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Resource Discovery Tools: Supporting Serendipity

Tammera M. Race
Western Kentucky University, tammera.race@wku.edu

Planning and Implementing Resource Discovery Tools in Academic Libraries

Mary Pagliero Popp
Indiana University, USA

Diane Dallis
Indiana University, USA

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Chapter 9
Resource Discovery Tools:
Supporting Serendipity

Tammera M. Race
Western Kentucky University, USA

ABSTRACT

Serendipity, the accidental discovery of something useful, plays an important role in discovery and the acquisition of new knowledge. The process and role of serendipity varies across disciplines. As library collections have become increasingly digital faculty lament the loss of serendipity of browsing library stacks. Resource discovery tools may have features that support serendipity as part of information seeking. A comparison of four commercial Web-scale discovery tools, Online Computer Library Center (OCLC) WorldCat® Local[1], Serials Solution[2]® Summon[3]™, ExLibris[4]® Primo Central[5]™, and EBSCO Discovery Services (EDS)[6]™, links product features to characteristics that support serendipitous discovery. However, having such features is only part of the equation. Educators need to include serendipity in discussions about the research process. Future research opportunities include determining whether serendipity can be encouraged, evaluating its occurrence in the web scale environment, and studying serendipity in relation to research instruction.

INTRODUCTION

What is serendipity? A common thread of all discussions is the perception that accident creates an opportunity. Observation and research show that serendipity plays a role in discovery across many disciplines, and may be a manifestation and/or a trait of creative research. Although these serendipitous discoveries can be significant in original thinking and advancement in different fields, serendipity is both lauded and condemned as a research strategy. Serendipity is also difficult to quantify. However, studies of user behavior positively support the role of serendipitous

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discovery as part of the research process. If we recognize that serendipity plays an important role, then we should ask how resource discovery tools can foster meaningful serendipitous discovery. Do some tools promote a discovery environment that encourages the searcher to be creative, to be open to accidental discovery?

The mission of this chapter is to explore whether some characteristics of commercial web scale discovery products may enhance opportunities for meaningful serendipitous discovery. To this end, this chapter will:

- Present comments in the literature relating to serendipity and discovery
- Discuss recent and current studies in searching behavior that recognize serendipity in the search process
- Using published articles and promotional materials, compare four commercial web scale discovery products with respect to features that support serendipity
- Suggest opportunities for research and evaluation of resource discovery tools with respect to users, search behaviors, and serendipity.

A FIELD DESCRIPTION OF SERENDIPITY

"Serendipity [noun]: the occurrence and development of events by chance in a happy or beneficial way" (Stevenson, 2010). Merton and Barber (2004) describe Horace Walpole's creation of the word "serendipity." Key to Walpole's coinage of the term was accident, "sagacity" (Merton & Barber, 2004, p.2), and discovery of something useful that was previously unsought. Since 1754 when Walpole coined the term, serendipity has proven difficult to define and quantify. However, researchers know serendipity when they encounter it (McBirnie, 2008). Based on author accounts of historic discoveries, information seeking strategies, and their own experiences, serendipity is:

- Accidental, random, unpredictable (McBirnie, 2008; Hoeflich, 2007; Hoffman, 2005)
- Elusive (McBirnie, 2008; Foster and Ford, 2003)
- Positive, exciting, fulfilling (McBirnie, 2008; Hoelfich, 2007; Hoffman, 2005)
- A rare, but regular, occurrence (McBirnie, 2008).

In her studies of information seeking behavior, McBirnie (2008) notes that serendipity can be an active occurrence (a "happening upon"; p.607) or a passive occurrence (a "happening"; p.607).-

"Serendipity is fundamental to all science, especially the most creative and important" (Friedel, 2001, p. 37). In their literature review, Foster and Ford (2003) demonstrate that serendipity is fundamental not only to scientific research, but to social sciences and humanities research, and artistic endeavors. Accidental discovery presents new information that changes perspective and courses of action (Johnson, 2010; Guha, 2009; McBirnie, 2008). Studies of information seeking behavior document that serendipity stimulates creativity by illustrating new connections, connections that were not consciously anticipated by the researcher. Foster and Ford (2003) note that serendipitous discovery is especially important across different disciplines. Erdelez (1999) also describes serendipity as leading to opportunities for "cross-pollination" (Erdelez, 1999, p.4) of concepts. Accidental discovery in information seeking supports creative thinking by fostering novel connections and frameworks (Nutefall & Ryder, 2010). Researchers tend to discount serendipity because it is not viewed as a formal search strategy (Erdelez, 1999; Liestman, 1992). However, recent studies emphasize that accidental discovery of information is a key piece of information research (Erdelez & Makri, 2011).

"Serendipity is a form of chance. It is a chance event with a positive outcome" (Lightman, 2006, p.33). Certain factors nurture serendipity. Chief among these is chance, or luck (McBirnie, 2008; Hannan, 2006). Gest (1997) attributes serendipity to the hard work and persistence of the researcher. Similarly, many authors describe serendipity as dependent on the researcher's state of mind. These individual characteristics include:

- A sense of curiosity or wonder (Hoffman, 2005; Gest, 1997)
- A prepared mind (sagacity), knowledgeable enough to recognize opportunity (Rubin, Burkell, Quan-Haase, 2011; Hoeflich, 2007; Lightman, 2006; Hoffman, 2005; Gest, 1997)
- An open, flexible mind (McBirnie, 2008; Hoelfich, 2007; Hannan, 2006; Lightman, 2006; Hoffman, 2005)
- An observant mind (Rubin, Burkell, Quan-Haase, 2011; Lightman, 2006).

Serendipity in information seeking combines chance, perceptions, and process (McBirnie, 2008). Without the proper mix, serendipitous discovery and the creative breakthroughs that it supports, will not occur.

Serendipity and Scholarship

Serendipity plays an important role in the research process in at least four major ways. For students, the concept of serendipity demonstrates that the process of discovery has a personal component. Serendipitous occurrences are partially dependent on what experience and prior knowledge an individual brings to the table, and how they determine relevance (Beale, 2007; Steinerova, 2007; Cosign and Bothma, 2006; Campos and deFigueiredo, 2001; Kennedy, Cole, and Carter, 1999). Awareness of the possibility of serendipity emphasizes personal exploration, helping the student take ownership of the research. This ownership generates the energy critical to creating a final, original product (Kennedy, Cole, Carter, 1999).

Another aspect of serendipitous discovery that is important to both novice and accomplished researchers is the positive reinforcement gained from accidental discovery. Serendipity can energize the search by overcoming negative feelings generated by failed searches and providing stimulus for continuing the process (Erdelez, 1999). In addition, researchers may become more confident, bolstered by useful information gained accidentally and unexpectedly (Erdelez, 1999).

Serendipity is key to creative scholarship. Nutefall and Ryder (2010) note that "serendipity is a method of research that many academics have incorporated into their own information seeking behavior" (p. 232). In their 2003 study, Foster and Ford found that serendipity "emerged as an important aspect of how researchers encounter information and generate new ideas" (p. 337). Serendipity can help new ways of looking at issues and problems, and novel connections between fields of knowledge (Foster & Ford, 2003; Erdelez, 1999). Accidental information discovery may also act to confirm a particular research path or concept (Foster & Ford, 2003).

Finally, for information literacy educators, awareness of the role of serendipity is important to the research interview process. George (2005) declares that "the entire information seeking endeavor is a grand, messy process of inquiry and education, which may be uncontrollable, unpredictable, and quite possibly serendipitous" (p. 384). She encourages reference librarians to embrace large sets of search results as a key part of the undergraduate research process, rather than attempting to prematurely narrow a topic.

Research on Serendipitous Information Discovery

Research on serendipitous information discovery focuses on user perceptions and search processes, including the systems that support such processes.

For example, many authors note the link between browsability of print resources and serendipity (Nutefall & Ryder, 2010; Johnson, 2010; Hoeflich, 2007; Gup, 1997; Liestman, 1992). The following examples illustrate how aspects of information retrieval tools can support serendipitous discovery.

Browsable systems are often described in conjunction with serendipity. O'Connor (1988) discusses "creative browsing" (p. 203) as a means of uncovering new knowledge and making unique connections. In contemplating a system that supports creative browsing, O'Connor notes, "The person seeking at the frontiers of knowledge may well require a system or environment which is not anchored to existing knowledge and relationships" (p. 205). Such a system could encourage serendipity in a number of ways. Rapid retrieval of a large number of results provides options (key to creative browsing), and allows the user to narrow the search as needed. In order to evaluate the options, there should be ways to study the attributes of the results. Transparency of document structure can help indicate selection points, and classification can help with navigation. O'Connor also describes the value of communicating with other users, by incorporating commentary and user profiles. O'Connor's vision is one of a "connections system" (p. 210) that supports creativity.

Rice (1988) describes the discovery potential of browsing Online Public Access Catalogs (OPACs). Maximizing access via many points is one way to promote discovery, including serendipitous discovery. OPACs offer many different ways to find information, thus providing more discovery opportunities than print resources. Rice (1988) also discusses browsable search indexes and similar article citation retrieval as encouraging serendipitous discovery.

Ford, O'Hara, and Whiklo (2009) translate the browsability of print resources to electronic resources. Using Library of Congress class numbers as filing points and vendor book covers, the authors created an electronic reference bookshelf. In addition, they included tagging by users, another avenue to create discovery opportunities.

Kennedy, Cole, and Carter (1999) recognize the value of large pools of results to exploration. In their study of undergraduates, the authors stress that a state of prefocus is necessary in order for students to understand the context of an issue, and to take ownership of a topic. During this state of prefocus, students benefit from broad searches, which they can gradually narrow as they move to becoming more focused. Kennedy, Cole, and Carter identify a need for better presentation of large citation lists to facilitate exploration.

Other researchers have looked at serendipity in relation to research on the Web. Campos and deFigueiredo (2001) created Max, a web browsing agent, designed to provide the user with "unexpected information" (p.162) as a jumpstart to creativity. Recognizing that serendipitous information discovery is very personal, Campos and deFigueiredo programmed Max to search based on user profiles. Using randomly selected words from these profiles, Max wandered the Web, looking for previously undiscovered information that might be of interest. Early results showed that Max could find unexpected information that changed research directions or stimulated different interests. These preliminary results support the idea of "programming for serendipity" (Campos & deFigueiredo, 2001, p. 163).

Toms (2002) focused on Web research in facilitating serendipitous information retrieval. In her study, users were provided with ten news articles, generated in response to an information request. This list included articles that were similar to and different from the initial information request. Participants described valuable accidental information encounters stimulated by the suggested articles. The results of Toms' research also indicate that serendipitous discovery can be evoked by system design.

Interactive Information Retrieval Studies

Interactive information retrieval studies look at personalizing the search experience, offering support for the subjective aspects searching. Beale (2007) created two systems that apply interactive information retrieval and facilitate personalized discovery in order to create "a more serendipitous environment" (p. 433). The Haiku system presents raw data visually, by linked data relationships. Users can comfortably explore while the system keeps and displays a history of the navigations. The second system, Mitsikeru, supports Internet browsing. Using word frequencies found on the pages visited, Mitsikeru builds a master table for each browsing session. The system maximizes the user's options by presenting all of the search results for evaluation, but the most relevant results are coded differently. Both systems support interaction between the user and the ambient intelligence of the system.

Cosign and Bothma (2006) describe the need for interactive information retrieval to support the subjective aspects of relevance. Standard information retrieval systems typically determine relevance by algorithms or topical relations. However, users determine relevance on cognitive, situational and socio-cognitive levels. Of these, cognitive relevance, the relation between the knowledge state of the user and the information being evaluated, is most related to serendipitous information discovery. Cognitive relevance describes the prepared mind necessary for serendipity to occur. Because cognitive relevance will change throughout the search process, system supports need to be dynamic and responsive to changes in determining relevance.

Tools that allow researchers to broaden and narrow searches, and work back and forth (recursively) as they create their search process promote discovery, including accidental discovery (Nutefall and Ryder, 2010; Steinerova, 2007; Kennedy, Cole and Carter, 1999). In a study of doctoral students, Steinerova (2007) begins with the assumption that relevance assessments are specific personal experiences, not results of algorithms. In addition, this study demonstrates that discovery experiences vary with each individual. The author describes the specific potential characteristics of the electronic environment that can support subjective relevance judgments. These characteristics include: flexibility in navigation and interaction, opportunities to present information visually, collective processing of information, and tools for backtracking to support non-linear searches. In order to support individualized experiences, Steinerova recommends that information retrieval systems focus less on locating information and more on providing "features of ranking, relating, and recommending" (Steinerova, 2007, p. 50).

Stevenson, Tuohy, and Norrish (2008) describe an example of enhancing resource discovery using the hypertextuality of digital resources. In designing a delivery framework consisting of a metadata repository implemented using ISO Topic Map technology, the authors created a system that mimics the browsability, the "structured serendipity" (Stevenson et al., 2008, p.1) of print collections. The topic map, using data harvested from texts in a digital resource collection, generates a graph of interconnections between people, places, and texts. These interconnections are displayed as hyperlinks, a browsable framework for navigation. This framework is dynamic, flexible, and supports non-linear exploration. All of these characteristics encourage accidental knowledge discovery.

Serendipity and Resource Discovery

Liestman (1992) cites Swanson's (1986) description of information retrieval as "a creative trial-an-error process, …a vital span in the bridge" between conscious experience and information resources" (p. 108). Liestman continues that "serendipity is a component of this linkage" (p.525). The physical arrangement of books has been described as facilitating browsing, supporting serendipitous

discovery (Johnson, 2010). McBirnie (2008) adds that serendipitous discovery is not limited to browsing, but can occur while seeking specific information as well. Toms (2000) concludes that digital libraries must provide opportunities for "serendipitous interactions" (Toms, 2000, p.3). Browsing physical collections is just one of the possible manifestations of serendipitous interaction offered by information resources. Resource discovery tools can offer other possibilities.

Based on the research examples discussed above (Research on Serendipitous Information Discovery and Interactive Information Retrieval Studies), it is possible to describe resource discovery tools which could foster serendipitous discovery. Such systems would provide many options with maximized access to resources. This access would be balanced with classification and structures that help to build connections yet minimize restrictions to exploration. Opportunities to make connections would be supported by ways to narrow large sets of results, suggestions for additional potential sources, tools for backtracking, and visual representations. Ideally these features would support interactions between the user and the system. In addition, recognizing that informal environments support serendipitous discovery, there would be ways to collaborate and communicate with other users.

TOOLS FOR SERENDIPITY

Comparing Characteristics of Web Scale Discovery Tools

"To discover something is to uncover that which is not in view" (Friedel, 2001, p. 37). Commercial web scale discovery products evolved to solve the problem of how to provide rapid access to large bodies of information across various formats and collections in the simplest way possible. The pragmatic approach has been to preaggreate multiple types of content, to index these collections, and to develop algorithms to determine relevance rankings. Each product differs as to indexing methods, algorithm components, and collection scope, but basically solves the overarching problem in very similar ways.

Given their predetermined structure, how well can these tools support the subjective aspects of searching, including those which foster serendipitous discovery? McBirnie (2008) notes that users describe serendipity as occurring in informal environments, more so than when using highly controlled systems. Yuan and Belkin (2010) point out that standard information retrieval systems emphasize support for specific searching rather than strategies that are more cognitive, affective, and situational. They describe interactive information retrieval as key to supporting the subjective aspects, not just the algorithmic aspects of searching.

A sample of current commercial web scale discovery tools shows that while such tools have yet to achieve the level of interactive information retrieval described by Yuan and Belkin (2010), these tools do have features that can support serendipitous discovery. Table 1 summarizes these features for OCLC WorldCat® Local, Serials Solution Summon™, ExLibris Primo Central™, and EBSCO Discovery Services (EDS)™. The list of tool features that support serendipity is a compilation of features described in reviews of the literature (see Research on Serendipitous Information Discovery and Interactive Information Retrieval Studies in this chapter). The table summarizes those characteristics that encourage accidental discovery. Published literature about each product, vendor web sites, and working examples were used to determine the presence or absence of these characteristics at the time of writing this chapter.

Maximizing Access

The goal of web scale discovery tools is to traverse barriers between information silos. In that

Table 1. Summary of web-scale discovery tool features that support serendipity

Tool Features that Support Serendipity*	OCLC WorldCat Local	Serials Solution Summon	ExLibris Primo Central	EBSCO Discovery Services
Access maximized	+	+	+	+
Metadata included in indexing	-	+	+	+
Browsability	+	+	+	+
Faceted browsing	+	+	+	+
Interactive browsing support	-	+	-	+
Suggests other resources	-	+	+	-
Hypertext links	-	+	+	+
Searches across full text	-	+	+	+
Stores searches for later sessions	+	-	+	+
Supports strategy change (i.e. "bread crumbs trail")	+	-	+	+
Supports changes in search scope	+	+	+	+
Visualization of results (graphic representation)	-	-	-	+
Social networking tools (includes option to share information via social and/or bookmarking sites)	+	-	+	+
Supports user input (i.e. tagging, reviews, suggestions)	+	-	+	-
OCLC WorldCat Local® (Vaughan, 2011; Rowe, 2010; Yang & Wagner, 2010) Website: www.oclc.org/us/en/worldcatlocal/defauly.htm Example: http://www.lib.washington.edu/				
Serials Solution Summon (Vaughan, 2011; Bhatnagar et al., 2010; Rowe, 2010; Yang & Wagner, 2010; Hadro, 2009) Website: www.serialssolutions.com/summon Example: www.library.drexel.edu				
ExLibris Primo Central (Vaughan, 2011; Yang & Wagner, 2010; Breeding, 2007) Website: www.exlibrisgroup.com/category/PrimoCentral Example: http://search.library.northwestern.edu				
EBSCO Discovery Services (Vaughan, 2011; Rower, 2010) Website: www.ebscohost.com/discovery Example: http://www.lib.jmu.edu				
***+ = present, - = absent**				

sense, they maximize access by indexing and providing access to bodies of information across disciplines, locations, formats, and publishers. This information includes resources of all types, such as journal articles, books, book chapters, and open access resources. However, boundaries do exist, and each vendor/library relationship defines the applicable boundaries i.e. which collections are included. Similarly, each tool maximizes information access points, but not necessarily by the same method. WorldCat® Localsearches are built on information collected from MARC record fields. Summon™, Primo Central™, and EDS ™ searches are built on information collected from metadata and full text. Each vendor has different ways of developing and collecting the metadata. Each tool has access limitations, but the options for discovery are maximized in many ways.

Creative Connections: Browsability, Facets, Interactive Browsing

Classification and structure can provide opportunities that foster accidental discovery and encourage creative connections. All four tools support browsing, and include enriched content such as book covers. As noted by Ford, O'Hara, and Whiklo (2009), including such enriched content can approximate the types of cues important to browsing in the physical environment. In addition, all four products support faceted browsing. Summon™ and EDS™ take faceted browsing one step further, allowing users to manipulate choices within the same facet or subject category. Support for interactive browsing is an effective feature for interpreting large data sets.

Creative Connections: Recommendations, Hypertext Links, Full Text Searches, Saved Searches

Other opportunities to make connections include the database recommender function when browsing with Summon, and the hyperlinked suggested searches offered by Primo Central™. WorldCat® Local, Primo Central™, and EDS™ allow searches to be saved between sessions. In Summon™, searches can be exported to be saved elsewhere.

Exploration: Adjusting Scope, Changing Strategy

All four tools support changes in the search scope, providing ways to broaden or narrow a search. WorldCat® Local, Primo Central™, and EDS™ also support changes in search strategy with a "bread crumbs trail" located on the search page. EDS™ includes a "search history" button to help with recursive searching. Such features encourage exploration and flexibility in searching.

Interpreting Large Result Sets: Graphic Representation

EDS™ is the only one of the four tools that has a significant visual component. The EDS™ Visual Search presents search results in blocks or columns. Results can be grouped according to subject or publication name, sorted by date or relevance, or filtered by date. The block view supports interactive search mapping. Although this feature is readily available, it is up to the library system administrator to decide if it is activated, and whether the block or column view is presented. Large result sets can facilitate serendipitous discovery, and tools that graphically represent results can be helpful to interpretation.

Social Networking Tools and User Input

Informal information sharing environments support serendipitous discovery. All four of these tools include some means of collaborating and communicating. WorldCat® Local and Primo Central™ provide for user contributions such as tagging or reviews. WorldCat®, Primo Central™, and EDS™ users can share information via social and/or bookmarking sites. Summon™ is the most limited; Summon™ allows users to e-mail items but it is not integrated with social networking sites.

Features Summary

The primary mission of commercial web scale discovery tools is to reduce the number of less relevant results retrieved, while maximizing the number of most relevant results, according to proprietary algorithms to ensure precision. However, there are other design aspects that are more critical to supporting serendipity. Large result sets can stimulate accidental information discovery. More emphasis on designing features to help users interpret large result sets, such as interactive browsing support and graphic representation of results, would better support serendipity. In addi-

tion, resource discovery tools can become more serendipity-friendly by building social networking tools into their products and including opportunities for informal information sharing. By being aware of the importance of serendipity and its link to certain features, web scale tool designers can consider a holistic approach, one that values precision but recognizes that the creative process often requires something less precise.

Solutions and Recommendations

Based on the features of WorldCat® Local, Summon™, Primo Central™, and EDS™, web scale discovery tools have potential to encourage serendipitous discovery. There are options to support recursive searches, creative browsing, and communication and collaboration. When features such as the EDS™ Visual Search are made available, discovery tools are even better suited for serendipity.

Designing appropriate tool features helps to support the process part of serendipity. Librarians and other educators have a role in supporting the perception part of serendipity. Although web scale discovery tools possess features that can encourage serendipitous discovery, the implied message of the single search box is that the research process consists of defining one magic query. For students beginning their academic career, a discovery tool search box may resemble a short answer test rather than a gateway to creative exploration.

Kennedy, Cole, and Carter (1999) emphasize the need for researchers to take the time to review large sets of results. Anderson (2010) describes the importance of being in a state of ambiguity in order to be creative. Teaching students to be aware of serendipity as part of the research process (Nutefall & Ryder, 2010; McBirnie, 2008) demonstrates the reality of research: it is time-consuming, recursive, and a personal experience.

FUTURE RESEARCH DIRECTIONS

Web scale discovery tools offer many opportunities for learning more about serendipity and information discovery. Some authors have asked whether serendipity can be encouraged (Liestman, 1992), and proposed that information "encountering" be evaluated in different information retrieval environments (Erdelez, 1999; p.1). Pursuing these questions in the context of current tools would help to guide future design, especially in relation to interactive information retrieval. For example, asking "super-encounterers" (Erdelez, 1999) to describe their serendipitous discoveries while using different web-scale discovery tools would demonstrate how existing features support serendipity, and offer guidance for improving. More recently, McCay-Peet and Toms (2011) identify core elements that support serendipity in digital environments. Asking users to evaluate web scale discovery tools according to these elements would help quantify whether certain tools are more serendipity-friendly.

Opportunities also exist in examining the role and impact of research instruction on accidental discovery in the web scale discovery environment. In addition, documenting how researchers at different stages of their "learning life" (Bent, Gannon-Leary, Webb, 2007) view and take advantage of serendipitous discovery could inform research instruction methods and discovery tools design.

CONCLUSION

WorldCat® Local, Summon™, Primo Central™, and EDS™ Web-scale tools facilitate access across boundaries and provide many access points. By doing so, these web scale discovery tools provide many options for serendipitous discovery. In addition, each tool includes specific features, such as faceted browsing and user supplied tags that can encourage serendipity. Future designs could better serve serendipity by providing ways to interpret

large sets of results, such as features that help to visualize connections. Additionally, incorporating more interactive features would support the subjective aspects of determining relevance, a key component of serendipity.

Tool design is just part of creating a search environment favorable to serendipity. Educators need to articulate and demonstrate that research is a process, not a query. Describing serendipity as a valid and important part of research depicts research more realistically, as a dynamic process. If researchers approach information seeking as an issue of rapid problem resolution, rather than one of exploration, then system characteristics that support serendipity will fall short of their potential to inspire creative discovery.

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KEY TERMS AND DEFINITIONS

Browsability: Browsing is the art of looking for needed information when one has not yet completely characterized the information needed. Browsability describes an information resource with regards to the ease of browsing. For example, a browsable resource provides enough clues to determine whether an information item may satisfy the need.

Discovery Systems: As used in this chapter, a discovery system describes a tool designed to search across large and diverse collections via a default option of a single search box.

Faceted Browsing: Faceted browsing describes a discovery system feature which groups results according to categories (i.e. subject, author, format, publishing date).

Information Encountering: Information encountering describes an occurrence of unplanned information acquisition.

Interactive Information Retrieval: Interactive information retrieval describes a dynamic system that can modify retrieval in response to the actions of the user and/or user input.

Relevance/Cognitive Relevance: Relevance describes how well an information item matches an information need. Cognitive relevance describes the personal, subjective aspect of determining relevance. As an individual gains new knowledge, information may be determined to be more or less relevant depending on the modified cognitive state.

Serendipitous Information Retrieval: Serendipitous information retrieval describes the accidental retrieval of needed information. The accident aspect may be due to a number of factors, including: finding information in an unexpected location, discovering information that was unknown to exist, developing a spontaneous information need in response to novel information.

Topic Map: A topic map is a way to graphically depict key concepts and their relationships to one another.

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