising: improvising to multiple audiences, each with a different and potentially conflicting set of expectations.

Improvising consists of enacting structures that serve as templates for assessing continuously, creating resourcefully, and adapting extemporaneously. These three activities are described in the following three sections, respectively.

6.5.2 Assessing Continuously

Both the process of creating a funding pitch and the process of developing a web prototype involved participants continuously soliciting feedback to inform the creation of the emerging product. Throughout the process of creating her ghost slide packet, for example, Rachel solicited feedback from her Project Manager, her colleague Sophia, people at the Incubator, and the Founders.

Assessing continuously was also a principal activity during the process of developing a web prototype. Throughout it, the web developers collected feedback from the Founders and GCF and in response, adapted the emerging web prototype. One of the first things the web developers did, for example, was collect stories from the Founders on different user scenarios, and use them to put together an initial version of a web prototype. As the web developers constructed the web prototype, they would ask the Founders for feedback to make sure the prototype was what the Founders had in mind. Later on, the web developers and the Founders visited GCF several times to learn about GCF's interests and concerns. As they did, the developers would change the web prototype in an attempt to make it more attractive to GCF.

Assessing continuously is about letting the situation inform the creative process throughout the process. In both the examples of creating a funding pitch and developing a web prototype, participants assessed the situation continuously to try to make their innovation more attractive to a specific audience.

6.5.3 Creating resourcefully

Closely related to the practice of continuously assessing the situation are the subsequent practices of making the most of what is available and adapting the emerging production to changing circumstances. Creating resourcefully is essentially about making the most out of what is available to piece together a production. An interesting aspect of several of the examples of improvising that I observed was that in the beginning, participants spent a great deal of time collecting information on how to go about accomplishing what they wanted to accomplish. One of the first things that Rachel did to develop a funding pitch,

for example, was talk with several people at Greenhouse and consult materials gathered from the Consultant company and her MBA classes to see how to adapt the Consultants' general ghost-sliding process to a nonprofit startup. Similarly, before Natasha managed the development of the web prototype, she talked with several web developers, investigated several different websites, collected material from a variety of sources, and participated in a two-day session with WebStrategy to develop a better understanding of the technical aspects of DotOrg. During the first nine weeks with the Fellows and Consultants, Natasha and Margaret considered numerous different potential business strategies for DotOrg before deciding to stick with their original vision. Finally, one of the first things Beth asked of the Founders was a set of stories describing imagined user experiences. In these cases, before creating anything, participants spent time gathering information on and learning about a variety of potential ways for accomplishing what they sought to create and about the expectations of their audience. Sometimes, when a general structure to guide the process already exists (e.g., the Consultant's ghost sliding process, the web developers' process for developing a web prototype) information gathering was part of assessing the audience to get a better understanding of their expectations. Other times, participants were striving to piece together a general structure to guide the overall process (e.g., Natasha trying to understand the various ways that DotOrg's Internet-based service could be built). In all these cases, participants began the process by piecing together a basic understanding of the project and possible ways to go about putting it together.

Although the beginnings of these improvisations differed from the beginnings of improvisations in jazz and theater, they were similar to the beginnings of African American quiltmaking. In jazz and theater, performances have a clear beginning and end. In African American quiltmaking, there were some cases where a quilt was not started until enough scraps of cloth had been collected. In other cases, when there was a demand for a quilt (e.g., an approaching winter), the quiltmaker had to gather whatever scraps of cloth and

filling were available and decide on a general pattern, before sitting down to begin stitching together blocks.

In addition to piecing together a production from what was available, the Founders of DotOrg felt they had no other option but to be resourceful. This was due, in part, to a paucity of financial resources, uncertainty regarding what few resources existed (e.g., it was not clear how much was actually available to DotOrg nor how much DotOrg needed to stay afloat), and a general frugal approach to living practiced by the Founders. Neither Margaret nor Natasha received any salary from DotOrg; both were simply living off of their own savings. Margaret, the one responsible for handling DotOrg's finances, was particularly consumed with financial worries and was always on the lookout for cost-saving opportunities.

Within a few weeks of joining Greenhouse, the Founders began discovering that several of the services that they believed were part of the winning package had never been fully secured. During the following two months at Greenhouse, the Founders struggled to diplomatically make sense of what resources were available to them and what they owed to the Incubator. Several people at the Incubator helped the Founders work around these uncertainties by offering their services at a discount or on a voluntary basis, "after work hours," and by helping them brainstorm alternative ways to secure promised resources.

The DotOrg business plan, funding pitch, and web prototype were all pieced together from material that was available for free or at a very low price. For example, the web prototype was pieced together using images from a stock house (acquired at a very low rate) and DotOrg's logos (designed pro bono by a web designer at Greenhouse). In creating a funding pitch, Rachel pieced together research that she and Sophia had already conducted, so as not to waste their efforts. Once team members had agreed that DotOrg's original business model was viable, the Fellows searched for ways to craft the data they had already collected into a story that supported the Founders' vision. As noted earlier, "data" was something that could be looked at more than one way, and "data" became an artifact that could be put to several uses. Finding new uses for

artifacts that already existed in order to not have them go to waste or in order to avoid spending additional resources, was a key practice at DotOrg.

In general, resourcefulness - specifically, making the most of what is available - is a highly valued skill amongst entrepreneurs and considered critical for survival. Stories celebrating entrepreneurship often include praise for how much he or she had accomplished with what little was available. In May 2002, for example, when the US Small Business Administration (SBA) named Thanh Lam, president of Ba-Le, Inc. & Dba Ba-Le Sandwich & Bakery, National Small Business Person of the Year, SBA Administrator Hector V. Barreto, praised his resourcefulness (SBA 2002):

> Thanh Lam is a true example of entrepreneurial success and of achieving the American dream. Resourcefulness and creativity have been key to his success. Small business must be innovative in securing their niche in a competitive market, and Thanh has clearly done that with his business.

Incubators were criticized in part because they were considered to be environments that did not encourage entrepreneurs to be resourceful. In contrast to Greenhouse, for example, which developed its office space using new equipment, DotOrg developed its office space recycling "trash." This spirit of resourcefulness extended to most of the Founders' work practices. The Founders tried to be as resourceful as possible and made the most of anything that was available as they struggled to make sense of their financial situation and stay financially afloat. Resourcefulness was not simply something that they had to practice, but it was also something that they bragged about as something that distinguished them from Greenhouse and the Consultants; their resourcefulness gave them a greater sense of being true entrepreneurs.

6.5.4 Adapting Extemporaneously

Adapting extemporaneously refers to changing the emerging production throughout the performance in response to changes in the situation at hand. Throughout the process of creating a funding pitch, for example, Rachel did not only solicit feedback from the Founders, but she also incorporated the feedback into the emerging packet of ghost slides. Similarly, throughout the process of

constructing and adapting the web prototype, Beth and Cynthia changed the emerging web prototype in response to feedback from the Founders and insights on the interests of GCF gleaned from meetings with them. In addition, in both cases, those responsible for producing the emerging production (e.g., Rachel and Sophia with regards to the packet of slides making up the funding pitch and Beth and Cynthia with regards to the collection of html pages making up the prototype) expected the Founders would continue adapting the production after they handed it off to the Founders and, consequently, made sure the final product was easy to adapt. Rachel and Sophia, for example, regarded the packet of slides that they gave to DotOrg simply as a key component of a future funding pitch and assumed that, depending on who was getting pitched, some slides from the packet would be changed, re-arranged, and/or removed.

The need to be adaptive and flexible in order to succeed was a theme promoted at the Incubator since its Liquid Launch Party - even the furniture was on wheels and the walls retractable. The Consultants and Fellows quickly discovered that their traditional consulting engagement process would have to modified to accommodate a greater amount of iterative adapting.

6.5.5 Comparing Improvising with Other Innovation Processes at DotOrg

Not all processes of innovation at DotOrg were examples of successfully improvising collectively. Two examples I will focus on in this section are the typical process of a consulting project, as described in the Fellow's training manual, and the first nine weeks of trying to develop a funding pitch ("creating a shared understanding").

Although neither the Consultants nor the Fellows practiced the typical consulting project process as neatly as depicted in the Fellows' training manual, it was an ideal that was part of the foundation from which both developed new strategies for accomplishing their tasks at DotOrg. It also serves as a useful contrast to what they actually did. As described earlier, the broad goals of a typical consulting project were to formulate a clear vision of desired change and develop an "action plan" for achieving it. A typical consulting project was

depicted as a set of consecutive phases, including a problem-solving phase that itself was an iterative process made up of defining the problem, collecting and analyzing data, and developing recommendations. Once the action plan was developed, change was "launched" accordingly. The consulting project fit within a broader view of change as planned.

Improvising presumes that the situation one is innovating in is unpredictable and dynamic. One approach to innovating in a situation that is changing unpredictably is to assess it continuously to see if any opportunities for potentially improving the innovation arise and then to try to make the most of those opportunities. These interrelated practices (i.e., assessing continuously, finding creative uses for whatever presents itself, and adapting extemporaneously) are core to improvising. In contrast, the process of planning and launching change represented in the training manuals of the Fellows suggested that the situation in which one was working did not change unpredictably. In such a situation, participants could first make sense of a situation, plan for a desired change, and then achieve the desired change by executing the plan. There seemed to be an assumption that the plan would not need to be changed in response to any circumstances changing unpredictably nor any indication that participants should be prepared to adapt to changing circumstances.

Consequently, if the Fellows and Consultants had practiced the typical consulting project process *as represented in the Fellows' training manual,*[19] the process would have been distinct from improvising in the practices of creating resourcefully and adapting extemporaneously (a typical consulting project was similar to improvising in that it was clearly structured and the "problem-solving phase" involved assessing continuously). In the typical consulting project, one first defines what one needs (forms a hypotheses) and then seeks the data necessary to prove or disprove it. Although at DotOrg, the Fellows and Consultants structured their thoughts in the form of hypotheses, they were

constantly changing them as they made sense of the situation with other team members. Hypotheses helped structure the sensemaking of an ambiguous and dynamic situation, but the sensemaking and the funding pitch were pieced together from the situation at hand - an aspect absent in the representation of a typical consulting project. Similarly, the only suggestion of adapting extemporaneously is during the problem-solving phase, but once an action plan is determined, it is assumed it will be implemented accordingly.

The Consultants and the Fellows quickly learned that their project with DotOrg was not going to be a normal consulting project, in part because the situation in which they were working was such that it was extremely difficult for them to develop a plan for a project before executing it. The situation was in flux in two respects: there were numerous critical aspects of DotOrg's organization (e.g., what was DotOrg's service, who were its ideal customers, etc.) that were only broadly defined and were shifting and, similarly, there were aspects of DotOrg's environment (e.g., competitive landscape, stock market) that were also vaguely defined and shifting.[20] Consequently, in trying to create a presentation of DotOrg, they were creating DotOrg. The process of developing a funding pitch was most similar to the iterative "problem-solving process" stage of a typical consulting project.

Another example of innovating was the first nine-week period of the process of developing a funding pitch. This period could be considered an example of a team trying to improvise but failing to, due to a lack of consensus regarding a key guiding structure: DotOrg's business model. Although the Consultants had a routine process for developing a funding pitch (i.e., ghost sliding), they did not

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[19] Based on conversations with other consultants, I suspect that in practice, a typical consulting project may have been an example of improvising.

[20] At Greenhouse, unpredictable change was expected. Throughout the time I observed DotOrg, it was typical for people at Greenhouse to remark on the changing nature of ideas and the need to be prepared to adapt accordingly. When the Founders were working with Debbie on building DotOrg's service for the Good Cause Run, for example, she asked them to develop a collection of walkthroughs. She acknowledged, though, that the collection would most likely change and that she was prepared to change the architecture accordingly, but regardless, it was helpful to start with something (as Debbie explained to the Founders: "This is not going to be an accurate representation of the product in two months... and that's okay!").

have a general business model that they believed in, and around which they could develop a pitch. During this period, team members debated whether or not DotOrg's original business model was viable and whether or not there were better alternative business models. Although everyone involved with DotOrg wanted the startup to succeed, there were two different notions of what it mean for DotOrg to succeed, which became apparent from the respective actions and prescriptive statements of those subscribing to them.[21] The Fellows, Consultants, and Incubator Advisor applied notions of success from the for-profit world to define success for DotOrg. They were focused, for example, on developing a business model for DotOrg that would generate enough money to be self-sustaining and dominate competitors. The Founders, on the other hand, defined success by how well they would accomplish their mission. They wanted to be as self-sustaining as possible, but most important, they wanted to help other nonprofits with special events. Each group was working off its own notion of success and consequently, each group was improvising separately, developing its own type of business model. It was as if members of a jazz band that had met to play together had split into three separate groups and ended up improvising off of a different song until a crisis forced them to agree on a single song. It was only when the team arrived to a shared understanding regarding DotOrg's business model, was Rachel able develop a funding pitch.[22]

Collectively enacting structures involves collectively re-constituting them in practice from rules and resources. In some cases, participants have relevant

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[21] In fact, more specifically, team members basically fell into three different groups: those advocating a for-profit startup business model (the Greenhouse advisors); those advocating a for-profit well-established business model (the Consultants); and those advocating for a nonprofit startup model (e.g., the Founders and web developers). These differences were significant to both what kind of business model was advocated (for-profit versus nonprofit) and how to go about developing DotOrg ("quick-and-dirty," as if DotOrg were a startup, or detailed and well planned, as if it was a well established organization). For now, I focus on the for-profit versus nonprofit approaches (e.g., strive to make money versus strive to accomplish mission). In the following chapter, where I discuss the role of identity in greater detail, I discuss the other aspects as well.

[22] In arguing that the first nine weeks were an example of the team struggling to improvise together, I am not arguing that it was wasted time. In the end, the team developed a common understanding that proved essential to the process of developing a funding pitch. In the following chapter, I

history that they can draw on and their practices complement those of other participants in such a manner that enacting a set of structures is routine and appears to require a minimum amount of effort. In other cases, however, participants struggle to collectively enact a set of structures because some may have little relevant history to draw on or there is little consensus regarding what to enact or how. In these cases, the process of coordinating a group of individuals' actions is more complicated, requires more effort, and requires that the collective, through trial-and-error and negotiating, piece together a collaboration. The effort to improvise becomes the foundation for the improvisation. The latter case is what occurred to participants at DotOrg as they struggled to create a shared understanding.

Given the ambiguous and dynamic nature of the environment, participants drew on their own histories to take what had worked successfully in the past and apply it to the current situation. Unfortunately, there was little synchronicity between the three general parties and each ended up improvising on their own, creating productions that did not complement the productions of others, until consensus was reached. During the first nine weeks, the group parties did not succeed at improvising a funding pitch because they struggled to improvise collectively.

6.6 The Roles of Artifacts in Improvising at DotOrg

Artifacts were integral to improvising at DotOrg. Figures 6.3 and 6.4 (following pages) illustrate how some artifacts were used throughout the processes of developing a funding pitch and developing a web prototype, respectively. The improvising process is depicted as a cone-shaped swirl, tightening around the center as it snakes around and up, to emphasize that it is an iterative process yet also structured. Artifacts are depicted as squares: small squares symbolize stable artifacts; and large squares symbolize emergent artifacts.

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describe how these first nine weeks could be seen as the team struggling to improvise an organizational identity and argue for the importance of developing such an identity to improvising.

Figure 6.3: Examples of artifacts used throughout the processes of developing a funding pitch

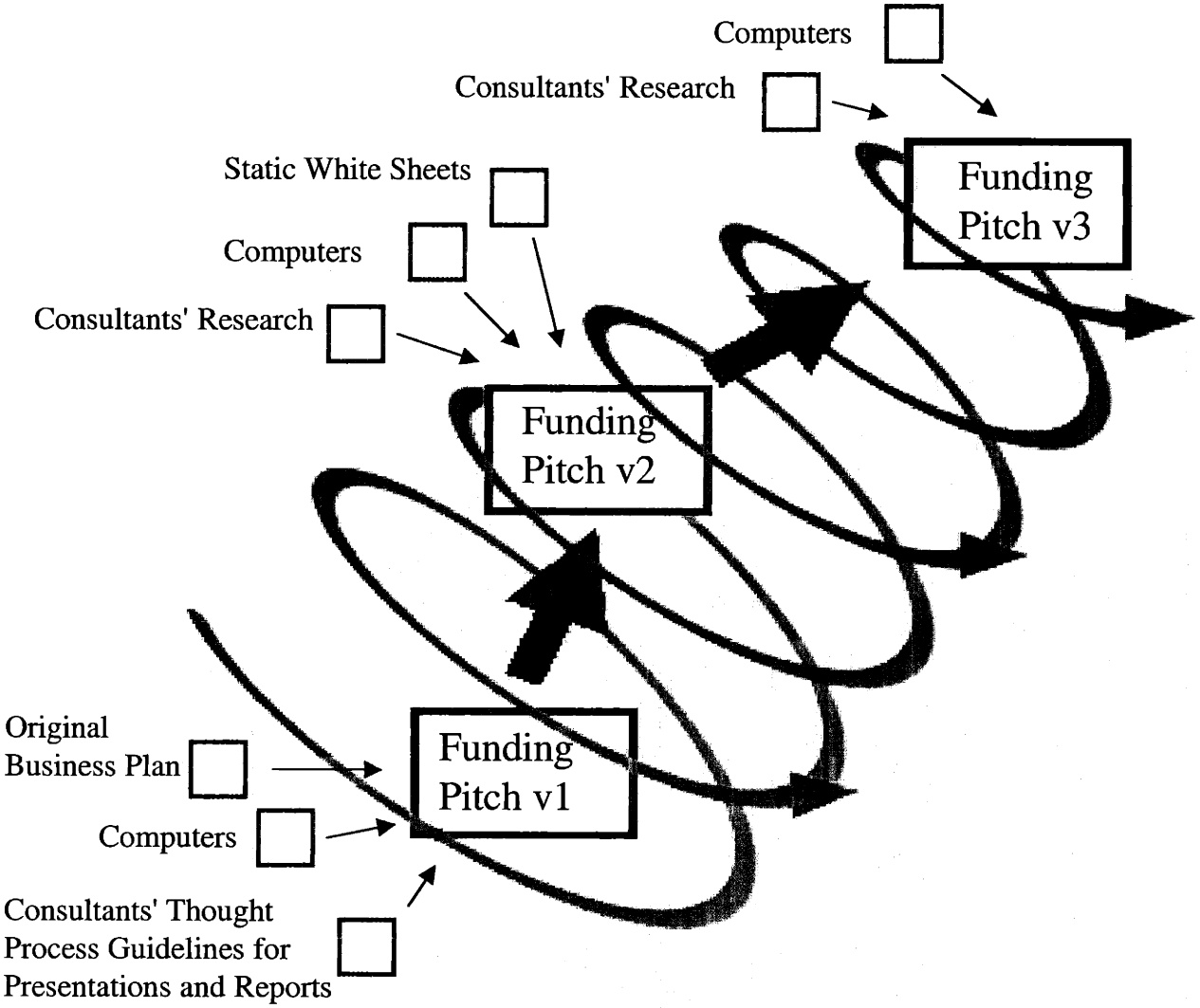
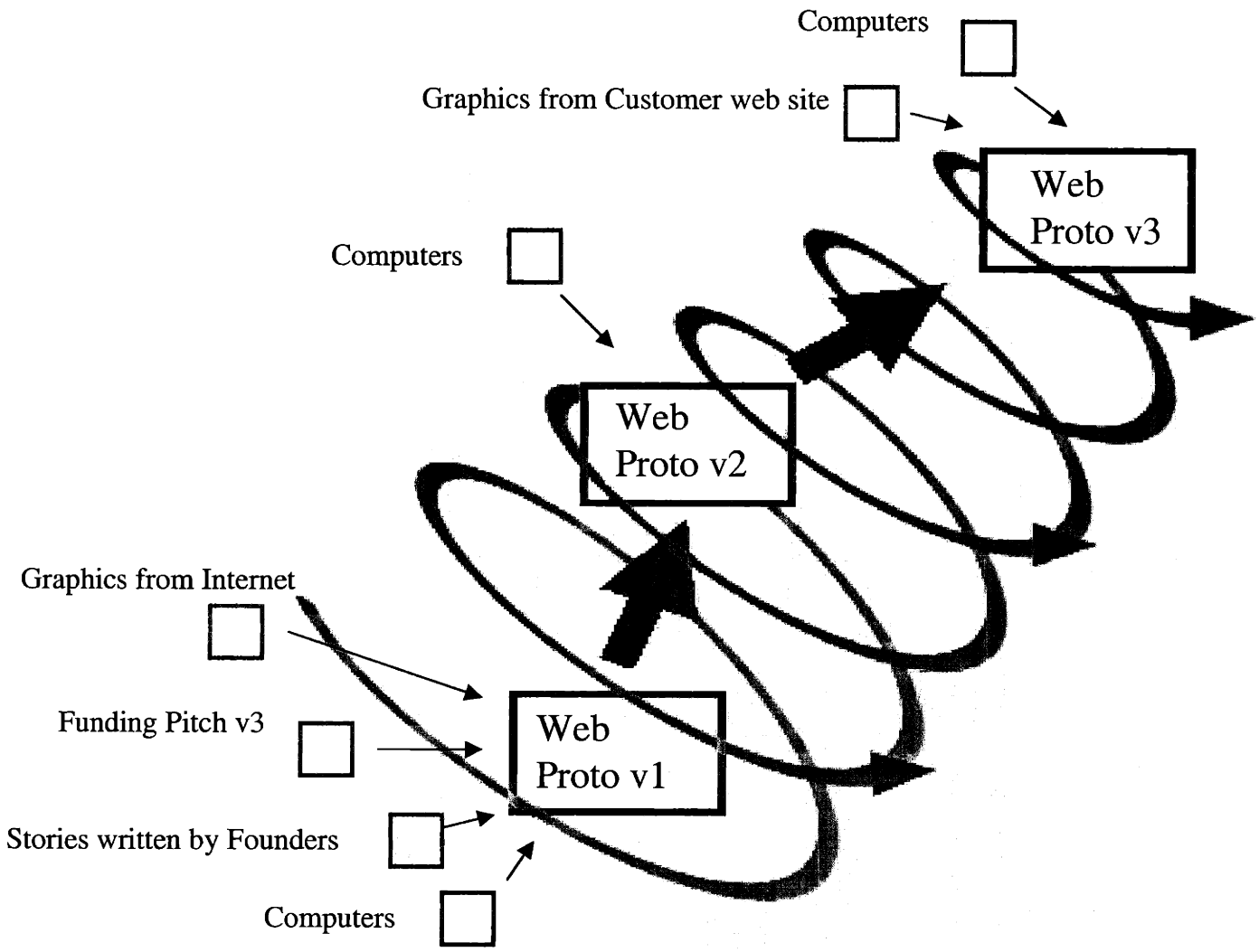


Figure 6.4: Examples of artifacts used throughout the processes of developing a web prototype



Both figures simplify the process (e.g., I only depict three versions of the emerging funding pitch when in fact there were six, and although many artifacts were used to develop each emerging artifact, I only highlight two or three) to make two broad points: different kinds of artifacts and different aspects of artifacts were used in a variety of ways throughout the improvising processes; and in particular, emergent artifacts were used to elicit, develop, and represent knowledge, assess progress (or lack thereof), bridge boundaries, and structure the ongoing process.

In developing the first version of the funding pitch, for example, Rachel drew on DotOrg's original business plan for content (since by this point, participants had agreed that it was a viable model for DotOrg) and the Firm's presentation guidelines ("Thought Process for Presentations and Reports") to structure the pitch, created hand drawn ghost slides using pen and paper to test ideas, solicit feedback, and make sure the emerging funding pitch was meeting expectations, and used electronic mail, instant messaging, cell phones, telephones, and fax machines to communicate with other team members (including the assistant at the Firm who translated Rachel's handwritten slides into slides formatted according to the 'look and feel' of the Firm). Rachel also attended several meetings at Greenhouse and at the Firm to discuss the structure and content of the slides and in these meetings, participants employed furniture to work comfortably, and white boards to write out and organize ideas. From these efforts, Rachel developed a version of the funding pitch that was about 16 pages ("Funding Pitch v1"). She then used this version to solicit more feedback and discuss and fine-tune a variety of aspects of the funding pitch, including making the most of the research she and Sophia had conducted earlier. During several meetings, static white sheets were used, in addition to whiteboards, to write out and organize ideas. The static sheets had the advantage that, after a meeting, one could keep what one had written down during a meeting in a conference room, take them, and put them up on the plastic walls of DotOrg's office. They had the disadvantage, though, that they were about a sixth the size

of a white board, and that they did not always stick easily to flat surfaces. After a few more meetings and working from Funding Pitch v1, Rachel developed a version of the funding pitch with 20 pages ("Funding Pitch v2"). A print-out of Funding Pitch v2 was then used as the basis of discussion during a subsequent meeting, where each sheet was laid out and overall themes identified. Participants used laptops to take notes, static sheets and two white boards were used to write out and organize thoughts and develop a new set of slides. After the meeting, Rachel used her laptop to search again through the research that she and Sophia had conducted, to find new data to support her arguments. When she was finished fine-tuning the latest set of slides, she re-wrote them by hand and faxed them to her assistant at the Firm, and followed up with a phone call to her. During the final team meeting, marking the conclusion of the Fellows' and Consultants' engagement, Rachel presented print-outs of the final version of the funding pitch (Funding Pitch v3).

Figure 6.4 represents the process by which the web prototype was developed, in a manner similar to Figure 6.3. Rather than describe Figure 6.4 in detail, I will note that in creating the first version of the web prototype (Web Proto v1), many different technological artifacts were used. Web Proto v1 was then shown to the Founders for feedback, and in response, the next version (Web Proto v2) was developed. Subsequent versions of the web prototype were much easier to develop than the first version and required fewer artifacts because they all worked from previous versions. Consequently, the role of the emerging prototype was very significant given it became an essential component of the subsequent version.

Figures 6.3 and 6.4 illustrate that technology was used in improvising at DotOrg not simply as a stable tool I used for practical purposes (e.g., the use of a laptop to communicate or create a PowerPoint presentation), but in several varied ways. Table 6.4 lists several examples of artifacts that were involved from the perspective of the framework on technology I presented in Chapter 3. During these improvisations, there were at least two general kinds of technologies: *stable artifacts,* which did not significantly change during the improvisation (e.g., the

Table 6.4: Examples of artifacts and associated uses at DotOrg

Artifact	Artifact-in-use	Kind of artifact	Primary role of artifact	Primary aspect of artifact used
computers	The use of computers as a communication tool and to maintain distance and proximity (e.g., instant messaging).	Stable	Tool	Practical
laptops	The use of a laptop to write Word documents in a cafe	Stable	Tool	Practical
walkie-talkies	The use of walkie-talkies to locate colleagues and to communicate.	Stable	Tool	Practical
pre-designed computer graphics (e.g., DotOrg logo, stock photographs, pictures from GCF website)	The use of pre-designed computer graphics as elements of a web prototype.	Stable	Component	Practical
furniture on wheels	The use of furniture from one office space in another space, so that more people could participate in a meeting.	Stable	Tool	Practical
furniture on wheels	The use of furniture to represent Greenhouse's philosophy (fluidity) and access to resources	Stable	Tool	Symbolic
ghost-slide packet (hand written)	The use of hand-written ghost slides to represent the process thus far.	Emergent	Product	Symbolic
ghost-slide packet (hand written and formatted)	The use of ghost slides to write down changes in pencil.	Emergent	Tool	Practical
web prototype-in-progress	The use of the web prototype-in-progress to solicit feedback.	Emergent	Product	Practical
placemat with original ideas for DotOrg	The use of the placemat to remind Founders original intentions of DotOrg.	Stable	Tool	Symbolic
static sheets (general)	The use of static sheets to write and organize ideas and to preserve and transport what was written.	Stable	Tool	Practical
static sheets with writing	The use of static sheets that had been written on to remind one of what had been discussed.	Emergent	Product	Symbolic
funding pitch	The use of the funding pitch to guide the development of the web prototype.	Stable	Component	Symbolic
web prototype	The use of the web prototype to guide the development of DotOrg's web-based service.	Stable	Component	Symbolic

walkie-talkies, furniture on wheels, computers) and *emergent artifacts,* which were created and adapted during the improvisation (e.g. the ghost-slides, the web prototype-in-progress). Both kinds of artifacts were used in three general ways ("roles"): as tools, where artifacts were used to construct the outcome (e.g., the use of computers for IM, e-mail, and creating Word documents); as components, where artifacts were used as components of the outcome (e.g., the use of graphic files to build the web prototype); and as products, where artifacts were used as outcomes of the improvising (e.g., the use of ghost-slides to represent latest version of funding pitch).[23] Each role involved at least one of two aspects of an artifact: practical and symbolic. Involving an artifact for its practical aspect refers to using the functional properties of an artifact (e.g., using a chair to sit on). Involving an artifact for its symbolic aspect refers to using the representational properties of an artifact, without necessarily depending on an artifact's functional capabilities (e.g., using a chair to represent status).

To better understand the role of technology as component, it is helpful to examine the use of picture files ("GIFS") to construct a web prototype and the use of a payment service as part of DotOrg's web-based service. When the picture files from the stock photography service were used to construct the web prototype, they were altered slightly to fit the particulars of the situation (e.g., there was some cropping, as well as some slight adjustments of colors, so that the picture "fit better" with the "look and feel" of the site). Even so, the pictures were essentially used in the same condition as they were when downloaded from the stock photography site. In this respect, the picture files were essentially stable artifacts that were used as elements of the outcome; that is, the role of the picture files was essentially that of component.

The clarity of the role of technology as component becomes more complicated, though, if one considers the role of technology in the process by

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[23] Another way to consider these three different roles is the use of technology as part of the process ("tool"), the use of technology as part of the content ("component"), and the use of technology as an outcome of the process ("product").

which DotOrg's web-based service for the Good Cause Run was developed. PayPal, a for-profit service that facilitated online credit-card transactions, was included as part of the site so that participants and donors could pay their registration fee and donate online. The PayPal component was adapted to fit in with the DotOrg service to ensure that any money collected via PayPal would remain associated with the Good Cause Run. These adaptations were a normal part of using the PayPal service and consequently did not change the nature of the service - i.e., PayPal essentially remained stable during its use. Thus picture files and PayPal were both stable artifacts used as components. Unlike a picture file, though, PayPal is an example of a stable technological component that itself performs a service. Thus, although PayPal is a tool for making online payments, from the point of view of one examining the process by which DotOrg's web-based service was created, PayPal was a practical component of the final product.

To better understand the role of technology as product, it is helpful to examine the use of emergent artifacts to represent what has occurred thus far in the process and solicit feedback on what to do next.

From the moment DotOrg was first conceived and those initial conceptions were written down on the back of the paper placemat/menu, emergent artifacts played a significant role in the development of DotOrg. Like an architect's napkin sketch that becomes the representative seed for the final building, the menu on which the original ideas of DotOrg were written down was kept by Margaret and used as a representation of what originally motivated the development of DotOrg. Similarly, throughout the processes of developing a funding pitch and developing a web prototype, participants created artifacts (e.g., ghost slides, static sheets with writing, the emerging web prototype) to elicit and develop new knowledge, assess progress (or lack thereof), bridge temporal and occupational boundaries, and structure the ongoing process.

In many respects, emergent artifacts were used essentially as boundary objects (Carlile, 2002; Henderson, 1998). Henderson (1998:146), for example, finds boundary objects (e.g., prototypes) are used for eliciting and capturing ("conscripting") tacit knowledge, garnering support or project buy-in ("support

networks"), controlling "who is permitted to have input into the new design process" ("gate keeping") and as reference points for negotiations. For example, Henderson (1998:143) describes visual documents used as:

> [T]hinking and note-taking tools... sketches help to capture concepts in a tangible and communicable form which then facilitates individual and communal critical analysis... collaboration over sketches is one of the best methods for accessing and sharing tacit knowledge.

At DotOrg, there were several examples of emergent artifacts that were created and adapted for similar purposes. Rachel, for example, developed and adapted ghost slides to write down and organize thoughts regarding the solicitation of funds for DotOrg. She also used the ghost slides to get buy-in from all team members, including the Founders and Consultants, and to control and negotiate the various suggestions she was receiving from each team member. Similarly, as Beth explained to me, the web prototype was created as way to get buy in from potential customers:

> There are lots of different types of deliverables that people might call a prototype. There's like a screens-only version, which is what we did, which is just showing people what the user experience might be like. But some people do a PowerPoint presentation. Some people actually build in a certain amount of functionality, but very limited. The objective here is to produce a presentation that a VC would respond to in way that would - specifically for this one, it was to appeal to the hearts and minds of venture philanthropists to get them to fund [DotOrg]. And we wanted to not spend much money in order to do that. But also, because a picture is worth a thousand words, it's just so much faster to take somebody through a prototype and communicate user experiences and functionalities in an image than by standing there and talking to them, which can be really boring, or by writing it out, which would be really really long. It takes hundreds and hundreds of words to illustrate something that you can illustrate with one button. Because there are so many standards in the internet now, graphically speaking, you can kind of communicate a set of underlying assumptions with just one button [...] It's just a great communications tool. Not only for venture philanthropists. Whomever you need to introduce this concept to, it becomes a really recyclable tool to communicate what the product vision is, like Cynthia said, overall. It's a great starting point for somebody that's coming into the product to take a look at the prototype, if it's screens only, and see and understand what the whole vision is.

The web prototype not only served to communicate the ideas of the Founders to others at Greenhouse, but it was also considered to be an important artifact for communicating to potential donors and customers.[24]

In addition to serving as boundary objects, emergent artifacts served a role in structuring the ongoing process (an aspect of boundary objects that the literature has not explored in detail). More specifically, as tangible representations of what had happened thus far, emergent artifacts played a critical role as structural referents (see Figures 6.3 and 6.4). For example, in using the first version of the funding pitch to solicit feedback and develop the next version, Rachel was re-enacting many of the same structures that she had enacted in developing the first version.

Emergent artifacts such as ghost slides were used as guideposts for structuring interactions - both within an improvisation and across different improvisations. For example, DotOrg's original business plan was an important structural referent in developing the funding pitch; the final version of the funding pitch was an important structural referent in developing the web prototype; and the final version of the web prototype was an important structural referent in constructing DotOrg's web-based service. As one of the Founders explained:

> It's cool because now we can take this prototype - and this is only something that became apparent [a few weeks ago...] - as a guide to show people this is what we want to do And it's easier than explaining to them. Because we don't necessarily understand all the components that go on the back-end. So by looking at it they can say 'Oh, you'll need this, this and that...'

The prototype proved to be an important communication tool for describing to Greenhouse's Internet Product Development Team what features needed to be built; it was considered a rough, ambitious sketch of what the final product may

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[24] Carlile (2001) finds that *effective* boundary objects establish "a shared syntax or language for individuals to represent their knowledge" (p.29), they enable individuals to learn about each other's values, difference, and dependencies, and they "facilitate a process for individuals to transform knowledge" (p. 32). In Chapter 7, I describe in greater detail the role of emergent artifacts as boundary objects during the first nine weeks of the Fellows' engagement, when bridging boundaries was particularly challenging.

be like, and an important (although not sufficient) guiding factor in developing the final product.

Although I have described several benefits associated with creating and using emergent artifacts, the first nine weeks of the Fellows' engagement (during which many emergent artifacts were created and used) highlights that simply having an emergent artifact does not ensure success. The value of emergent artifacts emerge from *how* they are created and used. For example, early during their engagement, the Fellows developed detailed interview guides to elicit and develop new knowledge regarding the competitive landscape and potential market. These guides and the reported results, though, were initially structured for an audience assessing a for-profit business. Because of the lack of structure during the initial stages of the development process, emergent artifacts significantly structured the ongoing process. Because the Fellows and Consultants produced most of the emergent artifacts, their interests - rather than those of the Founders - structured the ongoing process. In the following chapter, I describe in greater detail the role of emergent artifacts in relation to the claim-making process associated with improvising an identity in an emerging hybrid organization.

6.7 Summary

The findings I presented in this chapter describe a number of different examples of innovations - most of which were examples of improvisations, but a few of which were not. These findings also describe the difficulties of improvising in a startup environment with participants from different occupational backgrounds and consequently. Technological artifacts were integral to improvising at DotOrg. Drawing on the framework I developed in Chapter 3, I described how both stable and emergent technological artifacts were used as a product, component, or tool, and were used for both practical and symbolic aspects. Of particular interest, emergent artifacts served as structural referents to guide participants through an unstructured process. Emergent artifacts, however, were not enough to ensure collaboration. For that, team

members needed to share a basic sense of organizational identity - an aspect of collaboration that was unanticipated by all participants and extremely difficult to achieve.

In the following chapter, I examine the findings from both the Formulators and DotOrg and explore in greater detail the role of artifacts in the process of improvising identity, and the relationship between artifacts, knowing, learning and improvising.

Chapter 7: Some Takes on the Findings

7.1 Introduction

The purpose of this chapter is to compare the processes of improvising and roles of artifacts in improvising across the two field studies I reported in Chapters 5 and 6. I draw on the concepts and theoretical framework I developed in Chapter 3 and the findings from both field studies to develop a more nuanced understanding of both the practice of improvising and the roles of technology in improvising. I find that participants gather, communicate, and reflect on information as part of "assessing continuously," draw on sets of structural referents to guide and assess their activities, and often engage in negotiating and consensus building in order to improvise together. I define more precisely degrees of improvising and introduce the distinction between routine and non-routine improvising. Finally, I explore more closely the relationship between the activities that constitute improvising and the different kinds, uses, and aspects of technological artifacts that are engaged in improvising. Specifically, I examine the roles of emergent artifacts in the process of developing an identity of the collective endeavor ("project identity"). To engage successfully in coordinated efforts, groups of individuals develop a minimum common understanding of the collective endeavor, which includes an identity of the collective. In non-routine improvising, the process of developing a collective identity is an improvisation. During the process of improvising a collective identity, emergent artifacts are created and used as beacons in the sensemaking process, to establish some certainty amidst uncertainty, and to represent claims and proposals about the identity of the endeavor. Participants create and use emergent artifacts as representational components of collective identity. As such, emergent artifacts are used to solicit feedback from others, piece together an understanding of the collective endeavor, and in the process, structure the process of improvising a collective identity. These findings complement and contribute to recent research on the role of artifacts in the process of collective-

reflection-in-action (Levina, 2001) by describing the practices that constitute a specific kind of collective reflection-in-action (i.e., improvising) and by focusing on the role of emergent artifacts.

By examining the findings from Chapters 5 and 6 together, I can consider a broader range and richer set of both improvisations and non-improvisations. In Chapter 5, I presented a collection of practices that the formulating team at Blockasun engaged in as part of the process of creating new recipes for personal care products. In Chapter 6, I presented a collection of practices that participants at DotOrg engaged in as they tried to launch their nonprofit startup. Within each setting, there was a range of examples of improvising representing different degrees of improvising, as well as examples of practices that did not constitute improvising. At Blockasun, for example, improvisations ranged from creating minor workarounds in response to inconsistencies in testing equipment to creating a new formula. These improvisations were distinct from other, typically non-improvisational practices, such as sample testing procedures (e.g., the Stability Test). At DotOrg, improvisations ranged from creating an application for legal status as a nonprofit to developing a funding pitch. There were also examples of struggles to improvise, such as the struggle to develop a shared understanding of DotOrg, where participants had to first develop a complementary set of structural referents before they could improvise other projects, such as creating a funding pitch and developing a web prototype. In this chapter, I draw on the rich collection of examples from both field studies to re-examine the concepts and theoretical framework I developed in Chapter 3.

Taken as whole, my findings highlight several aspects of improvising as a *collective* practice. In particular, my findings indicate that improvising involves activities other than simply enacting structures in the process of assessing continuously, creating resourcefully, and adapting extemporaneously. In the process of improvising, the participants I observed gathered information, communicated with others, reflected individually and collectively, negotiated and engaged in consensus building. How do these activities relate to my framework? My findings suggest that gathering, communicating, and reflecting

on information are key activities in "assessing continuously." For example, in the process of trying to get a better understanding of DotOrg's customer market, the Fellows and Consultants searched the web and conducted interviews to gather information on nonprofits that organized special events, they put together their findings into presentations to the other team members, and in meetings, they discussed their findings with other participants to get their reactions. Assessing continuously, in this case, as I noted earlier in Chapter 3, is similar to sensemaking (Weick, 1995) in that an assessment of the situation is constructed from gathering, communicating, and reflecting on information.

Negotiating and consensus-building were most prominent at DotOrg as participants engaged in non-routine improvising and conflict arose during the process of improvising a common understanding. McGinn and Keros (2002), argue that improvising is a key negotiating activity because when participants first meet, they improvise the structure of the negotiation. My findings suggest that, in addition, negotiating may be a critical improvising activity. At DotOrg, for example, participants had to negotiate "rules of the game" before they could improvise collectively. In general, although negotiating and consensus-building are not defining activities of improvising, they may nonetheless be quite critical to improvising successfully.

Comparing my findings in light of my framework also suggests that participants draw on a set of structural referents, rather than a single structural referent, to guide their improvisational activities. The concept of a *set of structural referents* is helpful to describe degrees of improvising and offers a possible explanation for why participants engage in a particular degree of improvising. The concept of a set of structural referents is also helpful to describe two different kinds of improvising: routine and non-routine improvising. In routine improvising, the set of structural referents (e.g. "rules of the game") is consistent; that is, participants engage in the same kind of improvising each time. In non-routine improvising, the set of structural referents is itself improvised. The example of improvising a funding pitch at DotOrg was an example of non-routine improvising and it highlighted how the

process may first involve improvising a common understanding, of which the identity of the collective endeavor ("project identity") is an essential aspect.

In what follows, I describe structural referents, define more precisely degrees of improvising, and discuss the distinction between routine and non-routine improvising. I then draw on my theoretical framework and field study findings to examine the integral role of emergent artifacts in improvising a project identity.

7.2 Structural Referents: Different Degrees and Kinds of Improvising

Taken together, the instances of improvising at Blockasun and DotOrg represent a broad range of improvising activity, including different degrees of improvising and different kinds of improvising. Improvisations involve enacting structures and, consequently, are associated with one or more *structural referents* - i.e., templates (e.g., ideals, past instantiations, representations) that are used to guide and assess the instantiation of a structure. I use the concept of structural referents to categorize degrees of improvising and routine versus non-routine improvising. One way to distinguish improvisations from each other is to examine the novelty of constituting practices - i.e., of the activities that make up an improvisation, how many are unique to the performance? "Degrees of improvising" refers to the difference - specifically, the amount of novel activity - between an improvisation and its set of structural referents. It refers to the extent to which what happened was unaccountable by the set of structural referents. For example, the amount of novel activity in the process by which the formulation team at Blockasun developed a new formula for the client, NoRayz, compared to the team's description of how it "normally" develops formulas, is an indication of the degree of improvising involved in developing the new formula for NoRayz (i.e., high or low). Another way to distinguish improvisations from each other is by whether or not the improvisation included improvising the set of structural referents. In routine improvising, actors draw on the same set of structural referents each time they improvise. In non-routine

improvising, actors must improvise the set of structural referents as part of the improvisation. To better understand this, I need to discuss in greater detail the concept of structural referents.

7.2.1 Structural Referents

One way to categorize improvisations is according to the structures they enacted. In this manner, similar improvisations are improvisations in which a similar set of structures are enacted. In Chapter 3, I introduced the notion of "structural referent." A structural referent is a representation one develops about a structure, and may be a story, artifact, collection of memory traces, or a combination of representations. The structural referent serves as a template for enacting the corresponding structure and for making sense of instantiations of that structure. A structural referent that was used by improvisers to guide their activities during a particular improvisation could be used to identify similar improvisations by the same or different group of improvisers. It could also be used to describe variation within a set of similar improvisations. For example, one could compare improvisations of "favorite dishes" by different chefs by the recipes they used. Some improvisations would diverge more from the recipe than others. Those that consisted of activities that diverged significantly from those prescribed by the recipe, for example, would relate less to the recipe than those that "followed the recipe more closely." In general, the recipe is an example of a structural referent and it can be used to compare improvisations.

In Chapter 3, I described African American quiltmaking where the general process of creating a new quilt was guided in large part by the general pattern (e.g., Jacob's Ladder) - which I refer to as the key guiding or structural referent. The key structural referent can also be regarded as the principal organizing, guiding, or coordinating logic for the interaction among participants, including audience members. The findings from my field studies challenge the simplicity of the notion of a single "structural referent."

In developing a new formula at Blockasun, for example, there was no single dominant structural referent that guided the process (even formulas that were

considered exemplary helped only to define the goal but provided little guidance regarding how to develop a new formula). Instead, over time and after having developed many formulas himself, Bond had developed a process that was sufficiently consistent that he could begin to teach it to others. This general process involved drawing on tacit "laws of chemistry," safety procedures, sampling and testing routines, and team roles (e.g., Bond is the ultimate decision maker, Brown and Selene make up and test the samples). Consequently, the findings from my field studies suggest that it is more accurate to a *set of structural referents* that guide an improvisation rather than a single structural referent.

7.2.2 Degree of Improvising

One way to compare improvisations from the diverse collection of improvisations from Blockasun and DotOrg is by the amount of novelty that constitutes each improvisation. In Chapter 3, my discussion of structural referents and degree of improvising was based on my analysis of finished quilts, rather than an analysis of the process by which the quilts were made. I assumed that the product of the improvising (i.e., the finished quilt) was representative of the process itself. Consequently, my analysis did not take into account examples of improvising techniques for exactly replicating a pattern (e.g., improvising a new sewing technique or clever use of scrap cloth to piece a quit that replicates exactly a preplanned pattern). In contrast, the data I collected in my field studies enables me to focus in this chapter on the activities that constitute an improvisation, rather than simply the products of improvising. At DotOrg, the process of compiling an application for nonprofit status was an example of an improvisation that produced a product that did not seem as novel as the activities that constituted it. The expected final form of the application was extremely specific and left little room for divergence from the norm. The Founders enacted the expected form as best they could. On the other hand, the process of creating the text for the application involved creative inputs and a great deal of negotiating between participants (e.g., the Founders, pro-bono

lawyer, and Internal Revenue Service) as the Founders tried to craft text that represented DotOrg honestly but that emphasized its nonprofit aspects over its for-profit aspects (this did not turn out to be an easy task because of DotOrg's association with the for-profit Greenhouse). This example illustrates that focusing on the percentage of novel *activities* that constitute an improvisation, rather than simply examining the outcomes that emerge from it, is a better way to characterize degree of improvising.

I use the notion of *degree of improvising* to refer to the relative amount of novel activities that constitutes an improvisation. Degree of improvising describes the *process* of improvising, rather than any products. An improvisation with more novel activities than another improvisation has a high degree of improvising. Degree of improvising is a subjective and relative category: what may be novel to one person is not necessarily novel to another and an improvisation has a large amount of novel activities (i.e., it has a high degree of improvising) relative to other improvisations.

Although all the activities that constitute an improvisation are unique (in that they have been enacted within a unique set of circumstances) there are aspects that are common across improvisations. For example, if one were to examine all the activities that make up the process of developing a formula, they would include, among others, the activities of Brown and Selene as they made up and tested samples and the activities of Bond as he adapted the formula in response to his expertise and results from the tests. Comparing the activities that constituted one improvisation (i.e., the process of making up a specific formula) with the activities that constituted other, similar improvisations (i.e., the processes of making up other formulas), one notices there are similarities and differences, partially reflected, in some cases, in the final product itself. When Bond improvised a formula, for example, the formula tended to have a form similar to other formulas he had designed before. Although that similarity was not something Bond intended (he enacted it implicitly), it became a "signature" of his formulas that was recognized by other formulators. It was also representative of the structured aspects of the process itself. The process itself

was guided by a collection of rules and routines that Bond had developed over time - some of which were more explicit than others. In addition to Bond's activities, the process of creating a new formula included the activities of Brown and Selene, as they aided Bond in making up samples and conducting tests on them. Comparing the activities of Brown and Selene from one improvisation with those from another, one can see that the activities of Brown and Selene were more similar across improvisations than they were similar to Bond's activities. Comparing the activities of Bond from one improvisation with those from another, one can see that the activities of Bond were less similar across improvisations than Brown and Selene's. Stated differently, comparing the activities of Bond across improvisations with the activities of Brown and Selene across the same improvisations, one would find that Bond engaged in several more novel activities than Brown and Selene. The greater amount of novelty in Bond's activities could be an indication that his activities involve a higher degree of improvising than those of Brown and Selene. In general, the percentage of novel activities would correspond to the degree of improvising: the greater the percentage of novel activities, the greater the degree of improvising. Consequently, the overall process of developing a new formula had a higher degree of improvising than the processes of making up and testing samples.

At Blockasun, there were several routine activities that, although requiring a great deal of effort and expertise to enact well and involving minor adaptations, did not involve improvising. For example, one practice that typically did not involve any improvising was the Stability Test, which typically did not involve creating anything new, other than making an assessment of the sample.[1] Other routine practices, while requiring expertise and effort to perform consistently, rarely involved any improvising. These included, for example, the process of making up a sample and the process of conducting an SPF Test. These routines involved constant vigilance and adapting in response to idiosyncrasies in the lab

referents to guide them through the "engagement" with DotOrg because doing so helped them maintain their Consulting identity, and, during the first weeks of the project, there was no alternative set of structural referents to draw on. As a result, relative to typical consulting projects, there was a higher degree of improvising in the DotOrg engagement.

Specificity of the Set of Structural Referents

If a team enacts a set of structural referents as expected, then the specificity of the set may be a significant factor in the degree of improvising. As discussed in Chapter 3, the specificity of a set of structural referents refers to the relative number of pre-specified practices that constitute an improvisation. The more specific the set (i.e., the greater the relative number of pre-specified activities), the less room there is for adapting the improvisation to the situation at hand. Although specificity suggests explicitness, this is not necessarily the case. Bond, for example, followed a specific process for developing a new formula yet most of it was tacit. Over time, however, as Bond learned more about the process and developed a greater understanding of which chemicals worked well together, which didn't and why, he also tried to make his process more explicit so that he and others could learn from it.

Examples from my field studies suggest the following relationship between the specificity of the set of structural referents and the degree of improvising. Assuming the set of structural referents is enacted as specified, there may be structural referents sets that pre-specify so many activities that they leave very little room for improvising (e.g., any of the procedures for testing samples at Blockasun). Alternatively, structural referents sets may also be specific, but leave room for improvising, as in the example of improvising an application for non-profit status at DotOrg. Finally, some structural referents may not be specific enough to improvise with, such as the ghost-sliding process at DotOrg. These examples suggest that if improvisers enact structures as expected, improvising

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anticipated" and a formulator would improvise.

equipment or sample, yet rarely did these adaptations amount to creating something new. When improvising did occur during these routines, it tended to consist of creating a new technique, such as a new technique for using a syringe to apply a sample to tape, during an SPF Test. Changes to a routine did not necessarily occur suddenly (i.e., a new technique did not 'catch-on' immediately after it was developed), but rather gradually, over several enactments of the routine.

Within the rest of the process there was a range of practices that did involve improvising. Bond, for example, practiced a relatively high degree of improvising as he created a new formula. Those practices that were more improvisational were guided by relatively less specific structures (e.g., the guidelines for creating a new formula specified less of what to do throughout the process than the guidelines for making up a sample) and involved a greater degree of extemporaneous adapting (e.g., adapting a formula-in-progress in response to test results and customer feedback versus adapting one's technique for adding and mixing ingredients together in response to inconsistencies in the ingredients).

At DotOrg, a clear example of different improvisations based on the same set of structural referents was the difference between a typical consulting project (as depicted in the training material of the Fellows and suggested by the Consultants) and the consulting project at DotOrg (essentially, the funding pitch project, including the struggle to develop a common understanding). The Consultants had developed expertise and prestige by successfully executing projects (including making presentations, their key "deliverables"). In the process, they had developed a general structural referent for managing and guiding the process of executing a consulting project. Early on in the DotOrg project, the Consultants realized that they would have to adapt this general structural referent to the dynamic conditions and ambiguities of the situation. In addition, Consultants continued to refer to their traditional set of structural

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[1] I stress "typically" because there was always the chance that "something would not go as

may be hindered by enacting structural referents that are too specific or not specific enough, depending on the project, situation, and intentions and interests of participants.

In general, the degree of improvising can be described by the amount of variation between the set of structural referents and the corresponding set of structures as enacted. If the set of structural referents is drawn on as expected, an influential factor in the degree of improvising is the specificity of the set of structural referents.

7.2.3 Routine and Non-Routine Improvising

The diverse collection of improvisations from my field studies suggests that, in addition to there being degrees of improvising, there are also two general kinds: routine and non-routine improvising. The distinction between routine and non-routine improvising is not that of a clear dichotomy but a distinction between two ends of a continuum, where there is no clear transition point from one to the other. The distinction refers to the novelty of a set of structural referents used in improvisations. Routine improvising refers to improvising with the same set of structural referents, each time a group improvises. In contrast, non-routine improvising involves improvising a new set of structural referents. Stated differently, using a game analogy, in routine improvising, the rules of the game do not change significantly each time the game is played (although the game itself will clearly be different each time), whereas in non-routine improvising, the rules of the game are improvised as the game is being played. In sports, music, or theater, it is common for a group of individuals to engage in routine improvising. Individuals who have never played together before can do so successfully because they have engaged in similar improvisations before, developed complementary understandings of the rules of the game, and can thus enact them accordingly.

Table 7.1 (following page) illustrates several examples of routine and non-routine improvising from both field studies. The table highlights an interesting feature of routine improvising: in a group, although there may be some

Table 7.1: Examples of Routine and Non-routine Improvising

Improvisation	Participants	How novel is this set of structural referents for the participants?	Did participants draw on complementary sets of structural referents?	Did the set of structural referents have to be improvised?	Routine or non-routine?
Blockasun					
Sample testing (e.g., SPF Test)	Formulating Team	not novel for Formulating Team	yes	no	routine
Creating a new formula for sunblock *cream*	Formulating Team	not novel for Formulating Team	yes	no	routine
Creating a new formula for sunblock *spray*	Formulating Team	novel for Formulating Team	yes	yes	non-routine
DotOrg					
Creating an application for nonprofit status	Founders IRS	novel for Founders not novel for IRS	yes	no	routine
Creating business plan for nonprofit competition	Founders Greenhouse	novel for all participants	yes	yes	non-routine
Developing a common understanding of DotOrg	Founders Fellows Consultants Greenhouse Advisors	novel for all participants	no	yes	non-routine
Creating a funding pitch	Founders Fellows Consultants	novel for Founders novel for Fellows not novel for Consultants	yes	no	routine
Developing a web prototype	Founders Web Developers	novel for Founders relatively novel for Web Developers	yes	no	routine

participants with no experience drawing on a set of structural referents, there may be others who do and can lead the improvisation in a routine way. This is possible when participants draw on complementary sets of personal structural referents. For example, although the Founders at DotOrg had never improvised a web prototype, the were able to with the Web Developers in a routine manner because they respected the role of the Web Developers to lead the process and the Web Developers respected the interests of the Founders. When participants do not draw on complementary sets of personal structural referents, then the set of structural referents that will guide their collective endeavor must be negotiated and improvised. This was the case with developing a funding pitch at DotOrg. Participants began the process assuming it would be routine (and successful, given the Consultants were experts at developing funding pitches), but because several drew on conflicting personal sets of structural referents (e.g., for-profit versus nonprofit sets of structural referents), they had to first improvise a common understanding before using it as a structural referent for improvising the funding pitch in a routine manner.

The distinction between routine and non-routine improvising is distinct from the distinction between expert and novice improviser. This distinction refers to the amount of experience one has with improvising with a particular set of structural referents (i.e., an expert at routine improvising) or with improvising sets of structural referents (i.e., an expert at non-routine improvising). At Blockasun, for example, both Brown and Selene were learning to become experts in improvising formulas and, in the process, were developing their own personal guiding set of structural referents for doing so. If they continued learning with Bond, they would likely develop sets that were similar to each other and to Bond's. This is in part because the dynamics of the formulating team at Blockasun were such that Bond lead the process of improvising formulas. Over time, he had developed a set for improvising formulas and the process had become routine (so much so, in fact, that the routine nature of the process was also reflected in the routine nature of the products). Some time after my field study at Blockasun, the formulating team

was asked to begin developing formulas for spray-applications (e.g., sunscreens that are sprayed onto one's skin). This type of application was so different from their usual process that the entire team had to adapt their routine process of developing formulas (traditionally for creams) and develop a new one for sprays. Such adaptation to improvise a new formula for a spray sunscreen is an example of non-routine improvising.

Routine and non-routine improvising is also distinct from degrees of improvising. Whether an improvisation is routine or non-routine refers to whether or not it involves improvising a set of structural referents. The degree of improvising, on the other hand, refers to the relative amount of novel activities that make up an improvisation. The distinction between routine and non-routine improvising and degrees of improvising is important to maintain because, although non-routine improvising involves improvising a set of structural referents, it does not necessarily have a higher degree of improvising than a routine improvisation. The process of improvising a set of structural referents, together with the other activities that make up a non-routine improvisation, may or may not involve more novel activities than an example of routine improvising. Maintaining the distinction, for example, avoids the assumption that creating a new formula for a sunblock spray (an example of non-routine improvising) has a higher degree of improvising than developing a web prototype (an example of routine improvising).

As I noted in Chapters 2 and 3, Zack (2000) describes three general degrees of improvising relative to the structures that guide the improvising (what he refers to as "forms"): one can "determine" to improvise within those forms, with those forms, or outside those forms. My definitions of degree of improvising and routine versus non-routine improvising complement Zack's categories of improvising by separating the continuum into two dimensions. The notion of improvising within forms is similar drawing on a set of structural referents as expected and improvising within those expectations (e.g., improvising an application for nonprofit status by following the instructions for the application process). The notion of improvising with forms is similar to drawing on a set of

structural referents and improvising beyond what was expected (e.g., improvising a business plan for a non-profit organization using for-profit models). The notion of improvising outside of forms is the most "maximal" level of improvising. It is "*meta*improvising" where, rather than simply playing off the basic structure of the performance (e.g., the original standard, the melody, etc.), the basic structure itself is being improvised. Non-routine improvising and "meta-improvising" are similar in that both refer to improvising that involves improvising the set of structural referents. Non-routine improvising is distinct from "meta-improvising," however, in that it does not describe a level of *how* referent structures are enacted (i.e., it is not the "maximal level" of degrees of improvising). By distinguishing routine and non-routine improvising from degrees of improvising, I offer a framework with two distinct ways of categorizing improvising: by kind (i.e., whether or not an improvisation involved improvising the referent structures), and by degree (i.e., the novelty of the activities that constituted the improvising).

Although in general, improvising is a risky endeavor and requires a significant amount of effort, I propose the distinction between routine and non-routine improvising to highlight the added challenge in non-routine improvising of improvising a common set of structural referents. Research on the development of group norms (Bettenhausen and Murnighan, 1985, 1991; Feldman, 1984), negotiated belief structures (Walsh and Fahey, 1986), and shared logic of exchange (McGinn and Keros, 2002) lends support to the significance of this aspect of group work - and is particularly informative with regards to the emergence of a negotiated set of structural referents to coordinate the activities of a newly formed groups of individuals who have never worked together on a new task. These streams of research share several findings about how participants develop a shared "logic of exchange" (McGinn and Keros, 2002). Assuming the group project is new and ambiguous, participants draw on their own experiences, assumptions, expectations, beliefs, and structural referents to make sense of the situation and of how to go about accomplishing the project. If the participants' understandings of the situation and their structural referents

are complementary, they may quickly develop a common set of structural referents. If not, then they may negotiate such a set and may or may not reach an agreement. Even if they do reach an agreement, the situation may change (e.g., change in resources or incentives) or participants' interests may shift, thus requiring them to modify the common set of structural referents.

Group norms are "the informal rules that groups adopt to regulate and regularize members' behavior" (Feldman, 1984: 47). Norms can be an implicit and explicit group-based understanding that provides order to ambiguous situations and establishes expectations about how participants should behave, including what is appropriate and inappropriate behavior (Levi, 2001). Bettenhausen and Murnighan (1985, 1991) used a broad definition of norms ("regular behavior patterns that are relatively stable and expected within a particular group") that is similar to the concept of structures from structuration theory (Giddens, 1984). Based on findings from laboratory experiments, where participants engaged in role-playing and negotiating, Bettenhausen and Murninghan (1985, 1991) proposed the following prototypical norm formation process (1991: 21):

> When people organize as a group for the first time, they tend to observe others, behaviors to determine what is appropriate. They consider their own experiences and, if some are relevant, consider whether they might contribute to the success of the task. When each member's scripts (i.e., mental images of how the task should be approached and completed) and others' behaviors conform, action can proceed with little questioning, as all apparently agree. If someone's script does not match the others' behaviors, he or she can apply a different script, keep his or her script intact and tolerate the current instance as unusual exception, challenge the group, or withdraw. When a challenge is resolved, group action continues, and what may have been an implicit norm becomes both explicit and relatively immutable.

Eventually, "the group begins to act using the meanings that have developed within the group rather than the meanings the individuals used initially to anchor and understand the task" (Bettenhausen and Murninghan, 1985: 357).

Walsh and Fahey (1986) observed a similar emergent organizing logic but referred to it as "negotiated belief structure" and placed greater emphasis on the political dimensions of the process. In their research on strategic decision-

making by groups, Walsh and Fahey (1986: 325) defined negotiated belief structures as "the beliefs or assumptions that underscore a strategic decision, the enacted beliefs or assumptions that reflect the politics of decision-making." Different negotiated belief structures may emerge and evolve, depending on the interaction between the level of consensus between participants' beliefs and the power relationships between participants (i.e., who has the power to influence group decision making). Drazin, Glynn, and Kazanjian (1999), in their proposed multi-level framework on the process of creativity in organizations, argued that a negotiated belief structure is critical for a group of individuals with different frames of reference (e.g., individuals from different occupational communities) to be creative and discussed how it may shift during a crisis.

McGinn and Keros (2002: 444-5) examined negotiations as co-constructed interactions that involve improvising around a "shared logic of exchange" that is coordinated in the moment:

> The ambiguous features of negotiations, and the wide range of options that fit under the broad umbrella of appropriate behavior, call for the involved actors to construct the interaction jointly, making sense of the negotiation as it evolves. Negotiators are improvising rather than playing off a predetermined script [...] Parties work out the logic of exchange in accord with one another, based on previous understandings and new ideas that emerge as the negotiation evolves.

McGinn and Keros (2002) found three general types of improvisations, depending on what logic of exchange the negotiating pairs enacted (opening up, working together, or haggling). A large majority of the negotiating pairs quickly agreed upon a shared logic of exchange and coordinated their activities accordingly around it. A few pairs began the negotiation using a particular logic of exchange but then changed ("transitioned") to a different logic of exchange (e.g., from opening up to haggling). Another few arrived with asymmetrical logics of exchange. In these cases, participants were either able to agree upon a shared logic or were not and their negotiation resulted in an impasse.

At DotOrg, the struggle to develop a common understanding involved dynamics similar to the processes for developing norms, negotiated belief

structures, and a shared logic of exchange. The example of struggling to improvise a common understanding during the first nine weeks at DotOrg is an example of non-routine improvising. When team members of DotOrg (e.g., the Fellows, Consultants, and Interns) joined DotOrg in late May, they joined an organization that was already labeled a success. DotOrg had won a well-publicized nonprofit business plan contest. Those who joined wanted to build on that success and contribute their expertise to help make DotOrg become a well-established organization. While developing a funding pitch, the Fellows, Consultants, and several Incubator advisors began to question the financial viability of DotOrg from the perspective of their own structural referents. Fellows, for example, were "scared by the revenue numbers" that they were developing based on their research because they thought the market was much larger. As concerns grew and the Fellows tried to develop clear answers to questions, the Founders grew frustrated by the skepticism and apparent lack of support for their original business plan. The Fellows became so convinced that DotOrg was not financially viable that they developed 10 alternative business models for DotOrg and convinced the Founders to consider them; they proposed changing the identity of DotOrg to make it a *financially viable* organization. At a large meeting, the Founders narrowed down the ten to three and discussed them: becoming a volunteer and donation management tool for large organizations; becoming the nonprofit arm of a for-profit company, or becoming the Consumer Reports of e-philanthropy. The Founders finally decided to stick with their original mission statement and insisted that it was viable. Once team members came to a common understanding regarding DotOrg's identity, the Fellows developed a funding pitch.

When the Founders, Incubator Advisors, Fellows, and Consultants first met together, it was the first time for all of them to work together as well as the first time they worked on developing a nonprofit startup. In addition, there were few structural guides for how to go about accomplishing the general project of "launching a nonprofit startup successfully." It was as if a group of people had gotten together to piece a quilt, but there was no common pattern to guide their

efforts, and some team members were just learning to sew, while others were extremely talented sewers but had only pieced quilts that had been preplanned (i.e., they were "classically trained"). The team identified a number of projects to accomplish and pieced together or adapted guidelines for accomplishing them based on structures that were familiar to different parties. For example, in developing an understanding of the market and competitive landscape, Sophia structured her search and analysis based on her experience doing similar projects at her former employer (also a consulting firm), material she had collected from her MBA classes, and feedback from her teammates. In developing a funding pitch for the first time, Rachel used the ghost sliding process, developed at the Firm, to guide her activities. The ghost sliding process, however, was not sufficient to accomplish the funding pitch. Rachel, together with the rest of the team, had to develop and agree on what DotOrg did as an organization - specifically, they had develop a common understanding of the market, competitive landscape, and technological aspects of DotOrg. Categorizing the process for developing a common understanding as an example of non-routine improvising highlights that the process involved improvising a set of structural referents - a process that is similar to the processes for developing norms, negotiated belief structures, and a shared logic of exchange.

In their study on the emergence of a logic of exchange for improvising, McGinn and Keros (2002: 469) examined the effects of friendship and found that:

> friends are more likely than strangers to exhibit symmetry in their interaction, evidence that social embeddedness carries with it its own logic of exchange. Friends also had an easier time coordinating a shared logic, requiring fewer transitions than strangers to reach a mutually agreeable approach to the negotiation.

The effects of friendship on the findings from controlled laboratory experiments suggest collective identity may play an influential role in the process of developing a logic of exchange. Friendship is a kind of collective identity in that to be "friends" with someone suggests a particular kind of relationship and a particular logic of exchange. McGinn and Keros (2002) found that how participants identified with each other (e.g., "I am friends with X

participating in an experiment" versus "We are all strangers participating in an experiment") influenced what participants did together. Their findings highlight a potentially influential role of collective identity in the logic of exchange between a group of individuals. Identity is a key aspect of group norms (Feldman, 1984). One of the reasons why groups will establish or enforce norms is to express the central values of the group and "to clarify what is distinct about the group and central to its identity" (Feldman, 1984: 48).[2] The role of a collective identity may help explain why some teams fail to develop a shared logic of exchange. Those findings were generated from laboratory experiments, where "failure" had few "real-world" consequences to participants who were not friends with each other, thus they were less motivated to "succeed." In contrast, the process of developing a common understanding at DotOrg included participants with initially asymmetrical understandings struggling to work together and eventually developing a common understanding.

In what follows, I draw on examples from both field studies to examine the roles of emergent artifacts in the process of improvising an identity of the collective endeavor (or what I call here the "project identity").

7.3 Improvising a Project Identity

In this section, I draw on recent literature on organizational identity and the processes by which it becomes reconstituted and redefined (e.g., Gioia et al., 2000; Glynn, 2000; Hogg and Terrry, 2000; Hatch and Schultz, 2002; Ibarra, 1999) to highlight several factors that may make non-routine improvising and, more specifically, developing a common organizing logic, so challenging. I argue that the process of improvising involves, at a minimum, creating and negotiating an identity for the project from the situation at hand and from the various

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[2] It is interesting that, with the exception of Feldman (1994), research on the development of group norms (Bettenhausen and Murnighan, 1985, 1991), negotiated belief structures (Walsh and Fahey, 1986), and shared logic of exchange (McGinn and Keros, 2002) has not explicitly explored in great detail aspects of identity. This may be due to their methodology, which is either theoretical or experimental role playing in controlled settings. In experimental role playing, roles and identity are quickly established between participants and researchers given the routine nature of experiments, or pre-established for participants given their assigned roles.

identities of those participating in the process. In some cases, this process is routine and conflict-free, while in others, it is non-routine and may become contentious. In the case of creating a new formula at Blockasun and the case of developing a web prototype at DotOrg, the process of developing a project identity was routine and relatively conflict-free. In contrast, the funding pitch project at DotOrg proved to be problematic. Several factors contributed to the struggle of developing an identity here, some associated with the non-routine nature of the project (e.g., DotOrg was a hybrid organization with no history, there were significant aspects of the project that were unfamiliar and non-routine to participants) and others with the lack of consensus regarding DotOrg's identity (e.g., participants had some conflicting expectations regarding their roles and conflicting assumptions regarding what constituted a viable DotOrg).

7.3.1 Developing a Minimum Common Understanding

What factors enable a group of individuals - particularly, individuals who have never worked together before - to accomplish a new type of project that requires the coordination of each individual performing a series of interrelated tasks? In contrast to explanations that focus on singular, centralized control (e.g., success is attributed to either leadership or strategy), the example of developing a funding pitch suggests a "decentralized explanation" (Resnick, 1996) where coordinated group action is accomplished not simply by leadership or the presence of an overall strategy (e.g., "a game plan") but, more fundamentally, by a minimum common understanding between participants.

Donnellon, Gray and Bougon (1986: 53) argue that "organizational members have two alternative sets of organizing tools at their disposal: (1) shared meanings and (2) shared communication mechanisms." When group participants do not have "shared meanings" or shared interpretations, they may engage in coordinated action by engaging in a set of communication practices that enable them to create "equifinal meaning." Equifinal meanings, they explain, are (Donnellon et al., 1986: 44):

> interpretations that are dissimilar but that have similar behavioral implications. When organized action follows the expression of such dissimilar interpretations, we refer to these interpretations as equifinal meanings. That is, organization members may have different reasons for undertaking the action and different interpretations of the action's potential outcomes, but they nonetheless act in an organized manner.

Achieving a minimum common understanding does not require that participants achieve equal or overlapping understandings but rather, that they develop a set of understandings that lead to complementary actions (which may eventually lead to some common understandings). At DotOrg, participants struggled to communicate with each other (e.g., not all participants understood the ghost-sliding process nor the popular communication practice of presenting ideas in the form of hypotheses), yet they engaged in a set of practices that enabled them to eventually develop equifinal meaning. Donnellon et al. (1986: 53), drawing on Weick (1979), briefly acknowledge that even to engage in "shared communication mechanisms" (to compensate for an absence of "shared meanings") requires a minimum shared understanding:

> organizing requires only a recognition of mutual interdependence and some shared understanding of the code for interaction.

Weick and Roberts (1993) have a similar notion of minimum common understanding, which they refer to as "collective mind." As they note (Weick and Roberts, 1993: 357), collective mind is evident:

> as a pattern of heedful interrelations of actions in a social system. Actors in the system construct their actions (contributions), understanding that the system consists of connected actions by themselves and others (representation), and interrelate their actions within the system (subordination).

Drawing on Ash (1952), Weick and Roberts (1993: 362-4) describe four "defining properties" of collective mind: 1. individuals enact the form of the "social system of joint actions" that binds them; 2. individuals' actions are guided both by how they imagine the system of all participants' actions and how they imagine how their own actions relate to the system; 3. the form of the collaboration neither resides in any single individual nor outside the group of

individuals that enacted it (i.e., the form of the system is not embedded); and 4. the pattern of the form varies by how much heed each participant practices and by how interrelated are the actions of individuals.[3] Collective mind emerges from the "heedful interrelating" of actors (Weick and Roberts, 1993: 365):

> Collective mind is manifest when individuals construct mutually shared fields. The collective mind that emerges during the interrelating of an activity system is more developed and more capable of intelligent action the more heedful that interrelating is done.[4]

In this respect, collective mind shares many aspects of structures as articulated by structuration theory (Giddens, 1984) and discussed in Chapter 2: structures are socially enacted and virtual (structures only exist as practiced and as memories of their instantiations), and structures and practices are mutually constitutive. Collective mind does not reside in any single individual or artifact but, rather, it emerges from the interactions of individuals, and each time it gets enacted, it is open to change.

Thus, group collaboration involves not simply agreeing on the process but on the purpose of the project as well. To collaborate, it is not simply enough to have clear guidelines for how to collaborate - there must also be a sufficiently shared understanding regarding how those instructions are enacted. Attaining a

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[3] For example, Weick and Roberts (1995: 365-6) note: "Interrelations are not given but are constructed and reconstructed continually by individuals through the ongoing activities of contributing, representing, and subordinating."

[4] It may be worth noting that, to distinguish heedful performances from other performances, Weick and Roberts (1993: 361) explain that "people act heedfully when they act more or less carefully, critically, consistently, purposefully, attentively, studiously, vigilantly, conscientiously, pertinaciously." They contrast heedful performance with habitual (essentially routine) performance (p.362):

> Heedful performance is not the same thing as habitual performance. In habitual action, each performance is a replica of its predecessor, whereas in heedful performance each action is modified by its predecessor. In heedful performance, the agent is still learning. Furthermore, heedful performance is the outcome of training and experience that weave together thinking, feeling, and willing. Habitual performance is the outcome of drill and repetition ... Heedless performance suggests a failure of intelligence rather than a failure of knowledge. It is a failure to see, to take note, to be attentive.

I do not subscribe to this distinction, nor, more specifically, to their characterization of habitual performance, given that my findings from Blockasun show that enacting routines consistently requires acting heedfully.

"collective mind" not only requires "heedful interrelations" (Weick and Roberts, 1993) but also, I argue based on my data, a minimal amount of consensus regarding the identity of the project.

7.3.2 Piecing Together a Project Identity

An essential aspect of collective mind is a representation of the collective. Donnellon et al. (1986) allude to the fundamental importance that each participant has "a recognition of mutual interdependence." Weick and Roberts (1993: 363), when quoting Ash (1952: 251-2), further note that participants' representations must complement each other:

> There are group actions that are possible only when each participant has a representation that includes the actions of others and their relations. The respective actions converge relevantly, assist and supplement each other only when the joint situation is represented in each and when the representations are structurally similar. Only when these conditions are given can individuals subordinate themselves to the requirements of joint action. These representations and the actions that they initiate/bring group facts into existence and produce the phenomenal solidity of group process.

Drawing on recent literature on organizational identity, I propose that the complementary collection of individual representations of the whole that enables a "pattern of heedful interrelations" can be thought of as the identity of a project.

The identity of a project is similar to organizational identity, but at the scale of a group project. Organizational identity typically refers to an understanding shared by participants of a collection of central features that distinguish an organization from other organizations. For example, Golden-Biddle and Rao (1997: 593), drawing on Albert & Whetten (1985), defined organizational identity as the "members' shared beliefs about the central, enduring, and distinctive characteristics of the organization." It is a fluid, unstable, and hybrid construct - a "dynamic consistency" (Gioia et al., 2000) - that emerges from social interactions.

People draw on different identities (e.g., professional identities, organizational identities) to guide their activities as they navigate through a variety of social situations. In the introduction to a special issue on

organizational identity and identification, Albert et al. (2000: 13) remarked on the critical roles of identities in effective social interactions:

> Whether an organization, group, or person, each entity needs at least a preliminary answer to the question "Who are we?" or "Who am I?" in order to interact effectively with other entities over the long run. Similarly, other entities need at least a preliminary answer to the question "Who are they?" for effective interaction. Identities situate the organization, group, and person [...] A sense of identity serves as a rudder for navigating difficult waters.

Golden-Biddle and Rao (1997) examined the role of organizational identity in the activities of board members of a nonprofit organization and found that organizational identity influences how members define themselves, interpret and enact issues and roles, respond to problems, interact with others, and feel about outcomes.

Traditionally, identity has been regarded as a clear, stable, singular, construct that exists apart from practice and consistently across different contexts (Gioia et al., 2000). The definition of identity in the Oxford English Dictionary, for example, focuses on the enduring aspects of identity without describing any dynamic aspects: identity is "the quality or condition of being the same in substance, composition, nature, properties, or in particular qualities under consideration; absolute or essential sameness; oneness;" and "the sameness of a person or thing at all times or in all circumstances." Recent research on identity in organizations, on the other hand, emphasizes other aspects of identity and suggests that identity is a subjective and dynamic construct that emerges from situated social interactions and is inseparable from either the actions that constitute and reconstitute it or the specific situations in which they take place (e.g., time, place, social, organizational, and political contexts, etc.) (Gioia et al., 2000; Hogg and Terry, 2000). Gioia et al. (2000: 79), for example, consider identity to be a "dynamic consistency" where the most stable aspect of identity are its labels, while interpretations of those labels are more dynamic.

Organizational identification refers to how one's personal identity relates to an organization's identity (Dutton et al., 1994). Research in social psychology

exploring the relationship between group identification and cooperation has found that individual group members' level of identification with the group influences whether or not they confer trust or distrust on the group, and, consequently, whether or not they engage in trusting behavior (Kramer et al., 2001: 178). Similarly, Dukerich, Golden and Shortell (2002), found that physicians who considered the identity of a health care system and its construed external image (i.e., how they believed others viewed the health care system) to be attractive, identified more with the health care system, and consequently, engaged more in cooperative behavior.

At DotOrg, for example, the group involved in the funding pitch project consisted essentially of three different communities of practice: the non-profit startup community (e.g., the Founders), the for-profit startup community (e.g., Greenhouse advisors), and the for-profit consultants (e.g., the Consultants). Although I did not attempt to assess their professional identities, I believe I can infer them from what they said and what I observed them do. For example, it seemed clear that the Founders strongly identified as the owners of DotOrg and, professionally associated themselves more with their venture - the non-profit - than any other profession (e.g., their professional roles in previous jobs). The Incubator Advisor and Consultants seemed to strongly identify with their respective employers and often spoke as if they were representative members (e.g., "The way we do things at the Firm is..."). Several other Incubator employees did not identity solely with the Incubator. They were critical of top management at the Incubator (e.g., in their treatment of DotOrg) and seemed to identify more with their occupation (e.g., web designer, publicist, human resource manager, strategy consultant) than their employer. The Fellows seemed to be the most conflicted regarding their organizational identification. They were MBAs at a famous business school engaged in an unusual summer program. This was a temporary identity though: during the next year, they would be soliciting letters of recommendation and seeking employment. Neither was clear if she wanted to go into consulting as a profession (one had consulting experience, the other did not). During their project with DotOrg, there were

several occasions when the Fellows felt torn between their role as MBAs participating in a special summer program, their role as Junior Consultants, their role in "helping the Sisters" (i.e., DotOrg) and their participation in the Incubator. In summary, of all the people who participated in shaping aspects of DotOrg (e.g., the Founders, Consultants, Incubator Advisor, Fellows, and other Incubator employees), some had a clear, predominant professional identity (e.g., the Founders, Consultants, Incubator Advisor), whereas others identified with multiple constituents (e.g., the Fellows, other Incubator employees).

Building on these insights, I propose that an important collective identity for any group is the identity of the collective endeavor the group members are participating in (referred to here as the "project identity"). Similar to organizational identity, project identity is a complementary collection of mutually constituted, individually-held representations of a collective that simultaneously enables and constrains group interactions. Project identity is an image or model of the project that one refers to (either implicitly or explicitly) to guide, relate, and reflect on one's actions in relation to those of others in the group. To accomplish a project, group members' representations of the collective must complement each other at a minimum level. Participants do not need to have the same image of the collective nor the same identification with the collective, but there must be sufficient overlap between each participant's image of the collective and his or her relation to it. What exactly is shared between members regarding a collective identity is typically assumed until it is required to be made explicit.

As a structure from the perspective of structuration theory (Giddens, 1984), project identity is constituted by the interactions of individuals and it enables and constrains them. Identity involves both rules and resources. As Giddens (1984: 282-3) notes:

> Social identities, and the position-practice relations associated with them, are 'markers' in the virtual time-space of structure. They are associated with normative rights, obligations and sanctions which, within specific collectives, form roles. The use of standardized markers, especially to do

with the bodily attributes of age and gender, is fundamental in all societies, notwithstanding large cross-cultural variations which can be noted.

Individuals have memory traces and mental models of collective identities and self-identities which influence how they act. These memory traces and mental models are made evident through action; an individual's actions extend personal notions of identity into the public. In addition, project identity is not a fixed or stable entity but rather, continuously reconstituted in situated practices and, consequently, open to change. In the process, as it shifts, participants may no longer share ideas of their project identity.

Project identity is related to but significantly different from project goals. Research on groups notes that developing group goals is an important first task of groups but also one of its most difficult and time consuming. Levi (2001: 40), for example, notes that it often takes more time than anticipated before individual members of a newly formed group begin to accomplish tasks collaboratively because "it takes time to decide on the definition and goals of a project and to develop the social relations and procedures for effective teamwork." One aspect of the identity of a project is the purpose of the project. As Katzenbach and Smith (1993: 53) note, in listing the benefits of teams with a common purpose: "most important, team purposes give teams an identity that reaches beyond the sum of individuals involved."[5] The purpose of the project "sets the tone and aspiration" of a group, whereas goals define "team work-products" that help participants track progress (Katzenbach and Smith, 1993: 49-55). A mission statement or charter, for example, may articulate a group's purpose and values, but neither will ensure that participants accomplish either.

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[5] Interestingly, Katzenbach and Smith (1993: 53) continue to note:

> This team identity keeps conflict - something both necessary and threatening to teams - constructive by providing a meaningful standard against which to resolve clashes between the interests of the individual and the interests of the team. Armed with a team purpose, everyone on the team knows when an individual may be getting out of line and must put the team first or risk breaking it apart.

The conflicts at DotOrg emerged during the process of developing DotOrg's identity, thus there was no identity to mitigate the conflict. In addition, Katzenbach and Smith seem to assume that the team's identity, once established, is interpreted equally by all participants. I do not make such an assumption.

The difference between project identity and goals is similar to the distinction made in negotiation theory between interests and positions. Interests are the underlying needs, desires, concerns and fears that participants care about and that motivate them to take specific positions in the negotiation (Fisher, Ury, and Patton, 1991; Lewicki et al., 1994; Thompson, 2001). Thus, another aspect of project identity is the interests of the participants.

Table 7.2 (following page) summarizes various interrelated aspects regarding identity that are integral to organizational practices and which are discussed in the literature on organizational identity and which I develop from my data.

My findings from Chapters 5 and 6 offer several examples of how participants developed a project identity. In what follows, I focus on three projects: creating a new formula at Blockasun, developing a web prototype at DotOrg, and developing a funding pitch at DotOrg. The coordinated activities of individuals creating a new formula at Blockasun and developing a web prototype at DotOrg offer two examples of how participants developed a project identity without any significant problems. In both cases (described in more detail in the next section), participants approached their respective project with complementary expectations and assumptions regarding the general purpose of the project and the roles of each participant. At the start of each project, participants took time to develop, in their own terms, a more detailed common understanding and they accomplished this with few, if any, conflicts. Then, throughout the project, participants continuously created and adapted alternative project identities. In contrast, the process of developing a project identity for the funding pitch at DotOrg was significantly more challenging. In what follows, I describe all three examples.

Table 7.2: Key concepts from research on identity from the literature and my data.

From the literature	
Personal identity	Individual view of self: Who do I think I am? Who do I think I should be?
Organizational identity	Individual view of group: Organizational identity refers to the answers to "questions of self-reflection" (e.g., Who do we think we are? Who do we think we should be?) Gioia et al. 2000 Overlap of individuals' views of group: Golden-Biddle and Rao (1997, p.593), drawing on Albert & Whetten (1985), define organizational identity as the "members' shared beliefs about the central, enduring, and distinctive characteristics of the organization."
Image	Organizational image refers to "construed external image" developed in response to "questions of other-reflection" (e.g., Who do they think we are? Who do they think we should be?) Who do I want them to think we are?
Identification	Since identification is predicated on a perception of oneness between self and the collective, the process of identifying enables organizational members to reinforce their professional identity by advancing claims on the organization's identity elements that are congruent with their expertise and capabilities. (Glynn 2000)
Physical symbols	Physical symbols "are omnipresent and tangible and have the potential to involve all of our senses including sight, smell, and touch" and differ on at least two distinct, continuous dimensions: instrumentability (i.e., "the usefulness, or explicit task-fulfilling properties of a symbol above and beyond its symbolic value") and portability (i.e., "the ease with which a physical symbol can be carried or transported") (Pratt and Rafaeli, 2001: 94-5).
From my data	
Project identity	A complementary collection of mutually constituted, individually held representations of a collective that simultaneously enables and constrains the group interactions that constitute it.
Emergent artifacts as representations of identity	A kind of physical symbol that is created during the innovation process that is used to enact aspects of identity by representing them.

7.3.3 Improvising a Project Identity - Two Unproblematic Examples

At Blockasun, one of the first things that Bond did with a customer who requested a new formula was to develop a more specific understanding of what kind of sunscreen the customer was interested in manufacturing. For example, in Chapter 5, I described how a customer, Norayz, asked Bond to improve the stability and skin-feel of a set of "oil-free" formulas. When Norayz first approached Bond about this project, there was already a common understanding between participants that the project involved the formulating team at Blockasun developing a set of formulas for Norayz. To do this the formulating team needed a greater understanding of what kind of sunscreen Norayz wanted. The process of developing a greater shared understanding of the desired sunscreen involved communicating by fax and with samples. Along with a fax explaining the request, the customer also sent the formulating team at Blockasun a set of samples of the problematic formulations. The formulating team used the samples to, as Bond explained, develop a better understanding of the intended "general consistency of the product and make a qualitative assessment as to what [the team was] aiming at - in terms of viscosity and feel and that kind of thing." Norayz wanted the new formulas to maintain the viscosity of the current products so as to avoid having to change any packaging. After looking through the formula and examining the samples, Bond faxed Norayz a reply with three general questions about what the target SPF was, how much flexibility he had to try new ingredients, and what exactly Norayz meant by "oil-free." After Norayz replied with their answers, Bond had a clearer sense of what kind of sunscreen the client was interested in, as well as the parameters he and his team had to work with.

Bond had gone through the process of developing a greater common understanding with customers regarding the goal of the project several times before, when discussing potential projects with potential customers at trade shows and site visits and with customers requesting new formulas. It was a

process that sales representatives also had to go through. The more participants could develop a detailed and precise understanding of what the customer was interested in, the more likely it was that the formulating team could be of help. The process of developing a more precise common understanding between the formulating team and customer was common and so routine that Bond was able to develop reference guides to facilitate the process of translating the interests of customers into terms that were salient to the formulators.

After developing a more precise common understanding, the process of developing a new formula, among other things, involved Bond and his team proposing several alternative formulas, with the client deciding which ones it favored. Thus, the identity of the project evolved and became more specific as participants worked on it together.

Another unproblematic example of improvising a project identity occurred during the process of improvising a web prototype at DotOrg. Throughout the projects I observed during my field study at DotOrg, participants were grappling with issues related to the deceivingly simply question "What is DotOrg?" As they struggled to complete a variety of tasks, their actions informed and were informed by notions regarding DotOrg's identity. When the Founders approached Beth and Cynthia about having them develop a web prototype, Beth and Cynthia had already witnessed most, and participated in some, of the process of creating a funding pitch. Consequently, there was already some common understanding between participants regarding what DotOrg was and the general nature of the project: to have Beth and Cynthia develop a web prototype of DotOrg for the Founders. To develop a web prototype, however, Beth and Cynthia needed a greater understanding of what the Founders wanted from the process. Specifically, Beth and Cynthia wanted to understand with the Founders what "look and feel" they wanted the web prototype to have. Beth had gone through the process of defining a look and feel before and used other web sites to help the Founders formulate a desired look and feel. Thus, it was a relatively routine procedure for her. After agreeing on the look and feel, Beth and Cynthia

periodically sought feedback from the Founders to ensure that the group was in agreement regarding any changes made to the web prototype.

7.3.4 Improvising a Project Identity - A Problematic Example

In the case of DotOrg, the identity of the funding pitch project was inseparable from the identity of DotOrg. To create a funding pitch was essentially to create an image of DotOrg that would be attractive to potential funders so as to garner their financial support. The content of the funding pitch was the identity of DotOrg. Consequently, improvising the project's identity involved improvising DotOrg's identity. It was insufficient to simply agree that the purpose of the project was to develop a funding pitch. The funding pitch project also involved developing a minimum amount of consensus around the identity of DotOrg.

Organizational identity is not a homogeneous construct, but rather a hybrid of identities (Albert and Whetten, 1985; Foreman and Whetten, 2002; Golden-Biddle and Rao, 1997). DotOrg, for example, was a hybrid-organization - i.e., "an organization whose identity is composed of two or more types that would not normally be expected to go together" (Albert and Whetten 1985, p.270). A possible consequence of organizations with multiple identities is intra-role conflict between actors subscribing to different identities (Golden-Biddle and Rao, 1997: 593):

> When actions occur that breach the expected role performance of board members, latent contradictions in the organizational identity emerge, and directors are faced with the conflict of upholding one dimension of identity while undermining the other.

Members of such organizations may find themselves in either "conflicts of interest" or "conflicts of commitment" (Golden-Biddle and Rao, 1997: 593). They may belong to multiple organizations with rival expectations (e.g., the Fellows were members of the Consulting Firm and the DotOrg team and struggled to manage conflicting expectations, or "conflicts of interest") and they may belong to an organization with multiple, conflicting expectations (e.g., the Founders

struggling between presenting DotOrg as being as savvy as a for-profit Internet startup and as dedicated to good causes as a nonprofit).

Recent qualitative research on the role of identity in the process of socialization (Beyer and Hannah, 2002; Ibarra, 1999) suggests that part of what made the process of developing a common understanding so difficult for DotOrg team members was that, as participants sought credibility, they tried to adapt their professional identities in relation to a nascent hybrid organization. This would have been particularly challenging for those participants in multiple roles (e.g., the Fellows). Professional identity reconstruction is a critical aspect of *socialization*, the process by which newcomers adapt to the expectations and demands of new roles and settings within a social entity (Beyer and Hannah, 2002; Ibarra, 1999). Ibarra (1999) examined the process by which consultants and investment bankers adapted their professional identities, as they moved up to more senior positions. Moving up the career path was not easy, and required learning and developing a great deal of tacit knowledge about the organization and oneself, including adapting one's professional identity. As Ibarra explains (1999: 772-3):

> Study participants were highly cognizant of the need to command credibility with their clients long before they actually understood and felt competent in their new roles. As a result, issues of how to convey an effective image and define for themselves what kind of professional they aspired to become dominated their descriptions of transition hurdles. Inductive data analyses of their accounts suggest that adaptation involves three basic tasks: observing role models [to identify potential identities], experimenting with provisional selves, and evaluating results against internal and external standards.

To successfully move into senior roles, consultants and investment bankers had to adapt the way they defined themselves in their professional roles. They accomplished this by observing the practices of colleagues, experimenting with new ways of acting in accordance to temporary (but potentially enduring) identities, and assessing and modifying possible selves (Ibarra, 1999).

Adapting one's professional identity successfully improves with experience and practice. Beyer and Hannah (2002: 648) found that the kind of experience that one brings to one's new job ("diverse" relative to "narrow") was salient

because it provides the "cognitive raw materials that people use to make sense of new situations." They interviewed participants once a month, over a period of six months, to understand the sensemaking process by which experienced workers adjusted to their new jobs. Individuals with experience developing a multi-dimensional identity, doing some of the tasks required for the new job, and adjusting to several new jobs, were more likely to successfully adapt to their new environment than others with relatively limited experience because they could construct a greater number of provisional multi-dimensional selves (Beyer and Hannah, 2002).

There were several similarities between the process of socialization and the process by which participants of DotOrg struggled to adapt their professional identities and redefine DotOrg's. The situation at DotOrg was new to all participants, and consequently, many of their activities pertained to making sense of the situation. Sensemaking is grounded in identity construction (Weick, 1995: 20):

> [T]he sensemaker is himself or herself an ongoing puzzle undergoing continual redefinition, coincident with presenting some self to others and trying to decide which self is appropriate. Depending on who I am, my definition of what is 'out there' will also change. Whenever I define self, I define 'it,' but to define it is also to define self. Once I know who I am then I know what it out there. But the direction of causality flows just as often from the situation to a definition of self as it does the other way.

When placed in an unfamiliar situation, sensemakers strive to maintain consistent and positive identities and learn about them by projecting them into the situation and observing the consequences (Weick, 1995: 23). The sensemaking activities of participants at DotOrg were similar to the adaptation process described by Ibarra (1999). The ten alternative business models developed by the Fellows and Consultants, for example, were the clearest examples of experimenting with provisional collectives to convey effective images of the Consultants and Fellows, solicit feedback, and influence the consensus building process around DotOrg's identity (other examples included the "less official" reports of findings developed and presented by the Fellows and Consultants).

Yet, because the organizing logic and the identity of DotOrg were still under development, each participant reverted to their respective professional identities and organizing logics to structure and make sense of the situation.

Several notable complications distinguished the process of improvising DotOrg's identity from the process of adapting a professional identity within well-established firms. In contrast to consultants and investment bankers working in stable and clear roles along stable and clear career paths, for example, those helping DotOrg were only doing so temporarily (and consequently, did not have a clear or stable career path within DotOrg), were not all clearly associated with any single organization, did not have clear roles within DotOrg, and in fact, seemed to have conflicting roles between DotOrg and the firm they were associated with. Research on the role of identity in socialization has focused on settings where "outsiders" try to become "insiders" of a well established organization. In these organizational environments, work roles and career paths are generally clear and had long histories. Ibarra (1999), for example, examined the role of identity in the socialization process of workers moving up along well-established career paths within their organizations.[6] Beyer and Hannah (2002) examined the role of identity in the socialization process of experienced workers into new well-established jobs. In contrast, newcomers to DotOrg were defining the organization as they were trying to be part of it. Rather than becoming part of a well-established social entity with years of history, they were becoming part of newly formed hybrid organization that had only recently formed and only defined itself with a basic business plan.

In addition to the general challenge of adapting their professional identities to a hybrid organization with no history, there were conflicting assumptions

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[6] In the investment firm, for example, new members started as associates and were expected to develop financial models and perform routine tasks associated with completing projects. Four years later, associates were considered for promotion to vice president. Vice presidents were responsible for managing projects from beginning to end, including coordinating junior and senior personnel. In their seventh or eight year, vice presidents could be promoted to director, and later, to managing director. As one moved up to more senior positions, one was expected to play a greater role in cultivating relationships with clients and generating new investment banking business for the firm (Ibarra, 1999: 768).

regarding what constituted a viable DotOrg, and these contributed to the struggle of developing a common understanding. The process of developing an organizational identity can be thought of as a "claim-making process" regarding what is central, enduring, and distinctive about an organization, and it involves the "identity dynamics of professional and occupational groups" (Glynn, 2000: 295). This perspective is particularly helpful to making sense of the tensions that developed at DotOrg. Organizational identity affects and is affected by the perceptions of those participating in organizing the organization's core competencies, including strategic issues and resources (Glynn, 2000: 295). This is particularly notable when an organization is made up of individuals who identify with different communities of practice, as in DotOrg, where there were non-profit entrepreneurs, for-profit entrepreneurs, and consultants. There is a tendency for each participant to act consistently with the legitimating values of the profession s/he identifies with (i.e., her/his professional identity).[7] Consequently, in the process of identifying with an organization, as participants search for and define overlaps between their professional identity and an organization's identity, they tend to focus on organizational capabilities (and weaknesses) that validate their sense of professional self. As Glynn (2000: 293) explains, in relation to a symphony orchestra:

> It is through their professional and/or occupational affiliations that musicians and managers/board members *identify* with different elements of the organization's identity. Since identification is predicated on a perception of oneness between self and the collective, the process of identifying enables organizational members to reinforce their professional identity by advancing claims on the organization's identity elements that are congruent with their expertise and capabilities. For musicians, this involves emphasizing the aesthetic over the economic.

When a group is composed of individuals who identify with different professions or occupations, "the construction of organizational problems may not be clear and uncontested, but rather marked by divergent and sometimes

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[7] As Glynn (2000: 287) states: "Professionals have a stake in maintaining their identity in a professional field, and claiming a set of identity attributes that can be used to their advantage in

contentious claims, which spring from divergent ideologies held by groups who occupy different institutional positions" (Glynn, 2000: 294).

This was certainly the case with the group of individuals at DotOrg. As participants struggled to define a viable DotOrg, they struggled to define what was essential, as well as what was unique about DotOrg (Albert and Whetten, 1985). The participants from for-profit organizations (i.e., Consultants, Incubator Advisor) tended to focus on what was competitively unique about DotOrg. In fact, in developing alternative identities for DotOrg, they ended up changing several aspects of DotOrg that were essential to the Founders. The proposed alternatives proved to be contentious but helped make more explicit the differences among participants' understandings. Ultimately, the DotOrg team did not arrive at a single, homogeneous organizational identity but rather a broader and more detailed common understanding that proved sufficient and necessary for the Fellows to apply the ghost-sliding process and develop a funding pitch.

In summary, I argue that the process of developing a common understanding at DotOrg was an example of non-routine improvising, complicated by a struggle to develop a project identity. In routine improvising, given there are similar histories that participants can refer to, participants are more likely to arrive with complementary expectations to the project and quickly establish a common project identity, which enables them to engage in other coordinated activities. In non-routine improvising, on the other hand, participants must make a greater effort to develop a collective identity, given there is no history of similar endeavors to draw on. At DotOrg, there was the added complication that participants had conflicting views regarding what constituted a viable organization. Therefore, the process of improvising a minimum common understanding proved challenging because the process itself was non-routine, DotOrg was a nascent hybrid organization, and participants had conflicting assumptions about effectiveness. Participants struggled to adapt their

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society and/or in the marketplace of business."

personal identities, structure the process, and develop a common understanding. The improvising activities constituted the project's identity until a sufficient common understanding was developed for participants to work together on other projects. Throughout this process, different types of artifacts were created and used in a variety of ways. In what follows, I explore in greater detail the role of emergent artifacts in the non-routine process of improvising a project identity.

7.3.5 Creating and Using Emergent Artifacts During Non-Routine Improvising

What are the roles of emergent artifacts during non-routine improvising? In Chapter 3, I introduced the notion of emergent artifacts - artifacts that are created during a project and that may change significantly during their use in the project. Emergent artifacts may be involved in three general uses: as a tool, emergent artifacts may be used to construct the outcome (e.g., the use of ghost slides to represent potential funding pitches and solicit feedback from others); as a component, they may be used as an element in the construction of the outcome (e.g., the inclusion into the DotOrg website of graphics files and an article published in an online journal); and as a product, they may be used as an outcome of the improvising (e.g., the use of a prototype to represent the process thus far). These uses tend to involve two aspects of artifacts: practical and symbolic. In Chapters 5 and 6, I described how different kinds of artifacts and different aspects of artifacts were used in a variety of ways throughout the improvising processes at Blockasun and DotOrg, and in particular, how emergent artifacts were used to elicit, develop, and represent knowledge, assess progress (or lack thereof), bridge boundaries, and structure the ongoing process. In this section, I examine the role of emergent artifacts in the non-routine process of developing a collective identity.

Research on metaphors (Hill and Levenhagen, 1995; Morgan, 1980; Morgan, 1986), boundary objects (Bechky, 2003; Carlile, 2001; Henderson, 1995, 1998; Levina, 2001), single-text strategy (Fisher, 1978; Fisher and Ury, 1991; Raiffa, 1982; Susskind and Cruikshank, 1987; Thompson, 2001), and physical symbols (Pratt

and Rafaeli, 2001) has examined the use of objects to span boundaries and develop a (new) common understanding between users. These objects range from conceptual objects (e.g., metaphors) to tangible objects (e.g., written documents). Participants from different occupational communities, for example, may try to overcome differences in understanding by transforming their understanding through the use of artifacts as boundary objects to "[co-create] common ground" that relates understandings to each other (Bechky, 2003). The key is that the "common ground" must relate meanings, transforming incomprehensible practices or misunderstandings into something familiar. My findings on the role of artifacts used to develop a common understanding at DotOrg complement many of the insights developed from these streams of research and contribute to them by examining the use of a particular kind of object (emergent artifacts) in a particularly challenging collaborative endeavor (a group of individuals who have never worked together, striving to collaborate on an unfamiliar project). In this case, aspects of identity are especially salient, and the roles of artifacts in developing aspects of identity are quite significant. With the notable exception of work on physical symbols (discussed later on), however, identity is not explored in research on the role of objects in collaborative endeavors. In what follows, I explore the roles of emergent artifacts in constructing project identity during non-routine improvising.

Creating Emergent Artifacts as Representations of Identity

Organizational identity and image are highly interdependent (Dutton et al., 1994; Gioia et al., 2000). Gioia et al. (2000) proposed that the two can be distinguished by the different reflective questions they answer. Organizational identity refers to the answers to "questions of self-reflection" (e.g., Who do we think we are? Who do we think we should be?), whereas organizational image refers to a "construed external image" developed in response to "questions of other-reflection" (e.g., Who do they think we are? Who do they think we should

be?) (Gioia et al., 2000: 69).[8] Gioia et al. (2000: 67) note that "image in its multiple guises provides a catalyst for members' reflexive examination of their organizational self-definition." An organizational image may include verbal, graphic, and symbolic representations. Organizational members typically strive for consistency between how they see themselves and how others see them (Gioia et al., 2000). If there are important inconsistencies, then members can either change how they see themselves (i.e., change their organizational identity), try to change how others perceive them (i.e., change their organizational image), or both. In any case, given the strong inter-dependency of identity with image, changing one will most likely change the other (Gioia et al., 2000).

Physical symbols also play an interdependent role in identity. Pratt and Rafaeli (2001:123) examine physical symbols such as dress and personal adornment, physical landscape and office design, and technology and argue that they are "instrumental building blocks that are used to construct identity and status aspects of relationships." Physical symbols "are omnipresent and tangible and have the potential to involve all of our senses including sight, smell, and touch" and differ on at least two distinct, continuous dimensions: instrumentability (i.e., "the usefulness, or explicit task-fulfilling properties of a symbol above and beyond its symbolic value") and portability (i.e., "the ease with which a physical symbol can be carried or transported") (Pratt and Rafaeli, 2001: 94-5). Physical symbols help to communicate and negotiate parameters of a relationship (e.g., similarities and differences) between two or more objects and actors (p.103):

> social actors involved in a labeling process can use physical symbols to construct a cognitive frame that will guide how others interpret and guide the actor, the situation, and the relationship involved.

Physical symbols are essentially tangible representations of identity in a manner that is similar to but broader than "image," as described by Gioia et al.

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[8] Dutton et al. (1994:249) define construed external organizational image as "what organizational

(2000). Tangible representations can be used to address a number of questions: How do we represent ourselves to each other? How do we represent ourselves to others? What of ourselves do we represent to others? How do we represent who we think we are? How do we represent who we think we should be? How do others interpret our representations? How do others represent who they think we are? How do others represent who they think we should be?

Meanings are not embedded in physical symbols but, rather, are socially ascribed and constructed, depending on how images and physical symbols are combined, how actors use them, and the contexts in which they are used (Gioia et al., 2000; Pratt and Rafaeli, 2001; Weick 1990). The founders of Greenhouse, for example, invested resources into developing an interior design of the space made up of several artifacts (e.g., office equipment on wheels, partitions between offices that could slide open, conference room with Aeron chairs, kitchen with top of the line equipment, common area with fooze-ball table, etc.) that represented wealth, "cool," flexibility, fluidity, and collaboration, and enabled users to engage in all those aspects as they sought to launch their startups. These same artifacts, however, came to symbolize excessive spending as users engaged with them and the market declined. The context and use of physical symbols inform the meanings associated with them and vice versa.

Physical symbols can serve as labels of identity. Gioia et al. (2000: 75), for example, noted that labels contribute to both the enduring and equivocal aspects of organizational identity:

> The theoretical implication of acknowledging a socially constructed (and reconstructed) organizational identity is that even though we might use the same labels to describe the elements of a core identity, those elements are nonetheless subject to multiple and variable interpretations, which implies that identity changes with changing interpretations. Because we use the same labels over time to describe core elements of identity, it is deceptively easy to presume that identity is stable or enduring. The durability is in the *labels*, however - not in the interpretation of the meanings that make up the ostensible core [...] Although we maintain a belief in "core" elements of identity, that belief does not imply that the core is some tangible entity.

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insiders believe outsiders think is distinctive, central, and enduring about the organization."

Physical symbols, like the "labels" of images, are equivocal - i.e., open to a variety of interpretations (Gioia et al., 2000; Pratt and Rafaeli, 2001; Weick 1990). The audience for a physical symbol may not necessarily develop the same meaning as intended by the user of the symbol. When participants from different occupational communities use representations of knowledge to share understandings the same representations may not have the same meaning for both the people who created it and the people who try to use it because their meanings emerged from significantly different contexts and practices (Bechky, 2003). These "miscommunications" can take several forms, including "accidental signaling" ("when an audience interprets relationship information not intended by the actor"), "strategically ambiguous signaling" ("involves capitalizing on the fact that there is no one-to-one correspondence between a symbol and a particular meaning" - e.g., the use of a symbol to communicate different identities to different constituents), and "signaling interrelated relationships" (when the same symbol may have multiple meanings) (Pratt and Rafaeli, 2001: 119). "Miscommunications" may occur because of different boundaries between participants. Carlile (2001) explains that a "boundary" refers to at least one of three possible differences between two people working to solve the same problem: 1) there may be a difference in syntax (i.e., there is no shared and stable syntax that enables information sharing); 2) there may be a difference in semantics, or the interpretation of the same syntax (i.e., even if there is a shared syntax, each person may be drawing on significantly different experiences to interpret the same syntax); and 3) there may be a difference in the willingness to overcome these difference due to each person's investment in their knowledge (i.e., even if there is a shared syntax and an ability to understand each other's (different) interpretive approaches, overcoming these differences requires each person to be willing to alter their own knowledge).

"Miscommunications" may be either deliberate or unintentional and both enabling and constraining. For example, the business plan and presentation that the Founders of DotOrg created and used to win the business plan competition were two critical representations of DotOrg's identity. They were used to earn

the support of Greenhouse, the Consultants, and the Fellows. Based on those representations (and some brief conversations with the Founders) each party decided to be part of the DotOrg team and help DotOrg become "successful." The representations proved to be ambiguous, however, as it became apparent throughout the process of developing the funding pitch that each party had conflicting images of a "successful DotOrg." The ambiguity of the business plan and presentation enabled the Founders to win the support of Greenhouse, the Consultants, and the Fellows (and all the prestige associated with their support), but their conflicting views regarding what constituted a successful and viable DotOrg proved also to be a constraint.

To address potential or subsequent problematic interpretations, users of physical symbols, together with their audience, negotiate and adjust meanings associated with a symbol in a variety of ways: they may adopt a more intense form of symbol ("symbol intensification"), use additional symbols to reinforce an idea ("symbol redundancy"), delete some symbols to simplify and avoid mixed messages ("symbol pruning"), or develop a new use for the same symbol to transform a meaning associated with it ("symbol transformation") (Pratt and Rafaeli, 2001: 120-2). As my findings about emergent artifacts show, they may also *create* physical symbols to try and relate the understandings of participants.

Building on my field studies and the research on organizational images and physical symbols, I want to focus on a specific kind of physical symbol: emergent artifacts, as I have discussed them throughout my dissertation. I do so for several reasons. First, drawing on Orlikowski (2000), I want to make a clear distinction between the artifact and the different uses of artifacts. Pratt and Rafaeli (2001) interchangeably discuss symbols as doing something and symbols as being used (e.g., "physical symbols shape reality" and "the use of physical symbols by organizational members creates and recreates the organization") and in the process, risk anthropomorphizing physical symbols, downplaying the notion that meaning emerges from how physical symbols are used, and treating meaning as partially embedded in physical symbols. In addition, Pratt and Rafaeli (2001) treat the artifact itself as pre-existing and stable throughout its use

and do not consider physical symbols that may be created or change physically during use (e.g., emergent artifacts). In their discussion of meaning changes associated with physical symbols, they only consider ways to adjust the collection of physical symbols and do not consider creating new symbols or adapting existing symbols.

Participants in DotOrg were continuously engaged in endeavors that involved piecing together organizational identities and images of DotOrg from whatever was available. The processes of developing a funding pitch and developing a web prototype, for example, were essentially examples of developing images of DotOrg to use to convince others that DotOrg was an organization that was worth funding and partnering with. As such, they could be regarded as examples of "cultural entrepreneurship" - the narrative process by which entrepreneurs craft new venture identities (i.e., stories) to earn legitimacy from investors, competitors, and consumer, and consequently, increase their access to new capital and market opportunities (Lounsbury and Glynn, 2001:545). In what follows, I discuss briefly a few examples of creating representations at DotOrg. I will first discuss creating representations to develop relationships with parties outside of DotOrg (e.g., the public, other non-profits, potential investors) and then an example of creating representations to develop relationships within DotOrg. I will show how these activities addressed aspects of the larger struggle to develop an identity for DotOrg.

Creating Representations for Developing External Relationships at DotOrg

One of the first projects that the Founders engaged in at Greenhouse was to create a website for DotOrg. It was an extremely simple site (consisting of no more than five web pages, including a homepage and a page collecting news items and press releases) but important for the Founders because they wanted "DotOrg to have a presence" on the web. It was hosted by Greenhouse and, as a result, clearly identified DotOrg with the incubator. As I discussed earlier, this identification was both enabling and constraining to the Founders. The DotOrg website also included a section detailing who was part of the "DotOrg Team." A

digital photograph of the Founders, Fellows, and Interns was taken during the process of putting together the website. It was used for the DotOrg website and was also printed out and put up in the DotOrg offices. It was used as a positive representation of the often-used phrase, the "DotOrg team."

Another project that significantly involved issues of identity was an interview that the Founders had with Sam Bignaym, a well-known columnist from a popular business journal. Everyone at DotOrg regarded this interview as an extremely important opportunity for high-profile publicity, yet also recognized the risk that if the interview did not go well, it would be a lost opportunity, or worse, it would generate negative publicity. Therefore, rather than simply being a singular event, the "interview with Bignaym" became a project: the Founders worked with Greenhouse publicists, an external public relations firm (whose services DotOrg had won, as part of their winning package), and the DotOrg team to prepare for the interview. The interview, conducted by phone, was attended by several "coaches," and, once the interview was published online (the article exceeded all expectations), it was publicized in a variety of ways. In preparing for the interview, the Founders practiced pitching DotOrg as a viable organization and fielding questions developed by others challenging its viability. Bignaym had a daily column on the website of the journal he wrote for. When his piece on DotOrg was published, the publicists of Greenhouse announced via electronic mail the publication of the article and congratulated the DotOrg team on such positive publicity.

The article, both in the form of a URL link and as electronic text, became a component of many different e-mails, the Greenhouse website, the DotOrg website, and DotOrg's publicity package. To highlight the significance of having Bignaym's endorsement of DotOrg in *artifact form*, rather than orally, consider the following hypothetical alternative. Imagine if the Founders had simply met Bignaym at an industry social event, pitched the concept to DotOrg to him, and received verbal encouragement from him. In addition, imagine if Bignaym had subsequently told a "catchy" story promoting DotOrg to others at the social gathering and that the story was passed on by so many people that it helped

promote DotOrg and even attracted a few investors. What the Founders could do with an oral endorsement was very different from what they could do with Bignaym's views expressed in electronic text and published on a publicly-accessible, well-known website. Having an endorsement in the form of a digital artifact enabled the Founders to share it with others across time and space and include it as part of their website and promotional material.[9] These differences highlight the importance of distinguishing physical artifacts from other symbolic forms and of distinguishing them from their use. The material properties of an artifact enable and constrain a variety of uses.

Creating Representations for Developing Internal Relationships at DotOrg

The ghostsliding process involved creating emergent artifacts (e.g., rough sketches of slides) and iteratively building on, adapting, and receiving feedback on them until they become the final deliverables. The process of improvising an identity for DotOrg was similar in that several artifacts were created to represent and organize key ideas and findings, to question the financial viability of DotOrg, and to represent new potential identities for DotOrg. These were primarily produced by people with for-profit backgrounds using processes structured for for-profit concerns. The processes by which the Fellows gathered, collected, and organized their findings was structured by several guidelines developed at the Consulting Firm. "Findings," for example, were written out into handouts structured according to norms practiced at the Consulting Firm, including the official company disclaimer that accompanied all documents produced at the Consulting Firm.

This example illustrates that simply having an emergent artifact does not ensure success - what is key is how the emergent artifact is used. For example, the emergent funding pitch was used to elicit and develop new knowledge regarding the competitive landscape and potential market, but the information

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[9] Of course, the Founders could have transcribed the oral endorsement into an electronic text file and used that in the same way they used the article. The article may have been considered more prestigious, however, given it was published to the public, seen by so many people, and anyone

was initially structured for an audience assessing a for-profit business. The Founders, to the frustration of many, did not seem to build on these and other outcomes of meetings (e.g., represented by static sheets posted around the office and preserved on white boards) and instead seemed to ignore them. Although the emergent funding pitch was visible evidence of the discrepancies among all the parties, it proved very difficult to make the process more collaborative. Because of the lack of structure during the initial stages of the development process, the emergent artifact significantly structured the ongoing process. Yet, because it was essentially the product of the consultants, their interests, rather than the interests of the founders of DotOrg, structured the ongoing process.

Using Emergent Artifacts as Representations of Identity

Although emergent artifacts are similar to boundary objects and metaphors in that they can be used to bridge boundaries, it is important to understand how they are distinct. Emergent artifacts refer specifically to tangible artifacts that are created during the innovation process. Boundary objects, on the other hand, refer to a broader range of objects, including tangible and conceptual objects (e.g., Levina 2001) and stable and emergent artifacts. Metaphors, on the other hand, tend to refer to conceptual objects. In focusing on tangible artifacts, I can examine the specific significance of the enabling and constraining effects of an artifact's material properties on how they are or are not used (c.f., Orlikowski, 2000; Orlikowski and Iacono, 2001). My framework makes a clear distinction between different types, uses, and aspects of technological artifacts, and I distinguish, for example, the use and consequences of emergent technical artifacts from the uses and consequences of conceptual metaphors. By doing so and insisting on considering the material aspects of an artifact, I also avoid the risk of anthropomorphizing technology.

Having a concrete representation of a concept enables one to revisit it and reflect on it (although it is not the only way one can revisit and reflect on a

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could follow the accompanying link to the "original," if they didn't trust that the article on the DotOrg website was an accurate representation of the original.

concept). In addition, as Levina (2001) suggests, an accessible artifact enables collective reflection around the same reference point across time and space. These aspects of emergent artifacts, for example, explain a benefit of instant messaging, as used by one of the Founders at DotOrg. In addition to enabling Margaret to quickly communicate from her desk with the Internet Product Development team (IPD) located down the hall (rather than in person or by phone), she could save the text of the exchange and refer to it at a later date. Margaret often would ask IPD technical questions and did not always fully understand the reply. Once she learned more about the subject, she would revisit the saved text of the exchange to make better sense of it. She also would use the saved text as a reference. The ability to reflect on a representation at a later time is especially useful when one is feeling so overwhelmed at the moment of first receiving the message that one doesn't feel capable of fully making sense of it.

In addition to collective reflection in action around the same artifact (Levina 2001), concrete representations enable collective bricolage - i.e., the same representation can be used as a component in different projects and by different people for different purposes. For example, the link and text of the Founders' interview with Bignaym was included, among other projects, in promotional e-mails, the DotOrg website, the Greenhouse website, and DotOrg's press packet. Finally, the focus on emergent artifacts also highlights the fact that communicating via concrete representations involves *creating* them. The process of creating images and representations may involve additional time to reflect on the artifact as one takes time to compose and create the artifact.

Electronic mail and other Internet communication technology (e.g., instant messaging) enable more of the communication process to be documented. Consequently, with more of the process represented and stored as artifacts, more of the process is made explicit and more if it becomes available for reflection and re-use as a component for future projects.

The concreteness of artifacts, however, can be misleading. On several occasions, particularly during the first weeks of the funding pitch project, the

Consultants believed that whatever they wrote on the whiteboards was understood equally by all participants in the room. That is, they did not seem to consider the equivocality of their representations, and instead, seemed to assume that developing a common representation meant developing a common understanding. To their frustration, however, they soon realized that the shared witnessing of making ideas concrete on the white board and static sheets did not guarantee a shared understanding or collective subscription to their proposals.

7.4 Summary

In this chapter, I drew on my findings from both field studies to characterize different degrees of improvising and different kinds of improvising, based on the use of structural referents. Together, my findings highlight that improvising does not occur simply around a single structural referent, as I suggested in Chapter 3. Instead, groups tend to guide their improvising around a collection of structural referents - what I refer to as a "set of structural referents." Among other things, the set of structural referents represents expectations regarding what improvisers should and should not do. Improvisations may be classified relative to the set of structural referents that is enacted. The degree of improvising may be high because the structures corresponding to the set of structural referents were enacted as expected and doing so involved a great deal of improvising, or because the improvisers improvised with it, regardless of whether it was intended for such use. In addition to better understanding how degrees of improvising are manifest in organizational contexts, my findings suggest there are two general kinds of improvising: routine and non-routine. In routine improvising, the set of structural referents is relatively consistent across several improvisations, whereas in non-routine improvising, participants must create a set of structural referents. Recognizing the difference between routine and non-routine improvising highlights the additional effort that non-routine improvising requires.

The examples of improvising a funding pitch, a web prototype, and a new formula suggest several aspects about organizational improvising that are not

apparent from improvising in the arts. First, improvising involves improvising a collective identity. Similar to organizational identity (e.g., Golden-Biddle and Rao, 1997), collective identity is not a stable, singular, objective entity, but rather, it is construed, enacted, and interpreted during everyday interactions among individuals within particular organizational contexts. In routine improvising, participants begin the process already with a sufficient level of common understanding of the purpose and interests of the project to quickly develop consensus on the project's identity and improvise collaboratively. In non-routine improvising, on the other hand, the set of structural referents - of which the project identity is a critical aspect - must be improvised and negotiated. In the case of DotOrg, for example, the identity of the funding pitch project (i.e., an identity of DotOrg) evolved from the struggle of participants to improvise collectively. These findings underscore the importance of not taking for granted that a shared understanding exists whenever a group of actors gets together, nor assuming that it is effortless to develop.

My findings from both field studies suggest that to facilitate collaboration, individuals must develop a minimum common understanding, a key aspect of which is developing an identity of the collective (i.e., "project identity"). In non-routine improvising, the process of developing a minimum common understanding requires more effort than in routine improvising because there is less experience to draw on and that can mitigate any conflicting understandings. Artifacts are integral to this process. For example, participants create and use artifacts to bridge boundaries and engage in collective reflection-in-action, improvising, and consensus-building. They also create and use them as representations and components of identity to interpret the situation, piece together outcomes of projects (e.g., the DotOrg website, the funding pitch, etc.), structure the non-routine process. The equivocality of artifacts enables participants with differing understandings to develop and represent a collection of complementary understandings (i.e., a "minimum common understanding," including a project identity) and to structure and coordinate their activities around a common artifact without having to reach equal understandings. The

simple presence of emergent artifacts does not guarantee success, however. As my findings illustrate, artifacts may be used to structure the process in a manner that excludes the views of some participants and, although it may represent a minimum common understanding, it may also mask differences that prove significant later on in the process.

Chapter 8: Conclusion

8.1 Contributions

My goal in developing this dissertation was to address the general question, what are the roles of technology as groups of individuals work together in environments they describe as dynamic and unpredictable? To address this question, I grounded my work in two practice-based theoretical frameworks, structuration theory (Giddens, 1984) and an extension of structuration theory, technologies-in-practice (Orlikowski, 2000). Drawing on a growing literature on improvising in organizations and accounts of improvising in African American quiltmaking, I developed a framework describing the activities that constitute improvising and the different kinds, roles, and aspects of technological artifacts in improvising. I then applied this framework to examine the findings of field research I conducted into the work practices of two groups: a team of chemists developing new formulas for personal care products, and a management team developing a funding pitch and prototype web service during the initial stages of their small Internet-based start-up business.

I propose a view of improvising that sees it as a structured process of innovation that involves responding to changing situation(s) with resources at hand by creating a production and adapting it continuously. Overall, I found that two kinds of artifacts are significant to improvising: stable artifacts (i.e., artifacts that do not change significantly during an improvisation) and emergent artifacts (i.e., artifacts that are created and adapted during an improvisation). In addition, I found that there are three general uses of artifacts in improvising: tool (the use of an artifact to build an outcome), component (the use of an artifact as part of an outcome), and product (the use of an artifact as an outcome). Finally, these uses tend to involve two aspects of artifacts: practical (the use of an artifact for its functional capabilities) and symbolic (the use of an artifact for its representational capabilities). Artifacts, particularly emergent artifacts, were an integral part of enacting structures (the use of emergent artifacts as structural

referents), assessing continuously (the use of emergent artifacts as products of the improvisation to solicit feedback and examine the progress, or lack thereof, of the collaborative endeavor), creating resourcefully (the re-use of emergent artifacts as components of the final product), and adapting extemporaneously (the use of artifacts as tools to adapt the emerging output).

The findings and concepts I develop in this dissertation represent several key contributions to the fields of organizational studies and information technology. I now highlight what I consider to be the three most significant contributions of my research.

1. I offer a practice-based framework of improvising that describes improvising as constituted by enacting structures that guide the process of assessing continuously, creating resourcefully, and adapting extemporaneously. In the process, I also introduce the concept of structural referents to describe conceptual and tangible representations of structures that serve as templates to guide instantiations of structures. These concepts enable me to describe degrees of improvising in more precise terms than current literature does and to introduce the distinction between routine improvising and non-routine improvising.

Researchers, for example, have noted that some improvisations involve more improvising than others and have proposed several dimensions along which to distinguish degrees of improvising. Improvisations may vary depending on the "increased demand on imagination and concentration" of the improvisation (Weick, 1998:544), on the "time gap between composing and performing, designing and producing, or conceptualizing and implementing" (Moorman and Miner, 1998:702), on the degree to which the performance departs from "the original referent" (Moorman and Miner, 1998:703), or on whether one improvises within, with, or outside the basic structure of an improvisation (Zack, 2000:230). With the exception of Zak (2000), these conceptualizations have not been explored in greater detail or extended much beyond general observations noted above. A contribution of my research has been to explore in greater detail dimensions along which degrees of improvising varies. I draw on

the concept of structural referents to distinguish and compare improvisations based on the relative number of novel activities that constitute the improvisation (i.e., degrees of improvising) and based on whether or not the improvisation involves improvising a set of structural referents (i.e., routine and non-routine improvising). By distinguishing degrees of improvising from routine and non-routine improvising, I offer a framework for describing *how* individuals improvised (e.g., one group engaged in more extemporaneous adapting than another group) that is distinct from *what* individuals improvised (e.g., one group had to improvise the rules of the game).

As I noted in Chapter 1, there have been several calls in the fields of research on small groups, decision making, creativity, and innovation for more research examining *in situ* the *processes* that constitute the phenomena of interest. In the field of research on small groups, for example, McGrath and Hollingshead (1994) argue that to better understand how small groups interact with technology, researchers must collect detailed context-rich ethnographic data on key features of the group, task, situation, and technology over long periods of time. My dissertation work offers a practice-based framework for describing the roles of technology in improvising and two rich field studies describing small groups interacting with technology, each in a different organizational context. My framework enables other researchers to compare across other field studies, fine-tune concepts I have introduced (e.g., routine and non-routine improvising), and build on these. Similarly, my framework highlights the importance of creating resourcefully and adapting extemporaneously to improvising - two sets of activities that I argue are fundamental to the innovation process but that have received scant attention in research on innovation (a notable exception is the work of Garud and Karnøe (2003), which explores the role of bricolage in innovation at an industry level).

In Chapter 7, I drew on research on improvising, organizational identity, and coordination structures, and can make several contributions to them in return. I contribute to the growing literature on coordination structures (e.g., the emergence of norms, negotiated belief structures, and shared logic of exchange)

by describing the *process* by which a group of individuals develops a project identity and the integral role of artifacts - particularly emergent artifacts - in simultaneously structuring the process and contributing to its outcome. I contribute to the literature on organizational identity by introducing the concept of collective identity and describing the process by which collective identity is developed and the use of emergent artifacts as representations of identity.

2. Orlikowski and Iacono (2001) note that the IS literature lacks a systematic consideration of the IT artifact, and propose that IS researchers theorize more specifically about the nature and influence of IT artifacts as they incorporate such concepts into their studies. I offer a framework to think about technology not simply as a stable tool that is used for practical purposes, but also as an artifact that can be stable or emergent, used as a product, component, or tool, and engaged for both its practical and symbolic aspects. In addition, I focus on the roles of technology within the context of a specific practice (i.e., improvising) and explore the dialectic relationship between technological artifacts and their uses. My framework addresses technological artifacts in general (rather than IT artifacts specifically) and consequently, serves as a foundation from which to explore the specific nature and influence of IT artifacts in innovation. My framework offers a collection of concepts for understanding the role of digital components in the process of innovation. By generating a greater understanding of information technology and how it shapes and is shaped by innovative work practices, my research offers a new way to think about information technology - not simply as a tool or outcome but also as an emergent artifact with several roles to play during the processes of innovation and change.

3. Finally, I highlight the critical role of emergent artifacts in the process of improvising. In both field studies, emergent artifacts were integral to the process of improvising. Emergent artifacts enabled collective reflection in action around the same artifact (Levina 2001) and collective bricolage - i.e., the same representation was used as a component in different projects and by different

people for different purposes. At Blockasun, three instances of emergent artifacts were the printouts of formulas-in-progress used to guide the process of creating formulations, the formulations used to assess the formula-in-progress, and the lab book used to document every experiment conducted in the lab. Emergent artifacts made improvising palpable. The formulators represented the formula-in-progress in the form of a recipe on a computer file and printout and used them both as components of the final product and to structure the ensuing improvisation. Similarly, samples were emergent artifacts created and used to assess the situation. Finally, the lab book provided a representation of the history of experiments at Blockasun and enabled the formulating team to reflect on them.

At DotOrg, instances of emergent artifacts included proposals for alternative business models, ghost slides, and the emerging web prototype. Emergent artifacts were created and used to assess the situation and adapt proposals accordingly (e.g., creating presentations of findings and proposals to solicit feedback, gauge the situation, and conscribe). Emergent artifacts were also used as components to piece together (i.e., create resourcefully) prospective project identities. Creating emergent artifacts with a particular form and using them in a particular way (e.g., writing drafts of ghostslides by hand and then faxing them to an assistant to translate into Powerpoint, rather than personally developing a Powerpoint-draft) was a way to enact particular identities and structures (e.g., a summer associate using a well-respected consulting method for developing a key deliverable).

The three general contributions of my research illustrate how my dissertation contributes to both organizational studies and information technology. I have developed a framework of the roles of technology that encourages researchers and practitioners to expand their views of technology beyond simply a stable tool that has only practical value. My framework highlights multiple kinds, roles, and aspects of technological artifacts in relation to practices and in doing so, highlights the critical roles of technology in

collaborative practices. The concepts I have developed here enable us to see the various ways that technology is integral to what we do and how we enact knowledge, identity, and other fundamental aspects of organizing with them.

8.2 Implications

The findings and concepts that I presented in this dissertation have implications for both practitioners and academics. As I describe in this section, they highlight the following: (i) the value of drawing on artistic traditions to better understand organizational phenomena; (ii) the roles of structures in innovation; and (iii) the potential value of digital emergent artifacts. Because I am particularly interested in the implications of my research to the field of information systems, I will discuss this last point in greater detail than the other two.

My research underscores the value of drawing on artistic traditions to understand organizational phenomena. When I was first conducting my literature review on improvising, drawing on web-based databases such as Lexis-Nexis and ProQuest, I would periodically come across articles on African American quiltmaking among the results of my searches and quickly dismiss them as "mistakes." Fortunately, my curiosity got the better of me and I stopped to read one and soon realized there was immense value in understanding improvising in African American quiltmaking. African American quiltmaking was a creative tradition that offered relevant stories with which to better understand the roles of technology in improvising in general and compare and contrast examples of improvising from other situations (e.g., organizational settings). As I continue to explore the role of technological artifacts in innovation, I will continue to explore the role of artifacts in creative traditions, including the arts, sports, architecture, and cooking. Examples of improvising from the arts were valuable to my understanding of the roles of technology in improvising because they were examples of routine improvising in non-corporate settings. The routine nature and simplified context of the improvising facilitated the identification of key practices.

My research also highlights why in studying organizational improvising, it is important to go beyond examples of improvising from the arts and conduct field studies of improvising in organization settings. Although artistic traditions are valuable for rich examples of routine creative practices, they do not provide examples of practices in the contexts of organizations. It is important, then, to complement research on artistic traditions with empirical work of the phenomena of interest as practiced in organizational settings.

In the area of organizational studies, my findings and concepts have implications for how people think about the role of structures in improvising. My analysis on degrees of improvising, for example, suggests that managers interested in developing "semistructures" (Brown and Eisenhardt, 1997) would be well advised to recognize the virtualness of structures (i.e., structures only exist as enacted and are consequently, always open to interpretation and change beyond managers' expectations). My contribution is to bring this virtual aspect of structures into improvising. Rather than treat structures in improvising as inherently providing the ideal balance between enough structure to coordinate action but not so much as to stifle creativity (e.g., Barrett, 1998; Brown and Eisenhardt, 1997), it is important that organizational actors consider their form, the expectations they evoke, and how they are enacted. Organizational actors are not simply responsible for developing useful structural referents but are also responsible for developing an environment that will enable and inspire others to draw on structural referents effectively.

In the area of information systems, one of the implications of my findings is that management may find value in IT by recognizing that employees create and use digital components to piece together and adapt (i.e., improvise) a variety of projects. To achieve greater organizational agility, management should foster the capacity of employees to improvise. In the remainder of this section, I will draw on my framework and findings from my dissertation to examine one of the most developed streams of research on the design and use of technology for team work within the area of Information Systems - the research on Group Support Systems (GSS). I will argue that designers of GSS and organizations that use GSS

may discover greater value in the existing capacity of GSS if the systems can be tailored to support groups of individuals to create resourcefully and adapt extemporaneously, rather than simply using the systems to generate ideas in ways structured by system. The concepts I have developed suggest that enabling groups of individuals to create, store, combine, and adapt digital components enables them to innovate collectively. My findings show that IT enables users to create and store digital artifacts (e.g., an e-mail message, text files, music files, video files) and to adapt and combine these artifacts in ways beyond what the creators of the artifacts intended or anticipated. I discussed, for example, how the Founders of DotOrg re-appropriated the text of a web-based article and re-used it as part of their own promotional material. Outside of traditional business environments, there are similar examples where individuals have taken advantage of this enabling role of information technology to innovate in new ways.

In the music industry, a disc jockey's (D.J.'s) performance is no longer simply about deciding what song to play next and integrating it with the current song (although accomplishing both requires a great deal of skill). Today, D.J.s are also *sampling* "appropriating and remixing bits of other people's material" (Glaser, 2002: E5) and creating their own mixes of others' songs (essentially, a D.J.-version of playing a "cover" of someone else's song). D.J.s are using new technology to improvise with tangible (e.g., records) and digital (e.g., digital files of songs) musical artifacts, improvising acoustical quilts of samples, including their own. One of the most famous and successful D.J.s to sample is a thirty-six-year-old artist called "Moby" (his birth name is Richard Hall). His work is an example of an artist who creates music by re-using the music of others and mixing it together with his own music, and then having others (e.g., advertisers and movie producers) re-use his music for unanticipated purposes. Moby's 1999 album, *Play*, has sold about 10 million copies and all but one of its 18 tracks has been licensed for use in multiple commercials and soundtracks (e.g., the track "Porcelain" was used by Nordstrom and Bailey's Irish Cream) (Smith, 2002).

Music tracks are made into recyclable commodities - i.e., components that are open to multiple uses.

Related to this realm of music sampling, technology has also been developed to enable video sampling. Video jockeys (V.J.s) use video projectors (that once projected PowerPoint presentations at Internet startups but when the startups failed, became available to artists at very low prices), stored video clips of pre-shot and pre-manipulated footage, and special software to - live on stage - integrate and mix video clips, alter the color and speed of clips, and create transitions between clips and other effects (Glaser, 2002). As the most popular dance clubs in the world have become multi-media spectacles, D.J.'s and V.J.'s, once relegated to a hidden area of a club, now take center stage at dance clubs and are often the star attraction of the clubs.

One V.J., working for the Canadian band, Rush, explained that at concerts, he tries to create an experience that falls somewhere "between the tight choreography of a film or musical, and the spontaneity of an improvisational jazz musician" (Glaser, 2002: E5). Originally, Rush had opted *not* to use video during their live performances because it seemed unoriginal and staid. As lead singer and bassist, Geddy Lee, explained (Glaser, 2002: E5):

> [The use of video has] been very overused by pop acts. With the video culture of the last 20 years, there's too much explaining away from music. [But with new technology, video can be used] in an interactive way, pulsing to the music, which was exactly what I had in mind. Bands all have the same instrumentation, but they all sound different. With video, you have to look at it the same way - it's how you employ it.

Although artists have been using various projection technologies to accompany live music performances since at least the late 1960's (e.g., the use of colored oils on overhead projectors during concerts at the Fillmore West in San Francisco), new technologies have enabled video artists to sample and improvise in ways that have made them international celebrities and generated impressive record sales.

In general, these new technologies enable music and visual artists to create digital artifacts of music and video (that either they or other artists have created),

store them, mix them together, and play and/or project them to live audiences - all in the moment. In addition, the decreasing costs and increased availability of these new technologies has enabled more individuals to experiment with sampling and perform at clubs, expanding, as well, the audience for such performances (including, in the case of V.J.'s, the recent "dotcom bust," which suddenly made available cheap video projectors from failed startups). Using concepts from my dissertation, new technologies have enabled artists to create and store their own components (themselves the products of the performing artist or of other artists), and to mix and manipulate those components in the moment. Technological artifacts are not simply significant as tools for creating, mixing and manipulating but also as the products of previously developed work and as components for performances.

Information technology enables actors to create artifacts representing an emerging production and reflect on it. They can also be manipulated and recombined as components for the ensuing production. The more individuals who have access to these components, the more the components are open to being appropriated in ways unanticipated by their original producers. These basic roles may fundamentally affect innovation. A recent article in *The Boston Sunday Globe Magazine* (Mayor, 2003:21), describing the phenomenon of Internet fan fiction, where fans of various creative works (e.g., Harry Potter, boy bands, television shows) write fictional stories (including pornographic stories) using the characters from those works, describes how uses of digital components has changed traditional processes of innovation:

> In an age of endless and easy digital interaction, an author becomes merely the first in a line of people pitching ideas into the plot. 'It's an object-oriented approach, like when computer programmers reuse code,' observes Holland & Knight's Mahony. 'They're taking the raw materials of culture and lumping them together to make something new.'

Group Support Systems designed to facilitate brainstorming have the potential to be the organizational equivalent of music and video sampling technologies. Designers need to design tools that allow organizational actors to experiment with the technology. For example, the Talking Heads used aspects of

(what was then) new technology that to improvise their 1980 song *Once in a Life Time*, considered by National Public Radio to be one of the 100 most important pieces of music of the 20th century (Karr, 2000).[1]

Several organizations that have embraced electronic discussion groups and electronic knowledge repositories have experienced the potential downside of having conversations become artifacts: they quickly accumulate so many and such a variety of items, that organizing them in a manner that makes them easy to retrieve is difficult and time consuming.

These aspects suggest potentially beneficial roles of group support systems (GSS) and also suggest implications for future systems development. To illustrate my points, I will apply the concepts I developed to a recent study of GSS. Hender, Dean, Rodgers and Nunamaker (2002) conducted an experimental study with undergraduate students that explored the effects of using GSS to implement three different idea generation techniques (i.e., electronic brainstorming, assumption reversals, and analogies) on the quantity and creativity of ideas generated. They found that (Hender et al., 2002:60):

> Analogies produced creative, but fewer, ideas, due to the use of unrelated stimuli. Assumption reversals produced the most, but less creative, ideas, possibly due to fragmentation of the group memory and cognitive inertia caused by lack of forced movement among dialogues.

Hender et al. (2002:79) focus on the "structural impacts" of both creative techniques and GSS on creative outcomes and argue:

> The considerable potential of GSS to support creative process will be best realized as research continues to clarify how structural aspects of both creative techniques and GSS impact creative outcomes.

Hender et al. (2002) describe several attributes of GSS, which, in light of my findings, suggest that the numbers of potentially beneficial roles of GSS in organizational settings are far greater than simply the role they emphasize (i.e., the role of GSS as tools to structure idea generation). Specifically, Hender et al.

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[1] Many thanks to Stephanie Woerner for pointing this NPR segment out to me.

(2002:66) describe the ability of GSS to record and store ideas and configure them in different ways to represent "group memory" and generate ideas:

> GSS structures can be used to record ideas and to present other creative stimuli. The ability to store previously generated ideas so that they can be made available to participants has been termed *group memory*. The ability to configure group memory within GSS makes it possible to manipulate exposure of each participant to the idea generated by the other participants in a variety of ways [...] Group memory may be configured in two ways: by *partitioning* it into one or many dialogues used to collect ideas, or by *manipulating* movement among the dialogues. Both partitioning and movement are determined by the GSS tool used and the configuration of that tool.

Drawing on my research findings, the capability for GSS to be used to create various "group memories" would be valuable for assessing the situation, creating resourcefully, and adapting extemporaneously. The capability to develop and store representations of "dialogues" is essentially the capability to develop and store emergent artifacts representing "dialogues," and use them as components to explore different combinations of dialogues. In addition, the process of generating and gathering "dialogues" would not necessarily have to occur during a single moment, as in brainstorming, but could occur throughout the process, similar to the gathering of scraps of cloth throughout the process of quiltmaking. In addition, the process of combining and configuring the various dialogues does not necessarily have to be structured according to a pre-designed technique.

Although research on GSS has started to move from the laboratory into the field (Fjermestad and Hiltz, 2001), there is still a strong focus on GSS as a stable tool for enhancing productivity, expected to accomplish what its designers intended it to accomplish (Orlikowski and Iacono, 2001). The cost of this focus is that other, potentially more beneficial, uses of GSS are overlooked. In their review of research in GSS, Briggs, Nunamaker, and Sprague (1998) note:

> Idea generation and convergence are critical in all aspects of teamwork. However, there is much more to teamwork than just idea generation. Consider the problem-solving process: sense making, alternative generation, alternative evaluation, choice making, implementation planning, results

monitoring. Each of these steps is critically important, and yet very little is yet known about the use of GSS to support each of these phases.

The findings from my field studies suggest that organizational actors are already piecing together their own GSS, by creating emergent artifacts such as lab books and ghost slides. Imagine combining some of the insights from research on GSS with my findings on the use of the lab book at Blockasun to develop an IT-based lab book that facilitates the activities of assessing the situation, creating resourcefully, and adapting extemporaneously. As I noted in Chapter 2, Ciborra (1996) has written about similar uses of information technology (e.g., he proposed the use of information technology as a tool for capturing and managing information about an event, for enabling communication, and for collective reflecting and learning). He admits he lacked a theory of improvisation that would "help establish a common framework among what at present may seem scattered experiments or peculiar applications" (Ciborra, 1996:375). The concepts I have developed in this dissertation could serve as part of such a common framework. With a better understanding of how they are creating and using technological artifacts to develop their own "group memory," GSS designers will be in a better position to support IT-based improvisation.

In general, the distinction between technology as tool and technology as component is becoming increasingly important, as more practitioners and academics herald the value and use of object-oriented programming and component-based architecture. Closely related in theory, both object-oriented programming and component-based architecture stress the value of breaking down processes and services into essential elements that can be shared across different processes and situations. The challenge, however, becomes designing them so that they connect as effortlessly as possible. Work in object-oriented programming and component-based architecture address the potential negative consequences of having numerous programmers create their own digital components (e.g., managing an overwhelming number of components) and offers potential methods for managing them (e.g., governance strategies).

My framework on technology and improvising helps explain this in ways that other frameworks on innovation do not: my framework highlights creating resourcefully and adapting extemporaneously as core sets of activities in the process of innovation and describes technological artifacts as components that enable groups of individuals to create resourcefully and adapt in the moment. As organizations increase their investment in information technologies and a greater number of work practices become IT-mediated, understanding the roles of technology in improvising becomes particularly salient. My dissertation provides a framework for generating this understanding. In addition to contributing to the literature, I expect my research to help managers and workers become better improvisers with technology in the workplace.

8.3 Limitations

As I noted in Chapter 4, my dissertation is inductive and exploratory. Consequently, I have only begun to explore the roles of technology in improvising. I attempted to build a theory that does not tie improvising to a specific setting (chemists in a lab or entrepreneurs at an incubator). However, it would be interesting and important to examine improvising in other settings to see if the framework holds up and to better understand how improvising varies across settings, tasks, and practices. It would also be useful to explore the roles of technology across a large number of improvisations within a single setting over time.

I have also just begun to explore the implications of my analysis and findings of the roles of technology in improvising. More work is required to develop further the links between the framework of improvising and the framework on the roles of technology. I believe my framework helps to highlight the integral role of technological artifacts to numerous disciplines, but a great deal more work needs to be done to articulate those links more specifically.

8.4 Future Research

In a recent issue of one of the leading journals in information systems research, *MIS Quarterly*, Benbasat and Zmud (2003:186) repeat the call for more research that focuses on the IT artifact and the "application IT to enable or to support some task(s) embedded within a structure(s) that itself is embedded within a context(s)." Research that lacks this focus, they argue, "hamper efforts toward developing and reinforcing a central identity for the IS discipline" (Benbasat and Zmud, 2003: 192). Although I have only started to examine the specific roles of *IT* artifacts in improvising, I have developed a foundational framework and collected rich sets of data from which to explore their roles even further and distinguish them from non-IT artifacts. My future research will build on my dissertation work to explore the roles of IT artifacts in improvising and other core organizational practices. For example, I would like to explore the relationship between IT, improvising, and strategic agility, learning, and negotiating.

As organizations strive to become more "flexible" and "adaptive" to dynamic markets, several are seeking to foster improvising. A challenge for these organizations is how to institutionalize improvising. What kinds of structures should an organization develop to enable improvising, given the risks of imposing either too much or not enough structure? The way that the formulating team at Blockasun improvised new formulas suggests that a method for increasing the chance of learning from improvising is to structure the process of assessing the situation. It would be interesting to conduct further research into the roles of routines in the process of innovation. I was particularly interested in the role of routine practices in improvising a new formula at Blockasun. As a team, the formulators at Blockasun engaged in a number of different practices during the process of creating a new formula - some of which were improvisational, others of which were not. Those that were improvisational represent a range of improvising - from the periodic subtle creation of a new technique to enacting a routine more effectively or efficiently to the ongoing "artistic" process of creating a new formula. The overall process

of creating a formula was a clear case of improvising. Interestingly, routines, commonly regarded as the antithesis of improvising, were a critical part of the process. These routines were developed to bring "more science into the art" of formulating. The Formulators enacted them to continuously assess the situation and to learn from improvising. These findings may provide insights into how organizations can develop routines to support improvising.

From a "knowing in practice" perspective (Orlikowski 2002), knowledge is not a "separate entity, static property, or stable disposition" but rather, enacted in the practices of specific people in specific situations. As Orlikowski (2002, p.252-3) explains:

> Knowledgeability or knowing-in-practice is continually enacted through people's everyday activity; it does not exist "out there" (incorporated in external objects, routines, or systems) or "in here" (inscribed in human brains, bodies, or communities). Rather, knowing is an ongoing social accomplishment, constituted and reconstituted in everyday practice. As such, knowing cannot be understood as stable or enduring. Because it is enacted in the moment, its existence is virtual, its status provisional.

As one's knowing changes, one's practices change; as one's practices change, one's knowing changes. Orlikowski (2002, p.253) notes:

> As people continuously reconstitute their knowing over time and across contexts, they also modify their knowing as they change their practices. People improvise new practices as they invent, slip into, or learn new ways of interpreting and experiencing the world.

What is the relationship between knowing and the technological artifacts that represent knowing (particularly, tangible artifacts that, once created, do not change significantly over time)? Does the relationship change when the knowing is based on routine versus non-routine improvising? It would be interesting to explore the role of artifacts in the learning process of the apprentices at Blockasun - where artifacts were integral to the process of learning routine improvising.

Finally, interesting research can be done in relation to entrepreneurship. My research on the roles of technology in improvising promises to help better understand the process of entrepreneurship. Lounsbury and Glynn (2001), for

example, focus on the content of stories, and argue that ethnographic studies are needed to better understand the storytelling process. Interestingly, they do not explore business pitches (either formal or informal) as examples of stories that give entrepreneurs a competitive advantage. In examining the process by which two kinds of pitches (i.e. a funding pitch and web prototype) were developed, my research uses ethnographic methods to unpack a process of cultural entrepreneurship (i.e. improvising).

8.5 Closing Thoughts

With the introduction of team-based management strategies into the workplace (e.g., participative management, knowledge management, continuous quality improvement, total quality management) more individuals in the workplace are working in teams to accomplish projects (e.g., Levi, 2001; Turner, 2001). In addition, they are working in team in environments that are seemingly more dynamic and unpredictable and on tasks that are new and ambiguous. To accomplish their projects, many improvise. My framework specifically argues that groups of individuals enact structures as they assess continuously, create resourcefully, and adapt extemporaneously. In addition, IT is becoming ubiquitous in many work practices. As more individuals improvise in teams, they are using IT and although improvising itself is not a new phenomenon, improvising with IT is. My framework and findings provide a foundation from which to explore why this is significant. They show, for example, that IT enables team members to create and store emergent artifacts and use and manipulate them as digital components as they create resourcefully and adapt extemporaneously in the process of making sense of their environments and to accomplish their tasks. In short, my findings suggest that IT enables groups to improvise in new ways.

While groups tend to improvise frequently, few do so explicitly or deliberately or without the support of top management. However, in unpredictable environments, management that deliberately embraces improvisation as an explicit strategy can create an atmosphere in which change

can be navigated fluidly and can be leveraged towards achieving more successful innovation outcomes. In their research commentary, Sambamurthy and Zmud (2000:112) argue that firms need a new logic for organizing their IT activities:

> This new frame for examining the organizing logic for IT activities must focus on the core underpinnings of successful IT management practices today: identifying and developing an organization's core IT capabilities (rather than managing IT tasks); a recognition that these capabilities will be assembled, delivered, and then disassembled through a variety of intra and interorganizational networks (rather than through the IT function acting quasi-independently in a command and control manner), and the conviction that the most significant organizing mechanisms will be those associated with integration (rather than differentiation).

My findings and concepts of the roles of technology in improvising can help firms develop their new organizing logic. By better understanding improvising, we can better understand what activities people actually engage in as they adapt to local contexts and by examining the roles of technology in improvising we can better understand how they involve technology in this creative process.

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