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ORGANIZATIONAL IMPROVISATION AND ORGANIZATIONAL MEMORY

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We define organizational improvisation as the degree to which the composition and execution of an action converge in time, and we examine the theoretical potential of this definition. We then propose that both organizational procedural memory (skill knowledge) and declarative memory (fact knowledge) moderate improvisation's impact on organizational outcomes in distinct ways. We also suggest that improvisation influences organizational memory by (1) generating experiments and (2) permitting the development of higher-level competency in improvisation. Contemporary technological changes related to the nature of organizational memory intensify the salience of these issues.

Observers long have noted the presence and promise of improvisation in the arts, teaching, therapy, and athletics. For example, one can find detailed data on differences between improvisational performance by expert and novice mathematics teachers (Borko & Livingston, 1989), models of musical improvisation (Pressing, 1984, 1988), and guidelines for encouraging effective improvisation by therapists (Embrey, Guthrie, White, & Dietz, 1996; Gardner & Rogoff, 1990).

Organizational scholars often seek to provide strategic planning and project planning tools that, presumably, suppress the level of action occurring without prior design. Nonetheless, those in an important contrasting branch of work have argued that improvisation not only occurs frequently in organizations but may also have value for organizations (Preston, 1991a; Weick, 1979, 1987, 1993a,b,c, 1996). Researchers have also observed, however, that fruitful improvisation may require important resources and skills (Crossan & Sorrenti, 1997; Eisenhardt & Tabrizi, 1995; Hatch, 1997b; Weick, 1993b,c).

In this article we draw on work from several disciplines to generate specific propositions about how organizational memory will influence improvisation's impact. We argue that two different types of organizational memory—(1) procedural (skill memory) and (2) declarative (fact memory)—moderate the impact of organizational improvisation in different ways. In particular, we suggest these memory types enhance different organizational outcomes and can compensate for each other's drawbacks. We also formalize the insight that improvisation, in turn, affects organizational memory and represents an identifiable organizational competency (Eisenhardt & Tabrizi, 1995; Weick, 1993b).

To support these testable propositions, we draw on prior work to define *improvisation* as *the degree to which composition and execution converge in time*. Therefore, the more proximate the design and implementation of an activity in time, the more that activity is improvisational. This view of improvisation is primarily temporal, with a focus on the degree of simultaneity of composition and implementation. It is consistent with prior work (Crossan & Sorrenti, 1997; Weick, 1993a) but focuses on one key dimension: the temporal order of two specific activities. This enhances theory development by encouraging distinctions between the improvisation process itself and important potential correlates or outcomes, such as intuition, adaptation, innovation, and learning.

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The importance of predictions about organizational improvisation and memory goes beyond refinements to existing frameworks and theories, however. First, awareness of the changed pace in competition for many organizations has created a fadlike press on managers to abandon traditional planning. Managers face broad admonishments to be nimble and flexible (e.g., Imai, Nonaka, & Takeuchi, 1985) but often lack balanced information on the tradeoffs between improvisation and composing well in advance of action, and on the broader competencies required to improvise effectively. Such knowledge is increasingly useful as contemporary organizations face competitive situations, in which exogenous change may outpace traditional planning cycles (Burgelman, Maidique, & Wheelwright, 1996). This shift makes improvisation important to more than startup or creative organizations. A highly successful special session involving jazz improvisation at the 1995 annual meeting of the Academy of Management—documented and analyzed in a special issue of *Organization Science* (Meyer, Frost, & Weick, in press)—also points to the more general importance of improvisation for many types of organizations.

Second, work on improvisation is made substantially more urgent by the impact of technological change, not only on the tendency to improvise but on an organization's ability to deliberately manage the nature of and access to organizational memory. Regarding the tendency to improvise, technological change affects the chances an organization may execute an act while designing it because traditional buffers between choice and action have been reduced drastically. For example, a CEO could improvise a corporate response to a crisis by electronically mailing comments to thousands of employees and customers. This level of simultaneity simply would not have been possible if the CEO had developed a strategy in conjunction with a public relations staff and then created written memoranda and organized meetings to communicate the organization's position.

Technological change also influences the way memory can guide action in organizations. For example, in technically sophisticated firms, design engineers, who used to work from principles and prior training, now work on computers with corporate design rules encoded into design constraints so that prior memory is brought to bear more consistently on action. At the same time, organizations increasingly post organizational product specifications, policies, and notes from group meetings and budget information on firm intranets, as well as design internal search engines that invisibly guide employees' access to different parts and types of organizational memory (e.g., Diamond, 1997; Knott, 1997).

Our conceptual framework draws on this increasingly powerful role of organizational memory by suggesting that firms will need to design systems that enhance access to the right type of memory while undertaking improvisational action. It also implies that organizations could benefit from deliberate efforts to accumulate memory that will permit them to improvise more effectively over time, and to take into account the impact of different memory types on different outcomes, such as speed or effectiveness of actions. Taken together, then, our propositions imply that developing organizational improvisational competencies involves long-term attention.

To develop and consider our propositions, we have organized the article as follows. We first describe several types of improvisation and discuss the nature of collective improvisation. Next, we examine the theoretical potential of this definition of improvisation by assessing whether it extends the existing menu of organizational variables in a meaningful way. Following this, in the main body of the article, we present propositions linking organizational memory and organizational improvisation. Taken as a whole, these propositions suggest that, while improvisation may represent a potentially powerful organizational tool, its effective deployment is very demanding and may well require substantial time and investments by organizations. We conclude by considering the operationalization of key constructs, boundary conditions, and selected contributions of this work.

IMPROVISATION

Definition

In Table 1 we suggest that the notion of improvisation arises in varied contexts and that the term *improvisation* has been defined in varied ways, even in the organizational context. We suggest that whether or not improvisation occurs depends not only on *what* happens but also

TABLE 1
Improvisation Across Disciplines

Definition	Author(s)	Domain
A. Organizational perspectives on improvisation		
"the *acts of composing and performing are inseparable,* and each composition/performance is different from all previous compositions/performances" (p. 95)	Bastien & Hostager (1992)	Organizational communication
"Improvisation in the present . . . to stay focused on current conditions, . . . while maintaining project schedules" (p. 9)	Brown & Eisenhardt (1997)	Product development
"Intuition guiding action in a *spontaneous* way" (p. 1)	Crossan & Sorrenti (1997)	Management
"Intuition guiding action upon something in a *spontaneous* but historically contextualized way" (p. 5)	Hatch (1997b)	Management
"an activity which requires no preparation and obeys no rules" (p. 65)	Mangham (1986)	Management
"Improvisation—the casting around for a precedent or referent that will enable someone to deal with a circumstance *for which no script appears to be immediately to hand*" (p. 41)	Mangham & Pye (1991)	Management
"To be composed while performed" (p. 51)	Perry (1991)	Management
"Improvisation is to be distinguished from rewriting a musical in that *changes are introduced during the performance by the performing individuals and not by the composer before the event*" (p. 84)	Preston (1991a)	Organizational development
"*on the spot surfacing, criticizing, restructuring, and testing* of intuitive understandings of experienced phenomena" (p. 147); *"Knowing-in-action" and "Reflection-in-action"* (p. 276)	Schön (1983)	Management/education
"a *just-in-time strategy*" (p. 229)	Weick (1987)	Management
"There is no split between the composition and performance; no split between creator and interpreter; and no split between design and production" (p. 6)	Weick (1993a)	Management
"Improvisation implies *attention rather than intention drives the process of designing*" (p. 351)	Weick (1993b)	Management
"Thinking and doing unfold simultaneously" (p. 19); "Retrospective sensemaking" (p. 19)	Weick (1996)	Firefighting management
B. Musical perspectives on improvisation		
"Imagination guiding action in an unplanned way, *allowing for multitude of split second adjustments*" (p. 3)	Chase (1988)	Music
"Improvisation follows not the blueprint method but this second approach. The improviser may be unable to look ahead at what he is going to play, but he can look behind at what he had just played" (p. 61)	Gioia (1988)	Jazz/management
"The *spontaneous creation* of music" (p. 119)	Kernfeld (1995)	Music
"Free from the effects of previous training" (p. 345); the *opposite of pure composition* (p. 346)	Pressing (1984)	Music
"Real-time composition" (p. 142)	Pressing (1988)	Music
"Unlike compositional creativity, which involves a long period of creative work leading up to a creative product, in improvisational creativity, *the creative process and the resulting product are co-occurring*" (p. 1)	Sawyer (1992)	Music

TABLE 1
Continued

Definition	Author(s)	Domain
"playing *extemporaneously*, i.e., without the benefit of written music" (p. 378)	Schuller (1968)	Music
"Improvisation involves *making decisions affecting the composition of music during its performance*. The fundamental ideal of improvisation is the discovery and *invention of original music spontaneously, while performing it*" (p. 226)	Solomon (1986)	Music
"The art of *spontaneously creating music while playing or singing*" (p. 399)	Toiviainen (1995)	Neural network theory applied to music
"The *spontaneous* act of constructing or reconstructing; using any immediate or available properties (material or immaterial) into either material or nonmaterial forms used for a specific purpose (function) or need" (p. xii)	Zinn (1981)	Music
C. Theater perspectives on improvisation		
"to substitute . . . staid and preconceived notions for the unforeseen, the improvised, the unknown, the world of imponderables" (p. 59)	Knapp (1989)	Theater
"Playing the game; *setting to solve a problem with no preconception as to how you will do it;* permitting everything in the environment to work for you in solving a problem" (p. 383)	Spolin (1963)	Theater
D. Therapy perspectives on improvisation		
"*Practice without prior planning*" (p. 22)	Embrey, Guthrie, White, & Dietz (1996)	Pediatric physical therapy
"Complete freedom" (p. 221)	Esman (1951)	Psychoanalysis
"In clinical improvisation, therapists experience moments of *spontaneity*, creativity, and intuition" (p. 130)	Forinash (1992)	Clinical music therapy
Improvisation occurs when there is "evidence that the child used some lookahead [strategies] but *little evidence that the child's drawn solution was based on a completely deliberated plan*" (p. 482)	Gardner & Rogoff (1990)	Developmental psychology
"to be highly respectful of form even as it reworks its previous instantiations" (p. 229)	Lichtenstein (1993)	Psychoanalysis
"Being, acting, *creating in the moment* without props and supports, without security, can be supreme play, and can be very frightening, the very opposite of play" (p. 23)	Nachmanovitch (1990)	Therapy
"*Spontaneous* music behavior"	Orsmond & Miller (1995)	Music therapy
"Juggling with ideas and feelings (in one's head) and trying out silent interventions" (p. 81)	Towse & Flower (1993)	Music psychiatric therapy
E. Teaching perspectives on improvisation		
"*To move away from scripted lesson plans*" (p. 473); "An improvisational actor enters the stage with a definition of the general situation and a set of guidelines for performing his or her role, rather than working from a detailed written script" (p. 475)	Borko & Livingston (1989)	Teaching
"[to] process information continuously and make numerous interactive or *'inflight' decisions*" (p. 110)	Cleary & Groer (1994)	Health education

TABLE 1
Continued

Definition	Author(s)	Domain
"Situational decision making" (p. 200), "To do things in lessons they hadn't planned for—to discover whether they [teachers] *actually made up activities on the spot*" (p. 205)	Graham, Manross, Hopple, & Sitzman (1993)	Physical education
"Thinking in the midst of action" (p. 630); "Responding to the unknown *without advance preparation*" (p. 630)	Irby (1992)	Physician training
The creation of (algebra) problems that fit the immediate context of the students' misunderstanding in a way that preplanned problems could not. The fact that the problems were new for both student and teacher meant that the *problems were being composed by the teacher on the spot.* (p. 6)	Yinger (1986)	Teaching
F. Other perspectives on improvisation		
"Reading and reacting in parallel" (p. 1383); "Dual tasks" (p. 1384); *"Perception-in-action" and "thinking-in-action"* (p. 1386)	Bjurwill (1993)	Sports
"no agreed mechanism for changing the British constitution or even any agreement about what the constitution actually contains" (p. 18)	*The Economist* (1995)	Politics
"Role improvisation is defined as the extent to which the organization and meaning of roles are invented by the people immediately involved in a relationship" . . . *"actors re-interpret, redefine, and re-structure their relationships during the on-going process of interaction"* (p. 289)	Powers (1981)	Sociology
"Rapid, unplanned change" (p. 565)	Volkman (1994)	Anthropology

on the *temporal order in which* things happen. In ordinary discourse we usually assume that composition of an activity occurs first and is followed later by implementation or execution. In improvisation the time gap between these events narrows so that in the limit *composition converges with execution.* The more improvisational an act, the narrower the time gap between composing and performing, designing and producing, or conceptualizing and implementing.

One advantage of the proposed definition is that it is consistent with several features suggested by prior observers of improvisational activity (see Table 1). "Composition" implies that the improvisational activity involves some degree of innovation, because it goes beyond automatically repeating a pre-existing routine (Crossan & Sorrenti, 1997; Weick, 1996). Some improvisational actions may represent only modest shifts from prior behavior, whereas others may involve radical innovative activity (Weick, 1993a). This definition also describes another feature of improvisation noted by many observers: improvisation involves a semi-ordered activity. Specifically, improvisation typically has a referent or "an underlying formal scheme or guiding image" (Pressing, 1984: 346). Yet, the order is not fully predesigned and, in that sense, is partial. If the order were derived solely from following standard procedures, we would not consider it improvisation.

This definition also follows in a tradition of research on processes focusing on the *simultaneity* of events (e.g., Cohen, March, & Olson, 1972; Ginsberg & Baum, 1994; Van de Ven, 1986, 1993), of which improvisation is a particular type. By focusing on *when* rather than *whether* the design of action occurs, the improvisation construct invites attention to a new set of research issues, such as the advantages and disadvantages of the timing of actions. Like-

wise, some evolutionary theories have contrasted the potential value of fully random and accidental actions with preplanned actions (Aldrich, 1979; Burgelman, 1983; Miner, 1987; Weick, 1979). This improvisation definition offers a third mode of change, which may not be random, but does not necessarily reflect prior planning or even stable goals (Follett, 1930; March, 1976).

Levels of Improvisation

Observers of improvisation agree that there are, generally, three distinct levels of improvisation. We describe each level with examples from the arts—especially music—and studies of organizations.

The first level of improvisation involves modest adjustments to a pre-existing piece or process. In jazz, for example, musicians often begin with "the head" of a piece, playing the song and its standard chords, but making slight modifications in style and emphasis (Bailey, 1980; Berliner, 1994; Hatch, 1997b). Slightly more aggressive interpretation of a melody, termed *embellishment* or *ornamentation,* also occurs (Hatch, 1997b; Preston, 1991a; Weick, 1996). Observing similar levels of improvisation within organizations, Preston argues, "Many courses of action within a factory, for example, the rescheduling of production to meet customer demands, were really only of a paraphrase variety. In these situations the managers sought to make minor adjustments to the production plan" (1991a: 93).

A second level of musical improvisation involves stronger departures from the referent or underlying song. Preston refers to this as "chorus phrasing" (1991a: 84), and Weick labels this "formulaic improvisation" (1996: 21). In this mode the listener may hear few if any specific phrases from the original melody, but at least one element of the original referent—chord structure, rhythm, or style—remains a template around which the musician improvises (see Berliner, 1994, and, Kernfeld, 1995). Organizational examples of this level of improvisation include improvised new products that represent variations on existing products (Miner, Moorman, & Bassoff, 1996) and production processes (Stoner, Tice, & Ashton, 1989).

In the most extreme forms of improvisation, the improviser discards clear links to the original referent and composes new patterns (Berliner, 1994; Hatch, 1997b; Weick, 1993b). This form of improvisation—termed "motive" or "theme" improvisation by Weick (1996)—is often associated with "free jazz." There, the improviser may begin with a standard head but moves on to melodic improvisations that have internal patterns unrelated to the original harmonic, rhythmic, or melodic structures. In organizations, subgroups may create a new product not only outside of, but actually inconsistent with, existing firm strategy (Burgelman, 1983; Hutt, Reingen, & Ronchetto, 1988). A skunkworks team may improvise a new product, sometimes piecing together parts, machines, and people from other projects (Peters, 1988; Sutton & Hargadon, 1997). When the composition and execution of such projects tend to converge in time, these activities represent radical improvisation. From popular culture, the work of the NASA team that rescued Apollo XIII represented a radical, improvisational use of objects outside prior themes or structures (Lovell & Kluger, 1995). These forms represent a continuum, rather than a set of sharp categories.

Organizational Improvisation

Improvisation can be, and often is, executed by an individual. Weick's (1993a) descriptions of improvisation by firefighters, for example, frequently detail improvisations by specific individuals, although he also considers team phenomena. Similarly, in much of the literature, researchers describe improvisation by individual actors, athletes, therapists, musicians, and teachers. In one standard form of jazz improvisation, for example, a rhythm section will maintain rhythmic order and underlying harmonic structure, while an individual soloist improvises in various modes.

Observers of both artistic and organizational improvisation also have emphasized that collective improvisation occurs (Crossan & Sorrenti, 1997; Preston, 1991a; Weick, 1993a,b,c). For example, Hutchins (1991) describes a collection of people on a ship, on which the navigational system has failed. As they try to help navigate, calling out estimates of coordinates and calculating subparts of data needed to make navigational choices, they eventually develop a "system" of interaction that permits them to get successfully to port. However, although the group improvised

a solution to the instrumentation crisis, no individual member of the group fully grasped the system he or she was creating or why it was working.

Some scholars reject such ideas as improper reification and argue that such apparently "collective" order should be treated as merely the aggregate impact of actions by individual human beings (Argyris & Schön, 1978; see discussions in Walsh, 1995, and Walsh & Ungson, 1991). We believe, in contrast, it is meaningful to see such processes as collective improvisation. This approach follows in the tradition of other work, in which researchers argue for the value in considering other organizational features, such as memory (Cohen, 1991; Feldman, 1989; Hedberg, 1981; Huber, 1991; Walsh, 1995; Walsh & Ungson, 1991), culture (Martin, 1992; Schein, 1985), and routines (Cohen & Bacdayan, 1994; Nelson & Winter, 1982; Winter, 1987). Although studying such organizational-level phenomena can raise thorny definition and measurement problems (Cohen et al., 1995), these problems do not preclude the existence of these phenomena. We argue that organizational improvisation can occur if organizational design and implementation can occur.

How, then, does collective improvisation occur? One of the most common metaphors for group improvisation is the notion of "conversation," in which at least two agents interact around a theme or referent to compose while executing. Using this metaphor, we argue that collective improvisation may be produced by the joint activities of individuals, who are themselves improvising. The joint action of the individuals produces a "system" that we label a *collective improvisation.* Theatrical improvisation offers an obvious example here, when the ultimate shape of a scene arises not from any prior plan but from what unfolds after the first actor generates lines and movement, a second responds to that, and the group continues to interact (Crossan & Sorrenti, 1997; Mangham, 1986; Spolin, 1963). Likewise, the improvisation of technicians and radiologists in Barley's work (1986) was collective, because they jointly developed routines through their ongoing interaction. Therefore, if the crew members on Hutchins' ship each individually improvised in isolation of one another to save the ship, we would term this *individual,* not *collective,* improvisation.

In some cases an individual's behavior can trigger collective activities that are improvisational in nature (Hutt et al., 1988). The individual behavior may itself be extemporaneous, as when artists created new projects during the history of the Canadian Film Board (Mintzberg & McHugh, 1985). In other cases the stimulus for improvisation at the organizational level may actually be planned or deliberate at the individual level of analysis. Eisenhardt and Tabrizi (1995), for example, found that aspects of leader behavior played an important role in what appeared to be partially improvisational group product development (see also Quinn, 1986). Likewise, Miner (1987) reports the creation of new jobs that can be seen as organizational improvisation but that sometimes involved intentional individual action.

In this article we sometimes draw on observations made of improvisation by groups and teams for insight and ideas concerning improvisation. Is it reasonable to apply such ideas to entire organizations? We suggest that any entity that can reasonably be thought of as planning or executing action can also be thought of as improvising. This logic implies that problems and processes that occur between five improvising musicians can provide a useful lens for considering problems and processes affecting five departments seeking to improvise a joint project. In each case the crucial question is the degree to which design and execution converge in time.

This is not to say there are not potentially complex interrelationships between improvisations at different levels of analysis. The microsteps behind a particular organizational improvisation may involve improvisational actions by small groups, for example. However, because improvisation can occur at any level of analysis, it is also the case that not all organizational improvisation is strictly a process of small group interactions (Burgelman, 1984). For example, Mintzberg and McHugh (1985) describe a complex interweaving of improvisation at the individual and organizational levels in the evolution of organizational priorities at the Canadian Film Board.

Constructs Related to Improvisation

In this section we assess whether the construct of improvisation adds to the existing

menu of variables for understanding organizations. We explore this by arguing that improvisation does not describe a new empirical phenomenon—clearly, it has been observed in organizations for decades—but that, as a formal construct, it delineates a theoretically rich and measurable construct that can be distinguished from other, related phenomena.

Correlates of improvisation. In this section we describe several features of action that may or may not be present when improvisation occurs. On the one hand, our view of improvisation does not require the presence of these features for defining an activity as improvisation. On the other, these features may tend to occur when design and composition merge in time, or they may facilitate improvisation.

Bricolage is defined as "making do with the materials at hand" (Levi-Strauss, 1967: 17). Weick (1993a) suggests that bricolage may be an important part of improvisation in his description of firefighters at Mann Gulch. By putting temporal order at the heart of improvisation, our definition positions bricolage as an important skill that can occur during improvisation, rather than as part of its formal definition. Moreover, we believe that the more improvisational an act, the more likely bricolage is to occur, because there is less time to obtain appropriate resources in advance. Finally, we argue that being skillful at bricolage may actually help produce valued improvisation.

Although *creativity* has been defined in a variety of ways, a core aspect of most definitions is that creativity involves a degree of novelty or deviation from standard practice (Amabile, 1983; Barron & Harrington, 1981; Sternberg & Lubart, 1996). Creativity may involve absolutely no improvisation. For example, an organization could design a creative marketing plan without using improvisation. However, creativity may represent an unusually valuable competence for improvising organizations or individuals.

Crossan and Sorrenti define *intuition* as operating when "choices" [are] made without formal analysis" (1997: 3) and describe it as central to improvisation (Chase, 1988). We agree that intuition may be part of some improvisation. For example, a firm improvising a marketing strategy may skip market research and follow the intuition of a project leader to guide a product introduction. However, we also argue that collective improvisation can occur without an individual using intuition (see, for example, Hutchins 1991) and that intuition should not be used to define whether action is improvisational.

Process and outcomes associated with improvisation. In this section we describe several broad processes in which improvisation may play a role.

Adaptation represents a fundamental construct for scholars in many fields (Durham, 1978; Gould, 1977; Holland, 1975) and often raises problems of potentially tautological definitions. Here, we suggest that adaptation involves adjustment of a system to external conditions (Campbell, 1989; Stein, 1989). Using this view, adaptation is a much broader and more general construct than improvisation and does not necessarily invoke the same issues of temporal order. Adaptation can be achieved when an organization plans in advance to adapt to a change. An organization can also adapt by making contingency plans for different competitive situations that may unfold. Finally, an organization can adapt by deploying standard response routines—as when a fire department follows a rule, such as "adapt to the size of the fire by increasing the number of firefighters in the first two hours." Therefore, not only are there many forms of adaptation not involving improvisation as listed above, but, even more important, the construct of improvisation does *not* imply that all improvisation is adaptive. Thus, our definition of improvisation focuses on the process of improvisation and not its potential outcomes. By doing so, we confirm the need to examine the question of when and how improvisation is or is not adaptive for organizations.

We view *learning* as a process that involves the discovery, retention, and exploitation of stored knowledge (Epple, Argote, & Devadas, 1991; Huber, 1991; Levitt & March, 1988). If an organization improvises, assesses outcomes, and then acts again, this process can be seen as trial-and-error learning. However, many other kinds of learning are not improvisational. For example, an organization may execute a planned set of experiments in new ways to organize itself, may conduct research and development to learn about the properties of a key material, or may acquire knowledge by hiring people from outside (Huber, 1991). None of these activities necessarily involves improvisation at all. We argue that automatically equating im-

provisation with learning again confounds a process with one of its potential outcomes. The definition here leaves completely open the question of whether improvisation produces learning. Later, we argue that improvisation may, indeed, represent one avenue of organizational learning, and may even be learned itself. It is important that these possibilities not be left untested, which could happen if we equate the construct of learning directly with the definition of improvisation itself.

Scholars have defined *innovation* as a deviation from existing practices or knowledge (Rogers, 1983; Zaltman, Duncan, & Holbek, 1973). Because improvisation involves some level of creation or design, we believe it is a form of innovation. However, it is just one kind of innovation. For example, if an organization innovates a new way to store chemicals by analyzing its needs, gathering facts, designing the new storage facility, getting bids, and finally building it, the organization has innovated, but it has not improvised. Furthermore, improvisational activities may involve very different levels of innovation; a very large proportion or relatively small proportion of the activities may be novel. Some level of innovation is required for an activity to meet the temporal order definition because of its emphasis on design or creation of action. These considerations suggest a subtle link between innovation and improvisation. They also imply, however, that treating them as synonymous could reduce our ability to understand the specific issues of temporal order by confounding degree of innovation with degree of improvisation.

Clarifying these distinctions underscores the idea that our proposed definition makes no predictions or assumptions in and of itself regarding the consequences of improvisation. This makes improvisation more useful as a research area, since it is then feasible to theorize and test ideas about the conditions under which improvisation is and is not valuable. We argue here that organizational memory represents one of the key determinants of the nature of improvisational outcomes.

IMPROVISATION, MEMORY, AND ORGANIZATIONAL OUTCOMES

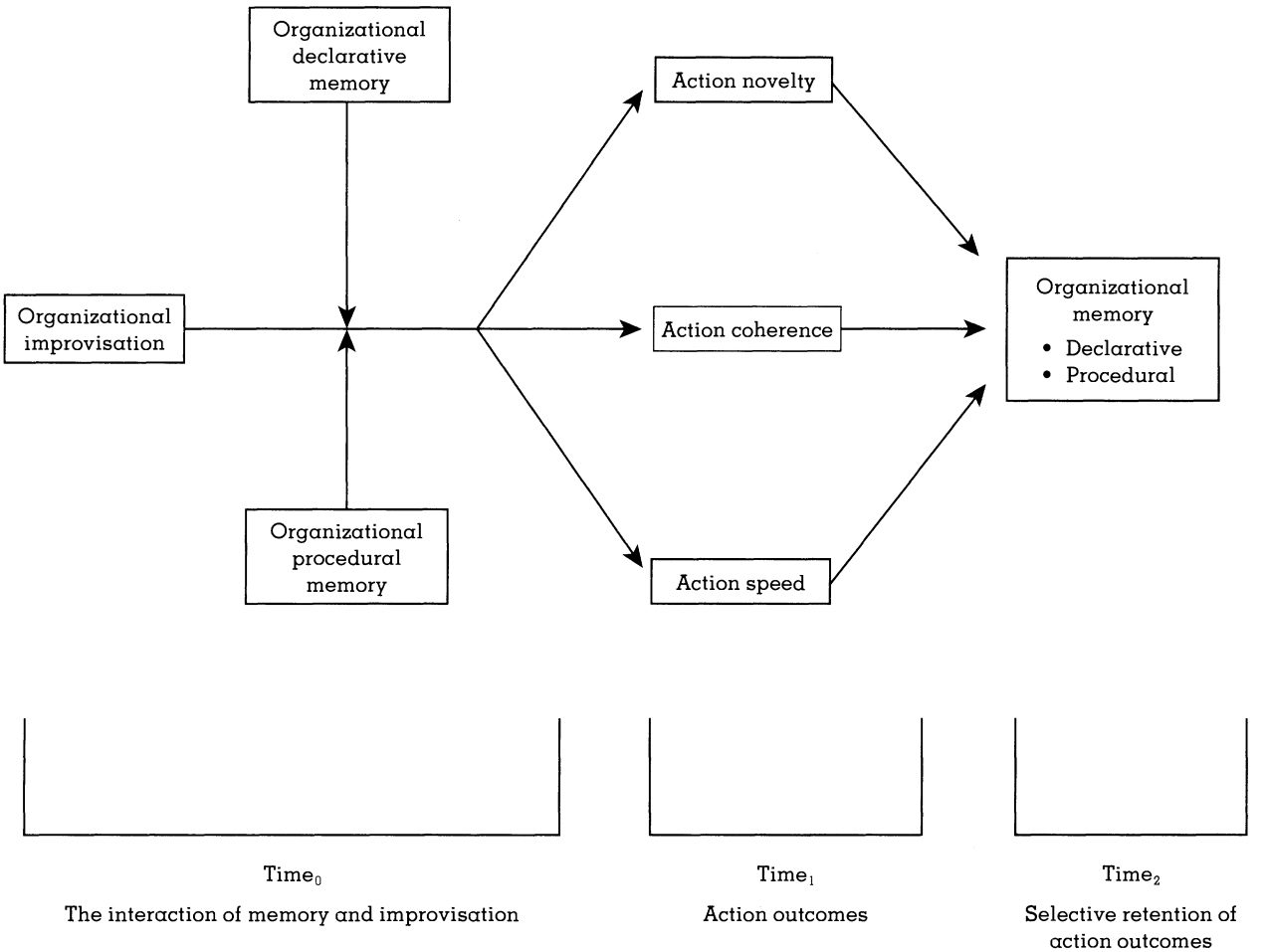
One thing that stands out in careful accounts of organizational, artistic, and other forms of improvisation is the impact of prior routines and knowledge of the improvising units (Eisenhardt & Tabrizi, 1995; Hatch, 1997b; Weick, 1993a, 1996). For instance, Berliner (1994) describes how musicians draw on pre-existing skills to append grace notes and produce chromatic fills. Barley's (1983) account of the creation of new interaction routines between radiologists and technicians suggests that their new routines drew on previous interaction routines. Metcalf's (1986) account of the Grenada rescue operation describes the military units involved as having certain important mental skills useful in improvising the rescue of an official during the operation. These and other examples suggest that prior knowledge and routines are important to improvisation, but that the presence of stable competencies is not inconsistent with improvising.

Building on this insight, we explicate specific propositions about how the effectiveness of organizational improvisation depends upon the processing of stored knowledge, termed *organizational memory*. In Figure 1 we summarize the proposed relationships. Specifically, the figure suggests that improvisation has a neutral relationship with organizational outcomes, but that procedural memory (skill or action knowledge) and declarative memory (fact knowledge) moderate this relationship. In addition to showing how memory influences the impact of improvisation, the figure shows that improvisation can, over time, shape the development of organizational memory.

Focal Organizational Outcomes

Organizational scholars writing on improvisation typically have emphasized *instrumental* outcomes (Brown & Eisenhardt, 1995; Eisenhardt & Tabrizi, 1995; Preston, 1991a; Weick, 1993a,c, 1996). Two specific criteria appear to dominate such outcomes. First, does the improvisation solve a problem? For example, improvisation saved the lives of firefighters at Mann Gulch (Weick, 1993a) and helped subvert a lorry strike (Preston, 1991a). Second, does improvisation permit the organization to harvest unanticipated opportunities? Brown and Eisenhardt (1995), for instance, describe how product development teams improvised to meet customer needs and introduce timely new products.

FIGURE 1
The Relationship Between Organizational Memory and Organizational Improvisation



Scholars focusing primarily on musical, theatrical, and other artistic improvisation typically emphasize *aesthetic* outcomes (Berliner, 1994; Hatch, 1997b; Spolin, 1963). Although it is possible to analyze both instrumental and aesthetic outcomes, we have chosen to focus on three instrumental outcomes, given the organizational context. First, action can vary in the degree to which it displays coherence. *Coherence* refers to the degree to which an action displays internal fit (components of an action have an internal consistency or order and work together well) and external fit (components of an action produce effects that fit the performance context).

Second, whereas all improvisation involves a threshold degree of deviation from prior routines, improvisation can produce varied levels of *novelty* in action. For example, it is possible for a new product development team to improvise in a relatively unoriginal manner, producing something that is not very different from prior products. In contrast, the team could improvise and produce an exceedingly unusual and novel product.

Third, *speed* refers to the time to plan and execute an action. Some observers have argued that executing well-made plans speeds up action by eliminating unnecessary steps, preventing time-consuming mistakes and midcourse changes, and building a common understanding that reduces coordination problems (Cooper & Kleinschmidt, 1986). Others have suggested that improvisation may speed up action because it supplants lengthy planning (Eisenhardt & Tabrizi, 1995). This equivocality makes our investigation into the impact of improvisation on speed not as straightforward as it might otherwise seem.

The Nature of Organizational Memory

As with organizational improvisation, scholars disagree about whether organizations store information in memory as individuals do. However, there is a growing sense that organizations do have frames of reference, routines, structures, and other physical artifacts that reflect the presence of stored knowledge (see Moorman & Miner, 1997; Walsh, 1995; and Walsh & Ungson, 1991, for reviews of this literature). We adopt this perspective but do not limit our analysis of organizational memory to the "storage bins" often associated with it, nor to its associated acquisition or retention processes or consequences (see Moorman, 1995, and Walsh & Ungson, 1991). Instead, we focus on the content and level of organizational memory (Moorman & Miner, 1997, 1998).

The *content of memory* refers to what Walsh and Ungson (1991) describe as the "what" of organizational memory (Walsh, 1995). In this article we focus on two types of memory often associated with individuals—(1) procedural and (2) declarative (Anderson, 1983)—that scholars recently have found to be associated with collectives as well (Cohen, 1991; Cohen & Bacdayan, 1994). The *level of memory,* which refers to the amount of stored knowledge and experience, is a well-known concern among cognitive psychologists who study expert-novice differences (Chase & Simon, 1973; Chi, Glaser, & Rees, 1981; Chiesi, Spilich, & Voss 1979), and is increasingly accepted by scholars as a trait of organizations as well (Cohen & Levinthal, 1990; Moorman & Miner, 1997, 1998; Walsh & Ungson, 1991). As an example of the content and level of memory, an organization that has been working in a particular industry for an extended period of time will likely accumulate a high level of declarative memory about the competitive structure and detailed traits of this industry. It might also accumulate a number of standard practices for dealing with others in the industry, representing a high level of procedural memory.

Procedural Memory in Improvisation

Procedural memory is memory "for how things are done" (Cohen & Bacdayan, 1994: 404) or memory for "things you can do" (Berliner, 1994: 102). Therefore, procedural memory involves skills or routines. The nature of these skills will depend on the particular domain in which the individual or organization is operating—whether it be jazz (Berliner, 1994; Hatch, 1997b), physical therapy (Embrey et al., 1996), physical education instruction (Graham, Manross, Hopple, & Sitzman, 1993), psychiatry (Esman, 1951; Lichtenstein, 1993), sports (Bjurwill, 1993), new product development (Brown & Eisenhardt, 1995; Sutton & Hargadon, 1997), or fighting wildland fires (Weick, 1993a, 1996).

In one study of jazz, Berliner provides dense descriptions of the critical role that procedural memory, which he calls "aural memory," plays in improvisation. He describes good improvisers as having large "vocabularies," "repertory storehouses," "musical biographies," or a "reservoir of technique" of "little sections or melodic fragments" that "provide readily accessible material that meets the demands of the composing music in performance" (1994: 102).

A key characteristic of procedural memory is that it becomes automatic or accessible unconsciously. Often referred to as "motor memory" (Pressing, 1988), procedural memory includes the skills needed to ride a bike or use a typewriter (Cohen, 1991; Pressing, 1984; Singley & Anderson, 1989). Procedural memory, therefore, often represents tacit knowledge for individuals and organizations (Cohen, 1991; Cohen & Bacdayan, 1994; Nonaka, 1990; Winter, 1987).

As a result of its automaticity, we argue that procedural memory is likely to have contrasting effects on improvisation. First, by providing a rich vocabulary of action from which to choose, it can improve the likelihood that improvisation will produce coherent action. In a musical setting, for example, high levels of procedural memory provide the jazz artist with a large repertoire of potential actions. As a result, the artist is able to select the most effective action, depending on the context and the actions of other band members. Likewise, Weick's (1993a) description of the bricoleur as a master improviser stems largely from the observation that the bricoleur draws on a repertoire of pre-existing routines, allowing for the creation of a tool that solves the problem at hand.

In the organizational context, Brown and Eisenhardt (1995) suggest that firms with deep technological routines will be more likely to generate improvisations in new product development. Although they do not use "improvisation," Mintzberg and McHugh (1985) describe how the Canadian Film Board continuously gen-

erated projects without a clear plan or goal, embodying what they define as an "adhocracy." Their description of the organizational features that supported this strategy clearly includes a rich density of routines embodied in both people and technology within the Film Board. The now-famous account of Honda's U.S. introduction of the Supercub motorcycle provides another organizational example of the impact of procedural memory. Honda's planned introduction of large motorcycles through traditional methods experienced difficulties, but managers noticed that nontraditional motorcycle customers tried to buy the Supercubs ridden by Honda's representatives. The Honda team successfully responded to the apparent demand in this context by improvising a new strategy to sell Supercubs through sports stores, discarding their original plan. Clearly, the effectiveness of this improvisation depended heavily on the fact that the Honda team had a repertoire of marketing, sales, financial management, and technical routines (Mintzberg, Pascale, Goold, & Rumelt, 1996; Pascale, 1984).

Although our argument about the importance of procedural memory applies to many forms of innovation, it carries special strength with respect to improvisation. In planned innovation, organizations can gather, in advance, tools needed to implement change. They can acquire, for example, both physical tools as well as ideas from sources outside the organization. However, given that there is little or no time between conceiving of and executing an action in improvisation, whether improvisation produces coherent action depends fundamentally on the existence of a large number and variety of procedural routines that can be recombined to fit in a given context. Therefore, we propose the following:

> *Proposition 1: The greater the procedural memory level, the greater the likelihood that improvisation will produce coherent action.*

In addition to increasing the likelihood that improvisation will produce coherent action, procedural memory is also likely to improve the speed of improvisation. Increased speed is due to the automatic or tacit quality of procedural memory, thereby producing an "economy of action" (Pressing, 1984: 355). In support of this, Carter, Sabers, Cushing, Pinnegar, & Berliner found that novice teachers took more time and were less efficient than experienced teachers in responding to students who led them away from scripted lesson plans (1987: 473).

Accounts of improvisation in war likewise suggest that rich repertoires of procedural routines play a role in fast improvisation. As Vice Admiral Joseph Metcalf observed during the 1983 U.S. invasion of Grenada, "The rescue of the governor-general had not been included in any of my earlier instructions. But it soon became apparent . . . that his rescue was of paramount importance" (1986: 288). He goes on to describe a rapidly improvised set of troop movements and a landing on an unsurveyed beach. Metcalf attributes the success of the rescue to the preparedness of the troops, which—in our terms—included a diverse and highly practiced repertoire of routines concerning movement of ships, movement of landing vehicles, and landing actions of Marines. This pre-existing procedural memory was recombined and redeployed for a purpose and in a setting not part of the original mission. Thus, we propose:

> *Proposition 2: The greater the procedural memory level, the greater the likelihood that improvisation will produce speedy action.*

A high level of procedural memory can also have a third and contrasting effect on improvisation, which is to constrain novelty. As Berliner notes, "In one of the greatest ironies associated with improvisation, as soon as artists complete the rigorous practice required to place a vocabulary pattern into their larger store, they must guard against its habituated and uninspired use" (1994: 206). Lonnie Hillyer, a famous jazz musician, has been quoted as saying, "Just trying to make phrases come out differently is hard at times, very hard, because we are programmed" (Berliner, 1994: 206). This constraining effect, to some degree, may be true of all types of information stored in a memory (Leonard-Barton, 1992). However, its consequences are more problematic in the case of procedural memory, because procedural memory tends to be accessed automatically (Cohen, 1991).

Consistent with this viewpoint, scholars have referred to procedural memory at the individual level as "use specific" (Singley & Anderson, 1989), which means that its accessibility and utilization are tied to particular issues or con-

texts present when learning a skill. For example, Singley and Anderson (1989) demonstrate that differentiation and integration skills in calculus generally do not facilitate learning of each other, nor do language generation and comprehension skills. Carraher, Carraher, and Schliemann (1985) have found that Brazilian child street vendors' knowledge of math computations is limited to use in the marketplace—not in a laboratory setting. Furthermore, sports commentators have noted that a player with strong procedural skills often will be "blinded" by the ball and that this "narrowing of attention reduces the visibility of important things that go on around him" (Bjurwill, 1993: 1384–1385).

Groups with strong procedural memories have also been found to be restricted. For example, Dougherty (1992) found product development teams with well-established procedures least likely to deviate from pre-existing action patterns. Similarly, Weick describes how experienced firefighters were unwilling to "drop their packs and tools" to "run faster" to escape catastrophic death (1996: 1). He speculates that this tendency was due to firefighters "overlearning" certain skills—a characteristic of procedural memory (Neustadt & May, 1986; Walsh, 1995). Thus, we propose:

> *Proposition 3: The greater the procedural memory level, the greater the likelihood that improvisation will produce action low in novelty.*

Declarative Memory in Improvisation

Declarative memory is "memory for facts, events, or propositions" (Anderson, 1983; Cohen, 1991: 137). Therefore, unlike procedural memory, which involves routine or skill memory, declarative memory can be more general. For example, although the procedural memory of riding a bike may be useful in some situations, declarative memory of the mechanics principles underlying riding a bike may have more general applications.

The importance of declarative memory to improvisation is found in a number of domains. In jazz, for instance, Kernfeld (1995) describes the acquisition of musical theory about chord progressions or rhythmic patterns as critical to improvisation. For organ improvisation, Bailey points to the importance of declarative memory, noting, "One cannot stress too much the importance of total mastery of the old disciplines of harmony, counterpoint, all types of canon and fugues" (1980: 50). Finally, Spolin (1963) describes several important "principles" important to successful theatrical improvisation, including good group dynamics and an effective relationship with the audience.

A key characteristic of declarative memory is the variety of uses to which it can be put. As Anderson has suggested, "[D]eclarative knowledge provides a basis for transfer between different uses of the same knowledge" (1983: 220). This characteristic leads to contrasting effects on improvisation. First, by providing the basis to transfer to a number of new areas, declarative knowledge should improve the likelihood that improvisation will produce coherent action. Specifically, when improvisers have rich stores of declarative memory, they are able to recognize various patterns in external events (i.e., see the higher-order principle) and to select actions that link their actions to these events so that a coherent whole is achieved, both within the action itself and within the context.

The importance of declarative knowledge in making sense out of new situations, deriving meaning from unstructured situations, or using principles to predict outcomes has been noted in descriptions of scientific discoveries, of course. In a famous example, historians of science often assume that Fleming's extended declarative knowledge of facts and theories about bacteriology allowed him to see the important implications when he noticed that bacteria did not grow around an accidental spore of the mold *Penicillium notatum* (Jewkes, Sawers, & Stillerman, 1969). At the firm level, Cohen and Levinthal argue that "fortune favors the prepared firm" (1990, 1994), referring to their finding that firms investing in R&D (which, by nature, is highly declarative) tend to be more effective at recognizing, interpreting, and using knowledge created outside the firm. At the group level, declarative memory may reside both in collective knowledge structures, such as shared information (Walsh, 1995), and also in material forms, such as blueprints, reports, summaries of prior research results, and the like. We propose:

> *Proposition 4: The greater the declarative memory level, the greater the*

likelihood that improvisation will produce coherent action.

In addition to assisting with pattern recognition, declarative memory does not carry as much risk of falling into pre-existing or "use-specific" (Singley & Anderson, 1989) patterns as does procedural memory. Because declarative memory typically is more theoretical and abstract, it may be applied to numerous situations in countless ways, thereby encouraging greater novelty. For example, in cognitive research, Singley and Anderson (1989) have shown knowledge of algebra to be utilized in understanding some calculus problems. Berliner describes the impact of declarative memory on jazz improvisation when he notes, "For many, the ability to interpret an appealing idea in theoretical terms facilitates exploration of the idea's implications, generating new phrases in the process of experimentation" (1994: 168). Finally, Weick (1996) suggests that a long, detailed list of firefighting procedures may be harder to adapt to unusual conditions. Therefore, general knowledge may be more useful in situations requiring improvisation.

This role of declarative memory influences innovation of many types, but it has particular importance for improvisation because of the rapid creation of rich meaning in novel actions. If there is substantial time to plan in advance of implementation, one can seek declarative memory during the conceptualization or design process. This might occur, for example, if an organization were planning in advance to move into a new technology and sought knowledge from outside the organization. In improvisation, however, the organization designs action while implementing it, so the strength of its own declarative memory has a crucial impact on the degree to which improvisation produces novel actions. This observation informs the standard insight that to sustain a "first mover" strategy in a fast-moving product market, organizations typically need stable access to cutting-edge science, whether through their own research or through links with sources of basic science (Maidique & Patch, 1988). We propose, then:

Proposition 5: The greater the declarative memory level, the greater the likelihood that improvisation will produce novel action.

Although declarative memory can enhance the chances of coherent and novel improvisation, it has one distinct drawback. Specifically, as Singley and Anderson note, because "declarative knowledge is not committed to a particular use, vast amounts of it are potentially relevant in any problem-solving situation, and this leads to serious problems of search" (1989: 220). For example, deductive reasoning (a declarative stock) can be retrieved in learning math, playing games that rely on logic, or in solving commonly encountered questions in life (Anderson, 1983).

In the organizational setting we can see evidence of this drawback to declarative memory in improvisation in numerous reports of organizations designing comprehensive information systems but finding them disappointing in times of crisis (Feldman & March, 1981; Goodhue, Wybo, & Kirsch, 1992; Laudon & Laudon, 1996). For example, a firm may need to improvise a modified manufacturing process in one plant, but it may fail to draw on knowledge of similar situations in other parts of the firm, because it is too hard to find out rapidly if and where such knowledge exists (Goodhue et al., 1992; Laudon & Laudon, 1996). In another example, during the Cuban missile crisis, Kennedy and his advisors had to create and execute responses within a very tight time frame. During this process, it took an extensive "search" through different government agencies and individuals to access knowledge about the true state of events in several important domains. As a consequence, although declarative memory was present, in principle, some of it was not used in improvisational aspects of the crisis (Allison, 1971).

This difficulty of declarative memory often has been seen by scholars as part of the divide between engineers and production professionals. In some settings production professionals believe engineers and others with strong theoretical knowledge create problems by searching through far too many forms of abstract knowledge, instead of drawing on heuristics that can be deployed rapidly (Dean & Susman, 1989).

Given these search problems, we expect that improvisation will produce slow actions when declarative stocks are accessed. We predict:

Proposition 6: The greater the declarative memory level, the greater the likelihood that improvisation will pro-

duce action that proceeds at a slower pace.

Combining Procedural and Declarative Memory in Improvisation

Our propositions imply that both procedural memory and declarative memory involve tradeoffs for improvisation. Procedural memory increases the likelihood that improvisation will produce coherent and rapid action, but it strengthens the danger of automatic behavior. In contrast, declarative memory permits richer, more complex meanings and connections (thus enhancing potential novelty and coherence), but it also makes timely improvisation less likely since it demands substantial search time.

Therefore, declarative and procedural memory can be viewed as complementary competencies that offset one another's weaknesses. As a result, their joint deployment may be especially effective in ensuring that improvisation results in coherent, novel, and speedy action. Bjurwill (1993), in the sports literature, describes the criticality of both mental skills (declarative memory) and motor skills (procedural memory) for thinking in action or improvisation. Likewise, Alinksy (1969) describes how community groups improvised the tactic of using stock shares to gain access to shareholder meetings in order to influence local firms. The community groups used many of their pre-existing organizational routines, such as protest signs and the willingness to confront authority. However, these routines were only effective in combination with the declarative memory of the firms they sought to influence and of social mores in corporate boardrooms.

Considering the specific mechanisms underlying this complementary relationship, we have emphasized declarative memory's generative potential for suggesting new meanings, new interpretations, or new linkages between concepts and action. There is also some evidence, however, that declarative memory plays an important role in the deployment of procedural memory. Specifically, Anderson suggests that subjects who have a great deal of declarative memory are also more likely to perform well in the "abstracted planning space of operator selection" (1983: 212), which is knowing which behavior to employ given certain problem conditions. In support of this, Borko and Livingston (1989) describe expert teachers as effective improvisers, because their theoretical knowledge can assist in choosing quickly those pre-existing routines to deploy in a particular setting. Hutchins (1991) likewise describes how declarative memory of how key navigational calculations influenced action made clear the need for someone to retrieve a navigation calculator to save the ship. In all of these cases, declarative memory appeared to guide the creative deployment of procedural memory.

This combination is facilitated by organizational structures and routines that funnel expert declarative memory directly into procedural routines. For example, anticipating the need for periodic improvisational troubleshooting to handle manufacturing crises, a chip manufacturer may require that a scientist with theoretical knowledge be on call 24 hours a day. This means that the procedural routines followed by technicians would be less likely to restrict innovativeness, because they would be complemented by more formal declarative memory.

Therefore, the degree to which improvisation produces novel action may depend on *whether the improviser is able to use declarative memory to make creative use of procedural memory.* Such skills might involve applying pre-existing routines to new contexts, recombining subunits within pre-existing routines, and recombining entire routines in new ways. Hutchins (1991) describes how the navigation team improvised by engaging in all three of these skills. First, they applied typical computation sequences to the new context of trying to save the ship. Second, this approach evolved into a mediating structure, in which the team used a calculator that changed the relation of the workers to the task and resulted in the team performing a key routine in a nonstandard sequence (i.e., they recombined units within the pre-existing routine). Finally, the team added a person to the computation process, thereby changing the availability of data and the accuracy of team understanding and predictions.

Considering the limitations of declarative memory, we suggest that the degree to which improvisation positively impacts speed may depend on *whether the improviser has developed procedural skills that allow for rapid access to declarative memory stores.* Such skills require the ability to find and incorporate declarative memory into action as improvisation occurs. At

the individual level of analysis in artistic improvisation, field reports suggest that individuals require time to develop procedural skills that allow them rapid access to declarative memory. In jazz, for instance, Berliner (1994) notes that musicians must not only know their chord theory but also learn to quickly access that knowledge during performance. In theater, improvisational actors may draw on declarative memory of literature, current events, or science, but they must practice to develop procedural skills in being able to "find" and quickly incorporate such knowledge into action as they improvise (Spolin, 1963).

Within organizations, scholars continue to wrestle with the complex issue of how information and knowledge can be stored and accessed formally (Feldman & March, 1981; Lee, Barua, & Whinston, 1997). Moreover, research for several decades has suggested that social ties constitute important avenues for storing and accessing collective knowledge (Scott, 1992). Consistent with this, organizations that deliberately seek to merge creation with execution, such as high-tech startups or firms seeking rapid product development, sometimes maintain multiple mechanisms for rapid sharing of declarative memory—through designing buildings with open office settings, enhancing interactions in lunch rooms and informal settings, or creating norms that permit multiple contacts with varied sources (Bowen, Clark, Holloway, & Wheelwright, 1994; Brown & Eisenhardt, 1996; Moorman, 1995; Moorman & Miner, 1998).

Quick access to declarative memory might also include routinizing search processes (creating procedural memory about how to find things). For example, some organizations have invested in dynamic internal electronic communication systems involving rather sophisticated search engines that allow employees to access specific organizational declarative memory quickly (Laudon & Laudon, 1996; Schatz, 1992). Specifically, network designers in large organizations, with highly developed intranets for their firms, can specifically configure search engines to help employees find certain product specifications, safety procedures, and other declarative memory likely to be needed during emergency improvisational activity.

Our discussion of the impact of the potential complementary impact of declarative and procedural knowledge on organizational improvisation suggests that it is dependent on the organization's (1) ability to use declarative memory to make creative use of procedural memory and (2) development of procedural skills that allow for rapid access to declarative memory stores. This strategic deployment of memory requires the organization to be very astute regarding how and when to utilize currently held knowledge and routines. The implication, therefore, is to reemphasize the importance of how memory is used by the organization, over the mere accumulation of memory. We propose the following:

> *Proposition 7: Combining procedural and declarative memory can enhance the probability that improvisation will produce coherent, novel, and speedy action.*

The Impact of Improvisation on Organizational Memory

In the previous sections we explored how organizational memory influences organizational improvisation. In this section we consider how improvisation impacts organizational memory.

Improvisations as experiments that influence memory. Observation of improvisation in the arts suggests that improvisational actions may serve as experiments that shape future behavior and the memory of the actors. Preston notes, "In jazz, collective improvisation has much to do with rehearsal. Much collective improvisation takes place in small ensembles during jam sessions. The fruits of the collective improvisation are then incorporated into subsequent public performances" (1991a: 84).

Two theoretical frameworks imply that a similar process occurs in organizations. Theories of organizational evolution and trial-and-error learning emphasize that random variations in organizational activity may produce unexpected benefits. Firms then observe the beneficial consequences of these random variations, and they repeat and even institutionalize these accidentally discovered actions over time so that they become part of the organization's memory (Aldrich, 1979; Miner, 1987; Weick, 1979). Cyert and March describe a similar process and suggest this can constitute a process of (unplanned) adaptation (1992: 117). In these models the initial activity—later repeated—may be nonrandom,

possibly resulting from efforts to solve an immediate problem. In addition to simply repeating successful actions, organizations may draw inferences beyond simple trial-and-error learning that guide future action as well. Finally, some observers argue that the process of acting and observing its consequences may produce deeper-level learning in terms of goals and interpretive schemes (Follett, 1930; March, 1976; Weick, 1993c).

Upon considering empirical evidence related to this claim, we note that in some cases organizational improvisation appears to serve local purposes and leaves undisturbed long-term organizational memory. For example, the improvisation of the new navigation system described by Hutchins (1991) permitted the large vessel to avoid disaster at a particular point in time, but it presumably had no lasting influence on organizational processes, once the regular equipment was running again. However, in other cases improvisational action can and does influence organizational memory. Miner (1991) describes how such activities as solving employment problems, analyzing financial data, and organizing training meetings moved from being improvisational actions to solve a local problem into new formal jobs, some of which were still in place 6 years later. In a manufacturing context, Stoner et al. (1989) describe how a firm not only improvised a series of cellular manufacturing constellations but retained those that seemed effective and kept experimenting with others. The procedural memory used in production within these cells, therefore, was shaped through this process.

Improvisational actions also can contribute to the organization's declarative memory. For example, Preston (1991a) describes how managers responding to a lorry driver strike improvised a new meaning to their firm identity, moving from a "plastics" company to a "food" company, which exempted them from the strike. This new identity, in turn, became a part of the organization's long-term identity. Similarly, Miner et al. (1996) describe how design engineers improvised by rewiring part of a product when it failed to work as expected. When the improvisation failed, they then investigated why it failed and discovered new theoretical knowledge about the product's technological base, which was recorded and became part of the organization's declarative memory. We predict:

Proposition 8: Improvisational actions can serve as unplanned experiments that generate changes in an organization's procedural and declarative memory.

Improvisation as higher-order procedural memory. Finally, we suggest that it is possible for an effective improviser to acquire—through practice—a general skill or competency in improvisation itself. This skill, while procedural, represents a metaroutine, as opposed to a single routine that the improviser can access during improvisation. Our review of the literature suggests that this skill can be learned and that it can, in turn, influence a variety of improvisational outcomes (see Borko & Livingston, 1989, and Pressing, 1984).

One can find interesting anecdotal support for the idea that improvisation represents a distinct organizational competency in Metcalf's (1986) discussion of the Grenada invasion, in which he argues that the Navy needed to practice improvisation itself. Simply having good routines and smart actors was not sufficient to produce effective improvisation. Similarly, a qualitative study of new product development activities showed two firms that had both developed traditions that actively encouraged some improvisation within formalized programs, and perceived these traditions as strengths (Miner et al., 1996).

In other work Brown and Eisenhardt (1995) identify three firms that exhibited the skill of managing improvisation. They found that new product development at these firms relied on real-time interaction and a targeted structure. From the perspective of our framework, the real-time interaction among team members represents a pooling of procedural and declarative memory that increases the amount of knowledge available for recombination in the firm. Brown and Eisenhardt (1995) also argue that structured managerial roles and clear project priorities are essential to effective improvisation. In our framework this structure is likely to evoke routines (procedural memory) at the appropriate time and place. Finally, although we see the organizational improvisational competency as largely procedural, it also appears that some organizations are becoming increasingly *aware* of their own improvisational activities. When they do, they sometimes develop declar-

ative memory about the process of improvisation itself (e.g., Sutton & Hargadon, 1997).

> *Proposition 9: The greater the organizational improvisation level, the more likely an organization will be to develop a higher-order organizational competency in improvisation over the long run.*

DISCUSSION AND IMPLICATIONS

In the preceding sections we first built on prior research to distill a formal definition of improvisation—as the degree to which design and execution converge in time—to illustrate degrees of improvisation in various settings and to clarify what collective improvisation is and when it occurs. Drawing on research suggesting that memory may deeply affect improvisational outcomes, we then proposed that procedural and declarative organizational memory influence the degree to which improvisation will produce coherent, rapid, and novel action and that improvisation can, in turn, influence memory.

In this closing section we reconsider our initial theory-based and practice-based problems and challenges in initiating this work. In doing so, we seek to demonstrate that our ideas about improvisation and the proposed framework contribute to resolving these challenges. We accomplish this in several ways. First, we examine issues specifically related to the main foci of our propositions—memory, improvisation, and organizational outcomes—and conclude that our propositions imply a set of rather demanding conditions within which improvisation may prove effective. Second, we offer concrete advice to consider in the operationalization of organizational memory and organizational improvisation. Third, we offer insight into selected boundary conditions of both our view of organizational improvisation and its relationship to organizational memory.

Improvisation, Memory, and Organizational Outcomes

In opening our article, we argued that improvisation long has characterized actions in selected organizations, such as startups or creative agencies, but now represents a crucial factor in the prosperity of many different types of organizations (Meyer et al., in press). We suggested that this is because advances in technology make improvisation not only more likely but also more valuable (Preston, 1991b). Our work provides a sense of the tradeoffs associated with improvisation, as well as the investments required for effective improvisation. We suggested that a key issue in ensuring that improvised action is effective is the development and deployment of organizational memory, including the systems that drive its accessibility and utilization during improvisational events (see Moorman & Miner, 1998). However, because organizational memory is both costly and difficult to develop, the frequency of improvisation and the importance of improvising well should, in the end, drive the degree of investment that the organization makes in memory systems.

Our definition of improvisation and the framework we have proposed also provide some resolution to a number of theoretical issues. In terms of the construct, our definition offers a more specific and distinct view of improvisation than generally has been used by scholars in the organizational literature. It also suggests that the appropriate focus should be on the simultaneity of design and action—not on whether planning should or can be eliminated from organizations. This approach promotes a different set of research questions concerning the advantages and disadvantages of various timing options. For example, designing nearly simultaneously with action may enhance success by reducing the time for opposition to organize collective resistance (Pfeffer, 1981, 1982).

In this article we focused on one research issue: the impact of organizational memory. We argued that organizational memory is important to all forms of organizational innovation, but of particular importance to organizational improvisation, because of the convergence of composing and acting. Specifically, as composing and acting converge, there is less time for organizations to purchase or develop knowledge and skills necessary to complete action. This approach supports work that has emphasized the identification of factors influencing improvisational effectiveness (Crossan & Sorrenti, 1997; Eisenhardt & Tabrizi, 1995; Weick, 1993b), by explicating the moderating impact of two different memory types on three different organizational outcomes. This contrasts with work by authors who have actively criticized acting without

planning well in advance, in great detail (Cooper & Kleinschmidt, 1986), or have emphasized the potential virtues of improvisation (e.g., Pascale, 1984).

Our propositions also clearly imply that improvisation may be effective only within a very narrow window of organizational contexts. They point to boundary conditions that may constrain the short- and long-term value of improvisational activity. For example, the propositions imply that improvisation may be ineffective at best, and possibly harmful, unless an organization has a rich repertoire of procedural memory, in the form of organizational routines, and a deep reserve of declarative memory, in the form of more abstract or theoretical information. Although not startling, these ideas imply a fairly unusual combination of organizational memory that must be developed and deployed for improvisation to represent a fruitful tool in organizational effectiveness.

Operationalizing Our Propositions

Organizational memory. Testing our theoretical propositions requires measuring procedural and declarative memory in organizations. The measurement of organizational memory is a complex task, but in a growing body of work, scholars have begun to address it (Cohen & Bacdayan, 1994; Cohen & Levinthal, 1990, 1994; Epple et al., 1991; Moorman & Miner, 1997, 1998; Walsh, 1995; Walsh & Ungson, 1991). Cohen and Bacdayan (1991) provide important evidence that we can both define and measure memory at the collective level, using experiments with small groups. Our definition of these constructs is consistent with their view that declarative memory involves the storage of facts, propositions, and events, whereas procedural memory stores the elements of skills and routines. Further, we suggest that both procedural and declarative memory can reside in social structures and practices (such as in group values or routines) and in material structures and practices (such as in the placement of a building or maintenance routines for the building [Moorman & Miner, 1997; Walsh & Ungson, 1991]).

A key to this measurement process is defining the boundary of knowledge relevant to a particular organizational concern—say, "order fulfillment processes." Day (1994) describes several processes relevant to order fulfillment in organizations, including order planning, order generation, order entry and prioritization, order scheduling, order fulfillment, and billing and payment. Therefore, to measure procedural memory related to this domain, one could measure the degree to which an organization has stored routines regarding these processes. This might include examining the number of formal written procedures as well as informal norms and accepted practices.

To measure declarative memory, one could examine the degree to which an organization has factual information relevant to this process, principles invoked in making decisions in this domain, and conscious representations of the reasons for the procedures used. Factual information in the example of order fulfillment processes might include knowledge; drawings; formulas; or stored facts concerned with post-sales-service activities, with cost-estimation pricing activities, and with relevant manufacturing and logistics processes. Such declarative memory might be stored in written documents, databases, group records, individual knowledge bases, and—in selected organizations—intranet systems specifically designed to make such declarative memory widely available within an organization. These intranet systems might contain drawings of parts specifications and standards that the firm uses, site drawings of buildings and systems within the buildings, laws of physics or specific formulas driving firm products, specifications for product families, and company policies.

Organizational improvisation. Concerning the measurement of improvisation, we see several plausible approaches to assessing improvisation in field studies of organizations.

Drawing on its core definition, the degree of improvisation can be operationalized by estimating the length of time between design and execution of action. The smaller the gap, the higher the degree of improvisation. Estimates of the gap could be gained in a number of ways. One could ask knowledgeable informants how long the time was between conceptualization and execution of specific activities at any level of analysis. This approach carries the danger of demand effects, however. Specifically, firms with strong sanctions against "shooting from the hip" might underreport improvisation, whereas more flamboyant organizational cultures might overreport improvisation in an at-

tempt to appear creative and flexible. These considerations underscore the potential value of archival and longitudinal measures of improvisation. Ideally, we recommend obtaining actual records or archival traces of plans or designs of action and of execution. In the new product development context, for example, it is possible to get formal plans and dates of execution. Researchers could also set up prospective observation or reporting schemes, in which both design and action are observed as events unfold. This strategy would offer the advantage of avoiding the typical normative pressure to report organizational actions as being planned before execution.

Another important measurement complication is that the degree of improvisation could seem to depend on the "grain" used to partition actions. For example, an observer might start with a formal plan specifying that certain machines in a manufacturing plant should be checked and maintained each month in a rotating schedule over a year. If the observer then checks whether those actions were followed, and they are, this measurement approach would not register as improvisation. However, if the same observer proceeds to make fine-grained observations of everyday activities in pursuit of the monthly commitment, she or he might observe many actions more or less composed as the actors go along, some of which might not involve prior routines. Even within prior routines—say, a standard maintenance activity—an operator might make, for example, adjustments on a day when some employees are absent or the weather is unusually hot. Are these tactical adjustments improvisations? From one viewpoint they are, because they represent convergence of design and execution at the level at which they occur. However, in the context of the large-scale monthly target plans, they are not, because that plan is followed more or less as written. At this level of analysis, the activity has all followed a prior plan and been implemented quite separately from its design.

How can we resolve this apparent problem in measurement? We suggest that the solution lies in making explicit the specific contrast that informs it. In general, we recommend that improvisation should be measured relative to the same level of analysis at which plans are made. Thus, in the plant maintenance example, an observer should make explicit that the measure of improvisation will be relative to the annual maintenance plan—not to the microlevels of plant activity. A different study of the same plant would make explicit that the measurement applies to the design and execution of action on a daily basis. There, some of the tactical activities might, indeed, be scored as improvisational. It may also be helpful to focus on measuring changes in *degrees* of improvisation, rather than absolute levels. For example, it may be more meaningful to contrast a particular organization's degree of improvisation at two points in time than to compare levels between two firms, all else being equal.

In addition to these approaches, we (Moorman & Miner, 1998) also experimented with simple rating scales that asked informants to assess directly the degree to which specific actions that occurred in a new product setting fit these descriptions: "improvised in carrying out this action," "figured out action as we went along," and "ad-libbed action." Using these ratings, we found, in a study of over 100 actions in two organizations, that 47.5 percent of all actions qualified as primarily improvisational (scoring 5 and above on a 7-point scale), with a mean of 4.242 (s.d. = 1.985). In the same study two independent observers also rated improvisation, and their joint ratings (at 70 percent agreement) produced an equivalent mean improvisation rating of 4.014 (s.d. = 1.539). In this study (Moorman & Miner, 1998) we also measured organizational memory (generally) and organizational innovation and found that they exhibit discriminant validity with measures of organizational improvisation.

Operationalizing collective improvisation requires special care, but it seems to us both feasible and critical. Walsh's (1995) review of the debate regarding collective knowledge and of recent empirical research, we believe, supports the idea that teams, departments, and whole organizations can improvise (Eisenhardt & Tabrizi, 1995; Hutchins, 1991; Mintzberg & McHugh, 1985). Memory embodied in physical artifacts is easy to distinguish as collective. Moreover, we have described how group processes, social interaction, and repeated communications may embody collective memory. An interesting additional form of collective improvisation arises when a small group or a few team members undertake a task extemporaneously. We argue that if they do so when officially

charged with the task, this constitutes organizational improvisation. But if an individual improvises not only alone but solely with his or her own authority, this does not represent organizational improvisation. Overall, we agree with Walsh, who suggests that the challenges associated with measuring improvisation, as with other collective traits, should "stimulate investigation, not serve as a rationale for a research moratorium" (1995: 286).

Boundary Conditions of Our Theoretical Approach

In this article we present improvisation as a special and important case of innovative activity, which, in the presence of appropriate levels and types of memory, can be effective. However, as with all conceptual frameworks and hypothesized relationships, our theories may not hold under certain conditions. We see two factors, in particular, that may prove key boundaries for the relationships we propose here.

The first factor deals with various aspects of organizational memory. Following Walsh and Ungson's (1991) idea that memory contained in storage bins (physical artifacts) or workplace ecology is the hardest to access, we suggest that the *form* in which procedural and declarative memory occurs may influence or limit the degree to which our propositions hold. Specifically, if declarative memory lies in fixed, enduring objects, rather than in portable information, it will be more difficult to recombine and redeploy knowledge to new ends. For example, a hotel cannot improvise a new combination of location and operating procedures as easily as a new combination of two different operating processes, because the hotel itself cannot easily be moved.

In addition to memory form, there are also organizations with extremely low *levels* of stored knowledge. In such conditions we would not expect memory to facilitate the effect of improvisation on outcomes. Other conditions exist where organizations have memory but their systems for accessing it and transmitting it (Moorman, 1995; Moorman & Miner, 1997; Walsh & Ungson, 1991) make the impact of memory more limited. We have captured some of this in our discussion of the differences in procedural and declarative memory. However, beyond these enduring differences, there are certain contextual conditions—including structural and cultural conditions—that further influence the accessibility of memory types. For example, when information is made available quickly to decision makers as the action unfolds, this facilitates the impact of memory on improvisation (Bastien & Hostager, 1992, 1988; Imai et al., 1985). Finally, our propositions suggested that improvisation could influence memory. However, that view assumes that the organization has adequately developed retention systems (Walsh & Ungson, 1991).

In addition to memory and its associated systems, the organization's environmental context is a second factor that may limit the generalizability of our propositions (Moorman & Miner, 1998). Specifically, in very stable environments the value of speed for its own sake may decrease so that the negative risks of improvisation begin to outweigh some of its potential value. At the other extreme, some environments may move so quickly that even the recombined or redeployed previous memory may provide inadequate knowledge for new conditions—as may occur in some instances of very swift technological change (Anderson & Tushman, 1990). Appropriate retention of inferences from improvisational events may be less likely to occur if there is a high level of interference created by noise in the environment (Baumgardner, Leippe, Ronis, & Greenwald, 1983).

Finally, by way of future research, the adoption of a focused definition and testable propositions for empirical research leaves many interesting related issues for further work. For example, this article sets aside, for now, issues of aesthetic versus instrumental organizational standards (Hatch, 1997b), questions of the emotional experiences of actors involved in organizational improvisation (Crossan & Sorrenti, 1997), and nuances of interpretative activities (Weick, 1979, 1993b). Our definitions and propositions leave the door open for further elaboration along these lines. For example, one could distinguish even more precise aspects of the ordering of design and implementation activities by contrasting more or less simultaneous composition and execution from improvisation that specifically involves design after action—as when meaning is found in previous actions, which then guides future activities (Weick, 1993b). In addition, although our work explicitly seeks to facilitate deductive research

on improvisation, it does not foreclose investigation of fundamental questions of the creation of meaning in parallel qualitative or hermeneutic research (Barrett & Hatch, 1995; Hatch, 1997a; Meyer et al., in press).

CONCLUSION

In this article we reviewed the literature on improvisation to distill and explicate the view that improvisation occurs when composition and execution converge in time. We suggested that this definition of improvisation offers a distinct and interesting construct that we hope can be used in further theoretical development and empirical research. In addition, by focusing attention directly on the temporal order of two specific organizational activities, we believe the improvisation construct may enhance research on the dynamics of organizational processes.

Stimulated by insights in prior research on improvisation and the observation that technological change appears to be influencing not only the value of organizational improvisation but also organizations' ability to radically alter organizational memory's content and access, we developed here a framework that focuses on the impact of memory on improvisational outcomes. We then detailed the effects of two types of organizational memory—(1) procedural and (2) declarative—and their varying effects on three improvisational outcomes. In particular, our framework suggests that procedural memory should enhance improvisational effectiveness and speed, while reducing its novelty. Declarative memory, however, should enhance improvisational effectiveness and novelty, while reducing its speed. Given these tradeoffs, we proposed that the presence of both procedural and declarative memory would be especially likely to produce valuable improvisation and that organizations could develop specific competencies to overcome the negative effects of each individual type of memory. Finally, we argued that improvisational activities can, in turn, influence the nature of organizational memory, if an organization observes the outcomes of improvisational actions and incorporates new routines or inferences into its memory.

As a whole, taking into account the theoretical promise and potential practical impact, tackling the tough conceptual and empirical issues required for fruitful research on improvisation seems, to us, a task whose time has come.

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