The distant mirror of the 16th century provides clues for contemporary information management

Magic and Hypersystems: A New Orderliness for Libraries

By Harold Billings

THE KNOWLEDGE situation of the late 16th century in Europe was much like the present. That era also was flooded with new information formats, a rapid expansion of knowledge, and efforts to order knowledge through systems that extended the capabilities of the mind. There was a breaching of previously accepted boundaries of place and time, through the introduction of a thought model that accepted and transcended Copernicanism. A comparison of our time with the historical foundations of memory and knowledge systems astir in the 16th century offers insights into the present situation and suggests where our knowledge systems are bound.

The growth of knowledge

For all the wider sowing of knowledge the printing press afforded, perhaps its greatest contribution lay in its secularization of knowledge. The place of books in those days was little in the academies and universities, but much within the church. Thought imprisoned by either the Inquisition or the Reformation was dead seed, but printing helped revive it. Dogma was replaced with new intellectual opportunities, and the revolutions in thought that followed should not have been surprising. It is certainly not surprising that reactionary agencies of both church and court found an intensely magnified challenge as the printed word and an astonishing new inquisitiveness ran rampant through the intellectual world.

How to organize this flush of books and ideas must have represented a real problem to those institutions and individuals who soon found themselves swamped with printed items. Print had to take its place among the manuscripts of the day, and that added considerably to the space required for storage. The *armarium*, or book chest, was no longer sufficient to hold the library of the time; and an unaided mind or memory was seen as inadequate for all the learning and lore set loose in the world.

Memory arts in ordering knowledge

For centuries, the art of memory had served as a major means for transmitting oral tradition and played a significant part in the art of rhetoric. From the days of the poet Simonides (fifth century B.C.), who, as told by Cicero, introduced the classical art of memory, the memory arts had helped organize knowledge and carry it forward. Memory arts were a major intellectual tool used for 19 light and dark centuries before the Renaissance. It can easily be understood how the memory arts—if generally regarded by the 16th century as a medieval scheme and no longer necessary for carrying the word into the future—nevertheless would early be looked to for help in organizing the storehouses of knowledge that grew so soon from Gutenberg's machine.[1]

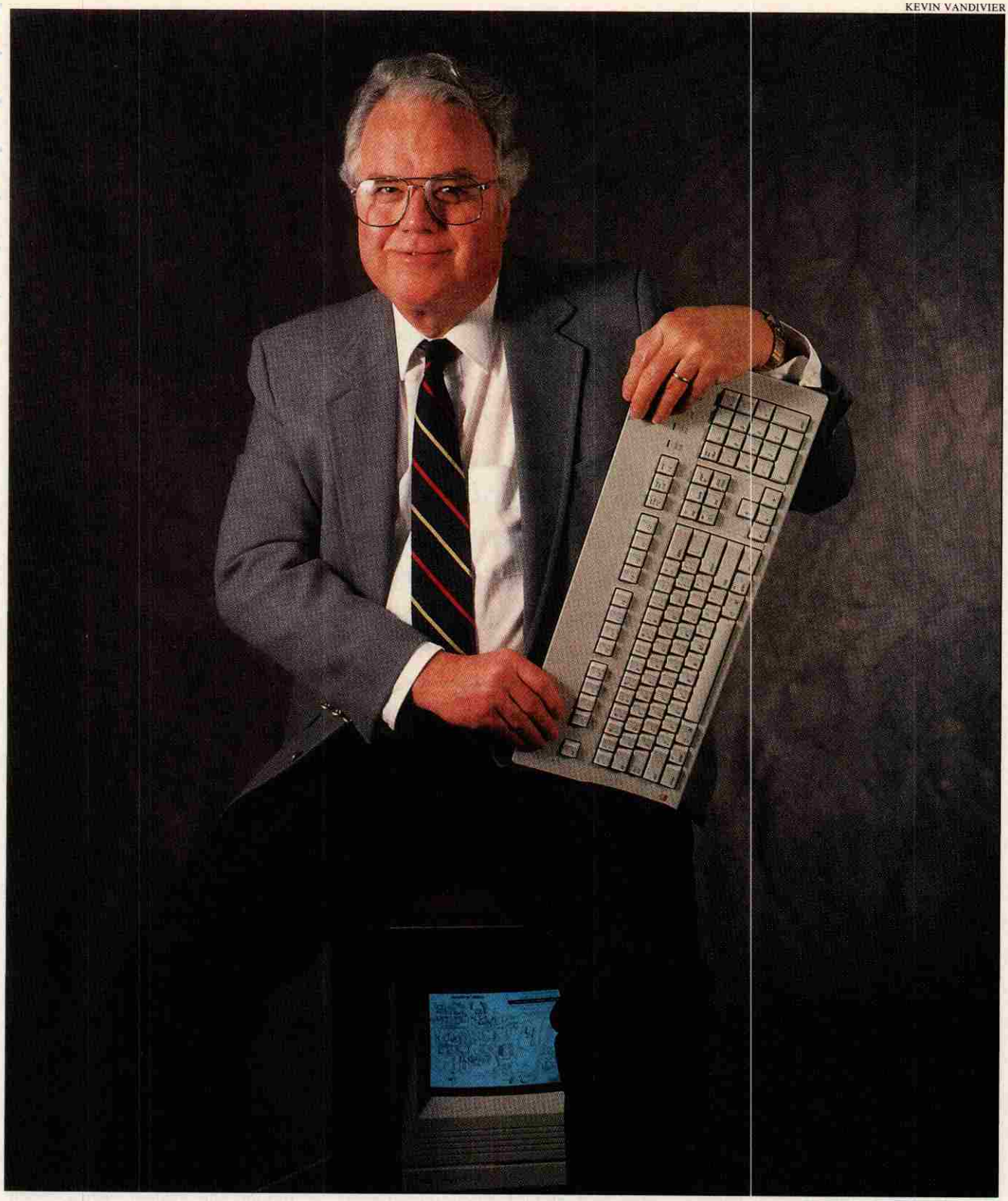
The human mind was seen as the device within which the memory arts could organize and relate the knowledge of the times.

Classical mnemonics held as a major principle the role of *place* and *image* in vitalizing the imagination of the ancient rhetor to recall his text. Simonides was said to have identified for relatives the mangled dead in the ruins of a devastated banquet hall by recollecting where diners had been seated. Thus, in the classical mnemonic, an elaborate building was visually imprinted on the mind, with all its features and furnishings to be recalled turn by turn, so that images in a text could be associated with scenes, and image and embedded text be recollected as each feature of the building was revisited in the memory.

A theater or its stage, called to the mind's eye, became common to this

Harold Billings is Director, University of Texas at Austin Libraries

KEVIN VANDIVIER



classical architectural mnemonic. By the 1530s (when appreciation for the classical arts had come round again) Giulio Camillo of Venice achieved fame for constructing a wooden theater filled with images and boxes, ordered and graded, to function as an elaborate memory system. Several centuries earlier, Ramon Lull laid the foundations for future memory systems by devising an "art" to relate the encyclopedia of knowledge by revolving wheels of divine attributes.

In the late 16th century, Giordano Bruno devised several magic memory systems (conceived on "magical" rather than natural images) that, while based on the ancient precepts of place and image, located astral images on a revolving Lullian wheel. There, virtually "every possible arrangement and combination of objects in the lower world—plants, animals, stones—would be perceived and remembered" by their relationship through innumerable metaphysical layers with a mystical, higher unity.

Fifty years later, in the 17th century, Robert Fludd would maintain these common threads by devising a theater memory system that combined a visualization of the stages of "real" public theaters with astrological images.

A wonderful genealogical memory tree could be constructed leading from Simonides through these increasingly magical thinkers of the Renaissance to the eventual spilling out of new "methods" of modern science—still linked to magical memory systems—from the minds of Bacon, Descartes, and Leibniz in the early 17th century.

Under a variety of other codes, concepts of magic seals, astral images, emblems, colors, pictures, mathematical characters, objects, signs, symbols, sigils: the visualization of images and places, were incorporated into numerous other efforts at developing memory systems. These attempted to relate and organize the extant universe of knowledge within the human mind: for the retrieval of information, for the discovery of new knowledge, and for bringing the individual closer and more powerfully to the divine.

The late Dame Frances Yates (1899–1981) was a pioneer in the history of the memory arts and did much to relate the topic to the flowering of modern science, though it passed through dark and magical places in doing so. By the 16th century, she writes, "The printed book is destroying age-old memory habits," but adds, "Nevertheless, far from waning, the art of memory had actually entered upon a new and strange lease of life . . . . Through Renaissance Neoplatonism, with its Hermetic core, the art of memory was once more transformed, this time into a Hermetic or occult art . . . ."[2]

Occultism was just as much a part of the learned scene as superstition and magic were part of the warp and woof of all human existence. John Crowley, in an illuminating work on ghosts in Shakespeare, has described a body of common wisdom regarding the supernatural that "extended through all strata of society."[3]

"It should not be forgotten," Crowley says, "that Elizabethan nights were darker than ours, roads longer, Hell nearer. The natural world had not yet divided itself from man's moral apprehension . . . ." Yates characterized the times as a "Renaissance borderland country, half magic, half emerging science . . . ." In the spindrift of ideas thrown off by the Renaissance, real science was never far from pseudoscience, or the two were so commingled that during those times it was difficult to distinguish the two. Astronomy, mathematics, and geometry were not far removed from the alchemical, the astrological, the geomantic, and the hermetic.

Libraries gradually were drawn into this maelstrom of new ideas and a world of knowledge very much at unrest. In the 1550s of the English Reformation, there was a great plunder and dissolution of the cloisters, and the monastery libraries that had guarded what little there was of the written heart of learning for a thousand dark years were almost completely scattered. At particular risk were any works that appeard "popish." Books or manuscripts containing mathematical diagrams were also regarded with peculiar suspicion. It has been estimated that only two percent of the 300,000 volumes in over 800 monastery libraries survived the review of reformers.[4]

"An unaided mind . . . was seen as inadequate for all the learning and lore set loose in the world"

Dee and Bruno

Yates not only established the concept of the importance of hermetical influences on the development of modern science, but also named as major catalysts for this movement the two magus philosophers, John Dee (1527–1608) and Giordano Bruno (1548–1600).

Doctor John Dee—astronomer, mathematician, toolmaker, magus, and librarian—suggested to Queen Mary as early as 1556 that the dispersed monastic collections be regathered to form a great National Library, but nothing came of the notion. Dee then began the building of a personal library which by 1583 numbered over 4000 books and manuscripts, perhaps the largest library in England or Europe, and certainly the greatest accumulation of scientific information. By contrast, the library of Sir Thomas Bodley, when he retired in 1587 to "set up his Staffe at the Librarie dore in Oxon," numbered only 2000 volumes.

After generally casual dismissal as a quirky, minor player on the Elizabethan intellectual scene prior to Yates's studies, Dee has been credited in more recent years with being at the very center of an academy of learning in England in the last quarter of the 16th century. Elizabeth, Philip Sidney, and a circle of literary and scientific friends are known to have spent time at Mortlake, Dee's home. But Dee's interest in mathematics, mechanics, and magic was not in the mainstream of the emerging humanist movement, and rather an occult and even dangerous interest to favor in the countryside but not at court.

Still, Dee was an adviser to Elizabethan mariners, worked on scientific instruments, shared his foreign-gained knowledge of geography in advancing navigation, and is credited with spreading a knowledge of Copernican astronomy among English scientists. He composed a preface to the English translation of the works of Euclid which, according to Yates, "As a manifesto for the advancement of science . . . is of greater importance than Francis Bacon's,"[5] while at the same time he composed a description of his attempts to conjure angels through cabalistic numerology. These widely disparate exercises of intellect and ingenuity, while perhaps the most marked signs of a universal Renaissance man, left Dee open to challenge for many years as nothing more than a "conjuror."

At the point of leaving for an extended visit to Europe in 1583 at the invitation of Prince Albert Laski of Poland, Dee produced a catalog of his library. It is one of the first library catalogs known, and one which Yates claims to be an "absolutely basic document for the understanding, not only of Dee himself, but of the courtiers, noblemen, poets, scholars, scientists of the Elizabethan age for whom this was the best library in the country." It also gives us some notion of how the ordering of knowledge and its physical representation was taking form: "partially systematic though the system varies. Some . . . arranged according to size, others according to language . . . subject groupings, Paracelsist books (a large section), Lullist books, historical books, books of travel and discovery . . . . Nevertheless there is nothing haphazard about the catalog; the entries are clearly written and usually include date and place of publication as well as author and title."[6]

Among the manuscript books in

his library were five on the art of memory, and in his approach to books and knowledge Dee took what could now be perceived as a very modern stance. He was less concerned with how the physical books and manuscripts were arranged than with how their knowledge might be organized and retrieved in his mind. While obviously familiar with the various magical memory methods, Dee was not himself a memory system innovator. However, he helped set in place a role for libraries in preserving learning, enlarged the horizons for Elizabethan exploration by ship and mind, and promoted the new concepts of a Copernican universe—but one whose stars were very much numbered with ghosts and angels as well as the stones of the field.

Meanwhile, to the south in Naples, Giordano Bruno, a young Dominican monk whose influence on European thought would far transcend even that of John Dee's in England, faced with charges of heresy, had broken from his monastic vocation and begun the travels that would carry his versions of Dominican memory systems, and his reframing of Copernican heliocentrism, to Geneva, Paris, London, and Prague.[7]

Copernicus, of course, had argued in his *De revolutionibus Orbium Caelestium* (1543) that the sun lay at the center of our universe, refuting the stubbornly maintained Ptolemaic concept of the Earth as center of all things. But Copernicus believed the stars to be living, bright animals that prowled an outer circular sphere that sealed the universe within. Bruno was greatly affected by Copernicus's ideas, but went beyond them in his interpretations based on the influence of the writings ascribed to Hermes Trismegistus. These suggested the concept of an *infinite* universe to Bruno, an idea that was violently resisted by the Church, but one that would fuel the new mathematics, the philosophies, and the sciences shortly to come.

Bruno's first two works, *De umbris idearum* and *Cantus Circaeus*, deal with his theories of magic memory but press far beyond mnemonics into solar magic and talismanic images, by which a thinker might bring those "shadows of ideas" in the archetypal heavens into his own consciousness: "If you embrace in your thought all things at once, times, places, substances, qualities, quantities, you may understand God."

Thus the "ex-friar, infinitely wild, passionate, and unrestrained" (Yates) published his ideas in Paris, solicited the favor of Henri III in the courts of France, then went to London in a rising tumult over his religion to seek the support of Elizabeth and address a challenge to "the most excellent Vice Chancellor of Oxford University and its celebrated doctors and teachers." Bruno argued for an animistic Copernican universe—but an infinite one. For two years he occupied the courtly and supper scenes of London, astounded audiences with memory feats, and published works sharply critical of the Oxford establishment. Those writings were not to lead these unenlightened to a new age of science, but to redirect them to the elder magical religions. Bruno left his influence on the Sidney circles and returned to Paris, Germany, and Prague.

"Frances Yates . . . did much to relate [the memory arts] to the flowering of modern science"

Eventually, Bruno and John Dee would both spend considerable time soliciting the patronage of Rudolf II of Poland, a supporter of studies of the occult. While they apparently never met—for Bruno was in England during two of the six years that Dee was in Europe—they would profoundly enlarge each other's influence, paving the way for a new science to spring from the magics they laid. While each solicited the support of the political rulers of the day, for no philosopher went far without political or theological blessings, each would suffer enormously from the reactions that came with every small intellectual advance.

Dee returned to England in 1589. His champion Philip Sidney was dead in a military foray to the Netherlands. Europe and England were stung by a series of witch hunts, and Elizabeth's coming successor James, the King of Scotland and author of *Daemonologie*, was violently damning anything ascribed to conjuration. Dee found his vast library and collection of scientific equipment vandalized, and lived out his final years in the shadow of disfavor, reputedly selling his books off one by one for his dinners. Bruno foolishly returned to Italy where he was secured by the Inquisition, spent eight years imprisoned under question; and on a cold February day in 1600 he was ridden backwards on a mule, in a white robe, to Rome's Field of Flowers where he was burned at the stake.

A legacy of memory magic

Dee and Bruno each left behind in the works they composed, and in those persons they enchanted, new dimensions of thought, a legacy of memory arts–based magic and knowledge systems no longer fettered by a finite, ecclesiastically defined universe. This influence clearly extended into the earliest years of the 17th century advance, as Yates has it, when "the art of memory survives as a factor in the growth of scientific method."[8]

Bacon, Descartes, and Leibniz (who brought us the inductive method, analytical geometry, and a universal calculus) all spent early days awash in the speculations of Dee and Bruno. All three considered the art of memory and how its reformation might influence the new methods from which modern science would so immediately blossom.

Bacon (1561–1626), much in the tradition of the early memory arts, wrote of "prenotions" and "emblems" for place and image as a primitive form of classification in the investigation of natural science.

Descartes (1596–1650) believed that the art of memory could provide "an easy way of making myself master of all I discovered through the imagination . . . through the reduction of things to their causes . . . that out of unconnected images should be composed new images common to them all, or that one image should be made out of which would have reference not only to the one nearest to it but to the all" (*Cogitationes privatae.*)

Leibniz (1646–1716) introduced "characteristica" from memory arts, significant signs or characters, as mathematical symbols; and he called images "notas" which could recall things or words to the calculating mind. The information system Leibniz envisioned was an encyclopedia that would bring together all the arts and sciences known to humankind, with "characters" assigned to all no-

tions, and a universal calculus applied to retrieve this universe of knowledge and solve all problems.[9]

Leibniz even devised a calculating machine, but ultimately had to be satisfied with the library as the means for repositing knowledge. As Daniel Boorstin describes, "Leibniz saw the library as a congregation of all knowledge with the librarian as minister keeping the congregation up-to-date and freely communicating. He pioneered in classification schemes, alphabetical finding aids, and abstracts to help the scholar. The library was his encyclopedia."[10]

So the magics were laid away, or became hidden in the rising arcana of Rosicrucianism. The new sciences and their methods flourished, and memory systems—finding no machine or the human mind capable alone of storing and retrieving knowledge as had been pursued by the magical memory brotherhood—relegated the transmittal of knowledge to the formats and order that libraries grew to provide.

Yates both summarized the influence of the hermetic philosophers on the development of modern science and moved toward prophecy when she observed in 1964, "the Renaissance conception of an animistic universe, operated by magic, prepared the way for a mechanical universe, operated by mathematics . . . . Bruno's assumption that the astral forces which govern the outer world also operate within, and can be reproduced or captured there to operate a magical-mechanical memory, seems to bring on curiously close to the mind machine which is able to do so much of the work of the human brain by mechanical means."[11]

Had Dame Frances been able to follow the development of the "mind machines" she found so curiously close to the memory systems of the Renaissance, and had she done so within the context of the information nova of the late 20th century, she would have found other curious parallels between the knowledge systems and magics of two widely separated centuries.

Modern magics/scientific complexity

As one construes things to be "supernatural" that lie outside the generally accepted definitions of present-day natural science, there is an increasing trend in the late 20th century to achieve some supernatural handhold on current knowledge. One wants to employ fresh language, and images as magical as any of the 16th century, in the attempt to find new order in the structure and complexity of the natural world, to bring new dimensions to the sciences we know.

For example, chaos, an information demon, and new angelic computations are invoked by today's most compelling thinkers in efforts to find meaning in a universe that has become as clouded by doctrinal examination and representation as it was in the days before Renaissance philosophies broke heaven's spherical panes.

One does not ordinarily expect the word "chaos" to define an elegant order, but rather the random, the erratic, and the utter unpredictability of certain natural behaviors. Yet a new science of chaos has offered a fresh approach the past decade, a new way of understanding the growth of complexity in nature. What several scientific disciplines could not descry from their traditional perspectives, new commonalities in the study of chaos are bringing thinkers together (as James Gleick describes) in rapidly "reshaping the fabric of the scientific society."[12]

"Memory systems . . . relegated the transmittal of knowledge to the formats and order that libraries grew to provide"

Sir James Clark Maxwell, the Scottish physicist who developed the equations governing electric and magnetic fields, posited a thermodynamic paradox in his book *Theory of Heat* (1871). Maxwell suggested a fantastical perpetual-motion device presided over by "a being whose faculties are so sharpened that he can follow every molecule in its course," an imp that was soon dubbed "Maxwell's demon." Maxwell's puzzle of energy creation took over half a century to resolve. Physicists still invoke the demon that early on had raised serious questions regarding the inviolability of the first and second laws of thermodynamics: that energy can neither be created nor destroyed, and that the entropy of any closed system can never decrease.

William Poundstone, in examining the state of information and structure in the universe, turned to a Maxwell's "information demon" and a computer game, "Life," to help validate the overwhelming complexity and richness of a universe that defies any explanation of order within it.[13] Poundstone used the information demon to construct and review an imagined Universal Video Library, defined to hold a copy of *every possible* videotape 100,000 frames long, with each pixel distinguished in all its individuality of color and degree of brightness. While there are no illogics in constructing such a library, the number of videotapes in such a collection can be calculated, and would far exceed the number of atoms in the observable universe, while any effort to locate recognizable objects in the tape library would yield nothing but video snow.

Chance is unable to explain the rich orderliness of the universe, Poundstone contends. He cites the work of the mathematician John Von Neumann on computers and automata that supports the notion that machines can be self-creating and self-improving, that structures can grow richer under physical law.

Similarly, he observes that Claude Shannon, the founder of information theory, working from the similarities between thermodynamics and information proved a growing entropy of information systems—an evolving information complexity derived from a simple, repeating transmittal code. To Poundstone, then, "Complexity is self-generating" and "Creation can be simple." A simple structure and basic physical laws established in a recursive (pattern-repeating) model will generate not only self-reproduction but systems more complex than their parent. An information demon and a computer game say it is so.

The whole field of physics is disquieted because the scientific method is no longer able to keep up with the conjurations of the day; observation can no longer confirm theory. Among some there is concern that the modern body of physics will crumble. Scientists contend in almost theological tones. Recently, in discussing this problem as it relates to "superstring theory" as a theoretical approach to understanding matter, the Nobel laureate Sheldon Glashow observed, " . . . the historical connection between experimental physics and the-

ory has been lost. Until the string people can interpret perceived properties of the real world, they simply are not doing physics. Should they be paid by universities and be permitted to pervert impressionable students? . . . Are string thoughts more appropriate to departments of mathematics or even to schools of divinity than to physics departments? How many angels can dance on the head of a pin? How many dimensions are there in a compactified manifold 30 powers of ten smaller than a pinhead?"[14]

Until risktakers make the effort to break the received tradition, there is never intellectual advance. The deeps of the universe, the boundaries of knowledge, the face of humankind, have always been circumscribed by the conceptual limitations of the human mind. The thought model that opened the universe beyond the spheres of Copernicus paved the way for modern science. Dare anyone imagine that the shores on which contemporary science and philosophy have paused are the final beachheads of humanity's knowledge enterprise? Or, as Glashow says, "Can anyone really believe that nature's bag of tricks has run out?"

A new orderliness in libraries

A thought model that incorporates new electronic information formats, that employs new magics relating image and place to shape the new computations, and that defines a fresh vision of the universe will open a way to the newer sciences undoubtedly to come. Now, as four hundred years ago, the profound influences that are reshaping the contemporary knowledge world have also great potential for affecting the means by which libraries acquire, house, retrieve, relate, and display knowledge and information.

Several library philosophers have begun a rethinking of traditional library programs and procedures given new electronic information formats and the capabilities of the computer to refine the ordering of information, knowledge, and the contents of libraries. Libraries may, in fact, be more profoundly affected by new means of "relating" and "displaying" information than by any other changes busy in the new knowledge world.

D. Kaye Gapen, in a talk to the American Library Association annual meeting in New Orleans on July 9, 1988, "Impact of Technologies on Resource-sharing, Linkages, Cooperation," discribed the changes in libraries, "becoming information systems that address problems, that clarify problems, and that attack problems."[15] Gapen describes three ascending library paradigms in a conceptual model of change: the Library Warehouse Paradigm, an Electronic Information Paradigm, and a third paradigm that will exist, she asserts, by 1995, "that will involve the creation of new Knowledge/Thought systems in which the human brain (which has been our primary information processing device) will be complemented by computer software that will allow not only the rapid storage and transfer of information, but also processing and representation of information in new and different ways."

"Scientific method is no longer able to keep up with the conjurations of the day; observation can no longer confirm theory"

"Hypertext is the first inkling," she says. "Having gained access to a point in the text you can use hypertext software to jump from point to point to point in the text, or between associated texts, through a web of associations." This will form the basis, Gapen asserts, for a synergistic networking of information sources, and a massive transformation of libraries and the information world.

Although the concept of hypermedia—the relating of works and sounds and images—has been with us for 30 years or so, computer software has only recently developed the hypertext capabilities that Gapen describes. The new capabilities are much like those systems the Renaissance memory artists believed would recollect and relate all things, because they will enable the accessing of all related information from any point of entry in a body of information associated by signs and locations. This leads, in turn, to new and striking possibilities.

First, I would suggest that we will move even more rapidly through hypertext concepts toward "hypersystems" in which knowledge and information *systems* themselves, not just information *databases*, will echo and reinforce one another toward more powerful accomplishments than any one system would allow alone. Traditional information systems—libraries, and their long-established programs and services—will be linked with any number of new "knowledge/thought" (information and computing) systems through open system interfaces. The result will be an enormous expansion of our capacities for storing, retrieving, representing, and manipulating information, and, therefore, a new order of achievement in the ages-old goal of generating new knowledge.

In the simplest of examples, the present scholarly information systems developing in research libraries represent "hyper" (or extended) relationships between the traditional library model (based on a book and journal collection, card catalogs, reference desk assistance, and interlibrary lending and other standard delivery services) and the heart of a rapidly permuting library system paradigm. Such a paradigm incorporates technologies and philosophies based on electronic information computer assistance networked through campus computation centers and remote databases as well as the local library collection.

John Sculley of Apple Computer has described a future Information Navigator that will allow one to enter an information system at any point and travel throughout it on a hypertext basis, while Steve Jobs's NeXT Computer refelects multitasking and multipath relationships that hint strongly at hypersystem concepts.

Hypersystems will magnify individual system capabilities in ways that will be technically reminiscent of the use of multiple parallel processors in computing, will promote the development of expert systems and artificial intelligence, and will allow for interactivity among knowledge and other systems in ways we cannot yet dream. Interestingly, the binary codes and icon-based commands of modern microcomputers are strikingly similar to the place and image concepts of 16th-century magical memory devices.

Second, and beyond the enormous potential of hypersystems to push us toward a new physics and theology of information, new prospects also appear promising for even the more mundane ordering and reordering of libraries themselves. The

latter is suggested in what appears to be a new approach to research librarianship.

The core of this approach lies in how the research library envisions its work, and especially in that respect, how it sees its relationship to research. Francis Miksa, a scholar of classification systems, has examined research patterns within the traditional universe of knowledge orientation of research libraries. He urges the adoption of a revised perspective of the research process that will more adequately provide for its support within the university. Technological innovation is not itself at the heart of the revised perspective, Miksa says, but rather an appreciation of several changes that have taken place in research itself: a shift toward more vigorous and sophisticated research methods, the professionalization of research, and "vastly different and more complex patterns of research information flow."[16]

These factors, and new patterns of research information flow, Miksa says, not only make necessary a striking reordering of research library collection development policies, but even more importantly the establishment of a demand-driven information acquisition and access process. The latter should be focused on "the point of need, rather than on the basis of long-range collecting plans which are themselves based on universe of knowledge parameters."

This rejection of the classic research library worldview of collecting in order simply to represent a mythically stable universe of knowledge will also require the organization of collections on a highly distributed basis, the employment of highly specialized subject experts, themselves broadly distributed at the points where research is being done, and the retrieval of either *sign* or *text* as an option for the scholar.

In other words, the scholar might either review a subject listing (including a bibliographic citation with its attendant descriptive information regarding the text), or would review the text itself in either an abstract or full-text version, before deciding to "acquire" the text through any of several types of delivery systems. Miksa suggests a "find out about" process and a "get" process, "bibliographic control at the source," as a definition for this activity.

In a sense, the scholar makes a conscious choice of what is needed and what is not needed at both extremes of this search and retrieve process. Then a hypersystem process, it seems to me, would be applied to this model to help guide and move the user about in the knowledge system and to make selections throughout the information flow.

These points are all brought graphically to focus in a recent news story that describes a new class microcomputer software that will dramatically extend the usefulness of personal computers, "programs known variously as daemons, sprites, phantoms, dragons or agents . . ." through which "computer scientists believe that the daemon programs will increasingly evolve into intelligent assistants for computer users." More specifically, with respect to libraries, the article describes a prospective national digital library that would use the concept of daemon programs and a "knowledge daemon" to provide access to a huge array of widely distributed databases, including technical information, card catalogs, and the text of research papers and periodicals, and enable a scholar "to find a document anywhere with a single command to a personal computer."[17] This is clearly the cloak of hypersystems.

All of this calls for a new breed of scholar-librarians who will develop views of their world that are every bit as paradigm-shattering as those promoted by their Renaissance and 17th-century librarian colleagues Dee and Leibniz. This is a new order of memory storage and retrieval systems within a knowledge/thought (hypersystem) paradigm. It represents as significant an opportunity for a new orderliness in libraries as when knowledge was cast out of the monasteries to begin a journey toward different types of storage—toward magic memory retrieval. The result seeded the quickening of new sciences and human advancement.

We have our own Information Demon and memory magics to compare with the pseudosciences and mysteries of Shakespeare's time, in our quest to extend the capacity of the human mind, to relate knowledge, and to bring a new orderliness to libraries. Have we another Renaissance before us? I suspect we do, as new magics charm away traditional acceptations, as the universe rebuilds its recursive richness of human ingenuity, as libraries gather and order human knowledge in new electronic book chests, when the hurly-burly's done.

References

1. Yates, Frances A. *The Art of Memory*. Univ. of Chicago Pr., 1966. Virtually nothing had been done in English on the history of the memory arts and its role in the development of modern thought science until Dame Frances Amelia Yates began serious historical study in the field about 1940. For her extensive body of work on the Renaissance she was made a member of the Order of the British Empire in 1972 and was awarded the Wolfson Prize for historical writing in 1973.
2. *Ibid.*, p. 127-128.
3. Crowley, John, "Shakespeare's Ghosts." In Sullivan, Jack, ed. *The Penguin Encyclopedia of Horror and the Supernatural*. Viking, 1986, p. 377-379. Crowley, a superb American fabulist, has begun a series of novels based on the mystical lives of Dee and Bruno, the first of which is *Aegypt* (Bantam, 1987).
4. Johnson, Elmer D. *History of Libraries in the Western World*. 2d ed. Scarecrow, 1970.
5. Yates, Frances A. *Theatre of the World*. Univ. of Chicago Pr., 1969, p. 5.
6. Loc. cit., p. 10.
7. Yates, Frances A. *Giordan Bruno and the Hermetic Tradition*. Univ. of Chicago Pr., 1964.
8. Yates, *The Art of Memory*, p. 369.
9. Loc. cit., p. 368-389.
10. Boorstin, Daniel. *The Discoverers*. Random, 1983, p. 535.
11. Yates, *The Art of Memory*, p. 225.
12. Gleick, James. *Chaos, Making a New Science*. Viking, 1987.
13. Poundstone, William. *The Recursive Universe: Cosmic Complexity and the Limits of Scientific Knowledge*. Morrow, 1985, p. 52-77, 90-102.
14. Glashow, Sheldon, "Tangled in Superstring: Some Thoughts on the Predicament Physics Is In," *The Sciences*, May-Jun., 1988, p. 25.
15. Gapen, D. Kaye, "Impact of Technologies on Resource-sharing, Linkages, Cooperation," is an unpublished paper presented at the American Library Association Annual Conference in New Orleans, Louisiana, July 9, 1988.
16. Miksa, Francis. *Research Patterns and Research Libraries*. OCLC, 1987.
17. Markoff, John, "For PC's, a New Class of Software," *New York Times*, Mar. 8, 1989, Section Y, p. 34.