Go with the Flow, or Abide by the Side, or Watch the Waves? Challenges of Change for Knowledge Organization

Abstract: Internet itself and the dynamic and diffuse nature of documents and collections on Internet are discussed. Some previously obscured assumptions of current and past modes of knowledge organization, based on a rejection of change, become apparent against this background. Three types of consequences found in the examination of these assumptions are outlined: that knowledge organization is a matter for everyone, there is a need for a re-definition, and for several partial re-orientations of aims, for knowledge organization. A number of proposals on areas for reflection, research and action are presented and the three types of responses to the challenges of change are briefly discussed.

The future of the Internet is a real-time future. We'll see a vast shift from static sites today to a much more dynamic world with information always changing with real-time streams of media—audio, video and data. (Nova Spivack, 1996)

Preamble

The aim of this paper is to indicate trends, expose hitherto obscured assumptions, discuss implications of these findings, and propose directions for future action. The title could also have been something like: From static to dynamic, from use to user, from principled systems to ad-hoc principles. It is more focused on the bases of knowledge organization and external factors than on current practice. Three types of responses (there are others) to the challenges of change are discussed at the end. Some of the challenges of change for libraries and archives have been outlined in a companion paper (Hjerppe, 1996).

In order to cover more ground than the limits imposed by the context, a keynote paper for a conference, usually would permit, some of the traditional rhetorics have been sacrificed. It is thus not a traditional scholarly paper, focusing on a specific, well defined issue, with all the proper references to prior literature, etc. Most of the pointers provided are to electronic resources, i.e., URLs, and many of them are to collections of resources rather than primary material. A search for traditional literature on knowledge organization and change yielded surprisingly few results, most of them recent, e.g., Lockenhoff (1994) and Schipper (1994).

We are at the juncture where the new modes of communication and expression enabled by distributed hypermedia—Internet, are being tested and experienced but where scholarly communication still (with some experimental exceptions) operates in the traditional mode—writings intended for printing on paper. The writing of this paper has hence been persisted experiences of frustrations and impatience. Foremost among these have been the need to linearize the presentation of subjects that form networks, internally and between each other, and the inelasticity and passivity of pointers on papers compared to the immediacy and reach of links in the hypermedia environment of Internet. (An interesting question on the side is what form conference presentations will have in the future when the conference papers are integrated into the web at submission, which perhaps consists of a URL?)

1. Introduction

Constancy and change are the foreground and background, the ying and yang, for each other. The concept of change is extremely closely tied to space-time. The passing of time is noticed through changes in the surrounding space, and change implies a transition, from one state, before/there, to another, after/there. In epistemology and ontology there are two extreme positions that can be taken, the Heraclitean "panta rhei", or the Parmenidian view that change is an illusion.

Our perceptual apparatus has evolved to discern changes of different types within and without ourselves. The dynamic ranges of our senses are limited and instruments have thus been developed to extend these ranges. The dynamic ranges of our senses seem to be adapted to rates of change that we need to and can react to. There are lower bounds on the rate of change we can sense; we cannot experience directly, e.g., the growth of grass, or "the slow fires" of decomposing paper. There are upper bounds as well; we cannot see a bullet fired from a rifle nor hear sounds of very brief duration.

The changes we perceive because they are changes close in time are different from the changes we are aware of because of memories, e.g., recurring change: the circadian, lunar, seasonal rhythms, which provide a different kind of change, renewed returns.

Memories are, however, not reliable, or rather, they are reinterpreted or put away. Different means have therefore been found and invented to support memory and to enable communication across space and time.

The intent of this paper is, however, not to delve into philosophical nor into perceptual or cognitive issues but rather to discuss the consequences of brisk changing change—flux, for knowledge organization. Knowledge organization has had two foci: documents—as carriers of representations of knowledge, experience, expressions, opinions, . . . , and the abstractions of these represented entities—knowledge, in abstract. Both of these have been static or semi-static, immutable (the documents) or changing only slowly (abstractions of current state of knowledge).

2. Internet—the Changing, Amorphous Catalyst

The impetus for the reflections in this paper has been provided by the rapid emergence and acceptance of Internet. Internet is today to many the epitome of information technology (IT), and its popular image is the World Wide Web—W3, as seen through one of the W3-browsers. Although the roots of Internet go back to the late 1950's and early 1960's, and although the term Internet has been used since 1982 as designation for interlinked networks, and although Internet was a commonplace in the science and engineering domains of Western Academia since mid-1980, it wasn't until 1994 that the public at large began to identify IT and Internet with each other, partly through the introduction of the graphical interface to W3, partly through the "discovery" of journalists of W3, and partly through the proliferation of computers.

There is already more written about Internet than anyone could ever hope to read and digest. The first place to look for information on Internet is of course Internet itself. The string "Internet" had in early April 1996 more than 5.5 million mentions among the 22 million W3-documents indexed by the Alta Vista search engine (internet is on the stop list, a non-discriminating word). Open text found more than 270 000 mentions. A Lycos search for Internet among its 37,643,037 unique URLs found 53 5,6 52 documents with the word internet. (The discrepancies can partly be explained by the fact that the first document listed by Lycos had more than 330 mentions of Internet!)

Dialog had in early April 1996 a total of close to 800,000 mentions in 340 files, with a very skewed distribution, 215,000 mentions in just one file (KR/T Business News 1989-1996/April 9)
and 588,000 mentions in the 15 first files.

Much of it is repetitive, much of it is superfluous, and much of it uses the term Internet as a designator of place/mode, and many of the files that have a lot of mentions are full text files. newspapers, etc., but most of these mentions have been made in a few years.

More than half of the mentions in Dialog, almost 53%, or 418 797 are from 1995, a further 27% are from the first quarter of 1996. Approximately 70% of the mentions are thus very recent, from 1995 or 1996. A cumulated frequency/time distribution diagram, see fig. 1 below, shows this very clearly. That which seems to be a drop in the exponential growth is due to the fact that the figures for 1996 are for the first quarter of 1996 only.

2.1 What Is Internet?

There are no easy general answers to the question of what Internet is, but a few classes of answers are provided below to provide a context.

- General answers:
  - A very large global open information metanetwork, a network of networks
  - That which enables communication between a very large number of computers all over the world

- Technical answers:
  - Narrow definition: IP-Internet—That part (ca. 7 million, July 1995,) of all registered internets that can exchange Internet protocol packets, i.e., the set of packet exchange-networks that have a common name and address space: DNS, and use the same protocol: TCP/IP
  - Broad definition: IP-Internet (above) plus all connected networks that can transfer traffic to a destination unit or process. This includes gateways at application levels (e.g., e-mail), store-and-forward networks, and networks that use non-IP protocols

- Resource emphasizing answers:
  - All the computers (10? million) that can be reached through the network, and
  - some of the programs and data that is in these computers, and
  - some of the services, information and experiences that these programs and data enable access to and use of

- Socially oriented answers:
  - The people (>30 million persons) who use, develop and can be reached through these networks and resources
  - The (sub)cultures and communities that have grown up in these networks

- Communicative role answers:
  - A new medium, or
  - access to everything that can be digitized,
  - for interaction, with data, information, equipment, people, organizations,
  - for (in)human activities: knowledge development, learning, entertainment, action, business

- Consequences/problem stressing answers:
  - Something that causes legal (e.g., copyright) problems, etc.
  - Something used for disseminating unwanted (e.g., pornography) material, etc.
  - Something leading to greater inequalities, etc.
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Internet is at the same time many things:

- a view by the user,
- a groupware, a collective workplace,
- a publishing medium for individuals, groups, organizations,
- a means for making money,
- ...

Of all the characteristics of Internet there are two that are implicated more than the others in this paper and they are its diffuse and ever-changing nature. This diffuseness and change is apparent at all levels, from the highest, Internet as a whole, to one of the lower, the documents. What keeps it all together are protocols at all levels, which also evolve.

2.2 Internet Is in Flux

Internet is in flux, ever-changing, in many different ways. The ones that are of interest here are those have to do with documents and document collections, their contents, and the organization issues relating to these.

Whereas print-on-paper documents integrate presentation, structure and content in one physical container, the use of W3 documents is based on a distribution of labor. The documents contain their own structural descriptions (using HTML, an application of SGML) and these are used by viewers/browsers (separate from the documents) to generate a view/presentation of the document. (The division of labor is actually much more distributed than is possible to relate here, among devices, programs, protocols, etc., and people.)

The views/presentations of the documents is partly under the viewer's/browser's control which implies that different viewers/browsers will provide different views/presentations. The viewer/browser for a handheld device cannot provide the same presentation as that for a sophisticated workstation.

The views/presentations of the documents is partly under the user's control (by setting parameters of the viewers/browsers) which implies that different users will have different views at the same time and the same user might have different views at different times. The viewer/browser at office can be different from the one at home, or the one at hand.

The views/presentations of the documents is partly under the creator's control. The structure and content within the structure is determined by the creator, within the bounds imposed by HTML, which is continuously being revised to accommodate the changing demands of users.

Internet documents appear, and disappear. Some of them are mirrored, i.e., replicated, at several abodes. If they reappear, who can tell whether its a new document, a changed document, or an old one?

Internet documents change: their appearance, extent and contents can and does often change as time passes. The abode of Internet documents, which is manifest as their location/address, URL, changes.

Internet documents embrace all media, all modes of expression. Internet documents, being digital, can furthermore perform transformations between these media and modes of expression. Text can, e.g., be transformed to speech or Braille, sounds can be encoded and presented in symbolic form, as notes or text, depending on the sounds and the needs.

With Java, and compliant viewers/browsers, the document—viewer distinction is also eroded, processes/programs are also becoming integral parts of documents, or documents parts of processes/program.

Collections, however they are defined, are likewise in flux. When documents are in flux and
documents appear and disappear, how can collections be static?

2.3. Internet Is Diffuse

Internet is furthermore diffuse. The documents are diffuse, a document can be monolithic, one medium, one mode, one file, etc., or composed of many parts, many media, many modes, many files, etc. A document that thus is built as a network of nodes with links between them will often have links to other nodes, external to it, in some senses. Where does in that case a document start and end? What is a document? Is a collection of pointers a document? Is one pointer a document?

Collections are likewise diffuse. When the items in a collection are diffuse how could collections be distinct? Will the membership in a collection of an item remain stable when the item changes? Will the categorizations applied to it at one time remain applicable?

Categorizations are also diffuse, built as they are in part on diffuse bases. As functions and capabilities are extended the categorizations that once were easy become difficult, as is witnessed by the questions above.

Previously stable roles become diffuse. Authors take on some of the roles of publishers, the printers and distributors are replaced by Internet service providers and networks, software and hardware producers were previously not needed and are now indispensable. Publishers look for new opportunities to capitalize on their old competencies. Broadcasters venture into publishing and publishers provide broadcasting material.

3. Hidden Assumptions of Knowledge Organization and Their Consequences

Accepting this flux and diffuseness: what can we learn about knowledge organization from Internet?

One of the important lessons for knowledge organization is the realization that our present systems for and habits of categorization and description are based on a number of assumptions, hidden until now, that no longer are necessarily valid. The consequences of the acceptance of these assumptions are many and varied but only some of them are apparent at this level of analysis. The implications of the unearthing of these hitherto hidden assumptions will need to be discussed in the future.

The first set of these obscured assumptions is that documents:
- are static, immutable, with respect to structure, content and presentation
- are delimited, with respect to extent
- are monolithic, or decomposable
- have distinct characteristics

The second set of tacit assumptions (related to the first and third) is that identity:
- is (i.e., there are identities)
- is static
- is specific

The third set of these implicit assumptions is that collections:
- are circumscribed
- grow, in size mainly, through additions of items
- are seldom weeded
The fourth set of these silent assumptions is that systems for knowledge organization:

- are based on different types of manifestations of knowledge—documents, which
  - belong to distinct domains
- are structuring devices, for documents, based on abstractions of their content
- are static, change occasionally, reluctantly, in stages
- are isolated, separate from other activities
- have distinct and different kinds of users

Some of the consequences of these sets of assumptions are obvious, e.g.,

- documents are described and categorized
  - once
  - as a totality
  - as abstractions, i.e., each document is seen as an instance of some class
- concepts, documents, collections
  - are identifiable, nameable
  - are regarded as (essentially) the same, as time passes
- collections
  - remain separate (might be dispersed, but are seldom integrated)
  - are seldom reorganized
- systems for knowledge organization
  - differ for libraries, archives, museums, etc.
  - are designed and constructed by appliers for appliers, for use in/by institutions

There are of course other unstated assumptions, with consequences, that will become apparent as other developments enable us to re-examine our future bases.

4. Implications for Knowledge Organization

Change in general, and the examination of the hidden assumptions, has implications for all aspects of knowledge organization: epistemological bases, design principles, construction processes, implementation details, application practices, and end user use.

Seen from a temporal perspective it is possible to distinguish:

- the current situation and existing systems
  - their present and future applications,
  - their adaptations and revisions,
- present and future situations and future systems
  - their application to traditional documents and collections,
  - their application to documents and collections that change.

The situation at present cannot be sustained, except for the continuation of current practice for existing collections. Current systems are inadequate, they were built for different situations, different types of documents, different types of collections, different producers and users. Current modes of using them are also inadequate. Application by institutions with regularized procedures, etc., is for use by users in other situations, with other needs than those envisaged at the design and construction, etc., of the systems. Current manners of designing, building, etc., are also antiquated, have the old foci.

What guidelines are then available for discussing future systems for knowledge organization, if the arguments above are accepted? A number of differing guidelines can be envisaged contingent
on the importance attached to the outcomes of analyses of the current and future situation.

4.1. Knowledge Organization Is a Matter for Everyone

Knowledge organization is a matter/necessity for everyone. Everyone using W3 and collecting bookmarks/hotlists faces the need to organize them, to build a knowledge organization, but the only immediately available tool is the simple hierarchical structure, as represented by lists with folder nestings. More and more people are using W3, at work and at home, and although it at present is inconceivable that “everyone” will use Internet the number of users is and will be much larger than the number of users of any existing system for knowledge organization. As the number of bookmarks/hotlists grows, as a consequence of continued use, the need for organization becomes manifest.

Knowledge organization in everyday life becomes more and more important as computers invade the lives of people outside work, including the homes. Computerization brings the need for organization, in abstract, as opposed to the organization of concrete objects, although the metaphors for and interfaces to these might be designed to resemble the traditional world, see, e.g., Bjerg (1994). Information seeking in the context of everyday life is one of the projects at the Department of Information Studies, University of Tampere, Finland (Annual Report, 1995) that, however, focuses seeking rather than organization.

Of the 3*2 possible worlds formed by the dimensions public-private, paper-digital, stable-dynamic (see table below, in which the dynamic, paper worlds have been grayed out since they are regarded as a contradictio in adjecto) it is only those constituted as stable, public, paper or digital that at present have functioning systems for knowledge organization. The stable, private, paper or digital domains could conceivably be served by traditional systems for knowledge organization whereas the dynamic, digital, public or private domains are in need of new forms of knowledge organization. (It is at present not quite clear what the dynamic, digital, private domain represents but there is no doubt that there will be one.)

<table>
<thead>
<tr>
<th>Stable</th>
<th>Public</th>
<th>Private</th>
<th>Dynamic</th>
<th>Public</th>
<th>Private</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper</td>
<td>Libraries</td>
<td>Everyday life papers</td>
<td>Paper</td>
<td>Paper</td>
<td></td>
</tr>
<tr>
<td>Digital</td>
<td>Electronic books, etc.</td>
<td>Everyday life files</td>
<td>Digital</td>
<td>“Internet”</td>
<td>?</td>
</tr>
</tbody>
</table>

Tools, for building and using systems, are needed. Some first attempts at providing assistance for the management of Internet related information at the individual and group level are now appearing. Being the first generation these tools organize links in tree- or Mac-Finder-like formats. Among these programs are:

- DragNet (http://www.onbasetech.com/Dragnet.html)
- Emissary (http://www.twg.com/emissary/quirtro.html)
- GrabNet (http://www.ffg.com/grabnet.html)
- Mariner (http://www.mariner.ncd.com/ProdInfo/index.htm)
- SmartMarks (http://home.mcom.com/comprod/smartsmarks.html; an add-on to Netscape)

Some of them monitor and manage changes on the Internet and private Intranets, automatically notifying the user when specified information changes. Tools for management of addresses and activities, usually called Personal Information Managers—PIMs or Personal Digital Assistants—PDAs, abound, see Carlsen, Dieterich and Schneider-Hufschmidt (1994) for a view on universal personal information management. From a knowledge organizational perspective these tools are primitive.
There is thus a danger that all the mistakes of knowledge organization of the past will be repeated again and again in the development of these kind of tools unless the knowledge and experiences from research on knowledge organization is communicated to and used in the building of tools. Likewise the aspirations, ideas and knowledge that these tool-builders have should be used in thinking about tools for knowledge organization in a changing environment. The capabilities and possibilities of formal and systematic approaches as realized in various knowledge based approaches need to be utilized.

Among the more interesting approaches, in general and in this context is CYC, a very large, multi-contextual knowledge base and inference engine, having "a huge amount of fundamental human knowledge: facts, rules of thumb, and heuristics for reasoning about the objects and events of modern everyday life. CYC is an attempt to do symbolic AI on a massive scale." CYC has a markedly low profile on Internet but an FAQ is available, see Whitten (1994).

The goals and criteria for knowledge organizations are for the changing environment not necessarily the same as for a static. More formalization could, perverse as it may seem, be one of the means needed to enable adaptation to change. Formalization enables knowledge based approaches to the handling of change. Two of the questions that need to be put and answered in this respect are: is there a need for re-defining systems for knowledge organization, and a re-orientation of their aims, in general and with respect to change?

4.2 Re-defining Systems for Knowledge Organization?

A system for knowledge organization is a strange thing, and, actually, strictly speaking, a misnomer. Knowledge cannot be organized. Abstractions of knowledge, e.g., concepts, given verbal representations, can, and collections of objects of various kinds, carrying representations of knowledge, often need to. A system for knowledge organization is therefore usually a system for organization of (expressions of) concepts or (descriptions of) objects.

Any such system is of course based on a stance, a conception of the nature of a kind of knowledge. Every system for knowledge organization has an epistemological foundation. Unfortunately these foundations are oftentimes neither deliberate nor explicit.

One of the findings from reflecting on the possible/potential epistemological foundations for systems for knowledge organization that accept or even assume change as an intrinsic quality is that only a small subset of all kinds of knowledge have been the focus and a limited number of epistemological bases have been used for past and present systems. A related finding is that the ones used are all similar, i.e., the unfocused kinds of knowledge and unused epistemological bases have a greater variety than the ones focused and used. A similar situation has been found in Information Systems, see, e.g., the analysis by Ivari (1991) who concludes that there is an identifiable orthodoxy in information systems research.

The ontological and epistemological bases of library and information science have been the subjects of occasional papers, examples of three recent ones being the papers by Budd (1995), Marco and Navarro (1993), and Dahlberg (1992).

In an attempt at describing systems for knowledge organization truly ab initio most concepts that are used: knowledge, organization, system, structure, relation, etc., would have to be defined, and somehow grounded in something. Recognizing this the workers in various fields of Artificial Intelligence have in the last few years started to build and use something they call formal ontologies—specifications of conceptualizations, for the sharing and reuse of knowledge among software entities, see Gruber (1993) for a discussion of design principles for such ontologies and Knowledge Sharing Effort public library (n.d.) for an overview of the Knowledge Sharing Effort, which is one of the generators of the formal ontologies, with further pointers to Ontolingua, a set
of tools for analyzing and translating ontologies. One compilation of links to further information on ontological modeling can be found at KBSI (n.d.).

What are then the differences between formal ontologies and systems for knowledge organization? One of the main differences is that formal ontologies are designed and built using strict representation formalisms, for use mainly by software entities, grounded, i.e., in logical theory, whereas systems for knowledge organizations have been built using semi-natural language, for use by people. Since software agents do not have any understandings of terms or concepts of the minds that humans have, not having grown up in the world and in that process, i.e., acquired a language, there has been a need to replace that understanding with formalism and logic.

An application of these formalisms and representation methods to systems for knowledge organization will be necessary for many reasons and with that will come a need for re-examination and re-definition. In the processes of making digital versions of systems for knowledge organization, viz., Electronic Dewey™, the first steps in this direction have been taken. The needs for agreements on formats, i.e., representations, in order to exchange data, will also provide incentives for movements towards the same direction. The USMARC Format for Classification Data is in this respect still just a container with content intended for human use and simple computer-based handling; it cannot be used for knowledge sharing and reasoning the way ontologies are.

All of these, systems for knowledge organization and formal ontologies, are, however, at present mainly concerned with representing static knowledge, a description of the state at a specific point or span in time. As time passes new versions of the systems for knowledge organization are generated, and the old ones are discarded. Until recently enough time had passed between each version so that the questions of the relations between material—old and new, and versions—old and new, were solved by applying new versions to new material, with sedimented collections as a result. The sediments are the result of the applications of new versions, and hence the boundaries of the layers do not necessarily reflect the changes of each "subject". One of the consequences is that current systems for knowledge organization are focused on mapping future knowledge states, documents and collections in terms of the situations at past times. In a situation where a very large number of people have access to vast and quickly growing numbers of changing and diffuse multimedia documents/streams and collections this is not enough.

A re-definition of knowledge organization is, if the preceding arguments are accepted, necessary to accommodate the challenges of dynamic situations, documents, collections. Some proposals on the bases for such a redefinition will be made later, after an examination of whether a re-orientation of aims is also necessitated by the arguments so far.

4.3 Re-orienting the Aims of Systems for Knowledge Organization?

What are the aims of knowledge organization and of systems for knowledge organization? These might, in the context of this paper—a conference on knowledge organization, seem to be odd or unnecessary questions, but a consideration of the need for a re-orientation of the aims has to start with an examination of current aims and relate those to the needs and situations at hand.

There are of course differences between the aims of knowledge organization in general, in abstract, and the aims of systems of knowledge organizations, in general, and in specific, concrete cases. This section of a brief essay can mostly discuss aims (and means, since they are the operationalizations of aims) in general and abstract terms. The traditional aims and means of a system for knowledge organization could perhaps be summarized to be to provide an abstract tool, that:
maps the state of knowledge, for a specified domain, at a certain time, by
- establishing a system of terms and functions, that
denote accepted bodies of knowledge or concepts in that domain, and
indicate the relations between these,
- provides rules and methods for
generating combinations, and
linearizing all instances,
can be used to
categorize specific items,
sort collections of categorized items,
find categorized items,

The aims and means of knowledge organization, as an activity and a discipline, can also be
summarized to be, i.a., to investigate the various bases and principles of systems for knowledge
organization, the methods and practices of designing, building, implementing, applying, using, etc.,
systems for knowledge organization.

At this general level of presenting aims there does not seem to be any need for re-orientation
of aims. One of the problems with the descriptions above is that they are static, reflecting static
views of static entities and systems. To paraphrase what Gertrude Stein once said of Oakland:
there is neither any there there nor any when when. What is needed above all—and this is a
proposed partial re-orientation, not a complete break with the previous—is an explicit awareness
and recognition of time and change. We are all cognizant of the fact that knowledge evolves, but
that has not had any impact on present modes of thinking about knowledge organization. We are
behaving like an explorer or driver, who steers and builds maps by looking backwards, through
a rear mirror, and only occasionally looks to the sides, to update the map.

One such re-oriented view could perhaps be modeled on organisms, recognizing birth,
growth, and death for individuals, and evolution for species. Awareness and recognition of time
and change bring new issues, new questions to knowledge organization, viz., recognition and
identification of changes. In a time-based perspective questions about the development of bodies
of knowledge, the states at specified times, and the changes would be natural and answerable. In
the paper by Chen and Gaines (n.d.) there is, i.a., an interesting discussion of the need for what
they call chronological awareness in group systems and some first explorations of systems for
facilitating that.

Another of the problems with the descriptions above is that there is no recognition of the
powerful search tools that are available today, enabling their users to create ad-hoc sets/
categorizations using any available characteristics of the items in a collection. Related to these are
on one hand the data mining, knowledge discovery and visualization tools being developed that
provide assistance in detecting patterns, or do it by themselves, and on the other the filtering tools
for message streams and agents/bots for, e.g., roaming on the net. Pointers to resources on such
tools are maintained by, e.g., Piatetsky-Shapiro (n.d.), Becket (n.d.) and Finin (n.d.).

The synergies possible in combining search/filtering and pattern discovery tools and
agents/bots with methods for knowledge organization in building tools for the generation of
systems for knowledge organization imply that the design and construction of systems for
knowledge organization for specific domains can today be experimental and tentative. Another
of the partial re-orientations of aims for knowledge organization is thus the recognition of the
needs and the means for experimental approaches, for handling streams, for discovery, and for
temporary and short-lived solutions—ad-hocness.

Yet another of the problems with the descriptions above is that knowledge organization and
the design and construction of systems is seen as a concern for a specific, small group of people, with the users using the resulting systems, but not participating in the design and construction processes, except perhaps by proxies, hostages. Knowledge organization, is, as has been argued earlier above, a matter for everyone. One of the consequences is that there is a need for yet another partial reorientation of the aims of knowledge organization, towards facilitating the participation of users in all stages of knowledge organization work. Until now users have been seen as users of finished results, i.e., applications of systems of knowledge organization to items and collections, that enable them (the users) to find items they need.

One of the observations from watching user behavior on Internet from a knowledge organizing point of view is that very many of them are engaged in activities aimed at generating structures and order, both at the individual, group, and collective levels. It is also notable that the tools and approaches used are, from a knowledge organizational point of view primitive, and without much coordination, see, e.g., Kempf (1995) for testimony from the “inside“ of a specific domain, and the paper by Burnett (1993) which discusses networked communication issues in terms that are reminiscent of self-organization. What can be witnessed on Internet now could be called the second steps toward self-organization, or autopoiesis, see, e.g., Whitaker (1995) for one introduction and Whitaker (1996) for a guide to Internet resources on Enactive Cognitive Science & Autopoiesis. Such activities have for a long time been part of the scientific enterprise, manifest as the citation networks of scholarly communication. The evolving networks being built the citations in individual papers, like this one, have until the advent of the W3, been time-consuming to map and use. The only tools available (apart from the scientific literature itself) have been the citation indexes produced by Institute for Scientific Information, Inc. Now all users of Internet are building similar but more complex structures, and since the links on W3 are untyped, all kinds of content are part of the same structures, which from some points of view is good, but from other points of view a nuisance. One more partial re-orientation of aims that is therefore proposed is towards all the issues around self-organization as applied to knowledge organization at different levels.

Knowledge organization has also for too long been concerned with what might be called medium level structures, organization of knowledge at the levels of subjects, collections of items. The micro-structures of knowledge organization, at the levels of discourse, the internal structures of individual items, has, for many reasons, not been a mainstream concern in knowledge organization. The macro-structures of knowledge organization, at the levels of different forms of knowledge representation, the structures of collections of collections, have received somewhat more attention in the form of broad systems of ordering. The inter-level structures have received some attention in, e.g., citation studies for micro-medium levels, and, e.g., switching languages for macro-medium levels.

The formalization of document structure popularized through HyperText Markup Language—HTML, an application of Standard Generalized Markup Language—SGML, and the diffuseness of W3-documents have the consequences that questions of level become more apparent. The relations between document internal and external structures, the possibilities of using explicit internal structures in conjunction with other techniques for elicitation of knowledge structures at different levels also raise the issues of interpretation vs. extraction both in terms of applications of systems for knowledge organization to documents or document parts and in terms of the generation of systems for knowledge organization. Further along come possibilities and questions that HyTime as a formalism for describing objects and events in space-time brings. The last (in this paper) proposal for partial re-orientation of aims for knowledge organization is thus towards the uses formalisms for document architectures in a wide sense, another kind of formalism than the ontologies. Many of the documents that we encounter on the net in the future will carry
descriptions of themselves that are based on some of the formalisms available in Cover (1996) which is an excellent collection of resources on SGML and related projects and applications.

5. Proposals

A number of brief proposals are made below, based on the analyses presented above. These proposals are to be regarded both as elaborations of the earlier thoughts and as items for further discussion.

Phenomenology could be one of the philosophical bases for change oriented knowledge organization, because it sees our lived experience of the world as the foundation of meaning, and because of the emphasis on knowing as a temporal process, see, e.g., Sharoff (1995) and van Gelder (1996) for discussions of time-consciousness from a phenomenological point of view, and Rieu (1995) for a discussion of the interactions between information technologies (in a very wide sense) and the humanities.

Qualitative research methodologies should be attended to even more than they are at present. They often involve making explicit—generation and exploration of—conceptual structures that are or were latent, ill-defined or unclear. Software tools that assist in the processes of uncovering and building of such structures can and are beneficially interacting with knowledge organization in its earliest stages. At the recent 20th Annual Conference of Gesellschaft für Klassifikation e.V., March 6-8, 1996—the program is available at Classification, Data Analysis and Knowledge Organization (1996)—there were six papers on uses of or software support for qualitative approaches.

Accept, in line with earlier arguments a few guiding principles:

- knowledge organization is for most people a means, not an end in itself, therefore
- tools (for individuals) rather than systems for knowledge organization are needed, see, e.g., Murray (1996) specific tools can, however, provide specific systems,
- tools that facilitate collective structure building and organization, to speed up the self-organizing activities being carried out anyway, are needed, hence
- meta-tools, tools for building tools, abstract and concrete, are perhaps the most important of the constructive activities to be undertaken within knowledge organization in the near future,
- plurality, many systems, at many levels, should be provided, see, e.g., Lethbridge (1994), who summarizes: "Users need a tool that involves the synthesis of several techniques for organizing the knowledge."
- ad-hocness, ability to generate structures on the spot are needed, but also
- continuity and maintenance, assistance in adaptation to changes for those areas that have a persisting interest, are increasingly needed as a complement to the ad-hoc structures that persist,
- visualization, in many forms, for displaying structures and relations, will be increasingly important as more types of users start using tools and systems, see, e.g., Fowler (1996), Korfhage (1995) and Judge (n.d.).

Behind us we have vast bodies of literature and documents of all kinds, not properly described or categorized even in the traditional mode, which will not or cannot as such be transferred to the digital domain in the foreseeable future, but which will be catalogued and categorized for the new access tools, see, e.g., Bearman (1994) for a museum perspective. Ahead of us we have bewildering and competing technological capabilities generating increasing numbers and forms of documents, with the concomitant needs for organization. Right now we have
(digital) documents appearing and disappearing at a probably hitherto unprecedented rate. Some efforts are being made to at least make partial snap-shots of the Web, e.g., the project KULTURARW3 in Sweden in which the goals are to regularly download all W3 documents in Sweden, whatever is meant by that.

Our concepts, however, do not change as rapidly as technology, although we do have to find new terms and concepts for what is new. The changes of underlying concepts for terms that remain are much more problematic. Many of the terms we use today did not have the same interpretations, connotations and associations a hundred years ago. The explanation and mapping of concepts and terms in a temporal perspective, as systems of knowledge organization are modified and built anew is a neglected area that will be ever more important as the rate of change increases.

Lastly, the ethics of knowledge organization and the activities surrounding it are largely disregarded. The quality of systems, services, documents, information, knowledge rests in the end on the ethics of the participants, and today there is precious little assistance or discussion to guide them in their deliberations.

6. Conclusion

A discussion of the types of responses to the challenges of change alluded to in the title of this paper has by design been evaded so far. The challenges of change are actually twofold: change as a(n external) phenomenon to recognize and deal with, and change as proposition, a summons to action, to come to terms with, to accept or reject, or dismiss. This paper has until now mainly been an attempt at showing why change as a phenomenon now has to be accepted as a concern for knowledge organization. There are, nevertheless, also explicit exhortations to change, e.g., in the arguments about the need for re-definition and re-orientation of aims. The reactions to these challenges do not, however, have to be simple and pure, absolute.

The designations of the three types of reactions were all chosen to allegorize together both the river which is never the same, into which one never can step twice, and attitudes to change. (There are of course many more types of reactions that could be symbolized by catch phrases, viz., build bridges, catch and carry, dig dikes, etc.)

Go with the flow is a deliberate yielding to the path of the force, full acceptance of change as a flow, always new. Go with the flow can in the context of knowledge organization be taken as a response that acquiesces in change. The foci in concrete terms could be attention to here and now issues, questions such as: What's up? What's on now? News, data/information streams, edu/info-tainment, shopping, trends/front mapping, etc., are some of the domains of interest.

Abide by the side has been and is the customary response. Behind this response is a disregard for the ephemeral and evanescent, and a care for the long term and the durable. The goal is to discern stable patterns, something to trust and use in the years to come. The foci in this response are hence the traditional ones. The river will of course not cease to flow.

Watch the waves, which is partly inspired by the short story/chapter "Reading a wave" in Calvino (1983), is neither an acceptance nor a rejection of change. It is an interest in change as a phenomenon.

All three responses to the challenges of change are valid, but the first, going with the flow and the last, watching the waves are the ones considered more important. Although going with the flow is the response that perhaps is more and of more immediate value to users of systems for knowledge organization it is probably the understanding of change, the watching of the waves, that will provide the long term benefits to knowledge organization.
Two dangers constantly threaten the world: order and disorder. (Paul Valéry)

Notes
1. An interesting overview of "how people have achieved their humanity in part by attaining a fuller comprehension of their own place in time and space" can be found in Clark (1992).
2. There are many documents on Internet about Internet and its various aspects. A starting point with many links on computer-mediated communication can be found at December (1996); IFLA also has a good collection of links to information resources on Internet at IFLA.net (1996).
3. Ironically, the paper does not have a date or time stamp!
4. In the context of this paper their Research Front Database and SCI-MAP Software System are of particular interest, see Research Services Group: List of products & services (1996).

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