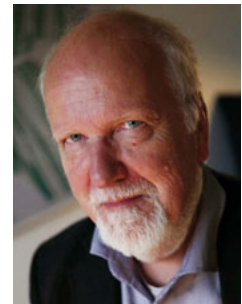


User-based and Cognitive Approaches to Knowledge Organization: A Theoretical Analysis of the Research Literature

Birger Hjørland

Royal School of Library and Information Science,
6 Birketinget, DK-2300, Copenhagen, Denmark, <bh@iva.dk>

Birger Hjørland holds an M.A. in psychology and Ph.D. in Library and Information Science. He is professor in knowledge organization at the Royal School of Library and Information Science in Copenhagen since 2001 and at the University College in Borås 2000-2001. He was research librarian and coordinator of computer based information services at the Royal Library in Copenhagen 1978-1990, and taught information science at the Department of Mathematical and Applied Linguistics at the University of Copenhagen 1983-1986. He is a member of the editorial boards of the *Journal of the American Society for Information Science and Technology* and *Journal of Documentation*, chair of ISKO's Scientific Advisory Council, and consulting editor of *Knowledge Organization*.



Hjørland, Birger. **User-based and Cognitive Approaches to Knowledge Organization: A Theoretical Analysis of the Research Literature.** *Knowledge Organization*. 40(1), 11-27. 95 references.

ABSTRACT: In the 1970s and 1980s, forms of user-based and cognitive approaches to knowledge organization came to the forefront as part of the overall development in library and information science and in the broader society. The specific nature of user-based approaches is their basis in the empirical studies of users or the principle that users need to be involved in the construction of knowledge organization systems. It might seem obvious that user-friendly systems should be designed on user studies or user involvement, but extremely successful systems such as Apple's iPhone, Dialog's search system and Google's PageRank are not based on the empirical studies of users. In knowledge organization, the Book House System is one example of a system based on user studies. In cognitive science the important WordNet database is claimed to be based on psychological research. This article considers such examples. The role of the user is often confused with the role of subjectivity. Knowledge organization systems cannot be objective and must therefore, by implication, be based on some kind of subjectivity. This subjectivity should, however, be derived from collective views in discourse communities rather than be derived from studies of individuals or from the study of abstract minds.

Received 25 August 2012; Revised 12 September 2012; Accepted 12 September 2012

1.0 Introduction

Hjørland (2008) listed six different approaches to knowledge organization (KO), including the facet-analytical approach, the information retrieval tradition, user oriented and cognitive views, bibliometric approaches, and the domain analytic approach. The theoretical assumptions underlying these different approaches have not been thoroughly discussed in the literature, and papers are planned about each of these traditions. The purpose of the present article is to examine the theoretical foundations of the user-based

and cognitive approach to KO, but it will not examine user-based or cognitive views in library and information science (LIS) in general, and will not include other subfields such as human-computer interaction. It will, however, include some overall perspectives on user studies and cognitive studies, which are considered important as background knowledge.

The user-based and cognitive approaches to KO developed as part of the overall development in LIS especially in the 1970s and 1980s. In LIS, studies of the users of libraries and information services go back, according to Siatry (1999), to 1948 in the Scientific In-

formation Conference of the Royal Society, where Urquhart (1948) and Bernal (1948) reported their research findings. According to Martin (1976, 483), however, they go yet farther back: "There is a long history of reader studies in American librarianship In the 1920s and 1930s the stream widened and deepened, with the efforts first of William Gray and Ruth Monroe (1929) and then of Douglas Waples (1939) all seeking to utilize reliable samples and to reach valid conclusions." Also, Wilson (1994, 2000, 2008) identifies studies of library use and users dating back to 1916, reviewed by McDiarmid in 1940. Another early contribution to the field of user studies was the Russian researcher N. A. Rubakin's (1862-1946) writings on bibliopsychology (Simsola 1968). It should also be mentioned that, in the neighboring field of media studies, "use and gratification studies" has been a related trend. Lazarsfeld (1940) is an early example who began seeing patterns from the perspective of the uses and gratifications of radio listeners. Menzel (1966) refers to two comprehensive bibliographies of user studies in LIS in 1964 and 1965, containing 438 and 676 studies, respectively. Since then, the field has grown further, and it is today one of the most researched areas in LIS (often referred to as information behavior studies).

Some studies seem to indicate that user-based and cognitive views became influential in information science from about 1980. White and McCain (1998, 351) write:

Our data have implied an increase of interest in the cognitive side of information science – and generally in user studies – since about 1980, the start of the second period. This independently corroborates claims to that effect by expert judges, such as Saracevic (1992), who calls it a paradigm shift, and Ingwersen (1996), who writes of it as "the turning point 1977–1980."

It is a very fragmented field with very many "theories." Fisher, Erdelez, and McKechnie (2005) presented 72 different conceptual frameworks (and this is, in no way, a complete coverage of approaches). Although it is a productive subfield within LIS, it is not without problems and critics. Cronin (2009), for example, wrote: "A great deal has been written on the subject of [users'] information seeking over the years ... but there is a regrettable lack of cumulation and coherence."

This development within LIS is related to developments in the broader society. Information scientist Harry Bruce (2002, 29) wrote:

In the past twenty-five years or so, we have seen what some have referred to as a user-centered revolution (Nahl 1996, 2003). This revolution is manifest in the policy, theory, methodology and practice of a range of disciplines and fields of study. The terminologies used to describe a focus on the beneficiaries or recipients of services, products, systems or professional actions vary. Engineers design end-user technologies. Businesses, organizations and institutions claim to be client centered, customer oriented or market driven. The education field is learner centered.

Various stakeholders in the development of the Internet have developed versions of the user centered revolution but overall we can see a shift from technology to people, from product to service, from outcome to process and so on. The common ground is a focus on people – user oriented, people centered, user based, human centered, user responsive and so on. The user focus is an amalgam of methods, approaches and techniques that provide professions and disciplines with ways to define, understand, explain, measure and ultimately serve, the needs of people.

What Harry Bruce describes here is a general interdisciplinary and social trend of which LIS forms a part. A recent trend is "customizing" to make products tailored to specific customers. Pariser (2011), for example, describes how sites from Google and Facebook to Yahoo News and the New York Times are now increasingly personalized—based on your Web history, they filter information to show you the stuff they think you want to see. That can be very different from what everyone else sees—or from what we need to see.

Very few people have questioned these user-based trends and discussed their overall ideological perspective. Such a discussion is much needed, however. It is not without problems to make educational institutions, libraries, scientific journals, databases, etc. driven by commercial criteria and user demands rather than by scholarly principles and criteria of quality (or, in the case of public libraries, by cultural policies). One hypothesis is, therefore, that the user-based approaches to LIS and KO are part of a larger trend, but that this has not been explicitly considered.

Only a few people within LIS (e.g., Suominen 2007; Rosenbaum et al. 2003) have questioned the user-centered revolution in the scholarly literature. Also very few people have contrasted this view with alternatives. It has often been considered a kind of safe basis

on which information professionals may avoid difficult questions. Recently, Jonathan Furner (2012) wrote in relation to the work about IFLA's principles known as "Functional Requirements for Subject Authority Records" (FRSAR):

Ultimately, the FRSAR Working Group does not take a philosophical position on the nature of aboutness; rather, it looks at the problem from the user's point of view (Zeng, Žumer and Salaba 2010, 8). The implication here is that, not only is it *desirable* to refrain from taking a philosophical position on the nature of aboutness when modeling bibliographic and authority data, but also that it is indeed *possible* to so refrain. On reflection, I have to admit that I am not comfortable with the Working Group's implicit endorsement of the latter claim. I am not sure that it is possible to avoid taking a philosophical position on this matter.

In this quotation, Furner expresses the view that researchers cannot avoid theoretical and philosophical problems by choosing user studies as an alternative. Theoretical issues are also inherent in user studies and therefore need to be examined.

2.0 The case for user-friendliness

A part of the trend described by Harry Bruce may be seen as a trend against user *un*friendliness. Would anybody argue that an information system or a knowledge organization system (KOS) should be difficult, cumbersome, and frustrating to use? This is certainly difficult to imagine today, but actually such ideals have formerly—to a limited degree—driven some design principles for libraries and KOS's. Around 1900, for example, it was a goal for many public libraries to limit the use of fiction (and to increase the use of non-fiction), and they deliberately made limitations on the relations between how many fiction and non-fiction books a user could borrow. And they consciously made attempts to make fiction books hard to find in the classification systems and on the shelves (Eriksson 2010; only available in Danish). We can also imagine that some university teachers, as well as librarians, have seen a prestige in making their lessons and their classifications difficult because it was another era, and "users" were not considered "customers," as they often are today, but were seen as people who should prove that they were capable and motivated to learn difficult things. (The idea

that it should be difficult for users may find theoretical justification in the "handicap-principle" (Nicolaisen and Frandsen 2007), which is in opposition to the "principle of least effort" (cf. Zipf 1949)).

Johannes Jensen (1973/1947 trans. from Danish) has a story about a person who (before 1947) looked for information about the mercantile law of the Netherlands. He comes to the Royal Library in Copenhagen, approaching the librarian and—rather than being helped directly—is referred to the catalog. He discovered the catalog was (at that time) written in Latin, and the title was: *Catalogus Bibliothecae Regiae Hafniensis sub Auspiciis et Jussu Munificentissimi ejus Evergetæ, Augustissimi Regis Frederici Vlti adornatus*. In spite of his knowledge of Latin, he was not able to find here what was needed and returned to the librarian, where he was informed that he was presumed to know Roman law, because the library's catalog was organized according to the principles of Roman law (after 1950, a new catalog was developed based on new principles, but it is still necessary to use the old catalog for books printed before 1950).

At the end of the 1970s, it was still common to come across the attitude that users should not have direct access to the shelves in research libraries, because only a catalog search would provide a full display of what the library owned on a given subject (although many libraries still do not provide access to the shelves, the motives are probably different today). So, yes, principles for design in the LIS context have sometimes been based on unfriendliness.

In what follows, it will be assumed that all approaches to LIS and to KO today are devoted in some way or another to the principle of user-friendliness. This article discusses "user-based and cognitive approaches" as one family of approaches among others. All existing approaches will argue that they provide user-friendly systems. Different approaches are competing views on how best to provide user-friendly systems. We therefore have to make a sharp distinction between user-friendly systems on the one hand and user-based systems on the other. User-based and cognitive approaches are therefore not different from other approaches by attempting to be friendly, but in their view on how to accomplish this goal.

3.0 User-oriented versus user-based design

In order to design good systems for the users, what kind of knowledge should the information specialists have? User-based approaches may be defined as approaches in which KOS are constructed on informa-

tion derived from either empirical studies of users or on users' input during the design process as suggested by Elaine G. Toms (2010, 5452):

User-Centered Design (UCD) ... is founded on the principle that users need to be involved in the design and development process for systems to be truly usable—efficient, effective, and satisfying.

It is important to say that user-based design is based on assumptions rather than on evidence. For people subscribing to this view, these assumptions may seem evident. It may seem evident, for example, that in order to design a user-friendly laptop, cellphone, database system, dictionary, etc., you should examine what the users need and what they prefer. However, if you look at many of the greatest design successes, such as Apple's computers and iPhones, and Dialog's search system, or the heart of Google's search engine, PageRank, they were not constructed on the basis of user studies. Apple's approach is described in the following quotation from Verganti (2009, viii):

A marketing manager for Apple described its market research as consisting of "Steve (Jobs) looking in the mirror every morning and asking himself what he wanted" (Young and Simon 2005). This claim seems preposterous and illogical—almost blasphemous. It contradicts popular theories of user-centered innovation. We have been bombarded by analysts saying that companies should get a big lens and peruse customers to understand their needs.

The framework provided in this book shows that even if a company does not get close to users, even if it apparently does not look at the market, it can be much more insightful about what people could want.

It is thus clear that Apple's philosophy is not based on user studies. The lesson from Dialog is similar: when it was established around 1972, there were two major competitors: Bibliographic Retrieval Services (BRS) and System Development Corporation (SDC). The latter examined the need for databases using survey methodology, but Dialog constructed a "supermarket" of different databases and became the leader; each database brought in new customers who in turn used existing databases—kind of a push/pull phenomenon. Our last example is Google, whose "Page-Rank" algorithm was not based on user studies, but

inspired by bibliometric links between papers. Although Google has since modified its system and have now also introduced principles based on customization and user-based principles (perhaps primarily in order to optimize advertisement rather than retrieval?), all three examples are powerful challenges to prevailing theories of user-centered innovation.

The idea of user-based approaches to KO is that the knowledge needed to design a KOS comes primarily from the study of users (or the involvement of users). This is in contrast to other approaches to KO, which focus on, respectively, technical aspects of computer systems, analysis of documents, expert evaluations, or the analysis of knowledge domains and genres, including their different epistemologies and ideologies. A historical voice from the founder of the UDC classification, Paul Otlet, is expressed by Boyd Rayward (1994, 247):

Otlet's primary concern was not the document or the text or the author. It was also not the user of the system and his or her needs or purposes. Otlet's concern was for the objective knowledge that was both contained in and hidden by documents.

Another classical demand in KO is Hulme's (1911) concept of literary warrant, which is also clearly an alternative to user-based approaches. Does user-based KO represent an alternative or a supplement to such alternatives? Not much has so far been said about this in the literature about user-based and cognitive approaches.

A remark should also be put in relation to folksonomies and related "social technologies," which is a hot topic these days. The success of such systems depends on the amount of qualified input; they are often considered user-based, but they could alternatively be considered systems drawing on a wide amount of volunteer and/or distributed subject expertise. Therefore they do not provide new arguments in relation to the examination of the value of user-based principles in KO.

4.0 Users: abstract or specific?

How are users being studied? What kinds of assumptions drive the field? Different psychological, sociological, and anthropological theories or paradigms have very different implications for the study of information user(s). In psychology, particularly in behavioral and cognitive psychology, there has been a tendency to

consider human beings as fundamentally governed by general, species-specific principles. “The human mind is physiologically and psychologically the same since the homo sapiens was born,” wrote Neelameghan et al. (1992, xiv). Neelameghan and other researchers thus work from the premise that the mind is closely related to the brain and therefore assume that the mind has not changed either. Apart from biologically determined variations in the population (as reflected, for example, in Bell curves), the mind is considered universal. That means that there are certain universal principles that can be discovered by experimental psychology and by cognitive ergonomics and applied to information science. Examples are that designers of information systems should avoid the color red because red is difficult to perceive, or that human short-term memory has a limited capacity and therefore designers should avoid presenting more than seven units of information at a time (Miller 1956). Cognitive psychologist George A. Miller is of particular interest to information science because he later developed the WordNet system. We shall return to him and cognitive psychology when we look at the cognitive approach to KO below. An alternative to the understanding of the mind as a universal mechanism (e.g., a universal computer) is to consider it as culturally, socially, and individually shaped. The fields of cultural psychology and social anthropology are based on the understanding that the basic functions of the human mind are determined by the languages and other cultural symbolic systems that are learned in a given culture or domain. This cultural view is in opposition to the cognitive view in information science and is the perspective from which the present author approaches problems of KO.

Case (2006, 2007) categorized the groups studied in information science as defined by occupation/discipline, by role, or by demographic status. Some examples of groups studied are:

By occupation/discipline: Scientists, engineers, doctors, nurses, pharmacists, social scientists, humanities scholars, psychologists, industrial managers, journalists, lawyers, farmers, artists, police officers, arts administrators, theologians, architects, teachers.

By role: Patients, students, researchers, professors, citizens, jobseekers, genealogists, hobbyists (e.g., cooks, coin buyers, knitters), library users, shoppers, readers, Internet users.

By demographic: Children, teenagers, women, mothers, older people, immigrants, poor people, homeless people, retired people, inhabitants of particular countries or areas, ethnic minorities.

Information-seeking behavior is, of course, partly determined by whether you are a scientist, a nurse, a farmer, or a teacher, and also by your role and demographic characteristics. But also individual characteristics are at play. Jannica Heinström (2005), for example, assessed information behavior of students by survey, identifying three behavioral patterns—fast surfing, broad scanning and deep diving—and related these patterns to different personalities and learning styles.

There seem to be four important critical issues in relation to such kinds of studies.

The first is that they are descriptive studies of what users do. But how can we, as information professionals, use such knowledge to help users improve their information searching? How can we come from descriptions to prescriptions? If we learn, for example, that students prefer Google to library OPACs (Rosa et al. 2005, 2006; Pors 2005), what do we learn from this on how to improve our information services? Larson (1991) informed us that people learned to avoid *Library of Congress Subject Headings*, but not how to improve the system for users. We, as information specialists, should have knowledge and be able to help people search for information. Our knowledge as information professionals cannot, therefore, be obtained from what the users do. Empirical studies of users may be popular because this seems to be a relatively simple way to do “scientific” studies in information science. But it is always important to consider what kind of knowledge it is important to gain.

A second problem is the tendency to consider the average or typical information behavior. Allen (1966) is a famous study showing that engineers prefer an easily available information source at the expense of information sources considered by the engineers to be of higher quality. But libraries need to be there with high-quality information in order to serve the minority who care to check the correctness of information. Information services may not be made just for the average user, but for users who are critical and who want to examine things carefully. Without such critical people (and quality information services to support them), errors would never have a chance of being corrected.

A third problem is the way studies are often generalized. Shiri, Revie, and Chowdhury (2002, 12), for example, found that the “results of these studies demonstrate the usefulness of thesauri both in terms of providing users with alternative search terms for query expansion and in improved retrieval performance.” The quality of the specific thesauri were not investigated, however. It seems obvious that the quality and

the usefulness of thesauri must be related and that the quality of specific thesauri depends on the principles and qualifications on which it is constructed. As stated by the authors: "Given the fact that few domain-specific thesauri have been evaluated in terms of their coverage and performance for query expansion, research needs to be carried out to evaluate thesaurus-aided query expansion in a range of subject domains" (Shiri, Revie, and Chowdhury 2002, 13).

The fourth problem is that it is a fundamental error to see users as "outside" information and to investigate information behavior as variables between supposedly independent factors. People need to obtain the information that is needed in, for example, their jobs. Otherwise, they are not qualified and would not keep their jobs. Therefore users always have some kind of pre-knowledge and are positioned somewhere inside the information ecology. Whitley's (1984/2000) *The Intellectual and Social Organization of the Sciences* is a book that classifies scholarly disciplines according to scientists' functional and strategic dependence, and technical and strategic uncertainty. Krampen, Fell, and Schui (2011) is a study of psychologists' information seeking based on this model. The point is that in some fields users may be freer to have individual preferences in formulating research problems, selecting research methods and seeking information, whereas in other fields there are narrowly defined norms that have to be followed. To understand human information behavior being shaped in this way by social arrangements is a much more fruitful way of understanding compared with study correlations between variables as they are traditionally done (Day 2011; Johnson 2011).

5.0 The Book House System as an example of a system based on user studies

One of the few prominent examples of systems developed on the basis of user/cognitive studies is the Book House System (or AMP system) developed in 1987 by Annelise Mark Pejtersen and associates (Pejtersen 1989, 1992). This system represents, in many different ways, a pioneering work and is probably one of the most prominent examples of KOS based on the user-based view. It was a Danish system developed for information retrieval in fiction over a period of 20 years. It contained about 3,000 references to books for adults and children. The books have been analyzed according to user preferences, and the system is based upon a comprehensive research. It was based eclectically on many ideas. It used the most advanced computer technology of the day, e.g., color

screens and icon-based user interface. It used a kind of facet analysis of indexing fiction, and Pejtersen abandoned many traditional properties of classification systems: the class marks, the hierarchies and the idea of exhaustivity and mutually exclusive classes (and the reason for doing so was that her classification was not meant for shelf arrangement). The system was well received.

Rune Eriksson (2010, 99-130) is a careful study of the AMP system (unfortunately, as already said, only available in Danish). Annelise Mark Pejtersen is the researcher, among all countries and all times, who has worked most intensively with the classification/indexing of fiction from the perspective of public libraries. She developed the AMP system in several versions, but they changed surprisingly little during its many versions, although it was constantly modified and improved. It was never finished in the sense that it was always meant to be followed by new, improved versions. Some of the versions were implemented in the so-called Book House System from 1987 (Pejtersen 1992). The AMP system is very thoroughly described and documented. There is (or was) the system itself, its empirical research base, a well-argued structure, detailed interpretations of the categories, examples of records, and manuals for indexers. Some of these things are published in English, but the overwhelming part is only available in Danish, and the manuals exist only in an unpublished form.

In this article, we have to disregard many things, such as the advanced technology relative to its construction, and just focus on the question: how did the study of the users contribute to this successful system? The claim that it is based on user modeling and applying a cognitive view in knowledge organization is, for example, expressed by Pejtersen (1992, 573) here:

Traditionally classification and indexing schemes have been developed to reflect the contents of a document in terms of its relationships with the knowledge structure of the subject field to which it belongs and does not usually take the users' request as a focus. What is needed to extend this foundation is an appropriate frame of reference of indexing and searching based on a cognitive analysis focusing on the needs and capabilities of the end-user. Among other things, this can lead to solutions which let the user choose search attributes which adequately cover the specific domain of interest and, at the same time, give the user the opportunity to solve his/her problem in a natural way.

In this quotation, Pejtersen expresses the view that traditional classification and indexing systems do reflect the subject field, but not the users' needs and requests. This is claimed without any critical examination of such "traditional" systems. It might be the case that traditional classification systems also use classification criteria, which are relevant for the users of the domain. For example, the genre concepts developed in fiction are relevant for classification in that domain. It is therefore not demonstrated in the quotation that "cognitive studies" are superior compared with literature-based studies. It is correct that the Book House System uses many more dimensions of indexing documents and is therefore superior to traditional classification systems, which is, of course, an important achievement of Pejtersen. But the idea to do so may simply come from the technology that enabled it and from knowledge of the nature of fiction. There is no evidence that this idea derived from the study of users. It should also be mentioned that Pejtersen was educated in literature studies/literary theory. Which role did this domain knowledge play in the design of the system?

The AMP system applied user studies in two ways: 1) The users were consulted before the system was realized in order to get information about how to design it; 2) Users were asked to evaluate versions of the system in order to improve it (or simply tell whether it was good or bad). The first user studies were recordings of conversations between users and librarians in real-life situations. On the basis of a careful reading of Pejtersen's publications, Eriksson (2010, 108-109; my translation, BH) writes:

In this way the quantitative analysis of the user-librarian conversations as well as the final examples of such conversations almost come to be a kind of postscript; perhaps it is just unfortunate, but as the publication is, it is the system which came first, while the quantitative analysis and the main part of the examples appear as the second link, that is rather as a legitimization of the relevance of the system for practice than as the foundation of the system.

This is not to say that the user-conversations have not played a role for the design of the system ... there are certainly elements from them, of which it can be said that they are expressed in the system. The connection between the conversations and the system is perhaps not quite as intimate as many of the publications say it is. Pe-

tersen has also acknowledged—in an interview with Eriksson on May 16, 2007—that one of the dimensions in the AMP system, the author intention, was partly inspired by literary theory.

Eriksson finds that literary theory plays a much bigger role than what Pejtersen expresses in her many publications and even in the interview in 2007. During her career, Pejtersen totally ignored the connection to literary theory after 1976. Pejtersen wanted to provide the impression that it was based on the empirical studies of users, not on the application of literary theory. It is Eriksson's opinion, however, that the AMP system is generally wiser than the user conversations on which it claims to be based—and this wisdom is attributed to Pejtersen's background in literary studies.

Pejtersen (1994) and Pejtersen et al. (1996) argued for "work domain analysis" as the methodological basis, but, according to Eriksson (2010, 103), this concept does not change the basic aspects of the AMP system, and, even if Pejtersen et al. (1996) have five authors, this publication is, for long stretches, simply a rewording of Pejtersen (1989).

Why would Pejtersen deny that she uses her knowledge from her formal education in literature? (Why would anybody make oneself look less wise than he or she in reality is?) The methodological descriptions of how the system was developed (Pejtersen 1989) underplays the fact that the author has a background in literature studies. Such an attitude may reflect a kind of positivism in which the empirical studies of users are seen as better research than the scholarly studies of literary genres. That might be one reason to repress the role of literary theory. (If the importance of literary theory had been acknowledged, the approach would have been domain-analytic rather than user-based.)

Eriksson (2010, 108) writes that Pejtersen's empirical investigations probably did not reveal all the needs of the users. He finds it ironic that it is another investigation by Pejtersen that makes this probable. Pejtersen et al. (1996, 42) demonstrated that 31% of users did not find that they had problems finding good books, but, of the remaining 69%, only 8 solved the problem by consulting the librarian. Eriksson (2010, 108):

This is unfortunate, but it demonstrates that the problems of the users are far more comprehensive than revealed by the specific enquiries. It is remarkable how many enquiries refer to the

easy genres, so perhaps users with more complex needs avoid asking the librarian because they do not expect that she is able to help. Another possibility is that they are not able to formulate their query properly, but that does not mean that there are no problems. It is therefore absolutely thinkable that the user-librarian conversations only reveal a part of the real user needs.

This is a criticism revealing that user studies are only to a limited degree able to identify user needs. Another problem with Pejtersen's user studies, according to Eriksson (2010, 108), is that she based her system on the same studies after 15 years. During that time, society changed, new user groups arrived, and the literature itself evolved in ways that provoked new kinds of enquirers.

We can conclude this example by stating that the Book House System was probably user-based and "cognitive" more through claims than in reality. The basic ideas and structures may have been based on domain knowledge and much of the careful empirical work may only have contributed to a limited degree. In addition, it can be said that the empirical studies probably could not have been carried out without solid domain knowledge in literary studies.

6.0 The word association method as an example of a user-based methodology

Marianne Lykke (formerly Marianne Lykke Nielsen) is a Danish information scientist. She applied the word association method in her Ph.D. dissertation (Lykke Nielsen 2002) as a method of thesaurus construction. In this method, subjects respond to a stimulus word by naming another word which first comes to the subject's mind. The method was developed in psychology by Sir Francis Galton (Galton 1883) to demonstrate his claim that very few thoughts or actions are ever the spontaneous product of the will but are related to desires and ideas, the associations of which we have little conscious awareness. Also, psychologist C. G. Jung (1875–1961) became curious about the time delay that occurred in responding to certain words. Jung theorized that the delay between stimulus and response indicated some sort of block in self-expression and developed a word association test in 1910.

The first consideration is, therefore, that the user-based approach in LIS here is applying a psychological methodology as a tool for thesaurus construction.

What is it an alternative to? It might be an alternative to literary collection methods. Lykke Nielsen (2002, 174) writes: "compared to literary collection methods it [the word association method] is an economic and efficient method."

However, both the literary method and the word association may be carried out in many different ways: different documents could be examined and different people could be used as subjects for the word association method. In order to determine the relative benefits and drawbacks of the two methods, both alternatives have to be considered carefully. In both cases the question arises: What are the information sources with the highest level of cognitive authority? In order to answer that question—and thus to select documents or persons—subject knowledge and subject theory are required. This leads to another question: should the people used for the word association test by Lykke be considered "experts," or should they be considered "users"? If they are considered "experts," then we are not talking of a method of thesaurus construction that is "user-based," but on a method to gain knowledge from experts. As I previously wrote (Hjørland 2002, 259-60):

The data collection methods described in Lykke Nielsen (2000) are well known in AI [artificial intelligence] as techniques or methods of knowledge elicitation. If you are going to build an expert system, you have to get the expert knowledge from somebody or somewhere. An obvious solution is to elicit the needed knowledge from somebody considered an expert on the task or issue. Cooke (1994), for example, presents a variety of such knowledge elicitation techniques, including group discussions and free associations. Such methods have primarily been considered of a psychological nature, while the domain-analytic methods that I have been a spokesman for have mainly been of a sociological and epistemological nature.

We shall go no further with the word association test here. As in the Book House example, there seems to be a problematic tendency to claim that the necessary information comes from users rather than from adequate domain knowledge.

7.0 The meaning of "the cognitive approach"

The cognitive view (or in the plural: the cognitive views) in KO is related to the cognitive views in LIS

in general as well as to broader trends related to the development of cognitive science. Within psychology, “the cognitive paradigm” is mostly used synonymously with “information-processing psychology.” Its basic assumptions have been expressed in this way (Pylyshyn 1983, 70):

[The approach is] the attempt to view intelligent behavior as consisting of processing information or to view intelligence as the outcome of rule-governed activity. But these characterizations express the same underlying idea: computation, information processing and rule-governed behavior all depend on the existence of physically instantiated codes or symbols that refer to or represent things and properties outside the behaving system. In all these instances, the behavior of the systems in question (be they minds, computers or social systems) is explained, not in terms of intrinsic properties of the system itself, but in terms of rules and processes that operate on representations of extrinsic things.

This paradigm was introduced in psychology around 1956 by, in particular, Jerome Bruner, Noam Chomsky, George A. Miller, and Ulrich Neisser. It was received as a scientific revolution. By the 1990s, it was, however, confronted by increasing criticisms, and many researchers, including Bruner (1990), turned against their own former understanding.

The relationship between cognitive psychology and information science is based both on a specific understanding of users as governed by internal rules, structures, capacities, and programs, such as George A. Miller’s study of limits in short-term memory. The relationship is also based on the concept of “expert systems,” and there has been a mutual inspiration between cognitive psychologists and computer scientists developing such “artificial intelligence.” This issue was also taken up in information science: for example, Peter Ingwersen (1992) developed the so-called MEDIATOR model, and he also decided that a textbook on cognitive psychology (Lindsay and Norman 1977) should form the basis for the new master’s program at the Royal School of Library and Information Science in Denmark in 1990. In his 1992 monograph, Ingwersen (1992, 157) saw the cognitive view as a synthesis between user-oriented approaches and the “traditional approach” and wrote: “The transformation from the user-oriented and the traditional approaches into a cognitive one happens when IR research comes to have each other’s isolated models in mind.”

In Ingwersen and Järvelin (2005, 191), however, user-oriented and cognitive views seem no longer to be separated. Here, the authors “[discuss] the development of cognitive and user-oriented research from the 1970s and onwards under one umbrella” and state that “the cognitive approach to IR could briefly be characterized as user- and intermediary-oriented.” I interpret this—in line with other writings—as a tendency to give up the cognitive approach as differentiated from user-based approaches. However, a broader historical description may be necessary in order to explain the appearance (and fall?) of the cognitive view.

After 1990, many people became skeptical about the theoretical basis of the cognitive paradigm, in particular the way the role of culture and society in cognition was marginalized by cognitive science. Also, in information science, this view has been seriously attacked (see e.g., Palermiti and Polity 1995). We shall return to this in section 9 “Reception and criticism of the cognitive view in KO” below.

8.0 Color classification as an example of a controversy over cognitivism

The purpose of this section is to address a fundamental issue related to the cognitive view as it has been discussed in the interdisciplinary literature; we connect a basic problem of KO with an important debate: should concepts and classification be determined by studying our biological make-up or by studying different domains? Research based on the assumptions in the cognitive view may assume that concepts are somehow “hardwired” to our mind or brain, for example, in our so-called “mental lexicon.” Sociocultural views, on the other hand, tend to assume that concepts are learned by growing up and living in a specific culture. The difference between these two points of view is perhaps seen most clearly in the controversy in the research on color concepts.

The book *Basic Color Terms: Their Universality and Evolution* (Berlin and Kay 1969) has had a big impact on the view of color terms. In that book the authors claimed the universality and evolutionary development of 11 basic color terms (BCTs); the following characteristics of this view are written by two of the main critics of that view, Barbara Saunders and Jaap van Brakel (2001, 162):

According to the dominant view in cognitive science, in particular in its more popularized versions, color sensings or perceptions are lo-

cated in a 'quality space.' This space has three dimensions: hue (the chromatic aspect of color), saturation (the 'intensity' of hue) and brightness. This space is structured further via a small number of primitive hues or landmark colors, usually four (red, yellow, green, blue) or six (if white and black are included). It has also been suggested that there are eleven semantic universals – the six colors previously mentioned plus orange, pink, brown, purple and grey.

One of the influential standards for classifying colors is *the Munsell color system* developed by the American painter Professor Albert Henry Munsell (1858–1918). This system is in cognitive science often assumed to reflect the human visual system, although all color names are not developed in all cultures (Saunders 1998):

The relation between Munsell, the workings of the visual system [in the brain], and the colour-naming behaviour of people, is so tight it can be taken to be a causative law. Diversity of colour-naming behaviour is defined as a system-regulated stability evinced by Evolution. The full lexicalisation of the human colour space is designated Evolutionary Stage Seven, as in American English; languages below this level are the fossil record.

Berlin and Kay's (1969) view of color concepts is contrasted with a cultural-relative view in which our color concepts (and semantics in general) are not supposed to be determined primarily by our visual (neurological) system, but by our relative needs to act in relation to the colored environment. Cultural psychologist Carl Ratner (1989, 361) writes:

Sociohistorical psychology emphasizes the fact that sensory information is selected, interpreted and organized by a social consciousness. Perception is thus not reducible to, or explainable by, sensory mechanisms per se. Sapir, Whorf, Vygotsky and Luria all maintained that sensory processes are subordinated to and subsumed within "higher" social psychological functions.

Van Brakel and Saunders (2001, 162) continue with critical comments of the cognitive view:

Scientific evidence for these widely accepted theories is at best minimal, based on sloppy

methodology and at worst non-existent. Against the standard view (Berlin and Kay's view), it is argued that color might better be regarded as the outcome of a social-historical developmental trajectory in which there is mutual shaping of philosophical presuppositions, scientific theories, experimental practices, technological tools, industrial products, rhetorical frameworks, and their intercalated and recursive interactions with the practices of daily life. That is: color, the domain of color, is the outcome of interactive processes of scientific, instrumental, industrial, and everyday lifeworlds. That is: color might better be called an exosomatic organ, a second nature.

Regarding relativism in color concepts, see also Goodwin 2000; Lucy 1997; Roberson, Davies, and Davidoff 2000; and Saunders 2000.

We may thus conclude that the universality of color terms is a controversial point of view. The dominant view (in a period) was (and probably still is) based on cognitivism and maintains the universality of concepts, while a well-argued minority maintains a relativist view of color concepts. This debate is important for the theory of knowledge organization: should colors (and all other concepts) be classified the same way for all groups of users? Should the study of concepts be founded on psychological studies, or should it rather be based on cultural and domain-specific studies? This is what the controversy about cognitivism is basically about.

9.0 Reception and criticism of the cognitive view in KO

The cognitive view came to the forefront of knowledge organization in 1992, where the Second International ISKO Conference in Madras had this approach as its theme (Neelameghan et al. 1992). In the proceedings, there is an introduction from which we quote (Neelameghan et al. 1992, xiii):

Cognitive paradigms indicate the knowledge-seeking behaviour of individuals and groups of individuals. It is a nascent state of human mind wherein a kind of gap in knowledge structure occurs and the mind searches for a connection through its external environment. In the context of Information Retrieval, the searcher seeks some relevant information from the vast store of a knowledge base to find some kind of equilibrium in the knowledge state. The analysis and

diagnosis of this state of inquiring mind provides guidelines for organisation of information in databases and similar environments. Such guidelines are aimed at providing a conducive compatibility between searchers' approach and knowledge organisation in the database.

It continues (Neelameghan et al.1992, xiv):

The human mind is physiologically and psychologically the same since the homo sapiens was born.

This introduction does not provide any hint at all about how to investigate the mind in a way that may provide a basis for indexing, classification, or metadata assignment, which is what KO is about. Their remark that the human mind is physiologically the same since the homo sapiens was born is related to the controversial assumption in the cognitive paradigm to consider the mind as a universal system of mechanisms. Against this view exists the alternative view that psychologically the mind is also historically, culturally, and socially determined. The introduction above thus disregards the social nature of knowledge. It also fails (as does Xiao (1994), cf. below) to compare the cognitive paradigm with other paradigms in KO.

Ingetraut Dahlberg, the founder of ISKO and the journal *Knowledge Organization*, wrote an editorial about the cognitive view in KO (Dahlberg 1992). Here the term "cognitive approaches" is declared a tautology because all approaches to KO must, in one way or another, be concerned with conceptual and cognitive issues; the term is thus not specifying anything new in KO. Then different paradigms in LIS are considered. Both the so-called "physical view" associated with the Cranfield experiments and the influence of Shannon's Information Theory are said to "have led astray generations of information workers." Ranganathan's approach is mentioned as the first (and only) paradigm in KO. Mey's (1980, 48) often-used definition that "any processing of information, whether perceptual or symbolic, is mediated by a system of categories or concepts which, for the information-processing device, are a model of his [its] world" is quoted by Dahlberg, as is the conclusion, that the meaning of the cognitive view is that "an information retrieval system should reflect in its operations, in some way or other, the cognitive world of the user." Whether or not Dahlberg see an inherent conflict between different approaches to KO or whether the cognitive view is somehow improving Ranganathan's

theory is not discussed. Perhaps she also felt that it would be inadequate to make a fundamental criticism since cognitive paradigms were chosen as the theme of the conference? This example demonstrates that it may be difficult to find clarification of theoretical views in the printed literature.

Xiao (1994) is a paper about facet analysis as a paradigm in KO which also includes a discussion of the relation between facet analysis and cognition. She fails, however, to consider the specific literature about cognitive views in LIS and the basic assumptions put forward using this label. She just says that Ranganathan had an epistemological view (that knowledge is dynamic, multidimensional, and unlimited). She fails to identify other contemporary approaches to KO with which the facet-analytic paradigm can be compared.

Bernd Frohmann (1990) is the most important critic of the cognitive view in KO. Based on the philosopher Ludwig Wittgenstein, he contests the "mentalism" represented in current work on human indexing. Frohmann claims that indexing "rules" are not based on cognitive processes resident in the mind of users (as understood in cognitive views, which he also includes in the term "mentalism"). By contrast, indexing is based on socially constructed rules apprehended by indexers. So Frohmann (1990, 96) argues that the focus in KO must shift indexing theory away from the cognitive view and rule discovery and toward rule construction:

Mentalism's focus on processes occurring in minds conceals the crucial social context of rules. Since we do not understand the rule we are constructing without understanding its social context, or the way it is embedded in the social world, its point, its purpose, the intentions and interests it serves, in short, the social role of its practice, indexing theory cannot avoid investigation into the historical, economic, political and social context of the rules in its domain. Mentalism, on the other hand, either erases the social dimension altogether by conceiving rules as operating in disembodied, ahistorical, classless, genderless and universal minds, or else acknowledges it only by expanding the set of rules of mental processing.

In a paper from the Second International ISKO Conference in Madras, Frohmann (1992, 47) writes:

Human subjectivity, or personal identity, consists far less in offering a stable ground for the

unification of messages into a coherent “picture,” “image” or “model of the world” than various competing, temporary, fragmentary and contradictory postures and poses, tentatively stitched together from the available products of real social relations. A genuine “shift to users” can therefore not be carried out within the abstract, universal and representational form of the cognitive paradigm in LIS theory.

A more recent criticism has been put forward by Jack Andersen (2004, 139-144). He discusses “request, user and cognitive-oriented indexing” and writes:

A cognitive approach to indexing has been put forward in several writings by John Farrow (Farrow 1991; 1994 and 1995). Farrow’s objective is to provide an understanding of the indexing process based on cognitive psychology and cognitive reading research. Reading research distinguishes between perceptual and conceptual reading. The former is relying on scanning the text for cues, whereas the latter is dependent on the background knowledge (e.g. knowledge of subject matter) a reader approaches the text with. Basically, Farrow argues that the indexing process may be viewed in light of these two modes of reading. It is, however, difficult to see what a cognitive approach to indexing offers and, if it offers something, what is cognitive about it. Turning indexing (and reading) into a cognitive matter is to remove attention away from the typified socio-cultural practices of document production and use, that authors, indexers and readers are engaged in. Mai (2000, 123-124) also criticizes Farrow’s cognitive model of indexing as it ... adds no further knowledge or instructions to the process. He simply says that indexing is a mental process, which can be explained by using models of human information processing from cognitive psychology. But these arbitrary models of minds, memory and cognition explain little about the indexing process.

Joachim Hansson (2006, 33) is also among the critics:

In knowledge organization theory, cognitive perspectives have not been as dominant as in information behavior research. The reason for this is it is practically impossible, at least in the long run, to avoid connecting knowledge organization and classification research to the actual content of the

documents and document collections in relation to the classification and indexing performed. This can seem trivial, but it is actually not.

As described above, the cognitive view in KO has been met by important criticisms. Unfortunately, the adherents of the cognitive view have not provided proper scholarly response. Konrad (2007, 23) also found that “the cognitive viewpoint’ literature [in LIS] is sparse in its use of, and even reference to, any of these [cognitive science disciplines], preferring to originate its own postulates in these areas.” The cognitive view in KO seems thus to lack sufficient intellectual foundations.

10.0 WordNet as an example of a system based on the cognitive paradigm

WordNet® is today a very large lexical database freely available on the Internet (<http://wordnet.princeton.edu/>) and it is constantly evolving. It is a very fine English-English dictionary that is useful for looking up unknown words and their relations to other words and underlying concepts. It was developed by previously mentioned cognitive psychologist George A. Miller as a tool for developing AI technologies and is claimed to be based on principles derived from psycholinguistics. The question for us is: what is the connection between the (claimed) cognitive foundation and the actual database? Although we cannot go into detail here, we shall briefly look into the issue but leave a thorough investigation until another time. The psychological/cognitive principles underlying WordNet have been presented in, among other works, Fellbaum (1998, 2005), Miller (1998a, 1998b), and Nikolova, Boyd-Graber, and Fellbaum (2009).

George Miller (1998b, 43) wrote:

In earlier descriptions of WordNet ... it was suggested that WordNet is based on psycholinguistic principles in the same sense that the *Oxford English Dictionary* is based on historical principles. That claim has not borne the fruit that was expected at the time it was first made. The fact is that WordNet has been largely ignored by psycholinguists.

Miller (1998b, 44) continues:

Development of the nouns in WordNet has therefore been driven far more by potential application to computational linguistics than by

advances in theories of cognitive psychology. Perhaps this outcome should have been foreseen. After all, a dictionary based on historical principles contributed little to the study of history.

These quotations are interesting for two reasons. First, if we consider dictionaries kinds of knowledge-organizing systems—as Hodge (2000) does—the quotations confront two different approaches to their construction: the historical versus the psycholinguistic/cognitive approach. Secondly, it is partially an acknowledgment that the cognitive approach did not succeed. (The claim that historical dictionaries did not contribute to the study of history may be wrong: the German tradition of *Begriffsgeschichte* has—as far as I know—contributed considerably to the understanding of the historical periods which they reflect). It seems that Miller does acknowledge that research in cognitive psychology has not had much to offer. It should be said, however, that Miller says more than what is quoted here. He also says that it is not false that WordNet is based on psycholinguistic principles and he exemplifies why that is the case, but we shall not go into those arguments here. Instead two things should be said:

Miller acknowledges that semantic relations (e.g., synonymy) are not universal, but context dependent. But WordNet itself does not reflect this. Later a semantic concordance was developed at the Princeton Cognitive Science Laboratory (Fellbaum 1998, 13). In my opinion, this is an approach that is closer to being a historical-social approach than a cognitive approach.

There seem to be underlying assumptions about one correct way of representing semantic relations (Miller 1998a, xvii). Nowhere is there an indication that semantic relations reflect scientific theories, for example that whether a certain drug is a tranquilizer or not depends on medical and biological experiments. Human users learn such empirical established knowledge that cannot be hardwired into our brains from birth. Therefore the cognitive enterprise seems to be based on problematic assumptions.

As was the case with the Book House System and with the word association method, it may be the case that WordNet is in reality less based on cognitive views than was expected and what has been claimed.

11.0 Psychology versus epistemology

Perhaps the popularity of the user-based and cognitive views is based on confusion between users and subjectivity, between psychology and epistemology?

Psychology is about general models of minds or about individual minds. Epistemology, on the other hand, is about ways of thinking (“paradigms”) as reflected by scientific disciplines and by groups of people. It is one thing to say that indexing should reflect an abstract human mind, quite a different thing to say that indexing can be tailored to specific groups of users, e.g., evidence-based medical doctors or feminist scholars. The domain-analytic view in LIS and KO is an attempt to base the field on the criteria of relevance shared by groups of people (Hjørland 2010). What Fidel (1994) calls “user-centered indexing” as opposed to document oriented indexing may very well be oriented towards certain perspectives such as evidence based practice or feminist epistemology without being based on studies of users.

It seems better to say that the epistemological view claims that a specific way of indexing may serve certain theoretical views better than others (e.g. an evidence-based view or a feminist point of view) compared to a specific group of people. If indexing leaves the studies of users and abstract minds and turns instead towards serving specific epistemological criteria, then we have turned away from the cognitive view to the domain-analytic approach to KO.

12.0 Conclusion

This article has put forward a wide range of problematic assumptions concerning the user-based and cognitive approaches to knowledge organization. Does that mean that the enormous amount of research in the field has been fruitless? Bawden and Robinson (2012) have provided their view on this issue and they try to summarize the results revealed so far. Their conclusions seem, however, rather vague and general. They state: “While there is therefore a large body of good evidence to support the practice of information provision to a variety of user groups, it is not so clear that many general findings have emerged. What, after over fifty years of effort, do we know about information behaviour in general?” (Bawden and Robinson 2012, 204). Bawden and Robinson do not, however, demonstrate that the large body of good evidence is useful in the construction of KOS. In general, their answers to what we have learned from many years of user studies are rather vague, for example, that users tend to follow the principle of the least effort and that they do not tend to use the products of LIS very much.

There is one thing in knowledge organization that we really seem to have learned from user studies: when online systems were introduced in the 1960s

and 1970s, a common experience was that searchers preferred verbal search languages. They did not consider classification codes to be “user-friendly.” Often user studies may also approach domain studies by characterizing the nature of information in a given domain (e.g., Bates, Wilde, and Siegfried 1993).

The basic issue in KO is, however, about questions such as: should document A be classified in class X? Is term A synonymous with term B? User-based and cognitive approaches cannot contribute to solving such core issues.

References

- Allen, Thomas John. 1966. *Managing the flow of scientific and technological information*. Ph.D. dissertation. Massachusetts Institute of Technology, Sloan School of Management.
- Andersen, Jack. 2004. *Analyzing the role of knowledge organization in scholarly communication: an inquiry into the intellectual foundation of knowledge organization*. Ph.D. dissertation. Copenhagen: Royal School of Library and Information Science. Available <http://www.db.dk/dbi/samling/phd/jackandersen-phd.pdf>.
- Bates, Marcia J., Wilde, Deborah N. and Siegfried, Susan. 1993. An analysis of search terminology used by humanities scholars: the Getty Online Searching Project report no. 1. *Library quarterly* 63: 1-39.
- Bawden, David and Robinson, Lyn. 2012. *Introduction to information science*. London: Facet.
- Berlin, Brent and Kay, Paul. 1969. *Basic color terms. Their universality and evolution*. Berkeley, CA: University of California Press.
- Bernal, John Desmond. 1948. Preliminary analysis of pilot questionnaires on the use of scientific literature. In *Proceedings of the Royal Society Scientific Information Conference*. London: Royal Society, pp. 589–637.
- Bruce, Harry. 2002. A focus on usings. In: *The user's view of the Internet*. Lanham, MD: Scarecrow Press, pp. 31–67.
- Bruner, Jerome. 1990. *Acts of meaning*. Cambridge, MA: Harvard University Press.
- Case, Donald O. 2006. Information behavior. *Annual review of information science and technology* 40: 293–327.
- Case, Donald O. 2007. *Looking for information: a survey of research on information seeking, needs and behavior*, 2nd ed. New York: Academic Press.
- Cooke, Nancy J. 1994. Varieties of knowledge elicitation techniques. *International journal of human-computer studies* 41: 801–49.
- Cronin, Blaise. 2009. Introduction. In *Annual review of information science and technology* 43. Medford, NJ: Information Today, pp. vii-x.
- Dahlberg, Ingetraut. 1992. Cognitive paradigms in knowledge organization. *International classification* 19: 125, 145.
- Day, Ronald E. 2011. Death of the user: reconceptualizing subjects, objects, and their relations. *Journal of the American Society for Information Science and Technology* 62: 78–88.
- Eriksson, Rune. 2010. *Klassifikation og indeksering af skønlitteratur – et teoretisk og historisk perspektiv*. Ph.D. dissertation. Copenhagen: Royal School of Library and Information Science. Available <http://pure.iva.dk/files/30769518/Eriksson%5Fphd%5F2010.pdf>
- Farrow, John D. 1991. A cognitive process model of document indexing. *Journal of documentation* 47: 149–66.
- Farrow, John D. 1994. Indexing as a cognitive process. In Kent, Allen, ed., *Encyclopedia of library and information science* 53 supp. 16. New York: Marcel Dekker, pp. 155–71.
- Farrow, John D. 1995. All in the mind: concept analysis in indexing. *The indexer* 19(4): 243–47.
- Fellbaum, Christina. 1998. Introduction. In Fellbaum, Christina, ed., *WordNet: an electronic lexical database*. Cambridge, MA: The MIT Press, pp. 1–19.
- Fellbaum, Christina. 2005. WordNet and wordnets. In Brown, Keith, ed., *Encyclopedia of language and linguistics*. Oxford: Elsevier, pp. 665–70.
- Fidel, Raya. 1994. User-centered indexing. *Journal of the American Society for Information Science* 45: 572–6.
- Fisher, Karen E., Erdelez, Sanda and McKechnie, Lynne. 2005. *Theories of information behavior*. Medford, NJ: Information Today.
- Frohmann, Bernd. 1990. Rules of indexing. A critique of mentalism in information retrieval theory. *Journal of documentation* 46: 81–101.
- Frohmann, Bernd. 1992. Cognitive paradigms and user needs. In Neelameghan, A, Gopinath, M.A., Raghavan, K. S. and Sankaralingam, S.P., eds., *Cognitive paradigms in knowledge organization: second international ISKO conference. Madras, August, 26–28, 1992*. Madras: Sarda Ranganathan Endowment for Library Science, pp. 35–50.

- Furner, Jonathan. 2012. FRSAD and the ontology of subjects of works. *Cataloging & classification quarterly* 50 nos. 5-7: 494-516.
- Galton, Francis. 1883. *Inquiries into human faculty and its development*. London: Macmillan.
- Goodwin, Charles. 2000. Practices of color classification. *Mind, culture and activity* 7: 19-36.
- Gray, William S. and Monroe, Ruth Learned. 1929. *Reading interests and habits of adults*. New York: Macmillan.
- Hansson, Joacim. 2006. Knowledge organization from an institutional point of view: implications for theoretical & practical development. *Progressive librarian: a journal for critical studies & progressive politics in librarianship* 27: 31-43.
- Heinström, Jannica. 2005. Fast surfing, broad scanning and deep diving: the influence of personality and study approach on students' information-seeking behaviour. *Journal of documentation* 61: 228-47.
- Hjørland, Birger. 2002. Epistemology and the socio-cognitive perspective in information science. *Journal of the American Society for Information Science and Technology* 53: 257-70.
- Hjørland, Birger. 2008. What is knowledge organization (KO)? *Knowledge organization* 35: 86-101.
- Hjørland, Birger. 2010. The foundation of the concept of relevance. *Journal of the American Society for Information Science and Technology* 61: 217-37.
- Hodge, Gail. 2000. *Systems of knowledge organization for digital libraries: Beyond traditional authority files*. Washington, DC: The Council on Library and Information Resources. Available <http://www.clir.org/pubs/reports/pub91/contents.html>
- Hulme, Edward Wyndham. 1911. Principles of book classification. *Library Association record* 13: 354-58, 389-394, 444-49.
- Ingwersen, Peter. 1992. *Information retrieval interaction*. London: Taylor Graham.
- Ingwersen, Peter. 1996. Information and information science in context. In Olaisen, Johan Leif, Munch-Petersen, Erlend and Wilson, Patrick, eds., *Information science: from the development of the discipline to social interaction*. Oslo: Scandinavian University Press, pp. 69-111.
- Ingwersen, Peter and Järvelin, Kalervo. 2005. *The turn. Integration of information seeking and retrieval in context*. Dordrecht, The Netherlands: Springer.
- Jensen, Povl Johannes. 1973. *Catalogue and scholarship: D. G. Moldenhawer's catalogue in the Royal Library of Copenhagen*. Copenhagen: The Royal Library.
- Johnson, Nathan R. 2011. *Review of Ron Day's (2011) "Death of the user"* Available <http://whoisnate.com/2011/07/01/ron-days-death-of-the-user/>
- Jung, Carl G. 1910. The association method. *The American journal of psychology* 31: 219-69.
- Konrad, Allan Mark. 2007. *On inquiry: human concept formation and construction of meaning through library and information science intermediation* Ph.D. dissertation. University of California. Available: <http://escholarship.org/uc/item/1s76b6hp>
- Krampen, Günter, Fell, Clemens and Schui, Gabriel. 2011. Psychologists' research activities and professional information-seeking behaviour. *Journal of information science* 47: 439-50.
- Larson, Ray R. 1991. The decline of subject searching: long-term trends and patterns of index use in an online catalog. *Journal of the American Society for Information Science*, 42: 197-215.
- Lazarsfeld, Paul Felix. 1940. *Radio and the printed page*. New York: Dvell, Sloan, Pearce.
- Lindsay, Peter H. and Norman, Donald. 1977. *Human information processing: an introduction to psychology*, 2nd ed. New York: Academic Press.
- Lucy, John A. 1997. Linguistic relativity. *Annual review of anthropology* 26: 291-312.
- Lykke Nielsen, Marianne. 2000. Domain analysis, an important part of thesaurus construction. In *Advances in classification research online*. <http://journals.lib.washington.edu/index.php/acro/article/view/12768>
- Lykke Nielsen, Marianne. 2002. *The word association method: a gateway to work-task based retrieval*. Åbo: Åbo Akademi University Press.
- McDiarmid, Erret Weir. 1940. *The library survey: problems and methods*. Chicago: American Library Association.
- Mai, Jens-Erik. 2000. *The subject indexing process: an investigation of problems in knowledge representation*. Ph.D. dissertation. The University of Texas at Austin.
- Martin, Lowell A. 1976. User studies and library planning. *Library Trends* 24: 483-96.
- Menzel, Herbert. 1966. Information needs and uses in science and technology. *Annual review of information science and technology* 1: 41-69.
- Mey, Marc de. 1980. The relevance of the cognitive paradigm for information science. In Harbo, Ole and Kajberg, Leif, eds., *Theory and application of information research. Proceedings of the 2nd international research forum on information science*. London: Mansell, pp. 49-61.

- Miller, George A. 1956. The magical number seven, plus or minus two: some limits on our capacity for processing information. *Psychological review* 63: 81–97. Available <http://psychclassics.yorku.ca/Miller/>
- Miller, George A. 1998a. Foreword. In Fellbaum, Christina, ed., *WordNet: an electronic lexical database*. Cambridge, MA: The MIT Press, pp. xv–xxii.
- Miller, George A. 1998b. Nouns in WordNet. In Fellbaum, Christina, ed., *WordNet: an electronic lexical database*. Cambridge, MA: The MIT Press, pp. 23–46.
- Nahl, Diane. 1996. The user-centered revolution: 1970–1995. In Kent, Allen, ed., *Encyclopedia of microcomputers* 19. New York: Marcel Dekker, Inc., pp. 143–99.
- Nahl, Diane. 2003. The user-centered revolution. In Drake, Miriam A., ed., *Encyclopedia of library and information science* (2nd edn.). New York: Marcel Dekker; Inc., pp. 3028–42.
- Neelameghan, Arashanapalai, Gopinath, M. A., Raghavan, K.S. and Sankaralingam, S. P. 1992. Introduction. In *Cognitive paradigms in knowledge organization: second international ISKO conference. Madras, August, 26–28, 1992*. Madras: Sarda Ranganathan Endowment for Library Science, pp. xiii–xvi.
- Nicolaisen, Jeppe and Frandsen, Tove Faber. 2007. The handicap principle: a new perspective for library and information science research. *Information research* 12(4): paper colis 23. Available <http://InformationR.net/ir/12-4/colis/colis23.html>
- Nikolova, Sonya, Boyd-Graber, Jordan and Fellbaum, Christiane. 2009. Chapter 5: Collecting semantic similarity ratings to connect concepts in assistive communication tools. In Mehler, Alexander, Kühnberger, Kai-Uwe, Lobin, Henning, Lungen, Harald, Storrer, Angelika and Witt, Andreas, eds., *Modelling, learning & processing of text-technological data-structures*. New York: Springer-Verlag. Available http://wordnet.cs.princeton.edu/papers/evocation_chapter.pdf
- Palermi, Rosalba and Polity, Yolla. 1995. Desperately seeking user models in information retrieval systems: benefits and limits of cognitivist and marketing approaches. *The new review of information and library research* 1: 57–65. Available <http://www.iut2.upmf-grenoble.fr/RI3/Usermodels.htm>
- Pariser, Eli. 2011. *The filter bubble: what the Internet is hiding from you*. New York: Penguin Press.
- Pejtersen, Annelise Mark. 1989. *The Book House: modeling user needs and search strategies as a basis for system design*. Roskilde, Denmark: Risø National Laboratory. (Risø report M-2794).
- Pejtersen, Annelise Mark. 1992. The Book House. An icon based database system for fiction retrieval in public libraries. In Cronin, Blaise, ed., *The marketing of library and information services* 2. London, Aslib, pp. 572–91.
- Pejtersen, Annelise Mark. 1994. A framework for indexing and representation of information based on work domain analysis: a fiction classification example. In Albrechtsen, Hanne and Ørnager, Susanne, eds., *Knowledge organization and quality management. Proceedings of 3rd International ISKO Conference*, Copenhagen, June 1994. Frankfurt: Index Verlag, pp. 251–64.
- Pejtersen, Annelise Mark, Albrechtsen, Hanne, Lundgren, Lena, Sandelin, Ringa and Valtonen, Riitta. 1996. *Subject access to Scandinavian fiction literature: Index methods and OPAC development*. Copenhagen: Nordisk Ministerråd.
- Pors, Niels Ole. 2005. *Studerende, Google og biblioteker: en undersøgelse af 1694 studerendes brug af biblioteker og informationsressourcer*. Copenhagen: Biblioteksstyrelsen and Royal School of Library and Information Science. Available <http://www.statensnet.dk/pligtarkiv/fremvis.pl?vaerkid=45550&repreid=1&iarkiv=1>
- Pyllyshyn, Zenon W. 1983. Information science as viewed from the perspective of cognitive science. In Machlup, Fritz and Mansfield, Una, eds., *The study of information: interdisciplinary messages*. New York: John Wiley & Sons, pp. 63–74.
- Ratner, Carl. 1989. A sociohistorical critique of naturalistic theories of color perception. *Journal of mind and behavior* 10: 361–72. Available <http://web.archive.org/web/20031029152929/http://www.humboldt1.com/~cr2/colors.htm>
- Rayward, W. Boyd. 1994. Visions of Xanadu: Paul Otlet (1868–1944) and hypertext. *Journal of the American Society for Information Science* 45: 235–50.
- Roberson, Debi, Davies, Ian and Davidoff, Jules. 2000. Color categories are not universal: replications and new evidence from a stone-age culture. *Journal of experimental psychology: general* 129: 369–98.
- Rosa, Cathy de, Cantrell, Joanne, Cellentani, Diane, Hawk, Janet, Jenkins, Lillie and Wilson, Alane. 2005. *Perceptions of libraries and information resources. A report to the OCLC membership*. Dublin, Ohio USA: OCLC Online Computer Library Center, Inc. Available http://www.oclc.org/reports/pdfs/Percept_all.pdf

- Rosa, Cathy de, Cantrell, Joanne, Hawk, Janet and Wilson, Alane. 2006. *College students' perceptions of libraries and information resources. A report to the OCLC membership. A companion piece to perceptions of libraries and information resources*. Dublin, OH, USA: OCLC Online Computer Library Center, Inc. Available: <http://www.oclc.org/reports/pdfs/studentperceptions.pdf>.
- Rosenbaum, Howard, Davenport, Elisabeth, Lievrrouw, Leah and Day, Ron. 2003. The death of the user. *Panel presentations at ASIST 2003 Annual Meeting*. Westin Long Beach, CA. Available <http://www.asis.org/Conferences/AM03/abstracts/Sun-330-4.html>
- Saracevic, Tefko. 1992. Information science: origin, evolution, relations. In Vakkari, Pertti and Cronin, Blaise, eds., *Conceptions of library and information science: historical, empirical and theoretical perspectives*. London: Taylor Graham, pp. 5–27.
- Saunders, Barbara. 1998. Revisiting basic color terms. Paper presented at the conference on *Anthropology and psychology: the legacy of the Torres Strait Expedition, St. John's College, Cambridge 10-12 August*. Available <http://human-nature.com/science-as-culture/saunders.html>
- Saunders, Barbara. 2000. Revisiting *basic color terms*. *Journal of the Royal Anthropological Institute* 6: 81-99.
- Shiri, Ali Asghar, Revie, Crawford and Chowdhury, Gobinda. 2002. Thesaurus-assisted term selection and query expansion: a review of user-centered studies. *Knowledge organization* 29: 1-19.
- Siatri, Rania. 1999. The evolution of user studies. *Libri* 49(3): 132–41. Available <http://www.librijournal.org/pdf/1999-3pp132-141.pdf>
- Simsova, Silva. 1968. *Nicholas Rubakin and bibliopsychology*, translated by M. Mackee & G. Peacock. Hamden, CT: Archon Books.
- Suominen, Vesa. 2007. The problem of 'userism', and how to overcome it in library theory. *Information research* 12(4) paper colis33. Available <http://InformationR.net/ir/12-4/colis/colis33.html>
- Toms, Elaine G. 2010. User-centered design of information systems. In Bates, Marcia J. and Maack, Mary Niles, eds., *Encyclopedia of library and information sciences* 3rd ed. VII. London: Taylor & Francis, pp. 5452–60.
- Urquhart, Donald J. 1948. The distribution and use of scientific and technical information. *Proceedings of the Royal Society Scientific Information Conference*. London: Royal Society, pp. 408-19.
- van Brakel, Jaap & Saunders, Barbara. 2001. Color: an exosomatic organ? In Eschbach, Reiner and Marcu, Gabriel G., eds., *Color imaging: device-independent color, color hardcopy, and applications VII. Proceedings from SPIE [the international society for optics and photonics]* 4663, pp. 162-76.
- Verganti, Roberto. 2009. *Design-driven innovation: changing the rules of competition by radically innovating what things mean*. Boston, MA: Harvard Business Press. Available <http://www.designdriveninnovation.com/letter.html>.
- Waples Douglas. 1939. *People and print*. Chicago: University of Chicago Press.
- White, Howard. D. and McCain, Katherine W. 1998. Visualizing a discipline: an author co-citation analysis of information science, 1972–1995. *Journal of the American Society for Information Science* 49: 327–55.
- Whitley, Richard. 1984. *The intellectual and social organization of the sciences* (2nd edn. with a new introduction 2000). Oxford: Oxford University Press.
- Wilson, Tom D. 1994. Information needs and uses: fifty years of progress. In Vickery, Brian Campbell, ed., *Fifty years of information progress: a journal of documentation review*. London: Aslib, pp. 15–51.
- Wilson, Tom D. 2000. Human information behaviour. *Informing science* 3(2): 49–55.
- Wilson, Tom D. 2008. The information user: past, present and future. *Journal of information science* 34: 457–464.
- Xiao, Yan. 1994. Faceted classification: a consideration of its features as a paradigm for knowledge organization. *Knowledge Organization* 21: 64–8.
- Young, Jeffrey S. and Simon, William L. 2005. *Icon: Steve Jobs – the greatest second act in the history of business*. Hoboken, NJ: Wiley.
- Zeng, Marcia Lei, Žumer, Maja and Salaba, Athena. 2010. *Functional Requirements for Subject Authority Data (FRSAD)*. IFLA Working Group on the Functional Requirements for Subject Authority Records. Available <http://www.ifla.org/files/classification-and-indexing/functional-requirements-for-subject-authority-data/frsad-final-report.pdf>
- Zipf, George Kingsley. 1949. *Human behavior and the principle of least effort: An introduction to human ecology*. Cambridge, MA: Addison-Wesley.

Theoretical approaches are more often used in branches of knowledge where causes are...
Literature of the United States of America, California State University, Chico (1980). Updated 2 years ago · Author has 676 answers and 698.2K answer views. Theoreticians seek to create logical or mathematical constructs that explain experimentally observed phenomena. Or, they may suggest possible new phenomena to look for, based on their hypotheses (guesses) about the underlying truths in science. means it's an act where the things you imagine hypothetically true with based on theories made before and trying to explain basis of that . 1.2K views. Harshit Soni. In literature, a scholar using postmodernist literary theory would analyze *The Great Gatsby* differently than a scholar using Marxist literary theory. In psychology, a behaviorist approach to depression would involve different methods and assumptions than a psychoanalytical approach. In economics, wealth inequality would be explained and interpreted differently within classical economics and Keynesian economics frameworks. As you write the theoretical framework, aim to compare and critically evaluate the approaches that different authors have proposed. After discussing different models and theories, you establish the definitions that best fit your research and justify why this is the case. The facet-analytic paradigm is probably the most distinct approach to knowledge organization within Library and Information Science, and in many ways it has dominated what has been termed "modern classification theory". It was mainly developed by S.R. Ranganathan and the British Classification Research Group, but it is mostly based on principles of logical division developed more than two millennia ago. Colon Classification (CC) and Bliss 2 (BC2) are among the most important systems developed. CONTINUE READING. View via Publisher. curis.ku.dk. Save to Library. Create Alert... User-based and Cognitive Approaches to Knowledge Organization: A Theoretical Analysis of the Research Literature. Birger Hjorland. Computer Science.