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**ORGANIZATION-LEARNING
DISORDERS CONCEPTUAL MODELS
AND INTERVENTION HYPOTHESIS**

**CEO PUBLICATION
G 97-10 (322)**

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September 1997

Organization-learning Disorders: Conceptual Model and Intervention Hypotheses

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Abstract

This paper presents a conceptual model that proposes how organization-learning disorders influence organization performance. The model suggests that organization knowledge mediates the relationship between learning disorders and performance. Specific organization-learning disorders are identified for each of the four phases of organization learning: discovery, invention, production, and generalization. The affect of learning disorders on organization knowledge is explored, and intervention hypotheses for treating the disorders are presented.

Key words: organization learning, organization knowledge, the learning organization, organization-learning disorders

There is growing need in organizations to move beyond solving existing problems to improving continuously in the face of changing conditions (Drucker, 1994; Hamel and Prahalad, 1994). The capacity for continuous change and improvement is particularly important in today's turbulent environments where technologies, markets, and competitive situations are changing rapidly and unpredictably (Mitroff et al., 1994). In this world, organizations' ability to change or redesign themselves continuously may be necessary for survival (Nadler et al., 1995).

The capacity for change and improvement has increasingly become associated with organization learning (OL) (Argyris and Schon, 1978, 1996; Huber, 1991; Senge, 1990). Researchers and practitioners have suggested that organizations must be capable of learning from their experiences and of disseminating learning widely if they are to change themselves to respond to emerging conditions (Garvin, 1993; Leonard-Barton, 1992, 1995). Moreover, because learning must occur continuously in the face of environmental change, it must become part of the organization's normal functioning (Ulrich et al., 1994). Consequently, there have been increasing attempts to help organizations improve their learning capability, and in some cases, to design themselves as learning systems (Argyris and Schon, 1996; McGill et al., 1992; Mohrman and Cummings, 1989; Purser and Pasmore, 1992; Roth and Senge, 1996).

In addressing how organizations can improve their learning capability, researchers have identified a number of problems that organizations face when trying to learn. Referred to "learning disabilities" (Senge, 1990; Van de Ven and Polley, 1992), "learning errors" (Marsick and Watkins, 1990), "barriers to innovation" (Quinn, 1985), "learning barriers" (Shaw and Perkins, 1992), "learning obstacles" (McGill and Slocum, 1994), "incomplete learning cycles" (March and Olsen, 1975), and "knowledge-inhibiting activities" (Leonard-Barton, 1995), these organization-learning disorders (OLDs) act as barriers to effective learning. They prevent

organizations from achieving their learning potential, and consequently can have an adverse affect on organizations' performance capability.

Understanding the nature and consequences of learning disorders is a necessary step towards resolving them. Like any ailment, OLDs are likely to have multiple, interrelated causes. Knowledge of the mechanisms underlying OLDs is essential both for analyzing the disorders and designing appropriate interventions for treating them. Moreover, focusing on OLDs seems prudent at this early stage of knowledge about organization learning. So far, OL scholars have been unable to define conclusively what an ideal learning system would be for any particular organization. Because learning processes are inextricably interrelated, it is more expedient to identify learning problems than to specify in practical or theoretical terms what an ideal learning system looks like for any specific organization. Evidence suggests, for example, that there are a variety of organization-learning types that may be equally effective depending on organization conditions (McGill and Slocum, 1994; Ulrich et al., 1994). For similar reasons, action researchers have recommend that organizations define production and learning objectives in terms of recognized problems rather than theoretical ideals (Argyris et al., 1987).

Unfortunately, current understanding of OLDs is deficient in at least three major ways. First, although researchers have identified a number of OLDs, there have been few attempts to link these systematically to the underlying processes that comprise OL. Such knowledge is necessary if we are to understand the problems organizations are likely to encounter at different stages of the learning process. Second, despite the widespread assumption that OL affects organization performance, there is relatively little understanding of the mechanisms through which OL translates into performance outcomes. Such knowledge is essential for understanding the performance consequences of OLDs. Third, although the relevant literature offers numerous

suggestions for improving OL, these practical guides tend to be generic and unconnected to specific OLDs or to particular OL processes. This makes it difficult to design OL interventions to fit particular OL problems and situations.

This paper addresses these deficiencies in the OL literature. First, we present a general model explaining how OL affects organization performance. It proposes that OL processes affect the amount and kind of knowledge that organizations possess, and that organization knowledge, in turn, affects performance outcomes. Then, we describe specific OLDs for each stage of OL, and show how they are likely to affect organization knowledge. Finally, we present preliminary hypotheses for how specific interventions can ameliorate the OLDs described in this paper.

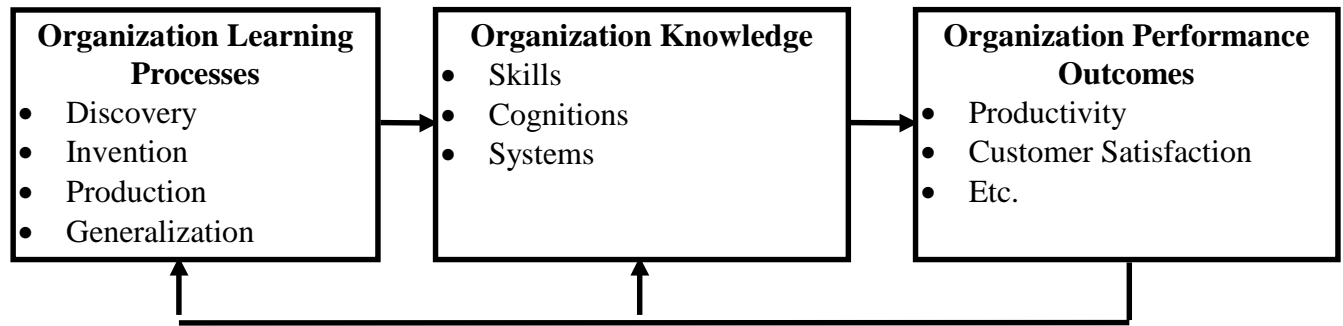
General Model of Organization Learning

Because the term “organization learning” is ambiguous and used in a variety of ways, a clear definition is essential for developing a model of OL. A major source of uncertainty about OL derives from confusion over whether it is an individual- or organization-level phenomenon. Some researchers have described OL as individual learning that occurs within an organization context; thus, OL is the aggregate of individual learning processes (Argyris and Schon, 1978; Senge, 1990). Others have described OL in terms of organization processes and structures; they emphasize how learning is embedded in routines, policies, and organization cultures (Adler and Cole, 1993; Cook and Yanow, 1993; Huber, 1991). Snyder (1996) argued for an integration of the two perspectives that treats organization learning as a relative concept. Individuals do learn in organizations but this learning may or may not contribute to organization learning. Learning is organizational to the extent that: (1) it is done to achieve organization purposes; (2) it is shared or

distributed among members of the organization; and (3) learning outcomes are embedded in the organizations' systems, structures, and culture. To the extent that these criteria are met, organization-level learning is distinct from individual-level learning.

Based on this definition, the model depicted in Figure 1 integrates research and theory about OL, and proposes how OL processes affect organization-performance outcomes such as productivity and customer satisfaction. The model depicts OL as consisting of four interrelated processes originally suggested by Dewey (1933) and elaborated by others (Argyris and Schon, 1996; Senge, 1990): discovery, invention, production, and generalization. Weick (1979), drawing on a formulation by Campbell (1960), referred to an analogous set of processes--enactment, selection, and retention--as "recipes for organizing." Successful learning occurs when organizations complete all four processes: they discover errors or dissonance between their desired state and their current state; diagnose the causes of this gap and invent appropriate solutions to alleviate it; produce the solutions through organizational actions and document the results; draw conclusions about the effects of the solutions and generalize the learning to relevant situations. Although these processes are presented as sequential, they interact and overlap considerably in practice. The performance gaps identified in discovery are influenced by cognitive maps that are developed and modified during invention and generalization. These maps also affect actions taken during production. Meanwhile, the types and range of actions can influence what is learned in generalization.

Figure 1: General Model of Organization Learning



The model proposes that OL processes affect organization performance through their influence on organization knowledge. Researchers have called for increased attention to organization knowledge as a measurable outcome of OL (Kogut and Zander, 1992; Starbuck, 1992). The model suggests that organization knowledge is directly related to organization performance, and mediates the relationship between OL processes and performance outcomes (Blackler, 1993; Snyder, 1996; Spender, 1999).

Organization knowledge consists of three elements: skills, cognitions, and systems (Snyder, 1996). Organization skills include the technical, professional, and social expertise of organization members. These cover both behavioral and “intellective skills” (Zuboff, 1988) such as running complex factory equipment, making a sale to a skeptical customer, or communicating a new strategic direction to employees. Cognitions refer to the information, ideas, attitudes, norms, and values shared by organization members (Crossan, 1991). Cognitions include know-that and know-why types of knowledge, while skills refer to the know-how in the organization (Kogut and Zander, 1992). Organization systems include the structures, procedures, and policies related to performing tasks, coordinating resources, and managing external relationships. They embody much of an organization’s collective skill and cognitive knowledge (Walsh and Ungson, 1991).

All three components of organization knowledge—skills, cognitions, and systems—are inextricably interrelated (Orlikowski, 1992). Researchers have referred to configurations of the knowledge components in terms that suggest their contribution to organization performance, including: “core competencies” (Prahalad and Hamel, 1990); “distinctive competencies” (Hitt and Ireland, 1986), “organization capability” (Ulrich and Lake, 1991), “invisible assets” (Itami and Roehl, 1987), “knowledge capital” (Zeleny, 1990), “strategic capability” (Lenz, 1980), “stock of expertise” (Starbuck, 1992), and “critical capabilities” (Bartmess and Cerny, 1993). Thus, how the knowledge components are configured with each other is likely to influence their combined affect on organization performance.

Learning processes, organization knowledge, and organization performance are interrelated through a number of feedback loops as indicated in Figure 1. Researchers have noted the importance of “platforms” or “path dependency” (Kogut and Zander, 1992; Quinn, 1992) of skills and knowledge required to learn advanced skills or capabilities in fast-changing markets. Organizations that fail to maintain and develop their knowledge base risk being locked out of future learning opportunities. What an organization knows can influence its “absorptive capacity” to discover opportunities or to appreciate innovative approaches to future organization problems (Cohen and Levinthal, 1990). Organization-performance outcomes determine the amount of slack resources available for learning processes (Singh, 1986). They provide feedback on knowledge adequacy, which can heighten motivation to improve or to redirect learning activities. Organization performance can also affect organization knowledge because the adequacy of knowledge components and of configurations of them is best defined in terms of their ability to produce performance outcomes (Pentland, 1992).

Learning Disorders

The framework described above suggests that OL will be successful to the extent that organizations can effectively engage in four processes: discovery, invention, production, and generalization. Existing research suggests, however, that organizations experience numerous learning problems (Argyris and Schon, 1996; Leonard-Barton, 1995; Levitt and March, 1988; Marsick and Watkins, 1990; Sitkin, 1992; Van de Ven and Polley, 1992). Although these difficulties occur in all four learning processes, specific problems tend to occur in certain processes. We refer to these problems as “learning disorders” because, as we hypothesize later in this paper, they can be diagnosed and treated with appropriate interventions. They are described below for each of the four OL processes, and their expected effect on organization knowledge is discussed. The disorders are named intentionally to evoke physical and psychological processes because organization learning is limited both by the structural features of the organization and by the social-psychological characteristics of its members; a view reflected in the two major perspectives underlying current research on OL: the “systems-structural view” and the “interpretive view” (Daft and Huber, 1987).

Discovery

Discovery processes include defining and setting organizational objectives and performance standards, and then comparing them with current outcomes. This process may result in the identification of performance gaps that motivate subsequent learning processes, such as invention and production. Two key learning disorders that tend to occur during discovery are “blindness” and “projection.”

Blindness. This disorder refers to obstructions in organization-scanning processes. Organization members may fail to perceive opportunities or problems because they lack high aspirations (Lant and Montgomery, 1987) or sufficient information (Modiano, et. al., 1995), feel powerless (Thomas et al., 1993), or are complacent (Leonard-Barton, 1995; Sitkin, 1992) or overconfident (Russo and Schoemaker, 1992). An organization's capacity to scan its environment for incipient problems or inchoate opportunities is critical to success (Daft et al., 1988). Yet, organizations are often unaware of the extent to which the environment can be controlled or enacted (Weick, 1995). They may not anticipate changes in the environment, or may engage in restricted search, a major cause of learning failures and low performance (Sitkin, 1992).

Successful organizations are prone to blindness because "success breeds somnolence" (Hedberg et al., 1976), or because they fall victim to the "fat cat syndrome" (Dutton and Duncan, 1987) or the "icarus paradox" (Crossan, 1991). Large organizations may also be susceptible to blindness because they are accustomed to getting their way, e.g., American auto and steel firms until the 1970's (Shaw and Perkins, 1992). Organizations may fall into "competency traps" in which they adjust to small changes successfully, but are not prepared for categorical changes that may occur after small changes have accumulated (Levitt and March, 1988).

Projection. This learning disorder occurs when organization members distort what they see. Projection may be caused by stereotypes, political and financial interests, or anxiety over what is perceived. Projection is most likely to occur when environmental data are ambiguous (Beyer, 1981). Research has shown how cognitive schemas can adversely affect data interpretation, e.g., the disastrous misinterpretation of coral reefs as seaweed in the Bay of Pigs (Eden, 1992; Walsh, 1995). Organization members may perceive phenomena that support political interests even when those perceptions are not supported by available data (Hickson,

1987). Members may be heavily invested in earlier financial or operational commitments resulting in “return-to-scale” projection (Levitt and March, 1988) or the “trapped-administrator” problem (Campbell, 1977). For example, investment in an inefficient technology (e.g., key design of typewriters, oil vs. solar sources of energy) may be maintained because a more optimal alternative would require additional search and financing. Members may see only what the strong culture of the organization permits them to see (Modiano et al., 1995). Finally, organization members may attempt to alleviate tensions that occur when goals are not likely to be achieved by adjusting their aspiration levels downward resulting in goal erosion (Hedberg, 1981).

Effect on organization knowledge. Discovery processes are responsible in large part for an organization’s learning agenda. Consequently, discovery disorders influence organization knowledge primarily through their effect on other learning processes. Discovery involves activities that establish the direction for invention, production, and generalization (Dutton et al., 1983) including problem formulation (Lyles and Mitroff, 1980), problem sensing (Kiesler and Sproull, 1982), problem creation (Nonaka and Kenney, 1991), and strategic-issue diagnosis (Dutton, et al., 1983). Learning is motivated by compelling visions or ideals (Senge, 1990), ambitious goals (Locke and Latham, 1990), and identification of performance threats and opportunities (Dutton et al., 1983). Narrow or weak visions and misinterpretations of the market can affect all other learning processes. If organizations address the wrong opportunity in the market or focus on too narrow a range of market requirements, they will not perform optimally, no matter how competent they may be at invention, production and generalization.

Persistent discovery disorders are likely to result in organization knowledge that does not sufficiently address market requirements or that addresses market demands of diminished value to the organization. Discovery disorders tend to result in a narrow range of competencies, often

targeted to the wrong areas, unsupported by the latest innovations, and uninformed by internal performance gaps and contradictions (Hamel and Prahalad, 1994). Discovery disorders can also lead to parochial attitudes and limited sense of urgency (Thomas et al., 1993). These negative effects of discovery disorders on organization knowledge can generate a vicious cycle: diminished urgency leads to restricted scanning which, in turn, leads to a continued sense of complacency, until a crisis occurs. This cycle explains why many organizations do not overcome learning disorders except under crisis conditions (Bolton, 1993) and why many others go bankrupt (Barr et al., 1992).

Invention

Invention processes consist of analyzing performance gaps and developing solutions to address them. This includes diagnosing the causes of the gaps, generating and evaluating alternative solutions, and deciding on plans of action. These invention activities have been examined extensively in research on decision making and problem solving which suggests that invention is prone to obstructions and non-rational influences (Eisenhardt, 1989; Hickson, 1987). The learning disorders associated with these problems are called “simplemindedness” and “multiple-personality disorder”.

Simplemindedness. This disorder refers to deficiencies in the conceptual maps that organization members use to guide analysis and to generate solutions. People use conceptual maps and behavioral schemas to guide cognition and action (Barr et al., 1992; Huff, 1990; Thomas et al., 1993; Walsh, 1995). These maps and schemas can cause simplemindedness when they fail to consider complex relationships, or when they sustain inaccurate beliefs and assumptions (Barr et al., 1992; Leonard-Barton, 1995). Invention processes can be constrained by

simple, cause-effect models that fail to address causal loops (Bougon and Komocar, 1990).

Organizations may fail to match the heterogeneity of the environment with a requisite variety of organizational skills, ideas, and values (Ashby, 1956; Weick, 1979). Members may use conceptual maps that fail to account for the systemic nature of organizations and their environments, and thus invent solutions without being aware of their likely unintended consequences (Argyris and Schon, 1996; Senge, 1990). Finally, members may simply be constrained by insufficient information or time to solve problems (Modiano et al., 1995).

Multiple-personality disorder. This learning disorder refers to lack of coordination between multiple, competing perspectives. One of the basic characteristics of organization learning is the integration of learning among various individuals and groups in the organization (Crossan, 1991; Walsh, 1995). Multiple-personality disorder occurs when individuals and groups carry out invention processes that are neither communicated publicly nor integrated with each other. This may occur because members are unaware of the related activities of others, or because departmental boundaries and dysfunctional reward and control systems encourage people and groups to keep ideas and proposals to themselves (Wenger, 1997). The organization may appear to act as if it has multiple personalities, each voicing points of view that are incompatible with the others. Such inconsistencies are more likely in uncertain environments (Bougon et al., 1977). When perspectives clash and differences cannot be addressed openly, organization members may face double-bind conditions that Bateson (1972) called “schizophregenic.”

Effect on organization knowledge. Invention disorders are likely to result in cognition-related deficiencies in organization knowledge. These problems are most visible when they are generalized throughout the organization, especially during planning, problem-solving, and innovating activities. The cognitive consequences of invention disorders tend to manifest

themselves as ineffective plans to address strategic opportunities (Walsh, 1995), unimaginative or ineffective solutions to persistent problems (Barr et al., 1992; Crossan, 1991), or infrequent or unsuccessful proposals to develop new products, processes, or administrative structures (Chew et al., 1991; McKee, 1992). Simplemindedness, for example, can result in excessive hierarchy and procedural rigidity that prevent organizations from responding adequately to diverse or changing customer requirements (Diamond, 1986). Although members of the organization may be intelligent as measured by conventional tests, they can be alarmingly simpleminded when it comes to understanding organization challenges and to developing systemic approaches to address them (Senge, 1990).

Production

Production processes include actions taken to implement solutions that have been invented to address performance gaps. Learning disorders that tend to occur here are called “paralysis” and “alien-hand syndrome.”

Paralysis. This disorder involves inability to act. Organizations may invent clear plans and proposals but never implement them (Leonard-Barton, 1995; Sitkin, 1992). They may fail to act or avoid tests because of organizational constraints, confusion, apathy, or complacency (Sitkin, 1992; Weick, 1979). Individual actions may be constrained by role definitions, discrepant goals, or contradictory proposals (March and Olsen, 1975). Executives may hesitate to make decisions or to sanction actions because they are anxious about negative outcomes leading to “paralysis by analysis” (Eisenhardt, 1989). Lack of decision consensus can obstruct action that requires commitment from diverse stakeholders (Walsh, 1995). Organization members may be

apathetic because they lack intrinsic or extrinsic motivation, regardless of goal consensus (Hedberg, 1981).

Alien-Hand Syndrome. This learning disorder involves a disconnection between organization intentions and actions. Neurologists define alien-hand syndrome as an "intermanual conflict" in which the left and right hands (or feet) seem to operate independently of each other (Heilman, 1985). The syndrome occurs because the neural fibers that connect the left and right hemispheres of the brain have been severed. The equivalent organization-learning disorder occurs when the motivational and coordinating mechanisms linking intentions to actions are deficient or do not exist. This may lead to inaction (the clinical term is "apraxia") or to uncoordinated, unintended actions (alien-hand syndrome). Organizations may have clear goals and well-defined routines, yet lack adequate incentives to ensure that actions are consistent with intentions (Cangelosi and Dill, 1965). Organizations may also lack control mechanisms to ensure that members follow proposed routines (Levitt and March, 1988). This may lead to audience learning where members are relegated to spectator status because they cannot influence actions on an organization level (March and Olsen, 1975). Meanwhile, individual actions may contradict each other as well as the learning intentions of the organization.

Effect on organization knowledge. Production learning disorders often manifest themselves as inability to act on ideas, risk aversion, or lack of experimentation (Sitkin, 1992). Eisenhardt (1989) documented paralysis symptoms in her multiple case study of decision making in organizations. Several of the organizations found themselves paralyzed by analysis processes that dragged on while opportunities to improve organization performance were lost. Over time, paralysis disorders yield fewer opportunities for organizations to learn from experience, and consequently there is less information to help make future decisions accurately and quickly, a

vicious cycle. Sitkin (1992) noted that organizations that avoid risks and failure do not develop competencies as quickly or as broadly as organizations that pursue strategies of incremental, intelligent failure.

Alien-hand syndrome can prevent coordination of activities across organization boundaries—functional, product line, division, or geographic—and thus diminish the opportunity to develop cross-boundary competencies. This effect on organization knowledge will depend on the type of boundary disorder. For example, production disorders between design and manufacturing subunits can prevent mutual learning about how to design for manufacturability (Hoopes, 1995); they can slow the cycle time of product development (Meyer, 1993). Disorders that cross product lines may prevent efforts to sell products from multiple divisions to primary customers who have a wide range of product requirements.

Generalization

Generalization refers to the process by which organizations evaluate their experience, document the results, and encode them through organization routines (e.g., policies and procedures), conceptual maps (e.g., strategic planning models), and social norms (e.g., respect for authority). This process involves diffusion activities where learning outcomes are made accessible to (or imposed on) members through communication mechanisms, training, socialization, and imitation. The learning disorders that most affect generalization are called “amnesia” and “superstition.”

Amnesia. This disorder refers to inability of the organization to monitor its experiences, document and encode results, or make the results available throughout the organization. Organizations may either lack automated systems to monitor and organize the results of their

actions or limit access to such systems (Levitt and March, 1988; Walsh and Ungson, 1991). Members may face a series of related learning events without making connections among them, thus limiting the learning derived from each event (Eisenhardt, 1989). Employee turnover may be so frequent that successful routines and critical knowledge are not documented or communicated to new members (Carley, 1992; Walsh and Ungson, 1991). Newcomers may discount the experience and knowledge of previous or existing members, and thus best practices and documentation of lessons learned are ignored (Cangelosi and Dill, 1965). Members may resist innovations that are “not invented here” (Shaw and Perkins, 1992).

Superstition. This learning disorder involves problems with interpreting accurately the meaning of experience. Organizations must often learn under conditions of ambiguity, particularly in turbulent environments (Daft and Huber, 1987). Members may perceive causal relationships where they do not exist, or interpret results in ways that serve self-interests. They may explain causal relations between organizational actions and environmental effects without controlling for alternative explanations and without considering the reliability of these interpretations (Levitt and March, 1988). Superstitious (or spurious) learning is likely to occur in strong environments that produce either negative or positive effects under a variety of conditions (Levitt and March, 1988). Cognitive psychologists have documented a number of attribution errors that can lead to superstitious learning, e.g., people tend to attribute success to their own efforts and failure to the actions of others (Nisbett and Ross, 1980). Sponsors of a failing policy tend to interpret failure as the need for further investments, while non-sponsors come to opposite conclusions (Staw and Ross, 1978). Causes of salient events tend to be attributed to individuals rather than to environments, and causality is often reduced to simple, linear and functional rules (Kahneman et al., 1982).

Effect on organization knowledge. Generalization disorders affect what is learned cognitively from experience and the extent to which all three components of organization knowledge—skills, cognitions, and systems—are disseminated throughout the organization. Generalization disorders can be especially crippling for organizations that operate in highly uncertain environments and must depend on learning from action to develop new strategies (Mintzberg, 1994), to find appropriate acquisition targets (Haspelaugh and Jemison, 1991), or to develop appropriate organization structures (Mohrman and Cummings, 1989). In these situations, competence derives heavily from the capacity to learn directly from one’s own experience and indirectly from the experience of competing organizations.

Generalization disorders can also prevent the dissemination of best practices and innovations across organizational subunits (Bartmess and Cerny, 1993). Organizations may develop pockets of expertise in one region or division and be unable to transfer them effectively to other appropriate areas of the organization (Attewell, 1992; Zmud and Apple, 1992). In other cases, generalization disorders can prevent organizations from benefiting from the unique competencies that derive from investment in acquisitions or joint ventures (Chambers, 1991; Tiemessen et al., 1995).

Intervention Hypotheses

Interventions to resolve OLDs may focus on particular disorders or combinations of them. Because the four learning processes are related in myriad ways, the OLDs associated with them

are likely to be interrelated. Blindness to environmental complexity can lead to simplemindedness. Multiple-personality disorder may be associated with alien-hand syndrome because both imply disconnections between individuals and groups within organizations. Multiple-personality disorder and simplemindedness can be interrelated because double-bind situations call for complex, higher-level learning capacities. Amnesia may be connected to simplemindedness because lessons learned are inaccessible and cannot be applied to current problems. The interrelatedness of these disorders suggests that a wide range of interventions may be required to address them.

To date, interventions aimed at resolving OLDs have been relatively broad and have not been linked explicitly to particular learning processes or to the range of learning disorders described in this paper. Moreover, these normative prescriptions for improving OL tend to lack conceptual clarity and coherence. They derive primarily from practice with relatively little grounding in OL theory and research which can inform wise practice (notable exceptions include the work of Argyris and Schon (1978; 1996) and of Senge (1990) and his colleagues).

In the following pages, we present preliminary hypotheses for how interventions can ameliorate the OLDs described in this paper. At this early stage of OL knowledge, the hypotheses are speculative and intended to stimulate research in this area. They provide a conceptual starting point for empirically assessing how interventions affect OLDs. Such knowledge is essential for developing scientifically-based OL interventions.

Discovery: Blindness and Projection

Blindness and projection obstruct or distort organization scanning and perception processes; thus, interventions need to *make the blind see*. They should enhance members' visions of what is possible while facilitating their ability to discover opportunities.

The motivational foundation of OL is felt need to improve organization conditions or to increase or change performance outcomes. Interventions to treat discovery disorders can address these underlying motivations. They can affirm the importance of personal aspirations and provide a context for members to align personal and organizational goals. For example, interventions that promote open dialogue among organization members, such as team building, search conferences, and organizational confrontation meetings, can help members build a shared vision that establishes a compelling agenda for OL (Senge, 1990; Weisbord, 1992).

Hypothesis 1a: Interventions to treat discovery OLDs are likely to be effective to the extent that they heighten members' aspirations and personal visions, and integrate them with organizational purposes.

Because discovery disorders are often correlated with past success (Sitkin, 1992), aspirations must be raised continually to sustain tension between existing and desired future states (Senge, 1990). Goal-setting interventions, for instance, can help members raise performance standards to motivate continuous search efforts (Locke and Latham, 1990; Sitkin, 1992). They can lead members to pursue different goals when established goals have been met (Cangelosi and Dill; 1965; Hedberg, et al., 1976).

Hypothesis 1b: Interventions to treat discovery OLDs are likely to be effective to the extent that they motivate members to search continually.

Organizations can improve the detection of problems and situational changes by exposing members directly to environmental influences, such as the demands of customers, suppliers, and regulators (Modiano et al., 1995). Such exposure may not result in the detection of unexpected

environmental variation, however, unless the mental models that members use to perceive and make sense of the world can capture those inputs (Huff, 1990). Because mental models tend to be tacit and taken for granted, they are rarely examined or tested for accuracy in detecting environmental demands (Senge, 1990). Interventions such as total quality management, cross-functional job rotation, and open-system planning, for example, can enhance members' exposure to external demands and information (Cummings and Worley, 1997). Similarly, OL practitioners have developed exercises and tools that can help members uncover and assess the accuracy of the mental models underlying their perceptions (Senge et al., 1994).

Hypothesis 1c: Interventions to treat discovery OLDS are likely to be effective to the extent that they increase members' exposure to environmental demands and members' awareness of the mental models governing their perceptions.

Invention: Simplemindedness and Multiple-Personality Disorder

Simplemindedness occurs when organization members reduce the complexity of phenomena so much that reality is grossly misrepresented; multiple-personality disorder surfaces when members cannot resolve incompatible perspectives during invention processes. Consequently, interventions to resolve invention disorders need to help members *complicate themselves* with the requisite variety of perspectives and actions needed to comprehend and respond to the complexity of their competitive environment.

Organizations can increase the number of alternative actions considered by using dialectical, decision-making processes in which recommendations are contrasted with alternatives before they are accepted (Fiol and Lyles, 1985; Morgan, 1986). Dialectics can be built into organizations through dual-management teams and parallel learning structures and by giving interrelated functional areas shared responsibility for performance outcomes (Bushe and

Shani, 1991; Watts, 1990). Examples of structures that bring together members from diverse functions to solve complex problems include cross-functional teams, design teams, and business-process teams (Hammer and Champy, 1993; Mohrman and Cummings, 1989).

Hypothesis 2a: Interventions to treat invention OLDS are likely to be effective to the extent that they promote dialectical decision making.

Conceptual and experiential training can help organization members develop reasoning and inquiry skills to increase cognitive complexity and insight (Argyris and Schon, 1996). Similarly, training in systems thinking can help people understand phenomena not explained by one-way, cause-effect interpretations (Senge, et al., 1994). Information technologies, such as shared databases, groupware, and decision-support systems, can increase the collective complexity of members' thinking and can facilitate coordination of thinking across distributed offices and subunits (Boland et al., 1994; Davenport, 1994).

Hypothesis 2b: Interventions to treat invention OLDS are likely to be effective to the extent that they increase the complexity of members' mental models.

To avoid falling toward the extremes of either simplemindedness or multiple-personality disorder, organizations must find ways to be both complex and coherent (Crossan, 1991; March, 1991; Weick and Westley, 1996). Decentralized structures that build in redundant capabilities can promote variety at the organization level while providing coherence at the group level (Morgan, 1986). Groupware technologies and community-building activities, such as search conferences and knowledge fairs, can help organizations balance complexity and coherence (Snyder, 1996).

Hypothesis 2c: Interventions to treat invention OLDS are likely to be effective to the extent that they promote a dynamic balance between the complexity and the coherence of members' capabilities.

Production: Paralysis and Alien-Hand Syndrome

Paralysis occurs when organization members are unsure, apathetic, or afraid to act; alien-hand syndrome arises when different members or parts of the organization act at cross purposes or behave as if unaware of each other. Thus, interventions need to *augment experience*.

Organization learning requires actions and events to interpret. Ideally, they would cover a sufficient range of experience to prepare the organization for future contingencies. Organizations can improve learning from limited samples of experience by discovering more aspects of a single experience or by encouraging participation of members who represent a wide range of preferences and points of view (March et al., 1991). Organizations can design experiments to test alternative procedures and technologies under a range of conditions to discover optimal configurations (Chew et al., 1991; Sitkin, 1992). They can broaden participation in experiments beyond small groups of experts to include users, suppliers, and other stakeholders. Chaparral Steel, for example, conducted research and development on the factory floor where new technologies were tested against current methods to find new ways to increase quality and to reduce costs (Leonard-Barton, 1992).

Hypothesis 3a: Interventions to treat production OLDs are likely to be effective to the extent that they enhance experiential learning.

Organizations can increase member willingness to innovate by avoiding rigid controls and encouraging risk-taking (Morgan, 1986; Sitkin, 1992; Weick, 1995). Unplanned, chaotic behaviors can be guided by overarching goals or principles that allow for orderliness to emerge from what appears to be a collection of random behaviors and events (Nonaka and Takeuchi, 1995; Wheatley, 1994; Zuijderhoudt, 1990). Open-space planning conferences, for example, can bring together for several days a broad representation of an organization's members (Bunker and

Alban, 1997). The conferences are loosely structured with few procedures or specified outcomes. Based on shared organization values and principles, participants are encouraged to find others with shared issues or problems and to develop proposals to address them. These seemingly chaotic gatherings can self organize into networks of informal teams that develop creative solutions to critical organization issues (Owen, 1994).

Hypothesis 3b: Interventions to treat production OLDs are likely to be effective to the extent that they promote experimentation and risk taking.

If organization actions and experiments are to produce successful learning, they must be of sufficient magnitude to produce discernible outcomes yet small enough to permit causal inferences. Organizations can undertake, for example, several modest-sized change projects in different places and with different members. Referred to as “small wins”, they can provide multiple opportunities for learning which can accumulate into larger-scale changes and learning (Weick and Westley, 1996).

Hypothesis 3c: Interventions to treat production OLDs are likely to be effective to the extent that they help members create modest changes that produce visible results.

Organizations can develop microworlds, such as computer simulations and hypothetical scenarios, to enable members to engage interactively with familiar and unfamiliar events (Tenaglia and Noonan, 1992; Senge and Lannon, 1990). Hanover Insurance and General Motors, for example, developed software models to replicate the systems dynamics of business processes (Senge, 1990). These process simulators enabled members to stipulate a variety of conditions and interventions and to test their impact on the business over time. Similarly, Shell Oil executives used scenario planning to imagine the viability of various business strategies under a range of industry conditions (de Geus, 1988). These interventions compress time and space to facilitate

learning from experience. They enable members to create future scenarios, to test current alternatives, and to revise histories.

Hypothesis 3d: Interventions to treat production OLDs are likely to be effective to the extent that they create microworlds where members can learn the consequences of their actions within simulated yet realistic environments.

Generalization: Amnesia and Superstition

Amnesia results either when organizations fail to document and encode what they learn, or when members cannot access knowledge that has been encoded. Superstitious learning results when encoded learning is false. Thus, interventions need to help members *remember what works*. Members need to retain knowledge that yields intended consequences and to forget knowledge that does not. Because organization memory is limited, members cannot afford to cloud it with superstitions.

The development of an effective and accessible memory depends on organizations' ability to monitor actions and events, and then to interpret and encode results (Levitt and March, 1988; Walsh and Ungson, 1991). New database technologies, for example, can not only store batches of information but also "answer gardens" (Ackerman and Malone, 1990) that relate questions and answers and "cause maps" (Eden et al., 1992) that logically connect events, actions, and outcomes. Organization members can access and revise this information and knowledge through on-line, common databases (Boland et al., 1994; Lee et al., 1992). Effective memory also depends on shared learning among organization members. Interventions such as employee empowerment and gainsharing, for example, can enhance members' willingness to share information and ideas (Cotton, 1993; Lawler, 1996). They can facilitate the creation of

informational channels and interpersonal networks for sharing lessons learned from working on common problems and issues

Hypothesis 4a: Interventions to treat generalization OLDs are likely to be effective to the extent that they create effective and accessible organization memories.

When organization members consider multiple explanations for the consequences of their actions, false explanations are less likely to survive (Argyris and Schon, 1996; Senge, 1990). Thus, training in reasoning skills, systems thinking, and dialectical decision making can reduce superstitious learning (Senge, et al., 1994). Organizations can also encourage members to form “learning sets” (MacNamara and Weekes, 1982) or “communities of practice” (Brown and Duguid, 1991; Wenger, 1997) to share common work experiences and to identify important lessons learned.

Hypothesis 4b: Interventions to treat generalization OLDs are likely to be effective to the extent that they help members explore alternative explanations for the consequences of their actions.

In turbulent environments where skills and knowledge can quickly become obsolete, organizations may need to unlearn nearly as much as they learn. This requires interventions that encourage members to break rules, to avoid regulations, and to overturn conceptual paradigms (McGill and Slocum, 1993). What is unlearned, however, must be replaced by new, more effective knowledge to prevent reversion to traditional but unproductive skills and ideas. Moreover, in situations where it is important to bracket traditional knowledge as effective under some conditions but not others, “parenthetic learning” (Klein, 1989) may need to supplement unlearning.

Hypothesis 4c: Interventions to treat generalization OLDs are likely to be effective to the extent that they help members unlearn obsolete knowledge.

Conclusion

Although interest in organization learning has intensified over the last five years, it is still characterized as a “murky” field with little cumulative, systematic research. There is limited agreement on basic concepts, few attempts to provide integrative frameworks or to specify how OL affects organization performance, and little connection between normative prescriptions and underlying concepts and research (Garvin, 1993; Huber, 1991). This paper is a preliminary step towards rectifying those problems. Based on a general model of organization learning, the paper describes specific OLDs related to four fundamental learning processes: discovery, invention, production, and generalization. It proposes how the learning disorders can affect organization knowledge, and suggests that organization knowledge mediates the relationship between OL processes and organization performance. Finally, the paper offers, in a speculative manner, hypotheses for how interventions can treat the learning disorders.

The general model can have practical implications for how organizations promote and manage OL. Organization members could diagnose the causal linkages proposed here--from learning processes to knowledge to performance--to discover how OL contributes to performance problems. For example, particular performance problems might be traced to specific elements of organization knowledge (i.e. skills, cognitions, and systems) that are insufficient, irrelevant, or poorly applied to task performance. These knowledge problems in turn could be linked to specific learning processes and the OLDs associated with them. Members could then use this diagnostic information to design appropriate interventions to treat the identified OLDs along the lines hypothesized in this paper. Of course, empirical tests of the general model and of the

intervention hypotheses are necessary before we can prescribe how to improve OL with any scientific rigor.

Consequently, the following directions seem fruitful for future studies of OLDs. Research is needed to assess empirically the general model of OL proposed here: OL processes affect organization knowledge which, in turn, influences organization performance. Studies could examine how OLDs are interrelated, how they affect the various components of organization knowledge, and how those components influence particular performance outcomes. In exploring the possible mediating role of organization knowledge, researchers could identify specific mechanisms by which OL processes are translated into organization outcomes. Moreover, comparative studies across different organization contexts could reveal how situational factors, such as competitive markets, cultural conditions, and technologies, contribute to the etiology of OLDs. Finally, action research is needed to explore the effects of interventions intended to treat specific OLDs. It could assess whether the hypotheses proposed here are empirically sound and practically feasible. Research along these lines is essential for understanding the nature and consequences of organization-learning disorders and for developing effective interventions for resolving them.

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