The Roles of Technology in Improvising

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Prepared for the International Conference on Information Systems, Doctoral Consortium, 2001

Keywords: Information Technology, Innovation, Improvisation, Organizational Change, Organizational Use of IS, Structuration Theory

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Abstract

A growing number of organizational researchers are using the framework of improvising to make sense of the process of innovation in dynamic environments. The roles of technologies in such improvising, however, have all but been ignored in this literature. Drawing on the theoretical perspectives of structuration theory (Giddens 1984) and technologies-in-practice (Orlikowski 2000), I first develop a theoretical framework of the roles of technology in improvising and then apply that framework to examine the roles of technology in 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 Internet-based start-up business. The findings of my research should offer a richer understanding of the complex roles of technology in the increasingly important practice of improvising in the workplace.

Research Focus

What are the roles of technology as groups of individuals innovate in work environments they describe as dynamic and unpredictable? With business environments increasingly marked by ambiguity and uncertainty due to greater competition, organizational changes, and increased investment in new information technologies, improvisation as a metaphor for organizing becomes particularly relevant.

In organizational studies, a growing number of researchers are using the framework of improvising to make sense of the process of innovation in dynamic environments (e.g., Bastien and Hostager 1988; Ciborra 1996, 1999; Hatch 1998, 1999; Lau et al. 1999; Miner et al. 2001; Moorman and Miner 1998; Orlikowski 1996; Weick 1993; Zack 2000). In the introductory essay to the special issue of *Organization Science* on improvising, Weick (1998, p. 544) offers a definition of improvisation:

> *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)*

Improvising is essentially a process of innovation that assumes changes are unpredictable and evolve out of situated experiences. Improvising involves using a set of common guidelines (structures) to create an innovative outcome (e.g., a jazz tune, theatrical performance, product design, web site, etc.) in the moment from the changing performance situation(s).

While organizational research on improvising covers a broad set of themes, the roles of technologies in improvising have all but been ignored. In my dissertation research, I develop a theoretical framework that begins to articulate the possible roles and influences of technology 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 prototype web service during the initial stages of their small Internet-based start-up business.

Research Foundation

In this section I discuss the brief organizational literature on technology in improvising, and then consider the one area of the literature where the role of artifacts in improvising is richly treated—African American quiltmaking.

There are two notable exceptions to the dearth of organizational research on the role of technology in improvising. First, Weick (1993), in his examination of organizational design as improvising, notes that a key factor for successful bricolage is the ability of the bricoleur to consider artifacts as unrestricted by any single use. I discuss this in greater detail below. Second, Ciborra (1996) postulates several potential roles for information technology (IT) as a tool in facilitating improvising in the workplace, for example, a tool for capturing and managing information about an event (including its context and rationale), and a tool for enabling communication and the development of shared knowledge. Notwithstanding these two studies, a theoretical treatment of the roles of technology in improvising is still lacking in the organizational literature.

In contrast, the role of artifacts in improvising has been extensively considered by literature on improvising in African-American quiltmaking (Archer 1997, Cash 1998, Davis 1998, Freeman 1996, Hindman 1995, Knight 1991, MacDowell 1997, Mulholland 1996). Within the US, improvisation in the making of quilts is a tradition originally developed by women in the early days of slavery. 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 resources, and instead had to create quilts from whatever scraps they could get hold of. Because they were not constrained to patterns preferred by their mistresses, they were able to design quilts based on their own rhythmic and color schemes (Hindman 1995). These quilts and the

process of quiltmaking simultaneously accomplish several things: individual expression, communal identity (Cash 1995, Hindman 1995, Davis 1998), income (Cash 1995), a link between generations (Davis 1998), and a "form of resistance to structures of dominance and control" (Davis 1998, p.67).

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; *putting the batting* or quilt filling in; and finally *doing the quilting*, that is, stitching together the top, the filling and the base. Each stage can be accomplished alone or, as is most often the case, with a group. 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).

Drawing on these descriptions, we can begin to make sense of the various kinds and roles of tangible artifacts in improvising. During the process of improvising, 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 *artifacts-in-progress,* which are created and emerge from the improvisation (e.g. the quilt-in-progress). We can see that artifacts play at least three general roles: as *product,* as *component* and as *tool*. The quilt, for example, as the product of the improvisation, becomes involved in a variety of uses, including providing warmth, representing talent, community and history, and communicating messages (as during the Underground Railroad when quilts were used to secretly signal safe houses). Scraps of cloth (frequently from old garments of significant others) and batting (the "stuffing" material) are examples of artifacts that play the role of components of the quilt. That is, they are core elements used in the process of improvising that help to constitute the "materiality" of the outcome. Artifacts that play the role of tool include shears, needles, pattern templates, and quilting frames (used in the last stage to facilitate the quilting). The emerging quilt itself is an artifact that plays all three roles: it is a

product representing what has been improvised; it is the core component of the ensuing improvising and its outcome; and it is a tool that enables the making of the quilt to be accomplished in a particular way and across several situations (places and times).

The roles played by artifacts in the process of improvising are influenced not only by actors' intentions and activities, but also by the material properties of the artifacts. For example, in Durham, UK, quilts with closely-worked stitching designs evolved 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 during washing, rendering the quilt impractical and unattractive. There are several examples of quiltmaking trends that originated from the introduction of new dyes and/or the introduction of a new technology. For example, in the 1840's, the introduction of indelible inks helped extend the autograph album trend into quiltmaking and for almost a decade, signature friendship quilts (quilts made from a collection of blocks pieced and signed with ink - rather than embroidered - by friends) were extremely popular. By examining the use of artifacts in quiltmaking, we can see how, during the process of improvising, artifacts are drawn on and produced. They play such roles as products, tools, and components, and within these roles, they influence the ensuing improvising process and the outcome in a variety of ways.

Research Framework

In this section, I outline the research framework I am developing to understand technology in improvising. The framework emphasizes the interaction of technology with three key characteristics of improvising: bricolage, structure, and extemporaneous adaptation. It posits that technology is both dynamic and emergent, and (drawing on the insights from the use of artifacts in quiltmaking) that it participates in improvising in at least three ways: as product, as component, and as

tool. I first examine the three characteristics of improvising, and then articulate the possible roles of technology in improvising.

Improvising is Bricolage

A core element of improvising is that improvisers rely principally on features of the situation (e.g., local norms, available artifacts, and audience feedback) and their memories to develop their innovations. Barrett (1998, p.616) notes:

> *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.*

Because improvisers are limited in what they can predict, they rely on the environmental conditions of the moment to make sense of the performance situation, that is, conditions such as the material, cultural and political environment in which the improvising takes place. The innovation that emerges from the process of improvising (e.g., the musical or theatrical performance, the quilt, the product design "solution") is an assemblage of material and social elements drawn from the situation(s) within which the improvising takes place.

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 associated with all the ways in which the materials were used before. By always being open to and in the process, 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, p.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 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.

Improvising is Structured

Improvising is not guessing or randomly piecing together resources but rather, it consists of creatively integrating features of the evolving situation in relation to structures common to the actors and audience—it is *structured* bricolage. Structures serve as templates from which the performance will evolve (Barrett 1998, Weick 1998). 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). Peplowski (1998) notes that structure also enables musicians to communicate with the audience. Without structure, an audience would only hear noise or simply see a random collection of scraps of fabric.

Structures, explains Hatch (1998, p. 565), are 'historical referents' which are

reinterpreted every time they are enacted:

> *... most 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. Structures are evident in recurrent social practices which exhibit a certain (though not necessarily exact) consistency across time and space. They are enacted to guide action and in their use, become an outcome of action. In their situated enactment, structures may be reinforced or changed. The guiding role of structure emphasizes how structures can be used both to facilitate action and limit it, depending on the situation. In quiltmaking, for example, the quilt that is produced both reinforces the structures that are referenced, and represents a unique assemblage that emerges from the improvisation (which, in time, may serve to facilitate a change in quiltmaking structures).

Improvising is Extemporaneous Adaptation

The third key characteristic of improvising describes *how* structures are enacted: in improvising, actors act in the moment and in doing so adapt structures to the situation at hand. This characteristic emerges from the interaction of the first two characteristics; in order to be as resourceful as possible and respond to the conditions of the situation at hand, it may be necessary to adapt the structures that are being enacted. In a 1991 exhibit of African-American quilts entitled "Improvisation in African-American Quilt Making," a quilt from the 19th Century was displayed so that visitors could view both sides. On one side of the quilt was a "fine example" of the 'flying geese' European pattern of repetition; on the other, a "fanciful, equally deft

improvisation of the [flying geese] motif" (Knight 1991). This quilt nicely illustrates that 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, p.40): "[Jazz] was not just playing music. It was playing—like a game—playing with music, for fun." When structures are played with, they are enacted *approximately*. To enact a structure approximately is to enact a variant of a referent structure as one adapts the referent structure to the situation. The goal of improvising is not to produce exact renderings of structures (to reproduce the referent structures exactly) 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.

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). At a more specific level, one notices different degrees of improvising (Moorman and Miner 1998, Weick 1998, Zack 2000). In my framework, the degree of improvising (often reflected in the degree of innovativeness of the final product) depends on how much the improvisation is tailored to the particulars of the situation(s) in which it takes place. In some cases, the structures afford tailoring to the situation at hand; in others, structures are approximated in response to the situation(s) at hand. In the later cases, the more the enactment deviates from the referent structure, the greater the degree of improvising. For example, a quilt maker may enact a flying-geese pattern almost exactly, and as a result, hardly improvise the design, or she may enact the pattern only approximately and improvise an innovative design based on it. 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 an evolving situation, and / or simply because the quilt maker intends to.

The Roles of Technology in Improvising

Improvising in quiltmaking offers clear and rich examples of the various roles of artifacts in improvising. As we have seen, there are two general kinds of artifacts involved in the process of improvising: *stable artifacts,* which do not significantly change during the improvisation (e.g., computer hardware) and *artifacts-in-progress,* which are created and emerge from the improvisation (e.g. web demo prototype). Stable artifacts may be involved in one of three roles: as product, component, and tool. Technology as product refers to the role artifacts play as an outcome of the improvising (e.g., a web site); technology as component refers to the role artifacts play as an element of the outcome (e.g., Java scripts); and technology as tool refers to the role artifacts play in the process of constructing the outcome (e.g., computer). The artifact-in-progress simultaneously plays the roles of product (e.g., it is the result of the improvisation thus far), component (e.g., it becomes a critical component of the ensuing improvisation), and tool (e.g., it enables the improvisation to take place across different situations).

To illustrate, we can apply this framework to the Internet start-up business I studied. In this example, technologies were involved in a variety of roles as the management team improvised a mock web site ("web-demo") to implement its prototype service. The core of the team was made-up of the two co-founders and, from the incubator supporting the start-up, a strategy advisor, technology advisor and web designer. The web-demo was to be used in funding pitches and for acquiring beta-customers. The service provided by the start-up was intended to help small non-profit organizations leverage the Internet to generate greater awareness and revenue from such special events as "walkathons." The process of developing the web-demo, as with most of the initiatives at the start-up, involved creating several versions of the product, testing them out, and modifying them to produce newer versions. The final web-demo consisted of eight web screens which together, conveyed to potential funders and users the experience of interacting with the suite of web-based services

offered by the start-up (for example, helping participants in the special event to solicit and manage sponsors, as well as track and collect donations). The web-demo was a bricolage of elements drawn from past projects done in the incubator, jobs previously held by the team members, pre-existing technologies, and image banks—all tailored in response to the new demands. For example, rather than design an online payment system from scratch, the team decided to "plug-in" an existing commercial product.

In this example, we see all three roles for the web technology. The final web-demo is a product of the team's improvising and it represents a number of uses: it was used as a pitch to potential funders of the start-up, as well as to sign up potential beta-customers of the service (i.e., small non-profits running special events). The technological components of the improvising include the graphics created by the web designer and the Java and HTML scripts that make up the back-end of the site. Technology was also a tool in the team's improvising process, the most central one being the computers used to run the software that generated the web site's code and graphics, and that stored and accessed its data. The evolving web-demo also serves to highlight how the same technology can play all three roles in a process of improvising: as a product, it was the visible result of the team's efforts thus far; as a component, it was an emergent and evolving foundation for the next version(s) of the web site; and as a tool, it served as a common reference point for the activities and deliberations of the team members, while it also helped to structure their next steps in the process.

Research Methodology and Plan

The next step in my research is to apply the framework I have developed to examine the findings of two field studies. The first study investigated the work practices of formulators—chemists who develop new formulas (recipes) for personal care products (e.g., shampoos, deodorants, lotions). I shadowed a formulating team for a month, as part of a larger, multi-year study of several small businesses owned by a

large chemical manufacturer.[1] The second study examines improvising by the management team of a non-profit Internet start-up located at an incubator, an organization that houses several start-ups during their initial stages and strives to help them get established rapidly. I spent four months with the management team as a participant observer, observing the day-to-day challenges of transforming their business plan into a prototype web service and fledgling business.

Most of the data collected in both settings consisted of on-site observations of the everyday work practices of participants. Data was collected in the form of daily hand-written fieldnotes, audio-tapes (interviews and weekly meetings), and paper documents (including print-outs of web-pages).

In collecting and analyzing data from my field work, I focused on examples of improvising, or what I refer to as improvisation events. An improvisation event is the set of actions and artifacts that are involved when actors innovate extemporaneously by enacting and adapting structures to make do with the situation at hand; it is the collection of actions and artifacts that were involved in the development of an improvised outcome. I identified potential improvised outcomes and then examined the actions and artifacts that were associated with the production of those outcomes. 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 new formulas. In analyzing my field notes, I began with a completed formula and trace back its history, identifying the actions and artifacts that were involved during the process. In the case of the start-up, I focused on the development of a mock web site that was going to be used to demonstrate the services offered by the start-up to potential customers and funders. There were several other improvisational events associated with the one I focused on,

[1] The study focused on the changes in work practices associated with the introduction of new groupware technologies.

including some that were components of the event I focused on. For example, one of the greatest challenges facing the founders of the start-up was to develop a clear identity and describe in greater detail what exactly their start-up did. This identity was in part reflected in their business plan and in part reflected in the various presentations they were developing for potential customers and funders, including the demo. Thus improvising the demo was associated with improvising the identity of the start-up. Consequently, in focusing on the improvisation of the web demo, I also examined the improvisation of the start-up's identity.

All the data have been collected, and I have begun an initial thematic analysis and coding of the field data (Glaser and Strauss, 1967) and this has produced some emergent themes. Subsequent analysis will involve relating the emergent themes to my framework, and then elaborating, modifying, or extending it, as appropriate.

Challenges Facing Completion

The greatest challenge I face is going through the very large amounts of field data I have collected. The iterative process of developing the theoretical framework and analyzing the data is time consuming and complex. A clear theoretical notion of improvising does not exist in the literature, and the process of developing one for my purposes here has been challenging as I grapple with how technology relates to such concepts as innovation, structure, bricolage, and play.

Expected Contributions

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. My research contributes to several fields of research - including information technology, organizational studies, and innovation - by

providing a theoretical framework for generating a greater understanding of information technology and how it is used within, and how it shapes, innovative work practices. It offers a new way to think about information technology - not simply as a tool but also as an emergent artifact with several roles to play during the processes of innovation and change.

In addition to contributing to the IS literature, my work should also contribute to the organizational research on improvising because it examines improvising in the workplace, rather than the arts. Further, I plan to show that the roles of technology in improvising are much richer than previously assumed in the organizational research that tends to draw most of its examples on improvising from jazz or the theater.

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 will provide 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.

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