

Dimensional Advances for Information Architecture:

Toward understanding the need for simultaneous occupation and manipulation of documentary space as a means to actualize Nitecki's model for intellectual foundations of library information science, or: Computers are too single-minded to show how elegantly librarianship thinks, but dimensional collaborative tool design might show the way.

*Joanne Twining
Doctoral Candidate
School of Library and Information Studies
Texas Woman's University
Denton, TX*

Introduction

Information architecture is the "Emperor's new clothes" for the work of librarianship. An investigation into information architecture leads quickly to artificial intelligence and the question of how *real* intelligence is attained, and how that process might be modeled.

The mathematics and logic of artificial intelligence is outside the philosophic scope of this paper and beyond the reach of its overarching practical project. However, if we ignore the infrastructure, which by definition is a means to an end ([Duguid 1998](#)), and concentrate on the end, which is the graphical (vs. sentential) representation of information ([Narayanan n.d.](#)), then we slide into the area of diagrammatic reasoning, and land in territory more relevantly related to the study of the architecture of information, and how to approach the unrepresented dimensionality of the librarian's mind.

The object of this article is two-fold:

1. to direct fellow researchers to a rich portal to the diagrammatic reasoning resources online, and
2. to *describe* the technological needs of a practical philosophical project stalled by the single-mindedness of computers, and to explain how incremental progress might be made by helping computers think beyond one-at-a-time document occupation as a design for the Collaboratory.

Diagrammatic Reasoning: Words Tell, Pictures Show

Diagrammatic reasoning is concerned with visual representation and reasoning, or how we make sense of logical information when it is represented by graphs, map, charts, diagrams, photos, video clips, computer generated graphics, models, and the like.

While the letters of the alphabet, the words they construct, the sentences to which they lend meaning, and the texts with which they tell stories are certainly symbolic, and thus graphical, diagrammatic reasoning departs from sentential representation and concentrates on the logical relations of non-alphabetic graphic representations of information.

A resource-rich research-based portal to the study of diagrammatic reasoning is [The Diagrammatic Reasoning Website](#), which provides access to fulltext online scholarly articles via the site bibliography, and points to other research sites containing books (some with tables of contents and abstracts), computer programs, online experiments and demonstrations, as well to fellow humans involved in this area of study. A visit to this site is a quick trip to the edge of what is known about the use of computers to represent logical information graphically. But, for the philosophy of librarianship, and thus for the practical applications it advances, it's just another empty-handed trip home.

The heart of diagrammatic reasoning is ascription: the assignment of meaning to the graphical forms, or the *in-form*-ation of otherwise meaningless objects. Librarianship has always used the alphabet as the tool of choice to achieve its ends: order and access. Librarians understand that once meaning is ascribed, the co-processing of informed objects creates understanding, and this process leads to knowledge, or the state in which multiple simultaneously-understood information objects are processed. Wisdom, a natural progression of this line of thought, is knowing what to make of the multiple simultaneously understood information objects. Expression, or the calculated depiction of wisdom achieved, creates objects, and thus completes the cybernetic circle of the life of the mind, and not coincidentally keeps the spirit of the library alive.

This process is not newly understood, nor has it been neglected in the literature of the profession. However, the fact that librarianship has done little with the diagrammatic tools of modern technology, and has yet to achieve a "showing" of the elegant simplicity of the miracle of the library, convicts the tools and not the attempts or the desires of the profession. This paper will show and tell that librarianship is not behind in the race with technology, but that it is so far ahead that we are losing ground waiting for technology to catch up!

Philosopher of librarianship [Joseph Z. Nitecki](#) has come closest to achieving the graphical representation of the sparkle of the mind that characterizes librarianship, and he has done it by developing a theory using the more difficult literary tool, not technology. Nitecki's capstone work, [The Nitecki Trilogy](#), and particularly Volume One, [Metalibrarianship: A Model for the Intellectual Foundations of Library Information Science](#), lies languidly online waiting for technology to catch up so to render the most powerful intellectual tool the profession has produced since Ranganathan's Five Laws

explicated *what we do*. Nitecki's Model offers a clear picture of *how we do it*, and so *how* we might do it better.

The problem is that Nitecki's work, while very well written, is a very hard read, even for the most dedicated among us. The concept of Metalibrarianship is just too elegant for words.

It needs to be shown.

"Diagrammatic reasoning is the only really fertile reasoning." -C.S.Peirce (1839-1914)

The Nitecki Model: Background of the Project

Diagrammatic reasoning research representations demonstrate the limits of the means available for the ends of the philosophy of librarianship's graphically stalled research agenda. Technology simply has not achieved what librarianship needs: simultaneous occupation and manipulation of a singular information object, and simultaneous occupation of multiple information objects in singular space.

In fact, technology seems to be working in the opposite direction: toward singular occupation of sequential information objects. While waiting for technology to advance from its singular state of mind and provide the tools we need to make a dimensional intellectual leap, the philosophy of librarianship is stuck in the world of text, and one-to-one sequential communication.

Some would have librarianship believe that technology is so far ahead we must feverishly race just to keep from falling into professional obsolescence, but the fact of the matter is that librarianship is in its youthful stride while technology is toddling clumsily behind. Technology cannot represent the intellectual model of the library, and librarianship cannot advance without that ability. While librarianship is a kind and gentle profession not given to blunt insistence, it is time for a kickstart lest we all get intellectually lazy thinking that mastering the Microsoft click is the answer to the world's information rut.

The end desired, or the practical aspect of this project, is to animate and activate Nitecki's (1993) Model for the Intellectual Foundation of Library Information Science as explicated in [Metalibrarianship](#). Nitecki's model takes librarianship to its next intellectual level, but playing with it is beyond the limits of the textual mind.

Actualizing the [Nitecki Model](#) requires that the individual layers of a series of one-dimensional graphical representations, which were incrementally produced for print on page, be rendered minimally in three dimensions, then integrated into a singular whole, and animated, and that each layer remain individually and interactively manipulable.

That achieved, technology will have enabled librarianship to show simply the intricately-intertwined processes behind the elegant front of the profession. By showing simply how librarianship keeps order of the world's store of knowledge, we shall see how to make the dimensional leap to a richer level of intelligence.

Fundamental to the Nitecki model is the concept of triangulation, or the need for threes to gain meaningful understanding. This in itself is a bold departure from the dichotomous thinking that has reigned through the scientific era.

The concept of triangulation can be reached incrementally, sententially: with *one*, we can achieve description; with *two*, we can achieve categorization and comparison; with *three*, we can achieve contextual meaning. Contextual meaning is a fundamental premise of the emerging naturalistic/constructivist philosophy, which claims a phenomenon cannot be understood outside its context ([Erlandson 1993](#)). Contextual grounding is what makes the Nitecki Model universally useful.

The beauty of the 3x3x3 layers of Nitecki's Model is that they are so universally flexible we can ascribe to them whatever meaning we've informed, and manipulate them to gain whatever understanding we seek. We can use the Nitecki Model, or any part of it, to diagnose, manipulate, and prescribe in any information environment. We can use it to show what has been, what is, and what needs to be. We can use it to learn what we need to know. We can use it for people, for documents, and for collections. We can use it at the intersection of any of these.

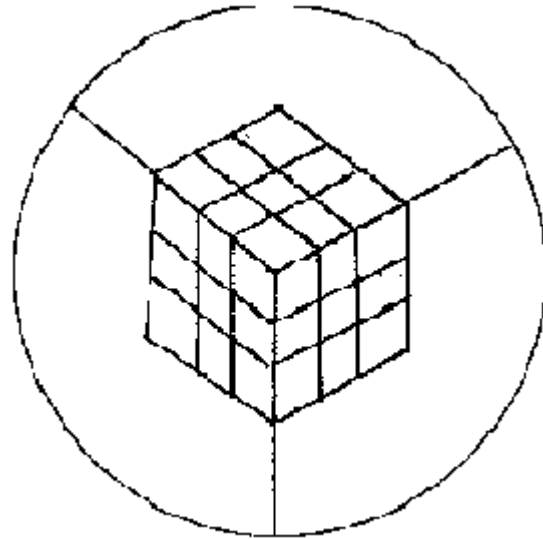
The question is, can we use Nitecki's Model to *tell* computers what we need them to do so we can use computers to show how it do these things?

Certainly, if librarians will not read the difficult [textual description](#) of the map to their own intellectual environment, we cannot expect computer engineers, programmers or designers to read it!

Seven Pictures and 1300 Words: The Vision Version of Nitecki's Model

To see if we can bridge the gap between reading about and activating the imagined promise of Nitecki's Models, let us take up the ancient art of storytelling and employ minimal graphical aids. The diagrammatic models are taken directly from Nitecki's print copies (with permission) and have not been enhanced or modified in any way.

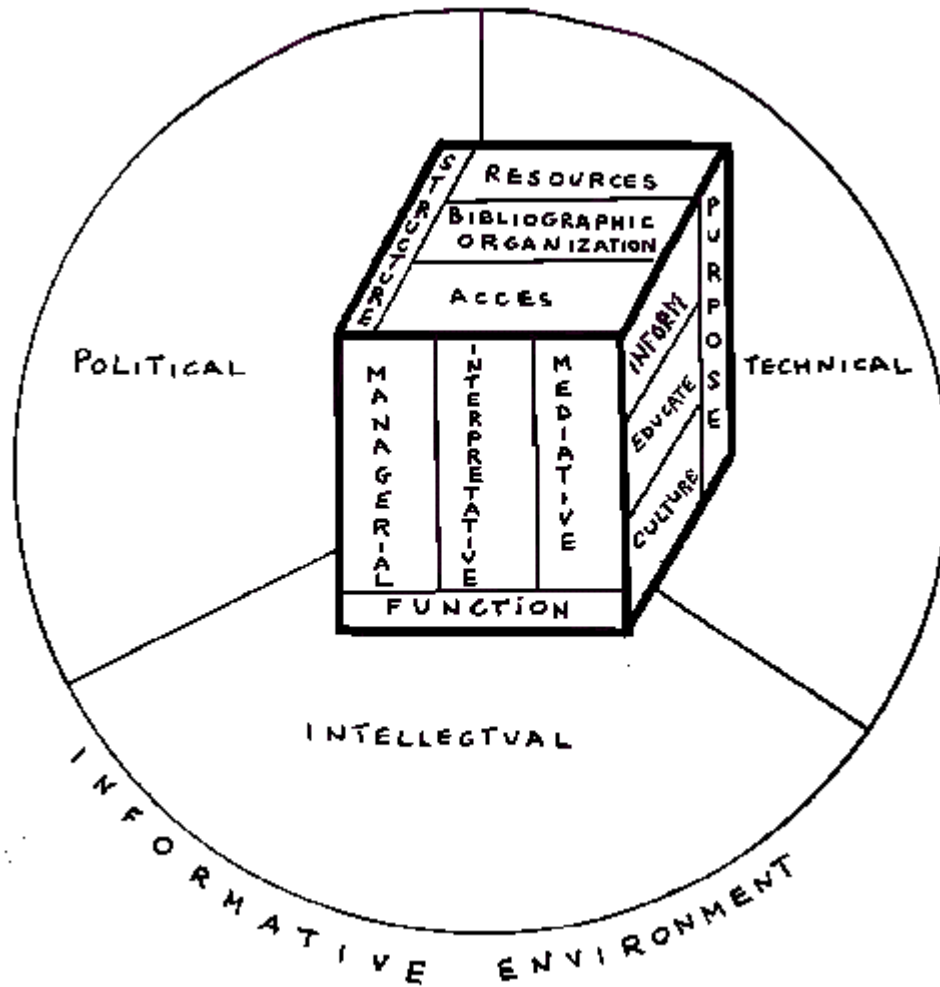
Imagine you are in an information *domain* which expands out in all directions around you, like a sphere (Fig. 1-1). This domain sphere is divided by three radiating planes that extend equidistant from the center. Each section of the sphere represents something different. For now, they will be the mind, the message and the medium. Nitecki calls these three sections of the information domain the alpha, the beta, and the gamma.



[Fig. 1-1 Metalibrary Patterns](#)

Within that domain sphere is a slightly smaller second sphere (Figure 4-1). This smaller sphere is the information environment, and it also has three radiating planes marking three distinct sections. Those sections are the political, technical and intellectual aspects of the information environment.

These two-spheres-in-one move independently of each other in any and all directions, at any and all speeds. They interact, they intertwine, yet they remain distinct. Sometimes the mind is in the political domain while the message is in the intellectual environment.



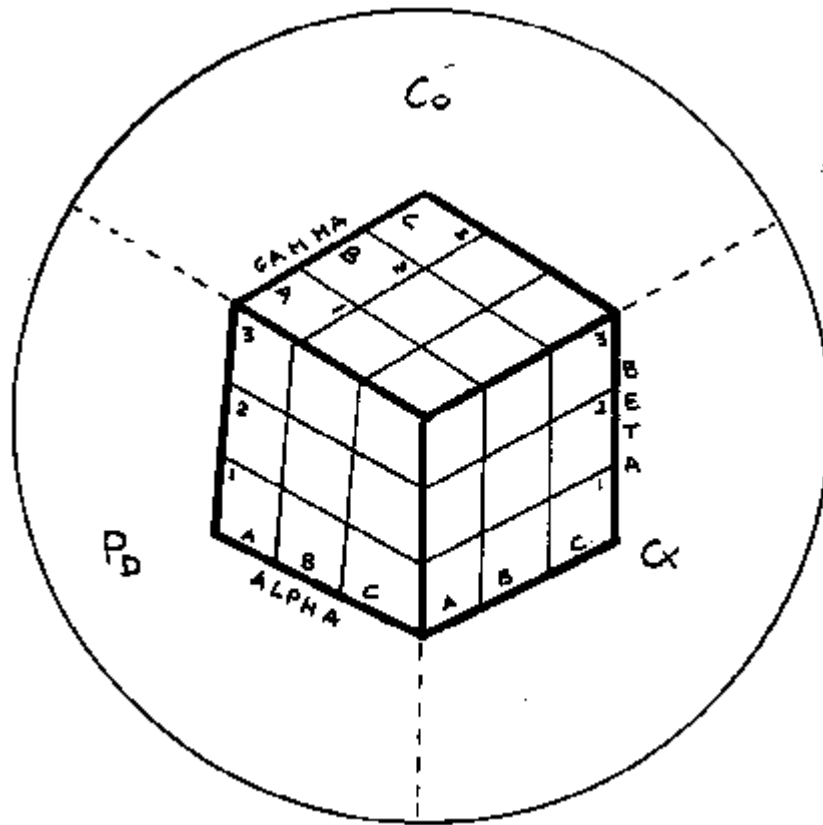
[Fig. 4-1 Common Denominators of Information Agencies](#)

Imagine that you get to choose how these two spheres will align and interact. Imagine that you can set them to exactly the alignment most conducive to your information need. Librarians do this every day. It is inherent in the way we think. We do it without thinking about it.

But let us add another layer:

Inside these two spheres is a cube (Fig 11-11). The cube is the information agency, or library. (Agency within Environment within Domain). You are also in the middle of the cube and it extends out around you in all directions, to the edge of the spheres. Three of the cube's sides are ascribed as function, purpose and structure. The

cube is divided 3x3x3 into 27 smaller cubes, each of which is a subfunction of the larger side(s).



[Fig. 11-11 Matrix of Metalibrarianship](#)

The structure side of the cube is divided into three: resources, bibliographic organization, and access. The "function" side of the cube is divided into three: managerial, interpretative, and mediative. The "purpose" side of the cube is divided into three: inform, educate, and impart culture.

The cube is like a Rubik's Cube. It can be twisted and turned to achieve a seemingly endless combination and coordination of purpose, structure, and function. And the cube interacts with the spheres: sometimes the mediative function of the agency is aligned with the political environment and the message domain. When this is so, it is time to interpret for the politician what the people are saying!

Sometimes the interpretive function of the agency is aligned with the technical environment and the mind domain. Then it is time to explain to the systems manager that she is not thinking quite right, yet.

Now, this would be a perfectly peaceful place to go to work: twisting and turning cubes and spheres to create the perfect alignment to suit the information task at hand.

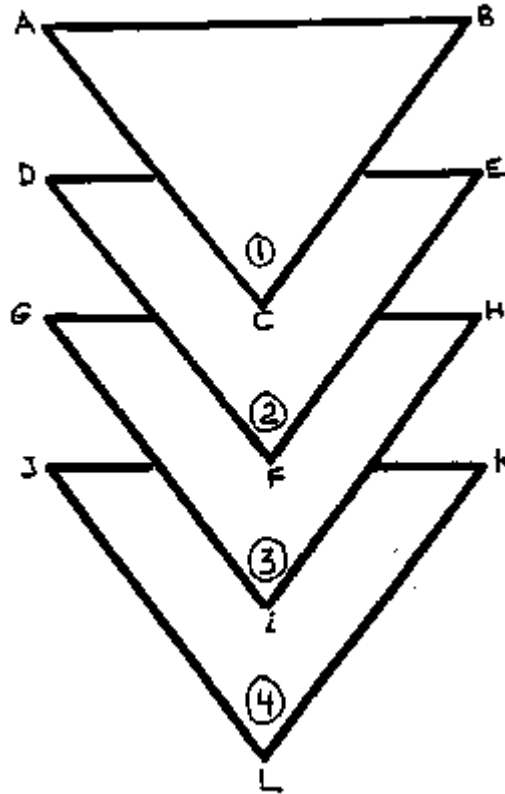
But life in the library is not that simple, so let's keep building.

In the sphere/sphere/cube space there is also a stack of triangular planes. Each plane extends to the edge of the domain and slices through the sphere/sphere/cube.

Each level of triangular plane has its own meaning: each is a domain of librarianship. Each corner of each domain of librarianship also has meaning ascribed.

The top triangular plane is the library and its corners are the generic book, the physical processing, and dissemination. The second plane is library science, and its corners are reprography, management, and bibliography. The third plane down is librarianship and its corners are individual, society, and mediation. The final triangular plane is information science and its corners are data manipulation, network, and information transfer.

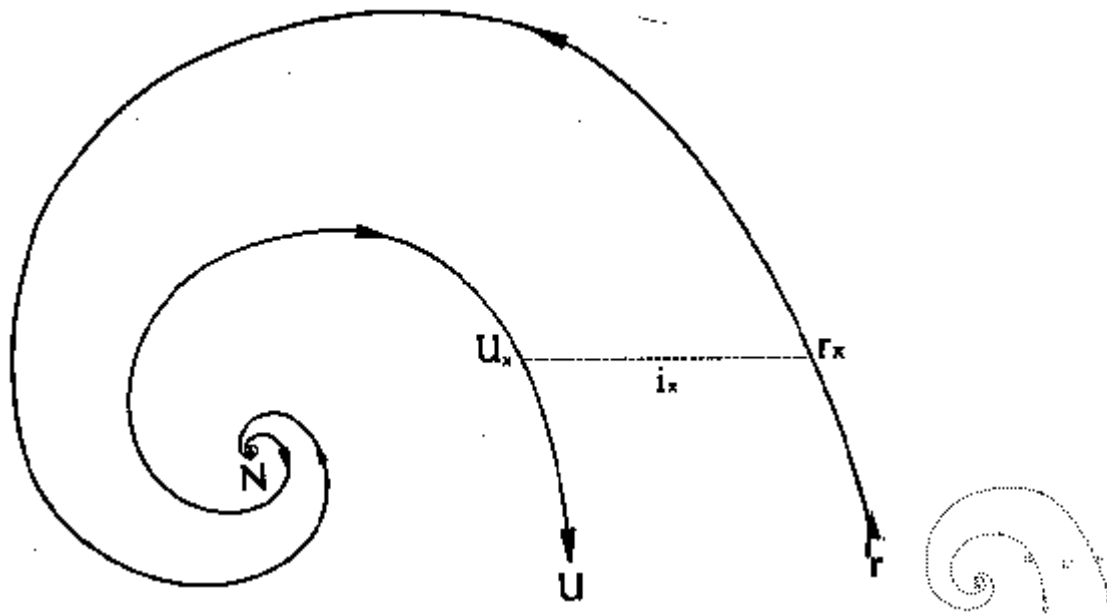
These triangular planes can move up and down in the sphere/sphere/cube. They can also rotate individually or collectively, and tilt, at times overlapping and intersecting each other. They, too, interact and affect the other parts of the model.



[Fig. 3-1. Emerging Subdivisions of Librarianship](#)

One day the transfer corner of the information science triangle aligns with the structural function of the agency, the technical environment, and the intellectual domain. This is the time to upgrade the network!

But wait! Within the sphere/sphere/cube/triangle is a three-dimensional helical spiral (Fig 11-8). The spiral is the user. The user is fueled by an uncontrollable spark that moves side-to-side within the spiral in a needs<->fulfillment two step.



[Fig. 11-8 Helical Representation of the Contextual Phase in Communication \(The Needs-Fulfillment Relation\)](#)

One day the user need spiral sparks at the agency's bibliographic organization/interpretive function subcube just as the technical/political environment's radial and the domain's mind/message radial align perpendicularly

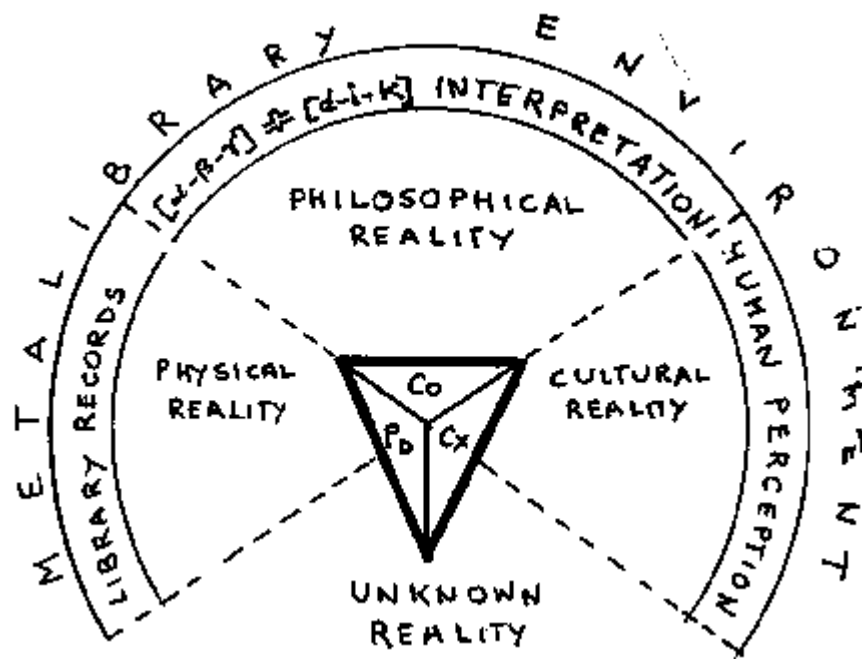
What's happening? Chaos! ...well, intellectual chaos, at least from a text-based model that is beyond the brain's capacity for linear processing of textual information.

We begin to need graphical representation.

But there's more!

Take the sphere/sphere/cube/triangle/spiral structure, and throw in a pyramid (Fig 9-2). The sides of the pyramid represent the procedural, conceptual, and contextual aspects of information: the know *how*, the know *what*, and the know *why* that are the roots of wisdom.

Now, take all that and throw it into a larger sphere, which is Metalibrary Reality.



[Fig 9-2: Metalibrary Reality](#)

The Metalibrary Reality sphere is divided into *four* radiating sections: the physical reality of the records, the cultural reality of the human perception, and the philosophical reality which is an equivalency relation between alpha, beta, gamma (mind, message, medium) and the data->information->->knowledge transfer process.

If we could stack and manipulate each of these layers individually within a singular space, and move them around, willy-nilly, to play with Metalibrary Reality, we could *see* what you could make of them.

But we cannot. Computers cannot do that yet. Computers can only let you manipulate individual objects in singular space, not multiple objects within singular space.

They cannot map the consequences of the alignment and interaction of aspects of individual objects within singular space.

Computers cannot do three-dimensional representations of the consequences of alignment of ascribed attributes of multiple individual object segments in singular space.

Computers cannot do much in singular space but let you click on one thing at a time, one click at a time. And computers cannot do anything outside singular space.

Life in the library is just not as simple as a series of clicks. There is not a library in the world, or a librarian within them that clicks one thing at a time! Librarians do what Nitecki's Model describes. We have been doing it for years, and doing it so well we rarely have to think about it any more. We have built such a huge and elegantly intricate system that it is almost beyond one mind's ability to comprehend it as a whole, let alone reconfigure it experimentally.

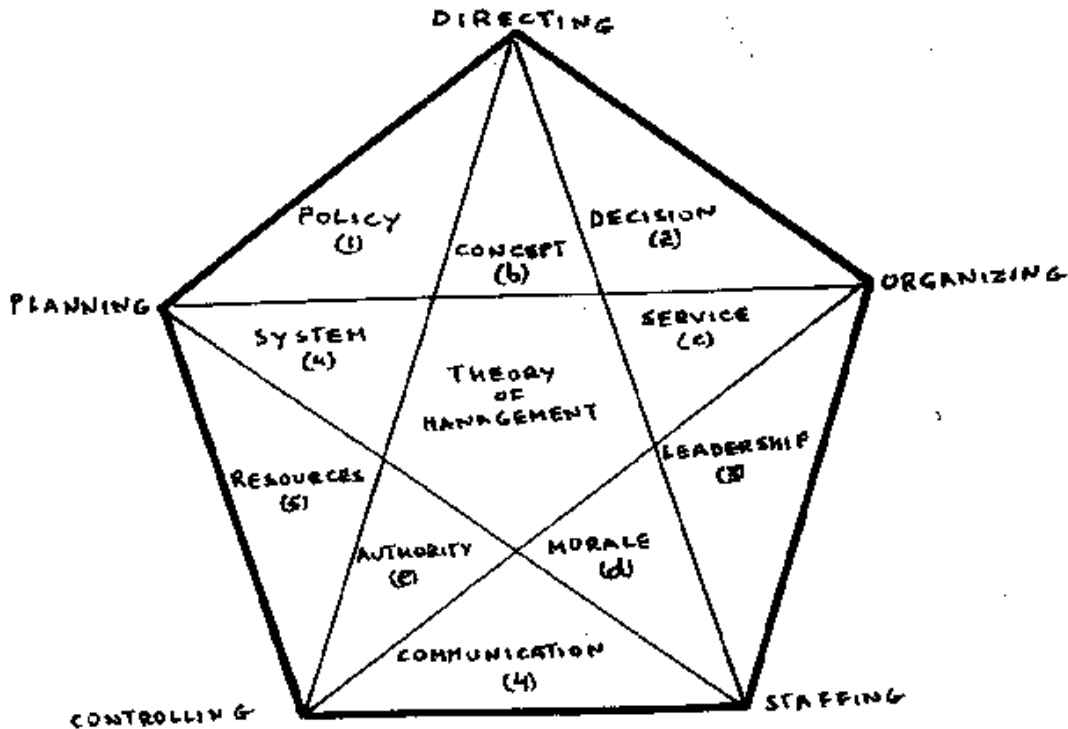
For librarianship to move beyond what it already does so well, it must have the tools to find out how to expand Nitecki's Model.

"But wait!" you might ask, "What is the fourth area of the Metalibrary Reality?"

It is the unknown reality, the place to which Nitecki has led us and where he has firmly planted the cornerstone of librarianship's future. It is the space without a literal guide; the space beyond the textual processing capability of the human mind; the space beyond the "five plus or minus two" object capacity of the human short-term memory. It is the space for which technology has failed to come up with the diagrammatic reasoning tool we might use to guide us to our future.

Rendered, the Nitecki Model will provide an assessment, diagnostic, and prescriptive tool that will enhance and improve our ability to manage information and information agencies (Fig 12-2). Activated by animation, the tool will facilitate aligning and manipulating the procedural, conceptual and contextual facets within each and any of the Model's layers.

Hyperdimensional physics tells us that if we encase an equilateral pyramid in a sphere and set it spinning on its Y-axis, a massive gravimetric energy is produced 19.5 degrees from the equator of the sphere ([Futomaki 1998](#)).



[Fig 12-2. Management of Information Agencies](#)

That point of energy is what will both render and animate the Nitecki Model, and reveal that which librarianship needs to know. That "new-teckian" energy is what will take librarianship into the 21st century.

How do I know this? I read [the book](#). I "saw" it in my mind as I was reading. Can I prove it empirically? Nitecki has already done that.

Can I *show* it graphically? Not until computers catch up with the multidimensional, intertwining mind of the librarian.

Pragmatists might ask, "What's the point in knowing we can create any reality we choose just by moving around the parts of the model?"

That is *exactly* the point! What we can imagine we can create, given the proper tool. Given the tool, we can find out how to tweak this, or beef up that, without disrupting the system of the functioning library. We can experiment safely.

Rendered, the Nitecki Model will not only let us manipulate the constituent processes of Library and Information Science (LIS) and the contexts and concepts of the library to see if we can discover the "hidden" knowledge beyond our linear textuality, it

actually shows is how to build the tool to make this possible because it has mapped the relations known between the intellectual elements of LIS.

The Nitecki Model is a metamodel, which means it has interdisciplinary applications...applications the wisdom-starved world is waiting for.

Simultaneous Occupation and Manipulation of Documentary Space As a step toward rendering the Nitecki Model

Rendering the Nitecki Model using diagrammatic reasoning is beyond the functional ability of any known computer, and certainly beyond the practical power of this philosopher of librarianship, who can do nothing more than preserve and share the information, and wait for technology to catch up.

For now, the only way to render the full potential of Nitecki's Metalibrarianship (which far exceeds the simple story just told) takes a visit to [the book](#). The reader, having *seen* the model activated in their own mind via the textual journey, can only *tell* others, they cannot *show* the model's magic. They, too, will be stalled, and the advances the model makes possible *now* will be delayed, if not buried and lost in remote storage and obscure digital files for discovery at a later date.

However, librarianship might take several steps sideways while we catch up on our reading and wait for technology to catch up with our graphically-stalled philosophical practicalities. We might lend our brains to the task of helping computers move beyond their single-minded "click here to make work" phase, and explore the use of diagrammatic tools for developing a logical environment for collaborating online.

Collaboratories are the new space for working together online. Hundreds of millions of government research dollars have been, and are being spent for the development of the Collaboratory, or "laboratory without walls" ([Wulf 1989, 1993](#)). Librarianship has benefited from this funding, out of which has come the hugely successful digital library project.

Unfortunately, the Collaboratory vision is following the single minded one-click-at-a-time, one-object-at-a-time, and one-occupant-per-object-at-a-time constraints of practical computing set forth by [Vannevar Bush](#) (1945) over fifty years ago.

Creating a shared documentary space will not only add dimension to the hypertextual and hypergraphical Collaboratory vision, it will be an incremental step toward creating the tools which allow us to render the Nitecki Model.

Shared documentary space means multiple occupants can simultaneously inhabit and manipulate a single online document (i.e. two people can work in the same document at the same time, online.) In the Nitecki model, multiple online objects simultaneously occupy the same space and are individually manipulable with systemic affect.

One way to find out how humans create understanding in the "shared minds" space ([Schrage 1990](#)) of the Collaboratory is to give them shared documentary space to play in. Online document occupation is currently limited to a single user, or, at best, multiple users sequentially. Collaboration within a document is still a linear, versionary function of sequential occupation. In other words, I cannot be in this document writing while you are also in this document writing. I can only be here alone, now, writing and you can only be here next, but just reading. We cannot be in this document at the same time.

This sentential representation of the concept of simultaneous occupation of documentary space should not be limited by notions of the popular functions of chat, which allows simultaneous occupation of space; or MUDS or MOOS, which allow simultaneous occupation of space and individual manipulation of objects in that space. Neither allow simultaneous occupation (and manipulation) of an extant document or object in space.

[Barwise and Etchemendy's](#) (n.d.) diagrammatic reasoning work at Indiana University's Visual Inference Lab allows the relative recognition of individual object size and object similarity in a singular online space. Concern that Collaboratory participants might have disparate ideas about how to collaborate, and functionally widespread literacy skills with which to collaborate, could be assigned to this object- and size-similarity recognition function. These differences, of course, must first be taxonomized through incremental exercise.

Many such preliminary design plays are underway, have taken place, and been reported. They are, however, predominately technology-centric at the expense of sensitivity to actual human behaviors and uses, simply because the *shared documentary space* described in this document does not exist. It is matter of the imagination. Consequently, single-minded systems are designed and given to the user to play with, in a sort of function-before-form convolution which progresses technology's paradigm but does not advance librarianship's journey.

By exploring an "as if" scenario based on [Gross's](#) (n.d.) "Cocktail Napkin" model of computerized brainstorming and information visualization, we might collectively shed light on how people might interact with each other, with and within a document online, and thus inform the tool design. But first, we must imagine what it would be like.

The recognition of, and contributions toward, design configurations accommodating individual stylistic preferences and literacy levels is one phase of this increment of research, but actualizing these elements for practical exploration will only follow the technological achievement of simultaneous occupation and manipulation of documentary space by multiple users. Librarianship waits.

The lack of evidence of progress in this direction is the conclusion of this "paper," and the reader is referred to [the book](#) for more information about how the need might be better communicated.

This paper also confirms the intuition that the "stress" felt by librarianship about technology is not because technology has gotten ahead of us, but because it is going in a functionally anti-intellectual direction at a fast, make-work pace, and it is doing so without providing the concomitant dimensional tools necessary for philosophical modeling and "shared minds" collaborative work to compensate for its single-mindedness.

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