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The Critical Role of Librarian/Information Officer as Boundary Spanner Across Cultures

Humans as Essential Components in Global Digital Libraries

Robert M. Mason
Management Information Systems
College of Business
Florida State University
Tallahassee, FL 32306-1110 USA
rmason@fsu.edu

Abstract

As libraries become increasingly based on digital storage and access technologies, knowledge management approaches seem particularly useful. Most knowledge management systems emphasize the role of information and communications technologies, and the question arises about the role of librarians in these systems. This paper posits that if globally digital libraries are to realize their potential for providing access to the widest feasible range of knowledge, librarians and information officers need to fulfill a challenging and critical role as boundary spanners across cultures. This paper is based on evidence that knowledge is culturally derived, acquired, and applied, and that learning—the acquisition of new knowledge—is enabled by skills that are culturally dependent. This aspect of knowledge suggests that the tacit dimension of knowledge and learning may require humans to aid in spanning the boundaries across different knowledge domains and different cultures.

This paper and presentation has three components. First, it reviews what is becoming known about learning and how this relates to knowledge creation and knowledge transfer. Second, it reviews a boundary spanning model proposed by Carlile, comprised of three levels—syntactic, semantic, and pragmatic—and applies this model to learning across cultures. Finally, the paper discusses the implications of such a model of knowledge for libraries that seek to serve as global resources for multiple cultures. For digital libraries, new skills and approaches may be required for the pragmatic category.

The Critical Role of Librarian/Information Officer as Boundary Spanner Across Cultures

Introduction

Since the 1990s, knowledge management has become an area of research and a popular topic in the management practitioner literature (Ponzi 2002). Over this same period, the relentless pace of Moore's Law has meant that the cost of digitizing and storing data has dropped by several orders of magnitude, leading to the concept of digital libraries that can enable anyone who has access to the Internet and who has a web browser to reach into a collection of the world's knowledge. Knowledge produced and stored in one place can be accessed from any other place. Individuals or organizations can learn through the convenience of electronic access to collected knowledge stored in digital formats. It is this vision of a digital library linked with a global network of similar libraries that provides the motivation for this paper.

This vision is an appealing one and would appear to be feasible with current technology. The value of such a network of digital resources for global economic and intellectual development is apparent to all who view such globalization as beneficial. For this vision of world-wide access to information to become a reality, knowledge must be created and stored in formats and architectures accessible to everyone.

Global organizations have attempted to realize this vision. Such organizations want to have information within the organization accessible to those who need it, when they need it. To achieve this goal, many have designed and implemented knowledge management systems (KMSs). For a knowledge-centric organization—an organization in which knowledge is the primary asset for creating and adding value—an investment in a KMS is seen as a competitive necessity, if not a basis for competitive advantage (Davenport and Prusak 1998). Most approaches to the design of a KMS follow a model similar to that in Figure 1, a basic process model in which knowledge is created, stored/retrieved, transferred, and applied (Alavi 2001). The goal of a KMS is to support each step in this process—that is, to support the creation, storage, transfer, and application of knowledge. The implication is that KMSs using computer-based systems will improve the effectiveness and efficiency of knowledge storage and transfer, two key steps in the process.

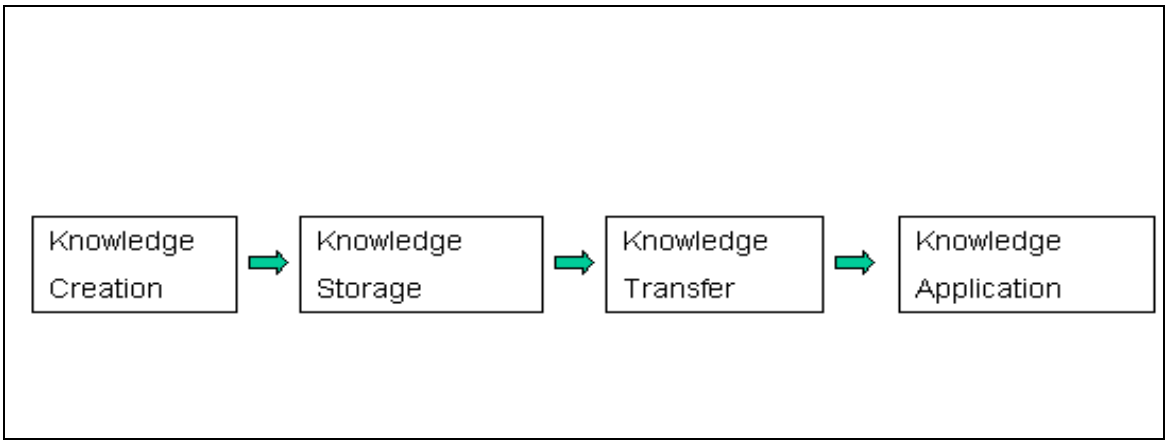


Figure 1. Process Model for Knowledge Management

Some have criticized this model, more precisely, the majority of the KMSs that have been implemented based on this model, as being too "North American centric," and as not recognizing or valuing the knowledge management approaches of non-western cultures (Nonaka 1995; von Krogh 2000). A recent review of published reports on KMSs concluded that such criticisms have merit (Mason 2003). Existing KMSs, including those that serve a global organization, focus on creating a strong organizational culture in order to be successful. The designs are not sensitive to any ethnic and cultural differences that may exist among their users. The implied assumption is that the benefits of a strong organizational culture sufficiently outweigh the costs of attempts to accommodate the distinct learning approaches that may be represented by the diverse cultural constituencies in a global enterprise.

The goals of a digital library typically will be broader than the goals of a KMS designed for a single global organization. A library that anticipates being a node in a global network can expect to have a wider constituency than a KMS designed for a single organization. In contrast to the digital library for a specific organization, such a library has less opportunity to create an overlay of a single organizational culture that would dominate the multiple national and ethnic cultures comprising the backgrounds of the final users of the library and library network. Consequently, cultural issues may be even more important for digital libraries than for organizational KMSs.

This paper is based on the evidence that knowledge is culturally derived, acquired, and applied, and that learning—the acquisition of new knowledge—is enabled by skills that are culturally dependent. These cultural bases for knowledge creation and absorption mean that knowledge management systems, especially those supporting digital libraries, must take culture into consideration in their design and implementation if they are to realize their potential for providing access to the widest range of knowledge.

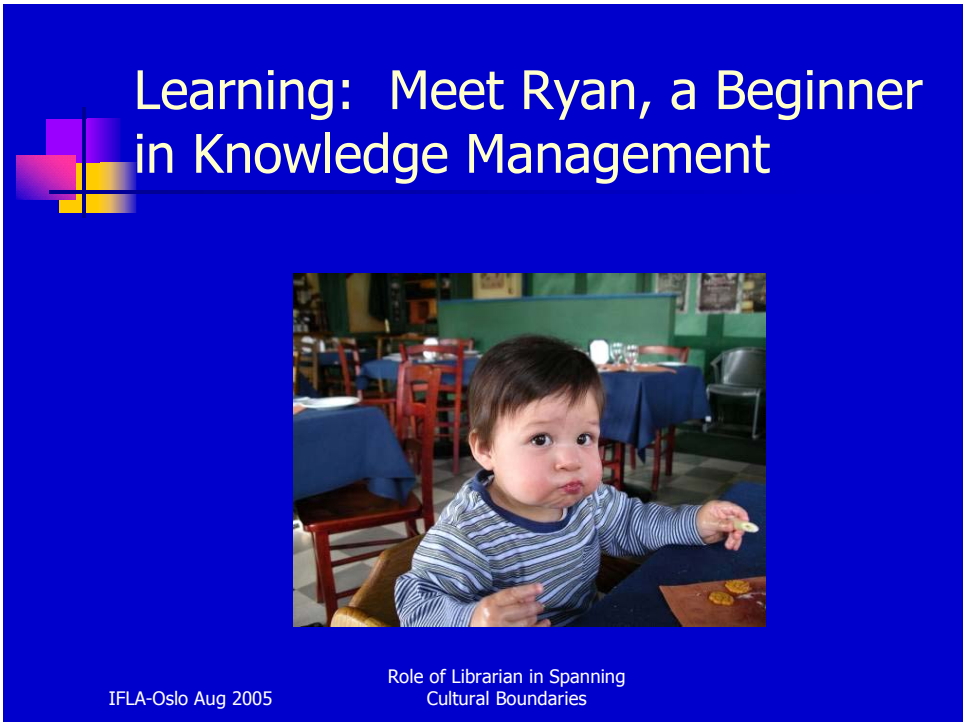
The paper proposes a conceptual framework for thinking about knowledge management in the context of digital libraries that may serve multiple cultures. The framework is grounded in the context of boundary spanning, a concept that acknowledges the need for mechanisms for communication across the boundaries between domains of knowledge and experience.

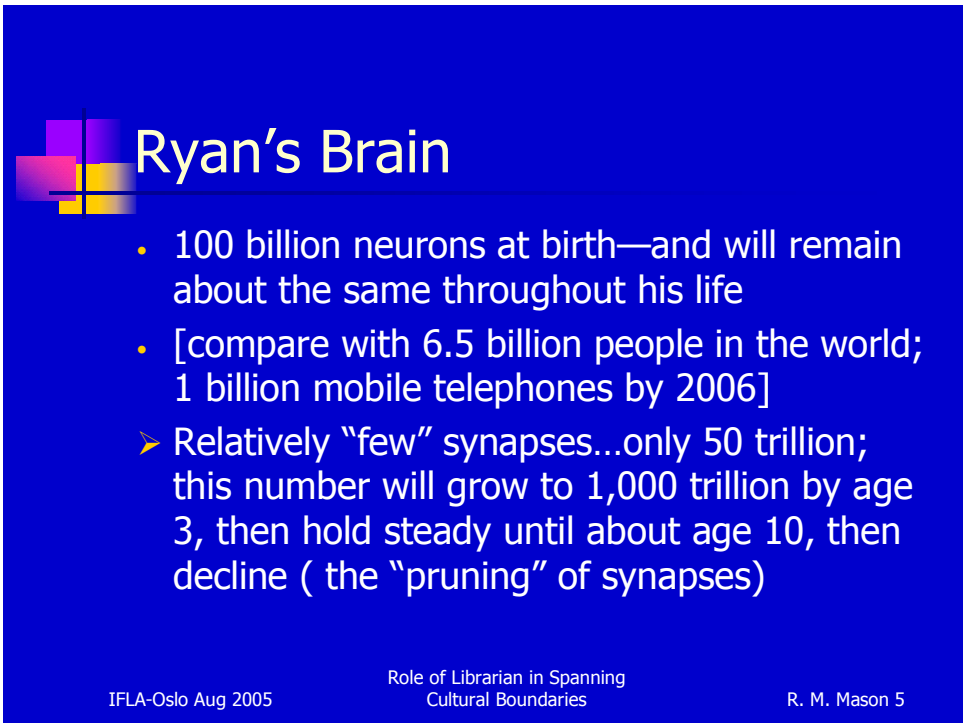
Culture and Learning

Culture generally is taken to be the shared beliefs, customs, norms, behavior, and practices of a nation or ethnic group or groups. Culture is both individual—it is manifested as individual traits that are learned—and collective—it emerges over time from the shaping of behavior and practices through the combined efforts of a nation or group.

Slides 4-6 illustrate how the cultural aspects of learning arise. In slide 4, taken early in 2005, Ryan (the author's grandson) is about ten months old. He's a beginner in knowledge management, but what happens in the first few years of his life is helpful in understanding why culture is so important in learning and why it needs to be considered in knowledge management for global libraries.

Slide 5 summarizes some important facts about the young brain (2005). When born, Ryan has about the same number of *neurons* (brain cells) as he will when he is an adult and about the same number as any other person: 100 billion. The difference between Ryan and an adult is that he has fewer *synapses*, or connections between neurons: "only" about 50 trillion.





The fascinating aspect of young Ryan's brain, and what happens to all children, is the rapid expansion of synapses. From about 50 trillion at birth, the number of synapses grows twenty-fold, to around a quadrillion, by age three. These synapses are *learning pathways* and provide a fertile environment for young Ryan to acquire new knowledge as he gains experience from his surroundings. From age three to about age ten, the number of synapses remains approximately the same. From age ten to adulthood, the number decreases as "pruning" takes place. If a learning pathway is used, the associated synapses are reinforced; those unused and inactive pathways are pruned.

Much of what Ryan is absorbing and learning later will be part of the tacit dimension of his knowledge. He develops "ways to learn" that are effective for his particular experiences and cultural environment; he is developing the meta skills of "learning to learn" and these skills carry over into adulthood. Hall summarized the relationship between learning and culture this way: "…once people have learned to learn in a given way it is extremely difficult to learn in any other way …culture reflects the way one learns" (Hall 1990).

Others have considered the same issue of culture and learning. Vygotsky and Luria proposed an explicit culture-centered approach to understanding learning (Vygotsky, Rieber et al. 1987), and others developed this approach further (Forman, Minick et al. 1993; Kozulin 1998). This perspective posits that culture (the collective) is a source of differences in cognition as (individual) cognitive processes are formed through sociocultural activities. Cole and others developed a contextual theory of cognitive functions, which posits that different cultures have different systems of mediated learning experiences (MLEs) (Cole 1971). Such systems and the resulting MLEs are important to cognitive development, thus leading to differences that become evident when a learner makes a transition from one system to another. It is significant that these differences are not simply differences in a factual knowledge base but reflect differences in how an individual learns.

For example, Kozulin (Kozulin 1998) studied young adults who had grown up in one culture and were learning in a different culture. He found that these individuals exhibited specific difficulties associated with coding schema, concepts, graphic and symbolic devices used in communication of ideas (e.g., tables, ordering, plans and maps). The difficulties extended to cognitive activities such as the ability to identify or define problems (the ability to apply already acquired knowledge to a set of data and infer the implicit question or issue that needed to be resolved) and the ability to work with multiple sources of information. In short, the young adults were missing cognitive antecedents that would enable them to excel in their new environment.

Kozulin concluded, "…cross-cultural differences in cognition are most probably related to learning practices characteristic of different cultures and subcultures…" and "Two major determinants of cognitive prerequisites are conceptual literacy and facility with other symbolic psychological tools, and a mediated learning experience responsible for the integration of these tools into the cognitive system of the student (Kozulin, 1998, p. 129)." His work showed that intervention could help learners develop the basic skills that would enable them to learn effectively in the new environment.

The relationship between culture and learning (the acquisition of new knowledge) suggests that knowledge management techniques that are appropriate in one culture may not be effective for digital libraries that seek to serve multiple cultures. This suggests our first proposition:

P1: If a KMS is to be effective for learning by individuals with different cultural backgrounds, it should either a) have culturally-sensitive access mechanisms or b) provide for skill-building that enables acquisition of knowledge classified and structured in non-native formats.

The Nature of Knowledge and Knowledge Management Systems

Philosophers and thinkers have considered the nature of knowledge for centuries, but recent interest in computer-based KMSs has renewed these discussions. For our purposes, three issues are important:

- The distinction between the explicit and tacit dimensions of knowledge
- The recursive relationships among data, information, and knowledge
- The cultural bases for learning and the meta skills that enable learning

Explicit and Tacit Dimensions of Knowledge

Explicit knowledge is, or can be, expressed in words or diagrams ("made explicit") and communicated to others using language, diagrams, or other tangible artifacts. Explicit knowledge typically may be recorded in articles and books. When one speaks of a digital library, the image typically is that of electronically stored articles and books, or digitally stored explicit knowledge.

The tacit dimension of knowledge, noted by Polanyi's now-famous phrase, "we know more than we can say" (Polanyi 1967), represents knowledge that can not easily be articulated. Examples of the tacit dimension include physical skills, such as riding a bicycle, but also include concepts of values and facts that are commonly known (sometimes referred to as "common sense"). Conveying the tacit dimension of knowledge often is done through apprenticeships, during which those who have the knowledge (the "masters") demonstrate the application of the

knowledge while the apprentices practice the skills under their tutelage. In some cases, the tacit aspects of knowledge can be transformed into explicit aspects (Nonaka 1995; von Krogh 2000). Culture, whether national or ethnic, conveys the tacit aspects of knowledge to persons who spend time in this environment. Much of cultural knowledge is tacit and may be difficult or impossible to make explicit (Hall, 1990).

Data, Information, and Knowledge

One generally imagines a hierarchy of "raw" data that are arranged in ways that are meaningful in order to produce information, and then this information is consolidated into coherent frameworks to form knowledge. In this view, generally taken as typical (Alavi 2001), data are precursors, or building blocks, of information, and information forms knowledge. However, as pointed out elsewhere (Tuomi 1999), awareness of data requires prior knowledge: without knowledge of what is salient, one would not be able to distinguish "data" from "noise."

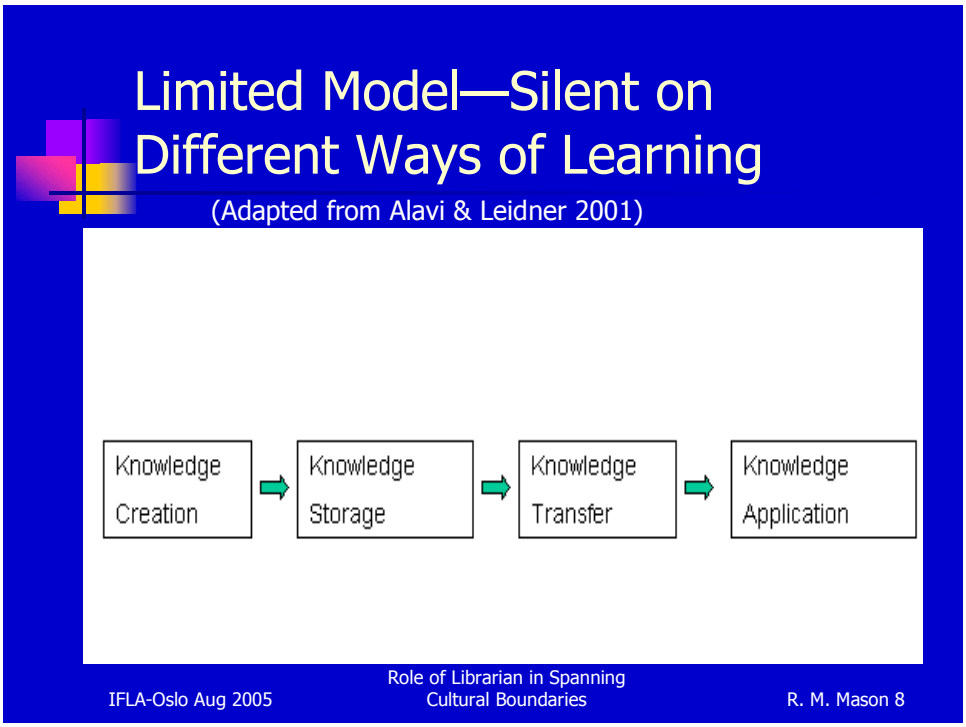
Perhaps the most meaningful conceptual framework within which to view the relationships among knowledge, information, and data is to consider the three concepts in a more hermeneutic, recursive process in which each is enriched and made meaningful by a consideration of the other. For data to be discerned from noise there needs to be a prior knowledge framework that anticipates possible signals. Given such a framework, data can be interpreted to create meaning and resolve questions (information). Information is the basis of communication between and among entities who can agree on interpretations and abstract concepts that can be the basis for new knowledge, which in turn can help recognize and interpret new data. At the same time, multiple schemas may be applied to develop alternative interpretations of data, providing for the construction of different meanings.

The recursive nature of data, information, and knowledge demonstrates the inadequacy of simple models that would create knowledge from information and information from data. An effective knowledge management system enables the creation of meaning and significance from the interactions of (prior) knowledge schema, (new) data, and (flows of) information. This suggests a second postulate:

P2: An effective KMS enable flows of data and information so that individuals can create new knowledge by considering multiple interpretations of new data using alternative schema.

Knowledge Management Systems

We can now see the limits of the model in Figure 1 and shown again in slide 8. Although a knowledge management system (KMS) is presumed (Alavi 2001) to support the four steps in the process—the creation of knowledge, the storage and transfer of knowledge, and the application of knowledge—the model is silent on how culture (which shapes the early development of the meta skills of learning) might the process of knowledge creation, how it is classified for storage, and the effective ways of transferring knowledge.



Systems of knowledge management for a particular organization may focus on one or more of these goals. However, a digital library can anticipate that its users, both individuals and organizations, may want to pursue any or all of these goals.

If one considers that one objective of a KMS is to enable individuals to have access to the widest range of available knowledge, it should provide for access to both the tacit and explicit dimensions of knowledge. This leads to our next postulate:

P3: For a KMS to be effective, it should facilitate the storage and transfer of both tacit and explicit aspects of knowledge.

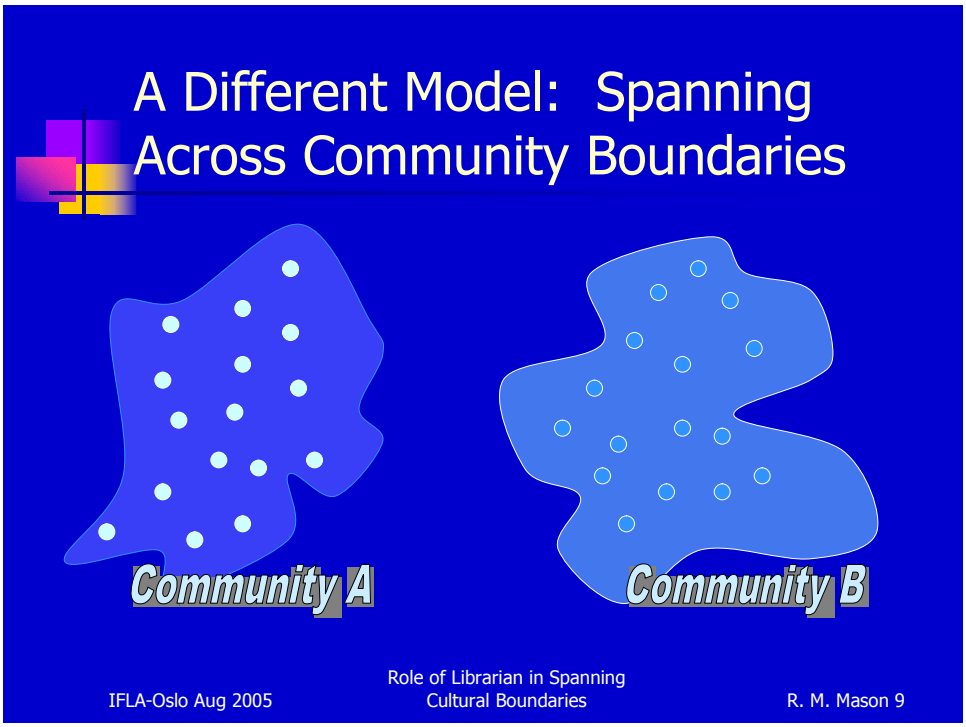
Because so much cultural knowledge is contained in the tacit dimension, a corollary to this postulate is that an effective KMS will incorporate considerations of cultural knowledge in its design and implementation. Not only will an effective KMS reflect cultural considerations in the transfer of knowledge (Postulate 1), it will acknowledge the distinct cultural schema that may form the basis for storing knowledge.

A Boundary Spanning Model for Knowledge Management

Boundary spanning has been recognized as a necessary component in processes that require coordination and translations among diverse groups (Star and Greisemer 1989) and different functional groups or “thought worlds” (Dougherty 1992). If, instead of the linear model for knowledge management shown in Figure 1 and slide 8, we consider a community of practice (Wenger 1998) model for knowledge exchange (see slide 9), we would approach knowledge management much differently than has typically been done in the past. Individuals within

communities of practice (CoPs) share similar experiences, a similar language, similar ways of learning, and similar values (slide 10).

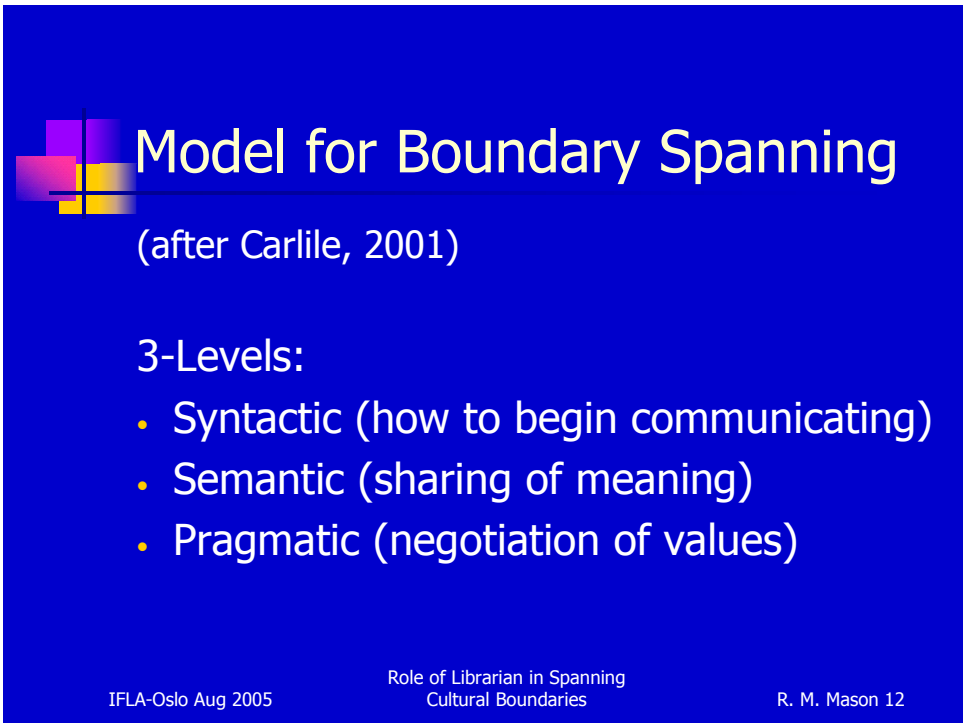
We might extend the CoP concept to virtual communities—individuals linked through information and communications technologies—and refer to these communities as "networks of practice" or NoPs (Brown 2001). Digital libraries may seek to serve global NoPs through knowledge management practices .



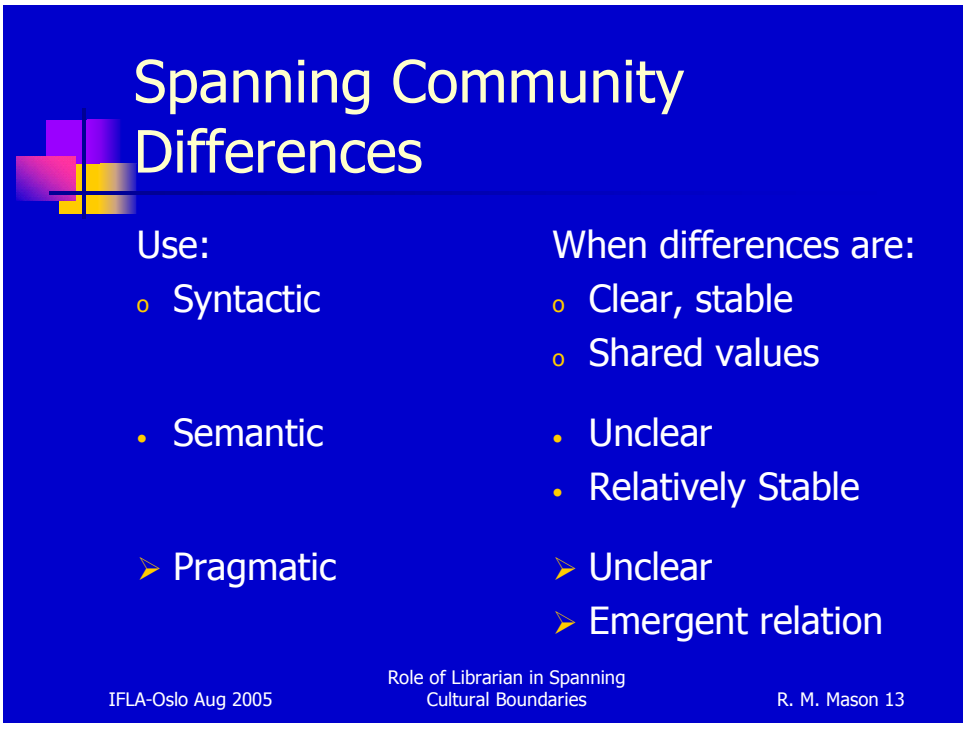
Knowledge management in this conceptual model of communities becomes a task of "spanning the boundaries" between knowledge domains and cultures. An earlier study (Mason 2003) applied the boundary spanning concept to a review of KMSs, drawing on business literature reports of KMS implementations and effectiveness. The following paragraphs build on this study but apply the boundary spanning concept to the need for digital libraries to span cultural boundaries.

Carlile's (2002) study of boundary spanning objects in a new product development (NPD) process provides a useful framework for examining the functions of KMSs. Carlile reports on an ethnographic study in which he worked with teams performing four primary functions in the creation of a new product (sales/marketing, design engineering, manufacturing engineering, and production). His work focused on how the teams worked together and dealt with the specialized knowledge of each area. Each of the four functional areas had different and specialized (in Carlile's terms, "localized and embedded") knowledge, structured in a way that made sense to the group. This knowledge specialization presented a barrier to the effective operation of the NPD team—the team found it difficult to exchange and synthesize knowledge as necessary for the successful development of a new product. Carlile observed that the team overcame this barrier by using boundary spanning objects that operated at three different levels: syntactic, semantic, and pragmatic (see slide 12).

At the syntactic level, shared repositories enabled communication of facts and agreed-upon tasks and actions. At the semantic level, standardized forms and methods enabled not only communication of facts but also provided a way for the different groups to clarify differences in meaning. The objects at this semantic level (standard forms and methods) enabled the team to translate the localized knowledge embedded in one group into forms that other groups could understand. At the pragmatic level, objectives, maps, and models enabled each group to transform embedded knowledge into knowledge that the entire team (and others not in the group) could understand.



In earlier studies of communities, Brown and Duguid (Brown 1998) pointed out the roles of boundary spanning activities and noted particularly the need for translators between communities. In commenting on Carlile's model, Brown (2002) suggests that Carlile's three levels correspond to three different levels of knowledge ambiguity among communities of practice. At each level, different types of boundary objects are necessary for communication, knowledge transfer, and learning (see slide 13).



At the syntactic level, the differences across the boundaries are explicit, clear, and stable. A shared syntax is a necessary (but not necessarily sufficient) condition for knowledge sharing under these conditions. Taxonomies and classification (e.g., shared databases) provide this syntax and enable the sharing and transfer of knowledge among groups that have a clear understanding of their differences and understand that these differences are relatively stable.

This syntactic level is a necessary condition for knowledge sharing in digital libraries. Agreements on syntax are required for data to be exchanged between culture and communities. As a minimum, agreements at this syntactic level deal with technical standards and data architecture. Such agreements are a necessary prerequisite for the sharing of digital data, but—as Carlile and Brown have noted—the sharing of data is insufficient for the sharing of knowledge and learning.

At the semantic level, the differences across the boundaries may be neither clear nor stable (Brown, 2002). The solution to spanning the boundary at this level requires a method of translating meanings across boundaries. At this level, Carlile (2002) observed the use of standardized forms and methods as boundary objects.

For digital libraries seeking to serve multiple cultures, this semantic level is an additional necessary, but insufficient, prerequisite for knowledge sharing. For groups that have similar cultures, in which concepts are similarly named and relationships among concepts are similar, relatively simple translations that involve mapping of concepts from one language or mental model to another may be sufficient. For concepts such as technology, in which concepts are not stable and different cultures may progress at different rates, frequent communication between the groups may be necessary to assure currency in meaning and to assure that new concepts are absorbed by both groups.

At the semantic level, if there has been agreement at the syntactic level and there is the basis for a shared communication language, metaphors may be a useful approach to communicating new ideas (Lakoff and Johnson 1980). For groups that have more distinct cultures, with few shared concepts, such translations or mappings may not be feasible without additional explorations at the pragmatic level. Indeed, even the metaphorical concept of a library may not be shared across some cultural boundaries (Duncker 2002), and a digital library would be even more difficult to translate.

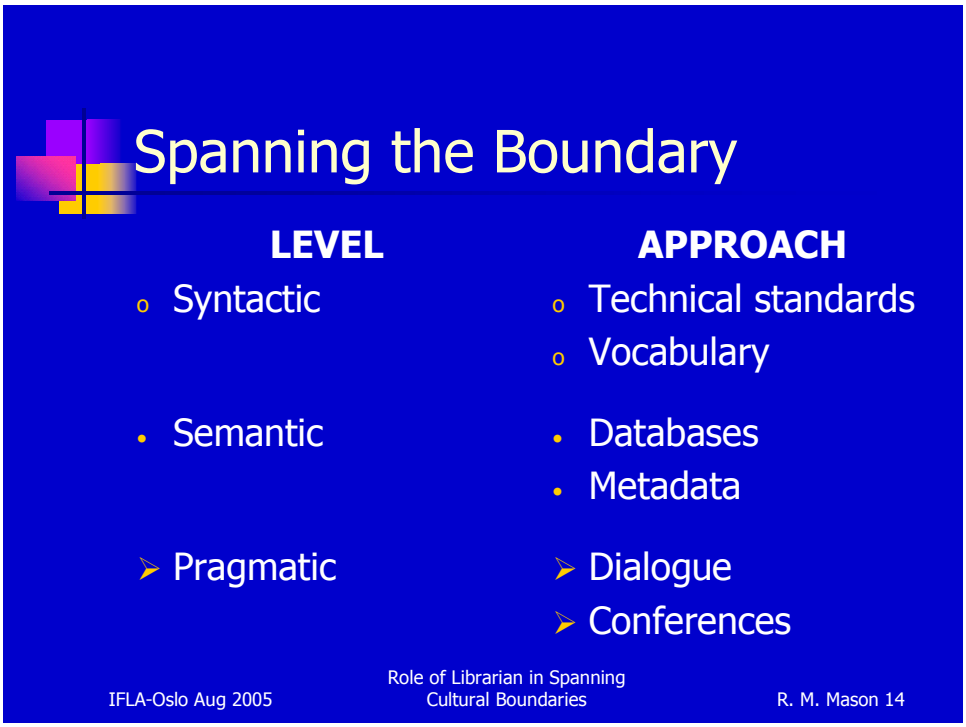
The pragmatic level provides a level for exploring other differences across boundaries. However, explorations at this level require some degree of agreement at the other two levels. In his discussion of this model, Brown (2002) notes that the knowledge of one group is not neutral to the knowledge of another group or community. Different communities may have different values and/or power relationships, and this level of difference requires boundary objects that provide additional capability beyond the first two levels. At the pragmatic level, the groups must transform their knowledge and create new (shared) knowledge rather than simply exchanging or transferring knowledge. Resolution of group differences requires objects such as models and maps, objects that enable the surfacing of assumptions, the tacit aspects of knowledge, and values. At this level, shared syntax and meaning must be sufficient to permit the sharing of methods of thinking and the development of a shared basis for understanding each group's values and mental schema.

In this model of boundary spanning, the lower two levels are necessary but insufficient for complete sharing of knowledge and the development of mutual understandings that would enable the creation of new knowledge. The mutual understandings and the associated trust

that comes from these understandings may be necessary if a KMS is to benefit a digital library that can support users from multiple cultures. This suggests our fourth proposition:

P4: For a KMS to be effective in a digital library supporting multiple cultures, it should provide boundary spanning mechanisms and processes at the syntactic, semantic, and pragmatic levels.

Mechanisms and processes at the syntactic and semantic levels of this model are readily apparent in observations of commercially-based KMSs implemented at individual organizations, but corresponding processes at the pragmatic level are rare (Mason 2003). The few cases in which such pragmatic level processes were reported noted the use of face-to-face meetings and structured forums in which distinct groups discussed values and differences. Some incentives and standards, designed to transform the executive level goals and values (e.g., the use of the KMS) into practice at the operational level of the firm, were judged to be pragmatic boundary spanning activities in which the boundary was a hierarchical rather than a national cultural or ethnic one (Mason 2003). Slide 14 summarizes the boundary spanning approaches for each level of the model.



Access to all the knowledge available within an organization is constrained when a KMS does not explicitly plan for the inclusion of multiple cultures in the creation, storage, and transfer of knowledge. A KMS designed by and for a particular organizational culture by its nature restricts the range of schema by which knowledge is classified and stored, and thus the creation of new knowledge is limited to discussions within the meta framework provided by the collective combination of these schema.

Conclusion and Discussion

Summary and Conclusion

Prior work in knowledge management systems can provide a useful framework to think about the development of digital libraries that can support global access to information. However, the theoretical goals of knowledge management systems—to enable access to the widest range of knowledge and to provide the capability to create new knowledge from existing knowledge—are not being realized in practice. Existing practices, as evidenced by published reports of knowledge management systems, inadequately provide for spanning the boundaries among cultures, thus limiting the knowledge that can be accessed and even the knowledge that can be created.

This paper suggests a three-level boundary spanning model to help guide the development of mechanisms for incorporating different cultures in a network of digital libraries. Each level presents different challenges for cooperation among countries and cultures.

The mechanisms for the syntactic level, including agreement on such topics as data architectures and other technical standards, while not simple, may be relatively straightforward. Groups already have made progress on these items and there is an existing base of knowledge on which to build.

Creating and using mechanisms at the semantic level represent additional challenges. However, once there is agreement on how data can be stored and exchanged across the boundary, different cultural domains can develop new shared understandings by a series of increasingly comprehensive and abstract exchanges at this level. The metaphor of building a bridge across a chasm illustrates how this can progress. In situations where there are few mechanical aids, two parties who desire to span the chasm between them can collaborate and build a strong bridge. First one party sends a thin string across the gap, perhaps by arrow or harpoon. This thin string is used to pull a stronger cord, which is used to pull a thin rope. The process is repeated until large cables can cross the chasm, and these cables can be used to support a walkway or roadbed.

The greatest challenge is at the pragmatic level. Progress at the first two levels is possible with a shared vocabulary and through translation processes that enable mapping of concepts from one culture to another. However, progress at both levels presumes some degree of shared values and goals. At the pragmatic level, differences in goals and values become apparent. Metaphors, useful at the semantic level to introduce new concepts and relate them to existing shared schema, may not be effective if there are few shared values.

In the case of digital libraries, even the simple concept of a library and the value a library may bring to the community, while generally accepted across many developed or developing nations, is not widely accepted by all cultures. Much of the developed world makes the tacit assumption that sharing information generally is a positive process, with few exceptions. Exceptions might include the distribution of pornographic material or information essential to a country's security. The controlled distribution of intellectual property, while not a universally accepted, principle, may also be an exception. Some cultures, however, place other values on information and knowledge. For example, in an ethnographic study of the use of library by native Maori, it became evident that new Maori library users had difficulty accepting the fundamental purpose of a library. According to the researcher, the Maori believe that it was a

violation of their core values to store and make accessible to many people their most valued knowledge, including Maori genealogical information. Such knowledge is considered tapu, or sacred, and the Maori hold that its dissemination should be done only in circumstances that respect the tapu nature of the knowledge (Duncker 2002). In some cultures, knowledge is valued only if it is shared sparingly; it loses value if it is readily accessible (Harrison 1995), much as many Western cultures view intellectual property. Such perspectives present barriers to realizing the concept of a network of digital libraries that enable the storage and transfer of knowledge electronically. Not only is there the barrier of converting the tacit aspects of cultural knowledge to more explicit expressions, there is the added barrier of the potential incompatibility of cultural values.

In conclusion, the application of knowledge management system principles to a digital library requires more than the application of the latest electronic storage and communications technology. To be effective at serving multiple cultures, a global network of digital libraries must create a culture within the network that appreciates and values the multiple perspectives of the distinct cultures the network seeks to serve. With the current state of development of digital storage of knowledge, it may be that digital libraries will require a range of human intermediaries to accommodate access by multiple cultures to the wide range of both tacit and explicit aspects of available knowledge.

Discussion: Implications for Research and Practice

Bridging the current gulf between the conceptual ideal for knowledge management systems and the level current practice implies the need both for research and for possible changes in practice. The postulates presented above and summarized below provide a framework for considering the next steps.

P1: If a KMS is to be effective for learning by individuals with different cultural backgrounds, it should either a) have culturally-sensitive access mechanisms or b) provide for skill-building that enables acquisition of knowledge classified and structured in non-native formats.

P2: An effective KMS enable flows of data and information so that individuals can create new knowledge by considering multiple interpretations of new data using alternative schema.

P3: For a KMS to be effective, it should facilitate the storage and transfer of both tacit and explicit aspects of knowledge.

P4: For a KMS to be effective in a digital library supporting multiple cultures, it should provide boundary spanning mechanisms and processes at the syntactic, semantic, and pragmatic levels.

Implications for Research

Postulate 1 indicates that an effective cross cultural KMSs should have either culturally-sensitive access mechanisms or mechanisms that enable some users to learn new skills that enable them to access what may appear to them to be strangely classified and categorized knowledge. This postulate equivocates and does not say which approach would be more effective or more cost-effective. From a Western business perspective, this is an important issue, and research might help resolve it. Do we know enough about cross-cultural learning to say that training new users of a digital library is the best approach? The practice in industry has been to take this “culture free” approach and create an overriding corporate culture for

knowledge management (Mason 2003), and Kozulin's work (Kozulin 1998) indicates that providing "help" to those trying to move into a different intellectual framework is effective.

However, it is unclear that these approaches are more effective (or more cost-effective) than considering the needs of different cultures when initially designing and implement the KMS. By providing for new users to accommodate to the existing KMS, the system benefits from standardization of knowledge storage and transfer approaches. However, enforcement of a single structure for knowledge and knowledge classification by necessity inhibits the storage and transfer of knowledge that does not fit within this framework. (Note that this sounds much like the old argument of how much "authority control" in bibliographic databases is appropriate.) What would be useful is research on the value of the knowledge that may be left out of a KMS if this approach is followed.

Conceptually, what may evolve is a multi-tiered KMS, one in which a core knowledge base is standard but a separate set of knowledge bases may emerge as the need and opportunity arises. For the emerging knowledge bases, the form and structure of the knowledge (e.g., classification schema) as well as the knowledge itself may require the interaction of users and contributors to the system. The theoretical bases for such emergent systems are just beginning to be discussed and established (Markus, Majchrzak et al. 2002).

The second postulate calls for data and information flows to enable individuals to use alternative schema to "make sense of" data and information in new ways. This role of a knowledge management system—to enable the creation of new knowledge from the reinterpretation of existing knowledge and information—is an exciting and unexplored aspect of KMSs in a culturally-rich setting. Additional research is needed to understand how individuals make sense of their environment, and this research likely will be disciplinary as well as cross-cultural.

In what may be related research, more work is needed to understand how a KMS can store and transfer the tacit dimensions of knowledge (postulate 3). The simple answer is that the KMS must include people who are aware of this tacit dimension, and this means that the effective KMS can be expected to have both human and electronic (digital) components.

Finally, postulate 4 suggests the need for three levels of boundary spanning in digital libraries that are serving multiple cultures. This suggests the need for applied organizational and structural research to determine how this spanning can be organized. The syntactic and even the semantic boundary spanning activities are underway through international standards setting organizations. As noted earlier, the challenge comes at the pragmatic level. The evidence in industrial organizations for effectiveness at this level of boundary spanning involves forums and face-to-face meetings in which values and power issues are resolved through discussion. As a first thought, a multi-tiered organizational structure might serve a global network of digital libraries much as is done with international technical standards. At this level, in which issues fundamental to each culture must be resolved, it is even more important that trust among the participants be established. (In the metaphor of building the bridge, trust is the "common thread" by which additional progress toward shared understandings can be built.)

In summary, researchers who take seriously the postulates that outline the design and implementation requirements for a KMS intended to serve multiple cultures can identify many unknowns. Research is needed that ranges from the conceptual to the pragmatic, and the best projects will combine elements of both—i.e., they will seek both understanding and practical applications.

Implications for Practice

Postulate 1 offers a choice between a KMS built with culturally-sensitive access mechanisms or providing for skill-building that enables newcomers to the KMS to acquire knowledge that has been structured in non-native formats (i.e., foreign to the user). Because existing KMSs are not designed with these mechanisms in place, the most practical approach would appear to be to provide skill-building for non-native users. Design of such programs requires an understanding of the target market and a program tailored to enable that market to use the system. This is no different from other applications of target marketing and interface design, and if the KMS is not intended to serve a segment, there is no need to provide this segment with specialized training.

Postulate 2 calls for the KMS to enable multiple interpretations of data. In practical terms, this means that the KMS must be an organization that tolerates, and even encourages, "out of the box" thinking. The KMS should implement appropriate structural techniques to assure the flow of information and knowledge across its boundaries: visiting scholars, rotating assignments and cross-training of staff and personnel, etc. These and other approaches can help the KMS remain an open (rather than a closed) system and one in which new ideas can be absorbed and implemented.

The third and fourth postulates both require slack resources. This implies that the measure of KMS efficiency should not be limited to a simple, short-term measure that might be used for a more limited library that stores and transfers only explicit knowledge.

Postulate 3 calls for the KMS to facilitate the storage and transfer of both tacit and explicit aspects of knowledge. By the nature of the tacit dimension, the storage and transfer of these aspects of knowledge are imprecise, non-mechanistic processes. Our current understanding of the tacit dimension indicates that this would require the inclusion of staff members (who are aware of the tacit dimension of knowledge) within and across the boundary of the KMS. The storage and transfer can be measured (with cognitive and behavioral approaches), but the KMS will need resources to facilitate the staff activities of learning and transferring this tacit dimension. The selection of which aspects of the tacit dimensions to store/transfer depends on the cultures being served.

Postulate 4 states that the KMS should provide for boundary spanning processes at all three levels. In the early development, the KMS will need human (perhaps face-to-face) interactions at all three levels.

Over time, the syntactic level interactions may be accommodated by shared data and knowledge bases. Similarly, machine translation may develop to the point where cognitive mapping across cultural domains will be possible. However, at the pragmatic level human interactions across the boundaries of the cultural domains will remain important. This suggests that librarians and information officers will include discussion forums and other communications channels so that issues of value may be discussed and decisions reached about how the goals of the KMS can reflect these values. Additional skills—skills not presently taught in information schools—may be required so that professionals can facilitate these forums with a sensitivity to the values and tacit dimensions of the knowledge embedded in the different communities.

In practice, these forums may not be face-to-face, and computer mediated communication may be even more effective. A key issue is trust, and different cultures may find it either more or less helpful to have longer periods of face-to-face communication. In some cases, the

nominally more constrained ("less rich" media) electronic channels actually may be more effective. In discussions of US-China research and entrepreneurial collaborations, email was much more effective than instant messaging or face-to-face communications. Because the exchanges were done in the common language of English, the Chinese participants were much more comfortable having time to reflect on the message, assuring themselves that they understood its meaning and implications, and not being pressured for a rapid response (Yim 1999).

In summary, the practical implementation of a KMS that can serve multiple cultures presents a challenge for librarians and information officers. Existing technology can be an important part of a system for storing and transferring knowledge, but the cultural boundaries require sensitive navigation of values and knowledge schema that may be incongruent, and this suggests that human intermediaries may remain essential participants in the knowledge management system.

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