

# Back to the Future: Information Science for the New Millennium

by José-Marie Griffiths

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The title of this paper, "Back to the Future," is a reflection of my desire to refocus our profession on the foundations of our disciplines, especially as we move into the new millennium. Clearly, the ideas that I present are shaped by my own experiences in information science. I have been fortunate in that these experiences have been diverse and have spanned research, education and practice.

## Integration: The Promises of Information Science

There are three important dimensions of information science, each of which will require integration or bridge-building in the future. The first dimension involves the many disciplines that have evolved more or less independent of one another, but which are essential contributors to information science. A second dimension contains the three building blocks of information science: people, recorded knowledge and tools. The third dimension deals with the three areas of our discipline: research, education and practice.

While many may see these dimensions and their component parts as separate and distinct from each other, I have tried to understand their interrelationships and show the importance of their integration. As we information scientists face the challenges of the ever-expanding "information age," I believe there will be ever greater demands on our profession to form the bridges – for us to be the integrators of multifaceted endeavors that blur the lines among information disciplines; the building blocks of information science; and research, education and practice.

With the passing of the 20th century and with ASIS celebrating the 50th anniversary of its journal last year and contemplating its future role and name, it seems an appropriate time to look back at past achievements; with the beginning of the new millennium, an opportunity to look forward.

## The Evolution of Science

Science has experienced tremendous change over the past half century:

- The number of scientists has grown seven-fold (from 1 million to 7 million in the United States alone).
- Nearly 90% of scientists who have ever lived are alive today.
- Science has seen increasing specialization through fission and fusion of disciplines; yet
- Big science is bigger than ever, for example the human genome project, Hubble space telescope, space science and high energy physics.
- Large projects addressed to social and other problems are becoming increasingly multidisciplinary in scope, and companies are assigning teams of scientists with different specialties to follow product development from discovery through to the marketplace.
- There is more collaboration among and between universities, government and industry, and global collaboratories are thriving.
- Science education is becoming multidisciplinary, adjunct faculty from outside academe are used more, and there is growing collaboration both among academic departments and among academic institutions.

All of these changes have required a continued splitting into new disciplines and combining of old disciplines and have made the lines among research, education and practice much less distinct than before.

In the past, scientific disciplines tended to be highly insular cultures, with individuals rarely venturing beyond their islands or surrounding seas. Norbert Wiener, 50 years ago, lamented that such disciplines developed their own vocabulary for common notions and, thus "important work has been triplicated or quadrupled, while still other work is delayed by the unavailability in one field

of results that may already have become classical in the next field." Fortunately, in my view, the changes in science over the past five decades have begun to tear down the "Berlin Walls" of science – mostly through necessity. As John F. Kennedy, in his now-famous Berlin Wall speech, said: "All the world knows that no successful system builds a wall to keep its people in and freedom out."

All disciplines, scientific and non-scientific, can benefit from an immigration of ideas, modes of inquiry, methods, analyses, etc. Such migration flows yield more knowledge in a richer array of underlying disciplinary combinations.

### Science and Information Science

So, how does the experience of science, in general, relate to information science? I believe that it is highly relevant. First, I believe that there is no single discipline of information science, but rather some 30 or 40 "disciplines of information," as identified by Machlup and Mansfield, some 15 years ago. These include:

Artificial intelligence	Linguistics
Bibliometrics	Living systems research
Communication sciences	Pattern recognition
Communicative theory	Phonetics
Computer science	Scientometrics
Control theory	Semantics
Cryptography	Semiotics
Cybermetrics	Speech science
Cybernetics	Systemics
Documentation	System science
Lexicology	Telecommunications
Library Science	

While each of these disciplines has in common a focus on the phenomenon *information* as the object of research, education and, sometimes, practice, they still tend to have distinct cultures located on isolated islands. Machlup, in his study of these information disciplines, indicates that such specialties tend to have their own languages that describe the same entities using different words; they are multilingual, although all use the English language. I would add that each discipline also has its own *patois*, a dialect other than the standard or literary language, which is most clearly demonstrated through the use of acronyms and other forms of shorthand. This discipline-specific linguistic conspiracy is further evidenced by what is not stated: the underlying foundational assumptions, which are assumed to be known by others in the "tribe," the group having the same character, occupation or interest. In fact, the only time these assumptions are made highly explicit is in the educational process.

Herbert Simon, the Nobel laureate, likened Machlup's project to an anthropological exploration into islands whose inhabitants speak foreign tongues: attempts are made by the explorers to help learn the meanings of the strange sounds and try to make sense of what is seen and heard. Perhaps we

have not progressed all that far, although some academic institutions are making some breakthroughs.

### Research for Information Science

The model I use to describe information science has three key components: people, recorded knowledge and tools. I believe that the emerging disciplines of information span all three components. Information science focuses on the relationship between people and recorded knowledge and uses a variety of tools to help understand and improve the relationship. So, how does research involving each of these three components inform (through educational processes) practice?

**People.** Research about people includes, for example, study of cognitive processes (remembering, recognizing, organizing, storing, retrieving information, etc.) and structures (models of knowledge structures); the study of information seeking preferences and behaviors; the study of information use and non-use; study of organizational and community use of information and knowledge.

Developing deeper understandings of the preferences and practices of individuals, groups, communities, etc., helps in the design and delivery of improved processes and services associated with the production, dissemination, receipt and use of recorded knowledge.

**Recorded Knowledge.** Research related to recorded knowledge includes the study of literature, information theory, infometrics, bibliometrics, scientometrics, library science, documentation, archival studies and so on. Also included here is the study of form and organization, described by Marcia Bates as "the content of form" in her excellent overview of information science.

Developing deeper and broader understandings of the structure of knowledge in various disciplines and contexts, the format and medium used to communicate information content, publishing practices, etc., helps in the purposeful selection of content into organized collections, improved modes of dissemination and communication, etc.

**Tools.** Research related to tools tends to be more applied in nature, although not exclusively so. Research in this area includes classification schemes, indexing vocabularies, automated systems and other technologies, retrieval algorithms, search engines, economics, statistical surveys and experiments, to name a few.

Research associated with tools design, development and evaluation can be used to help improve the relationship between people and recorded knowledge, in its creation, capture, storage, preservation, identification, dissemination and use.

### Education for Information Science

If indeed, all the research that different disciplines pursue can have some bearing on the relationship between people and recorded knowledge, what are the implications for educational programs in information science? Clearly, it would be impossible to cover the content of each of the contributing disciplines. It is also clear that no single academic school

or department could, nor even should, attempt to prepare future information professionals with all the detailed knowledge and skills needed for each potential area of practice.

An NSF study in the early 1980s showed that, at that time, there were nearly two million people working as information professionals in the United States. They were engaged in the following types of activities:

- preparing data and information for use by others;
- analyzing data and information on behalf of others;
- searching data and information on behalf of others;
- performing other operational information functions, e.g., storing, ordering, etc.;
- managing information operations, programs, services or databases;
- conducting systems analysis;
- designing information systems;
- performing research and development related to information; and
- educating and training information workers.

Most of these information professionals had no formal education directly related to their information professional practice; rather they had migrated from other fields such as various of the sciences, business, medicine and so on. Today, the number of information professionals must be at least twice as large as in the early 1980s. So, what role can education play in preparing these professionals for practice?

To answer this question we must first examine the goals of higher education. Boyer defines four basic roles of research universities:

- to create knowledge by conducting basic research;
- to transmit new knowledge through teaching, writing, publishing, meetings and promotion;
- to apply the knowledge through consulting and applied research; and
- to preserve knowledge through archives and libraries.

I would modify Boyer's list somewhat. His first role is essentially one of *knowledge discovery and creation*. The transmission role, however, falls far short of what I believe educational institutions are expected to perform. Instead, I would characterize this role as the development of *knowledge understanding* (among our students, our colleagues and the public). The application role should be extended to *knowledge development and application*. And I would extend the preservation role to *preservation of knowledge and its accessibility*.

Hargreaves in 1996 contrasts academic knowledge with that of practicing professionals as indicated in Table 1.

Education, particularly, graduate education, pushed by research findings and pulled by the needs of the workplace, seeks to find a happy medium between theory and practice. The research universities are also responsible for preparing future generations of faculty. Each educational program in information science should define itself relative to the strengths of its parent institution and faculty. Elements of faculty research should be woven through the curriculum at both the foundational and specialized levels. The challenge that remains is how can in-

stitutions successfully build research and education programs that are increasingly interdisciplinary and can continue to serve the practice of future information professionals?

### The New Explorers

The population we serve – the producers and consumers of information – has expanded dramatically. For example, the adult population (18 and over) of Internet users in the United States alone has grown from 48 million in 1998 to 58 million this year and is expected to reach 88 million in 2002. However, the rush to “disintermediation” first resulted in the development of some rather primitive interfaces and navigational tools, followed by the reinvention of some of the information retrieval tools from the 1960s and 1970s. Had there been more cross-discipline and cross-profession interaction, the new developments might have been informed by the successes and failures of the past, especially in the context of current technology capabilities.

Once again we hear cries of information overload, of information anxiety, etc. Many of the tools available today are too simplistic for effective retrieval for many purposes, especially retrieval from an environment which can support an explosion in the volume of information made available. The Web is an excellent tool to find some (but not all) information on a topic, to find very current and rapidly changing information and to communicate with others who have similar interests. But it provides less and less support to the serious information seeker. I have likened the Web to the Library of Congress with all its materials shelved randomly or, perhaps an even more accurate image, with all the materials in large unorganized piles on the floor, with pages torn out!

An expanded base of practice will require an expanded base of theory and of education. These pressures are placing a tremendous strain on existing schools and faculty. We are already seeing information sciences programs emerge in business schools, communications schools and even as new free-standing schools (e.g., at Pennsylvania State University). A more interdisciplinary approach provides an alternative solution.

Interdisciplinary activity is best performed by those individuals we classify as “boundary spanners.” These individuals need to have a certain self-assuredness of their position and standing in their originating discipline; be open to new ideas and approaches; be patient enough to learn new modes

Table 1.

Academic Knowledge	Practicing Professional Knowledge
Generalized	Context specific
Propositional in form	Metaphorical, narrative, story-based in form
Rational	Rational but also moral and emotional
Public	Interpersonal or private
Written	Oral
Explicit	Tacit
Theoretical	Practical

of discourse (language, both formal and informal), foundational elements and methods; and be creative in applying their home discipline to new areas.

Being a boundary spanner is not easy. Swimming between islands in uncharted waters can be dangerous. Academic institutions need to modify their recognition and reward systems to encourage, rather than discourage, interdisciplinary activities. I also stress that institutions should design their own solutions. In addition to swimming from island to island, they could build bridges, boats or other forms of transportation to move from one island to another.

### The Practice of Information Science

As we seek to serve all these "new explorers," I believe that information professionals must learn to take on new roles. In a recent article in the *Bulletin*, I described these new roles: **Guidebook publisher:** an expansion of the information professional's traditional role of classification and cataloging. Increasingly, tools defining content, structure and procedures will be needed to facilitate the identification and selection of relevant information at much greater degrees of disaggregation and discrimination than previously available. This is especially the case in multidisciplinary endeavors, where the existing resources are organized by disciplinary divisions that are no longer applicable to the knowledge process.

**Knowledge prospector:** the need to mine through vast amounts of recorded knowledge to identify those "nuggets" which contribute to particular knowledge domains. The creation of validated, virtual collections of digital materials and their relationship to non-digital materials will offer a significant value-add to the serious information seeker, while allowing other linkages to be developed and used. This will be especially critical in multidisciplinary domains, where there is no existing organizational structure or established source(s) for validated materials.

**Expedition guide:** as the knowledge universe expands, the information professional and the information user will need to be partners in knowledge exploration. The success of the expedition will require the information professional to be both leader and follower, consistently providing guidance from either role.

**Knowledge interpreter:** the need for the information professional as intermediary has never been stronger, and there is now a movement toward re-intermediation (although those in the information profession always knew the critical nature of the intermediary!). With the expansion in amount of information available, users need help extracting the information they require and interpreting it in the context of their immediate need.

### The Role of ASIS

ASIS has, since its inception as the American Documentation Institute (ADI), had a multidisciplinary focus. Its members were nominated representatives of affiliated scientific and professional societies, foundations and government agencies. In 1952 the bylaws were changed to admit individual as

### For Further Reading

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well as institutional members. According to Claire Schultz, the name of the society was changed in 1968 to the American Society for Information Science as a reflection of the expanding scope of interests and "the emergence of information science as an identifiable configuration of disciplines."

The multidisciplinary forum that ASIS provides is essential to the continued development of the information disciplines. Furthermore, it is critical that ASIS continue to span the research, education and professional practice communities. In the early 1980s, ASIS conducted a survey of its members and found that members engaged in all the types of activities represented in the NSF study. Further, as was true for the general information profession, many ASIS members had had no formal education to prepare them for the work they were then performing. Both of these findings present opportunities for ASIS.

As I have said before, we have a great responsibility to the future of our discipline and profession. We are living at a time in history when we may have more impact on the creation, sharing and use of knowledge than our predecessors could even have imagined. It is a responsibility that cannot be taken lightly. As John Buchan so eloquently stated: "We can only pay our debt to the past by putting the future in debt to ourselves."

As we pay that debt, I am encouraged that we can simultaneously reach *back* to the science of our disciplines and into the *future* filled with new frontiers to explore, new roles and possibilities.