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ANTICIPATING THE MNEMONIC SHIFT: ORGANIZATIONAL REMEMBERING AND FORGETTING IN 2001

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ABSTRACT

Following a review of prior work, the paper presents a model of organizational memory. Relying on *structuration theory* for its development, the model overcomes some of the problematic dualisms of conventional approaches (i.e., subject/object, social/technical, abstract/concrete). According to the model, co-memory (for collective memory) consists of rules and resources that recursively mediate both interactivity and structure in organizations. The model provides the basis for a taxonomy of existing and projected IT-based co-memory systems. Four classes of co-memory systems are described: transactional, managerial, strategic, and team. An analysis of driving trends concerning people, structure, and technology is used to project four scenarios for organizations in 2001: bureaucracy, factory, affiliation, and infocracy. Co-memory systems that can be expected in each scenario are discussed. Predictions indicate that a *mnemonic shift* is occurring in which society is moving toward discursive organizational forms that will increasingly rely on IT-based co-memory. The paper concludes with a number of research questions designed to foster further research on the relationship between information systems and organizational memory.

1. INTRODUCTION

For centuries, sailing vessels of all kinds have navigated the globe and, although the technology of navigation has become sophisticated indeed, charting a ship's course still requires the same basic information about its past movements, speed, and direction. Similarly, charting the course of an organization's future requires a knowledge of where it has been and a deep appreciation for the momentum of its past.

The use of information technology to support day-to-day operations and management is commonplace in today's organizations; these systems and processes are well-understood. In recent years, information scientists have placed high on their research agenda the study of strategic planning and decision-support systems. As this work progresses, it is becoming clear that for such systems to effectively guide an organization into its future, they require a solid understanding of its past. This critical understanding can only be developed through a study of the memory of organizations.

Organizational memory is an area of increasing interest among researchers from information science and a number of related disciplines. Unfortunately, there is a conspicuous

lack of well-developed, coherent theory in this area (Huber 1991). For example, Walsh and Ungson (1991) note that "extant representations of the concept of organizational memory are fragmented and underdeveloped" (p. 57). A key problem hampering the development of a theory of organizational memory is the identification of its locus. While some researchers propose that organizational memory resides primarily in the structure of the organization and within the minds of its members, others believe it to be located in the organization's archives and information systems. Regardless of where organizational memory is located, there are signs within today's post-industrial organizations that a *mnemonic shift* is occurring that has significant consequences for the study of information systems. As we have progressed from the iron cage of Weber's bureaucracy to the stream-lined efficiency of Drucker's flat organization, we have simultaneously reduced the mnemonic potential of the former's complex hierarchies and organizational structures. Furthermore, the increased transience of workers at all levels of organizations means that individuals are increasingly inadequate repositories of organizational memory.

If these changes indeed represent a reduction or loss of major repositories of organizational memory, what is there to prevent total organizational amnesia? Fortunately, these

changes are concurrent with developments in information technology that have the potential to counter much unwanted organizational forgetting. With its current and increasingly vast storage and rapid retrieval capabilities, information technology promises to have an ever more important role to play in the creation, preservation, and use of organizational memory. Thus, Huber's (1990) call for the investigation of organizational memory by information scientists seems appropriate and timely. The purpose of this work is to investigate the impact of information technology on organizational memory. Whether information technology is a catalyst to the *mnemonic shift* currently taking place in organizations, or merely a response to this shift, is not certain at this time. Either way, it is clear that information technology will continue to have a significant role to play in the stimulation of organizational remembering and forgetting for some time. Understanding the nature and direction of this impact is essential for the design of effective organizational memory systems.

An important contribution of this paper for IS research is its demonstration of how structuration theory may be applied to provide a bridge between seemingly irreconcilable perspectives. Following a review of prior work, we will develop a model of organizational memory that overcomes some of the problematic dualisms present in conventional approaches (i.e., subject/object, social/technological, abstract/concrete, and representation/interpretation). This model then becomes the basis for a taxonomy of existing and projected IT-based organizational memory systems. The taxonomy in turn permits the prediction of the *mnemonic shift*, a process that could have profound consequences for information systems research.

2. PRIOR RESEARCH

Maurice Halbwachs was the first scholar fully to articulate what was, until that point, a rather vague notion of collective memory. It is painfully ironic that in an age of rampant historical revisionism his definitive and, indeed, lifetime work on the subject, *Le Memoire Collective* (1950), was cut short by his deportation and death in Buchenwald in 1945. As a student of Bergson and subsequently Durkheim, Halbwachs managed to temper the extreme objectivism of Durkheim's (1938) theories of collective consciousness through a critique of Bergsonian subjectivism. As this work will demonstrate, bridging the gulf between the active subject and the social object is critical to developing a useful understanding of collective memory.

Early organization theorists believed that organizational memory was a valuable resource that could be drawn upon (Simon 1948), scanned (Mintzberg 1975), and formulated in policies and standard operating procedures (Cyert and March 1963). More recent conceptualizations of organizational memory have been categorized according to their ontological form and epistemological function in the framework in Figure 1.

Using metaphors to help understand the complex processes of organizational remembering seems both natural and appropriate. Those who define organizational memory rely heavily on them. Unfortunately, as handy as these concrete analogies appear, they tend to break down. In this case, there is a danger when applying them to the understanding of collective memory (Middleton and Edwards 1990).

		FUNCTION	
		Representation	Interpretation
Concrete F O R M Abstract	data documents and hypertext formalized knowledge formalized expertise information	orientation device policies standard operating- procedures	
	cognitive maps conceptual lenses frameworks	culture ecology language social structures	

Figure 1. Conceptualizations of Organizational Memory (Sandoe, Olfman, and Mandviwalla 1991)

For information scientists who are inclined to view organizational memory as concrete and representational,¹ notions such as storage and retrieval processes, read/write access to internal and external memory devices, searching and sorting algorithms, and databases all appear as apt and useful metaphors for collective remembering. However, the memory of a group or organization is very different from the memory of a computer because it involves a human component and hence computational metaphors cannot apply fully. On the other hand, sociologists and organizational behaviorists have conceived of organizational memory as abstract and interpretative.² For them, concepts from cognitive psychology such as short and long term memory and selective perception seem appropriate for describing aggregations of individual memory. However, drawing parallels between individual and collective memory is not only overly simplistic but, as Walsh and Ungson (1991, p. 59) warn, raises serious problems of (1) anthropomorphism (organization as brain) and (2) unit of analysis (reductionism).

Thus, it is important to avoid the temptation either to conceive of memory as an information processing mechanism or to reduce complex social phenomena to the "single-minded" view of cognitive psychology. In the following section, we will introduce a theoretical perspective that can provide an important bridge between these seemingly irreconcilable perspectives.

3. THE STRUCTURATION OF MEMORY

There is growing interest on the part of researchers in information science in the use of the "theory of structuration" (Giddens 1979, 1984) as a potential framework to guide theory and practice within the discipline.³ IS researchers explain their attraction to structuration theory as an exercise in void-filling, making up for a dearth of rigorous theory in this, our fledgling discipline. Perhaps a more compelling reason for the affinity is that both IS and structuration theory are "bridges" — the discipline of IS bridges technical and social worlds, economics and politics, while structuration theory bridges many of the underlying concerns of our discipline (e.g., agency versus structure, material versus social, etc.).

Giddens' reliance on specialized terminology may mask some important insights for IS. At the heart of his project is a concern with trying to understand the complex phenomena that result when people interact with one another. He tells us that, when trying to understand a particular phenomenon, it is not sufficient to seek explanation solely in the motivations of individuals on the one hand, or in the constraints imposed upon those individuals by social structures on the other hand. Understanding, says Giddens, comes from a perspective that acknowledges the interrelationship of the two. Structuration theory is an attempt to provide such a perspective.

According to Giddens, structure can be conceived of as properties. These properties allow the "binding" of time-

space in social systems. Such bindings, in turn, allow similar social practices to exist across varying spans of time and space. Structure does not have any material existence, but exists as instances of practice and "memory traces orienting the conduct of knowledgeable human agents" (Giddens 1984, p. 17).

Agency, for Giddens, is of equal importance to structure. Thus, the activity of human beings is an essential part of structuration theory. Giddens is particularly concerned with interactions of people, their conscious and unconscious motivation, and their knowledgeable ability in the face of unacknowledged and unintended consequences of their activity and interactivity.

Structuration occurs as an ongoing process of people interacting with each other in ways that are in part pre-defined, in part defined during the course of the interaction. People develop routines or patterns of interaction, and these routines become ingrained in daily life. According to Giddens, "routine practices are the prime expression of the duality of structure in respect of the continuity of social life" (1984, p. 282).

Finally, it is important to note that, although structure itself does not have a tangible existence, the process of structuration is a concrete phenomenon situated in time and space. Critical to structuration theory are the concepts of positioning (simultaneously social and spatio-temporal) and regionalization as "the zoning of time-space in relation to routinized social practices" (Giddens 1984, p. 119).

3.1 The Organization of Remembering and Forgetting

In this section, we introduce the term "co-memory" as shorthand for "collective memory." We draw heavily on structuration theory to define co-memory and use Giddens' interpretations of consciousness, routinization, and regionalization to describe some of the complex processes of organizational remembering and forgetting.

In essence, co-memory is a framework of mutual understanding through which knowledgeable human agents maintain temporal and spatial continuity. It guides and orients people in their everyday activity when working together and interacting in groups. Co-memory is a pre-condition of "sense-making," whereby current activities are reconciled with a structure of prior interactions.

In structurationist terms, co-memory has two key attributes:

- Co-memory is a modality of structuration.
- Co-memory consists of rules and resources.

As a modality of structuration, co-memory constrains and enables interactivity and is both a medium and an outcome of this interactivity. At the same time, co-memory is recursively implicated in the reproduction of structure. Figure 2 locates co-memory within the duality of structure.

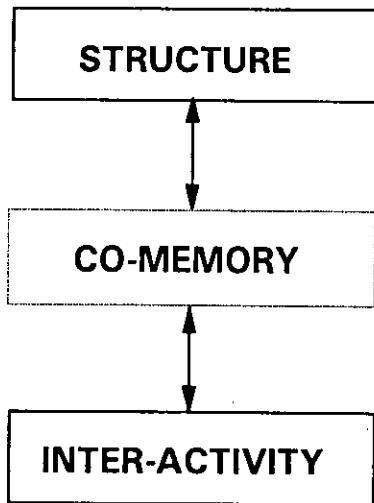


Figure 2. The Duality of Co-memory

Co-memory consists of rules and resources that provide its constraining and enabling aspects. Giddens conceives of rules in a broad sense, defining them as “techniques or generalized procedures applied in the enactment/reproduction of social practices” (1984, p. 21). He also describes some of main characteristics of rules that apply to questions of social analysis (Figure 3).

As rules, co-memory can be usefully characterized according to the dimensions in Figure 3. The informal/formalized dimension corresponds roughly with the ontological dimension of form (concrete/abstract) used to classify prior research earlier in this paper (see Figure 1). In addition, Giddens’ description provides dimensions of intensity, discursiveness, and sanctioning to analyze organizational remembering. These dimensions will be applied to IT-based co-memory later in the paper.

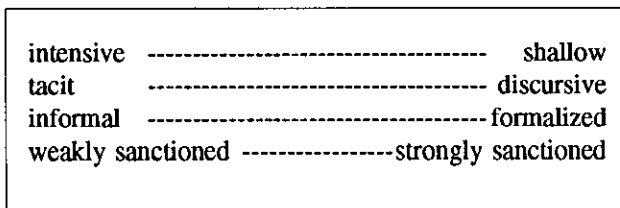


Figure 3. Characteristics of Rules
(Adapted from Giddens 1984, p. 22)

For Giddens, resources fall into two categories: allocative and authoritative. As resources, co-memory has both allocative and authoritative features. Consisting of stocks of knowledge and expertise, co-memory is a resource for the allocation of productive capacity. Expert systems are an example of a class of information systems designed to capture allocative features of co-memory. Co-memory is also an authoritative resource, enabling coordination and synchronization of agents across time/space. Group calendaring, scheduling, and project management systems are examples of information systems that focus on authoritative resources.

3.2 Remembering and Forgetting in Teams

In an organizational workgroup or team, for example, the development of a history of interactions — a co-memory — is critical for the maintenance of stable relations across time/space. One can imagine a hypothetical situation in which a team has no co-memory. Thus, on every occasion that members meet or otherwise interact, they do so as complete strangers. They must continually recreate the context of their interactions, a never-ending process of introductions, of beginnings — locked in a land of “How do you do?” This hypothetical team would, in essence, be paralyzed by its social amnesia, bracketed off from authentic temporal existence.

Obviously, such situations do not exist in reality, but this example demonstrates just how essential and taken-for-granted co-memory is as a basis for social interaction. Teams *with* co-memory have the rules and resources necessary to continue — to “go on” — in everyday interactions. Furthermore, teams are continuously engaged in reconstructing these rules and resources — “remembering” them — by applying them in the enactment of their localized practices. In addition to being the stocks of techniques and procedures used by teams, co-memory consists of the resources necessary for the coordination of productive activities across time/space. Teams draw on their co-memory to schedule and synchronize activities as well as to allocate their productive capacity. Later in the paper, we will discuss how IT-based co-memory systems will become increasingly important for the coordination of team activity.

Table 1. The Stratification of Co-memory

stratification model	co-memory
discursive consciousness	history
practical consciousness	tradition/routine
unconscious	habit/reflex

3.3 Co-memory and Consciousness

In his analysis of the cognition and motivation of competent actors, Giddens develops a stratified model that distinguishes between discursive consciousness, practical consciousness and unconscious motives. In a similar way, we can see how remembering occurs at all three levels of consciousness (see Table 1).

At the level of discursive consciousness, co-memory could perhaps best be described as history: collected stories, myths, and public accounts. Remembering occurs as the conscious, often effortful, process of co-memorization and collaborative recollection. Information systems operate primarily at this level of consciousness.

Within the practical consciousness of groups are its traditions: the unarticulated skills and practices which comprise the bulk of routine interactivity. At this level, remembering occurs through entrainment and patterning of daily activities (McGrath 1990). Co-memory at the unconscious level consists of habits and habitual behaviors acquired by agents through imprinting which occurs in the back regions of interactivity (Cohen 1991).

Most organizational remembering occurs in between discursive consciousness and unconsciousness, at the level of practical consciousness. Although aware of the processes of remembering at this level, people typically do not articulate this awareness. In other words, remembering at this level consists of action, rather than talk about action.

The primary vehicle for remembering within practical consciousness is through the creation of routines. At one level, routinization is an essential economic feature of everyday life in organizations. Routines minimize the effort required for recollection by singularization: the collapsing of multiple recurrent events into singular events. Further efficiencies occur through serialization, whereby sequences of recurrent activities are collected in such a way as to allow recollection to occur in an automatic, "chain reaction" fashion. Through the continual re-enactment of its routines, an organization reinforces its co-memory. The most commonly enacted routines form the most "ready" co-memory. These routines require little thought — even less talk — and their availability and ease of enactment make them a key factor in overall organizational efficiency.

An organization's repertoire of routines is constantly shifting. As it reinforces certain routines, others sink into the Lethan waters of organizational forgetting. The cliché, "use it or lose it," is particularly apt in characterizing how routines are — and are not — maintained as organizations struggle to balance the efficiencies gained through routinization with the ability to respond innovatively to novel or critical situations.

This balancing point, essentially an economic trade-off between routine efficiency and flexible response, is located at different points across and within organizations, but it remains highly sensitive to the kinds of rules and resources

that comprise the co-memory of organizations. By reducing the costs associated with storage of and access to an organization's memory, information technology is changing this balance and permitting organizations to be efficient and conscious at the same time. As we will see, the influence of IT on the economics of co-memory and on the location of this balancing point is a key determinant of the mnemonic shift.

4. CO-MEMORY AND INFORMATION TECHNOLOGY

This section explains how information technology can act as co-memory, identifies existing and projected information systems that can serve as co-memory, and classifies them according to the model of co-memory outlined above.

4.1 Why is IT Co-Memory?

Recall that co-memory is a modality of structuration. Information technology fits this role as it constrains and enables the interactions of people and is simultaneously modified by these interactions. Accounting systems, for example, constrain and enable the activity of accounting. At the same time, the activity of accounting continuously reproduces the accounting structures of organizations.

Co-memory was also defined as consisting of rules and resources. Clearly, much of information technology is driven by rules such as algorithms, formulae, and heuristics. Information technology has features of both allocative resources — as instrumental in production — and authoritative resources — as a means for coordination (cf. Barley 1988). As allocative resources, accounting systems take raw materials (data from transactions) and process them into artifactual memory (reports). As authoritative resources, these reports help coordinate the activity of organizations.

4.2 Information Systems for Remembering

In their role as mnemonic devices, information systems serve two purposes: (1) they develop memory by providing data collection facilities where the data will be used for future analysis (e.g., a transaction processing systems [TPS]) and (2) they facilitate remembering by reconstructing collected data (e.g., a decision support system [DSS]). While a TPS or a DSS is an information system, each can be viewed as a generic mechanism, often incorporated in more specific systems. In the section that follows, we will focus on systems that support specific organizational functional areas (e.g., accounting) and organizational functions that cut across functional areas (e.g., meetings). Some of these systems are well-developed, common components in most organizations. Others are well-developed but are typically in an early adoption phase. Still others are poorly-developed or not feasible today.

Table 2. Selected Organizational Functions that Utilize IT-based Co-memory

Accounting
Calendaring/Scheduling
Group Authorship
Institutional History/Scrapbooks
Meeting Memory/Group Diaries
Planning/Forecasting
Project Management
Records/Archives
Tracking/Auditing
Version Control

4.3 Classification of IT-Based Co-Memory

This section describes and classifies information systems that we expect will be used for organizational remembering in 2001. Each is analyzed according to its rules (intensity, discursiveness, formality, and strength of sanction) and resources (productive and coordinating).

Of the organizational functions shown in Table 2, it is clear that accounting, records/archives and calendaring/scheduling are common. These functions were in place long before automation through technology and are largely routine, automatic and occur daily in organizations. Each of these functions is composed of *intensive*, *tacit* and *formalized* rules. Accounting systems are strongly sanctioned in organizations. Both accounting and records/archives are productive resources, while calendaring/scheduling are coordinating resources. We refer to the information systems that support these functions as *transactional co-memory*.

A number of other functions in Table 2 are almost the opposite of those related to transactional co-memory. They include group authorship, tracking/auditing and version control. These functions became sophisticated and prevalent with the introduction of information technology. They are effortful, non-routine and commonly depend on and support transactional co-memory. They are composed of *shallow*, *discursive*, and *formalized* rules and may be either *weakly* or *strongly sanctioned* in organizations. They are primarily resources for coordination. We refer to the information systems that support these functions as *managerial co-memory*.

Two other functions shown in Table 2 have *shallow* and *discursive* but *informal* rules. These are planning/forecasting and institutional history/scrapbooks. The former, a production and coordination function, is well established in most organizations and often supported by decision support systems. The later, primarily a coordination function, is yet to be automated in organizations. Because their time horizon is longer than for transactional

or managerial co-memory, we refer to information systems that support these functions as *strategic co-memory*.

The remaining two functions in Table 2, project management and meeting memory/group diaries, have both *tacit*, *discursive* and *strongly* or *weakly sanctioned* rules and operate as both productive and coordinating resources. Project management is a function that has been in place for many decades and has a fairly sophisticated set of supporting automated systems. Meeting memory/group diaries are a function that is just receiving attention with few systems available. Sandoe, Olfman and Mandviwella (1991) describe a prototype meeting memory system. Group support systems such as GroupSystems (Dennis et al. 1988) can act as group diaries. We refer to the information systems that support these functions as *team co-memory*. Table 3 summarizes the classification of information systems for co-memory.

5. THE MNEMONIC SHIFT

In this section, we speculate on the forms of information systems for co-memory that organizations can expect to utilize by the year 2001. Our overall expectation is that organizations will move toward more reliance on IT-based co-memory. This drive we term a *mnemonic shift*. Yet, there will be variation in the way organizations adjust to this shift. By 2001, organizational forms will vary, depending in part on their previous history, industry, and culture. In the following discussion, we use the terms structure, technology and people. Figure 4 shows the concrete forms of the constructs shown in Figure 2 and defined earlier.

Figure 4. Concrete Forms of Co-memory

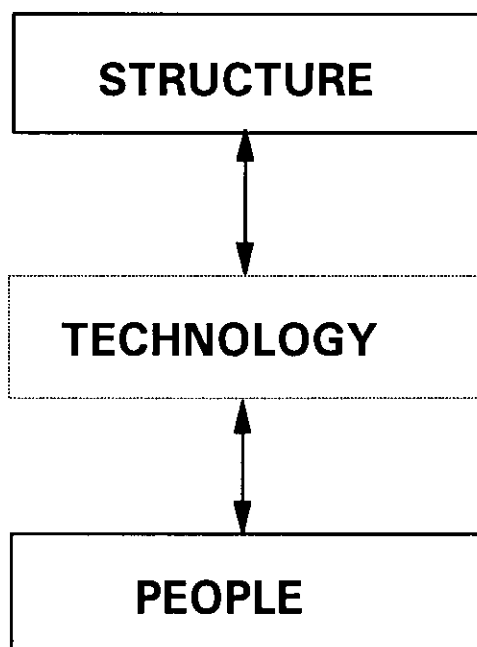


Table 3. Summary of Classification of Information Systems for Co-memory

	RULES	RESOURCES
TRANSACTIONAL	intensive, tacit, formal	production
MANAGERIAL	shallow, discursive, formal	coordination
STRATEGIC	shallow, discursive, informal	coordination
TEAM	tacit and discursive	production and coordination

Table 4. Futurists Contributing to the Assessment of Driving Trends

Roy Amara	President of Institute for the Future
Robert U. Ayres	Professor of Engineering and Public Policy at Carnegie Mellon University
Daniel Bell	Professor of Social Sciences at Harvard
Kenneth E. Boulding	Professor of Economics at University of Colorado
Arthur C. Clarke	Chancellor of the University of Moratuwa, Sri Lanka
Peter F. Drucker	Professor of Social Science at Claremont Graduate School
Victor C. Ferkiss	Professor of Government at Georgetown
Barry B. Hughes	Professor of International Studies at the University of Denver
Alexander King	President of the Club of Rome
Richard D. Lamm	Attorney and former Governor of Colorado
Michael Marien	Editor, Future Survey Annual
Dennis L. Meadows	Professor of Engineering at Dartmouth
James A. Ogilvy	Director, Revisioning Philosophy Program, Esalen Institute
Gerard K. O'Neill	Professor of Physics at Princeton
John R. Pierce	Emeritus Professor Engineering at Cal Tech
Peter Schwartz	Engineer, planner; has his own futures institute
Robert Theobald	Economist and chairman of Knowledge Systems, Inc.

5.1 Driving Trends

What forms will technology, people and structure assume by 2001? In order to answer this question, we examined the predictions of futurists and others who speculate about the future of society and technology. Our main reference is Coates and Jarratt's (1989) compilation of the thoughts of seventeen individuals who have written about the future (see Table 4). This summary is based on analysis of writings and personal interviews. In addition, Coates and Jarratt provide their own scenarios of what organizations can expect in the 1990s and beyond.

While Coates and Jarratt covered a broad set of issues, our analysis focuses on issues of technology, organization structure and people. The futurists basically represent two views: one that technology drives organizational and social change directly and the other that political and social structures control technology. Those with the latter view can see some possibility of slow-downs in the adoption of technology in the near future. There is a sense that technological impacts are underestimated in the long run, even though they are overestimated in the short run. Machines will probably put many people out of work, especially blue collar workers and low and middle level office workers.

Information Technology. Hardware trends are toward faster processors (massively parallel systems), larger and faster storage (e.g., read/write optical disks; business card size disks) (see Hennessy and Jouppi 1991). Software trends are toward tools for managing complexity and toward software (expert systems) that does automated jobs in the office. User interfaces will tend to be three-dimensional and animated (Marcus and van Dam 1991). Increasingly sophisticated speech recognition/speech generation systems will be developed. There is also a possibility that human memory extensions will be produced, although this is unlikely by 2001. Generally, the drive in information technology will be to support the development and maintenance of "intellectual property."

People. Most of the futurists see an increase in telecommuting, a decrease in the number of jobs, and a decrease in the work week for most: the knowledge worker will be dominant. Some predict labor force shortages due to an aging population. Our ability to increase knowledge-based work will be facilitated by communications technologies. There is a belief that job mobility will increase (also see Fisher 1989).

Organizational Structure. Most of the futurists see a prevalence of flatter/leaner organizations with increased automation of knowledge work, although there will be exceptions (also see Turnage 1990). There will be less of a distinction between private and public organizations. There will be more organization-based education. Organizations will manage complexity; they will be more global; and they will continue to change through financial impacts (e.g., mergers and acquisitions).

It is clear that information technology is expected to keep on increasing its capabilities in all areas. The speculation about the future of people and organizational structure is less clear. While employer turnover could increase, historical trends do not bear this out, although the evidence is not clear either way (Carey 1990). While some organizations will move to a flatter team-oriented structure, there is a strong likelihood that others will not (Perin 1991). Our analysis of future trends in co-memory systems takes these variations into account.

5.2 Scenario Analysis

Herein we discuss the kinds of information systems for co-memory that organizations are likely to use ten years from now. Assuming that technology is a constant increasing variable, we see organizations in 2001 as varying in terms of their structure and people. For simplicity, organization structure is viewed as having either a narrow or a wide span of control and personnel turnover as being either high or low. This results in four scenarios (see Figure 5) that are examined in terms of their potential for adoption and use of IT-based transactional, managerial, strategic, and team co-memory.

Bureaucracy. Organizations that maintain a narrow span of control and successfully restrain employee turnover will

keep the form of traditional bureaucracies. These entities will certainly enhance their transactional co-memory systems, but will be unlikely to automate managerial, strategic, and team functions. However, the development of transactional co-memory will provide capabilities to adopt other technologies if there is a shift to another cell in the matrix, say, if the level of employee turnover begins to increase.

The growth of personal filing systems that can provide accurate and rapid information retrieval (Lansdale and Edmonds 1992) will enhance records/archives functions. Calendar/scheduling systems are making a major impact on the software marketplace and will continue to increase in sophistication and use.

Factory. Organizations that maintain a narrow span of control, but do not restrain employee turnover are forced to create job roles that can be easily substituted. Here, transactional and strategic functions will be automated. The need to provide for ways of coping with employee turnover will cause these organizations to adopt strategic co-memory. These organizations will be positioned to move to wider spans of control.

One of the effects of high turnover will be the need for more sophisticated planning/forecasting systems. Expert systems will provide some of the impetus here. Simon (1991) points to the need to replicate the memory of individuals in systems; as turnover rates increase, these systems will become more and more prevalent.

Affiliation. Organizations that have a wider span of control and that manage to keep employee turnover rates low will utilize transactional and managerial co-memory systems. The need for managerial co-memory systems derives from the requirement to include automated tools for information tracking and group work support. These organizations may also begin to utilize team co-memory systems.

Wider spans of control require more support for management and for teams. The managerial systems replace levels of bureaucracy. The team concept is a likely consequence of this change in structure. While teams can utilize automated systems, the level of turnover will play a role. Organizations with low turnover may not require the kinds of team automated support that those with high turnover will need.

Infocracy. Organizations with wide spans of control but high employee turnover will require an entire suite of IT-based co-memory systems. Tools for tracking, team support and strategic planning support will be necessary. High turnover rates and wide spans of control make organizations susceptible to potentially harmful forgetting unless mechanisms are in place for maintaining the institutional memory (Carley 1992). Such mechanisms will undoubtedly include co-memory based upon natural language recognition and processing. Institutional history will be retained in "electronic scrapbooks" supported by multimedia databases. Additional uses of imaging technologies will be widespread in IT-based co-memory.

STRUCTURE

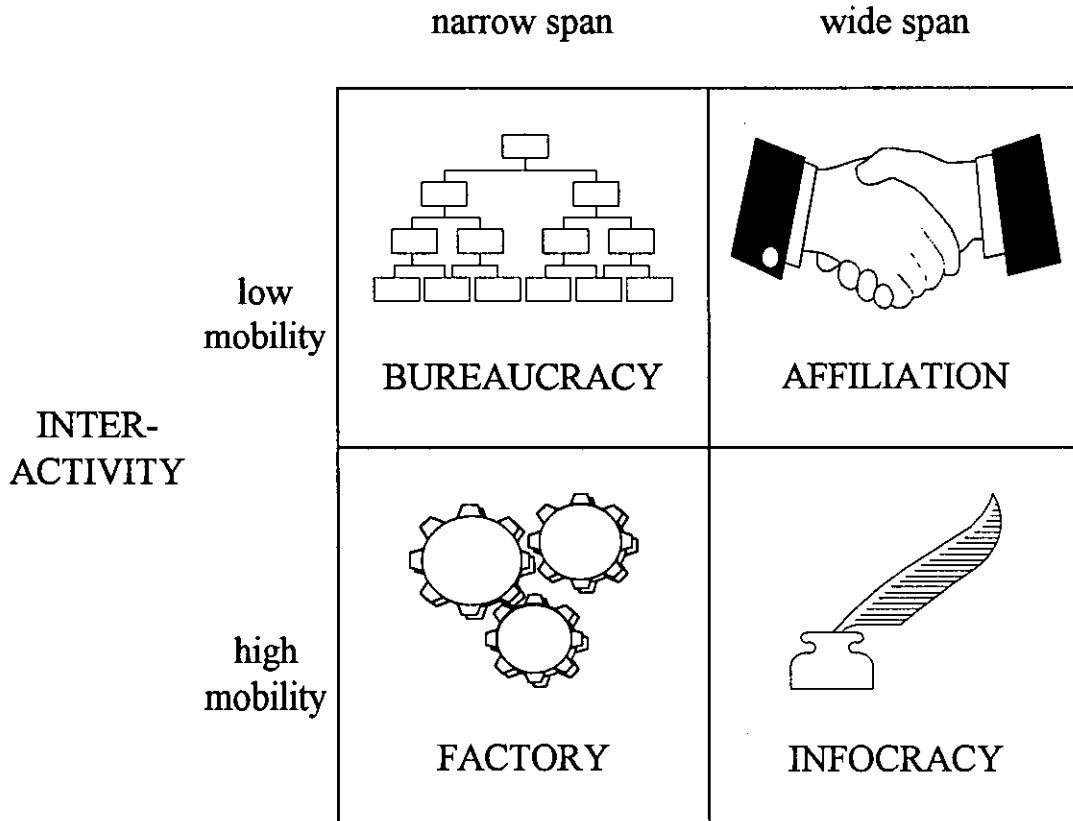


Figure 5. Organizational Scenarios in 2001

6. IMPLICATIONS AND CONCLUSION

We sense that the majority of futurists are correct and that most organizations will eventually become infocracies. In tribal societies, people were bound to land, with tradition and culture rooted in specific locations in time-space. The invention of writing increased time-space distancing, allowing for greater mobility, by dislocating tradition from its localized roots and centralizing memory in the urban form. As Weber (1968) argued, the invention of double-entry bookkeeping furthered this process, allowing the division of production and capital and resulting in class-divided societies and the rise of bureaucracy. The introduction of computing and telecommunications has radically altered the relationship between tradition and society by replacing tradition with information. The outcome will be infocracy, and the co-memory of these organizations will require information technology to thrive and grow.

More than anything, research conducted to date indicates that organizational memory is multi-faceted; it takes many forms and serves multiple functions. Many of these functions are thought of as aspects of organizational learning (cf. Huber 1991); and research on co-memory systems

appears to fit within the agenda of Organizational Decision Support Systems (cf. King, Ruhleder, and George 1992). At this point, researchers must be able to respond to the many questions that remain unanswered about the complex processes of organizational remembering and forgetting, including

- Will changes in the automation of co-memory drive organizations more rapidly toward infocracy?
- How will IS managers learn to anticipate and cope with the mnemonic shift?
- Is organizational forgetting ever beneficial? Is IT-based co-memory more vulnerable to accidental or purposeful forgetting than its traditional forms?
- Is it true that bureaucracies never forget? Does "streamlining" result in organizational amnesia?
- Can the burden of IT-based co-memory be justified?
- Is the constitution of organizational memory constrained by rights protection and subject to privileges

of democratic participation in its creation as well as its use?

It seems likely that organizations will rely increasingly on IT-based co-memory in the future. Such systems have the potential to displace or alter existing forms of organizational memory, triggering organizational forgetting in potentially harmful ways. It is hoped that this work will provide guidance for the design of IT-based memory systems in such a way that they complement and support organizational remembering and forgetting in a positive and beneficial direction.

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8. REFERENCES

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9. ENDNOTES

1. These include frameworks (Minsky 1981), stored information (Dretske 1982), indexed documents and hypertext (Johansen 1988), formalized knowledge and expertise (Carlson and Ram 1990; Ackerman and Malone 1990), and stored data and expertise (Huber 1990). Also, an unusual perspective is the concrete-interpretative view of memory as an "orientation device" (El Sawy, Gomez and Gonzalez 1986).
2. These include conceptual lenses (Allison 1971), cognitive maps (Argyris and Schon 1978; Weick and Bougon 1986), social structures (Douglas 1986; Shotter 1990), and stored stimuli and responses (Walsh and Ungson 1991).
3. For an overview of the use of structuration theory in IS, see Walsham and Han (1990) and, more recently, Orlikowski and Robey (1991).