
6 Browsing: A Multidimensional Framework

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INTRODUCTION

The ultimate goal of information systems and services has been to serve human needs for information and to facilitate the processes of information seeking, retrieval, and use. To this end, much recent research has addressed the concern for better understanding of human information behavior from the user's point of view (DERVIN & NILAN; HEWINS; KUHLTHAU).

A commonly observed form of human information behavior is browsing. According to *Webster's Third New International Dictionary* (MERRIAM-WEBSTER, INCORPORATED, p. 285), to browse is:

1. To look over casually (as a book): SKIM / he lazily browsed the headlines;
2. To skim through a book reading at random passages that catch the eye;
3. To look over books (as in a store or library) especially in order to decide what one wants to buy, borrow, or read;
4. To casually inspect goods offered for sale usually without prior or serious intention of buying;

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5. To make an examination without real knowledge or purpose;
6. Browsing room: a room or section in a library designed to allow patrons an opportunity to freely examine and browse in a collection of books.

Although browsing has been observed and investigated in the general context of information seeking in the library (AYRIS; HYMAN, 1972) and has increasingly assumed an important and integral part in human and machine interaction (ODDY & BALAKRISHNAN; THOMPSON & CROFT), the concept and nature of browsing have not been systematically studied and thus are not well understood.

In an attempt to make explicit and synthesize different concepts of browsing, this chapter first notes several outstanding problems concerning browsing. Then it summarizes various notions of browsing and relevant research from six disciplines, which are then integrated into a multidimensional concept of browsing. The tentative model suggests that several contextual factors affect other influences on browsing, the process of browsing, and the consequences of browsing. Further, aspects of the resource and of the browser's motivation and cognition all can influence the process of browsing. The browsing process itself can be characterized by behavioral, motivational, and cognitive dimensions. Browsing can have various consequences. Finally, both processes and consequences can affect subsequent contexts, influences, and processes, establishing the iterative nature of browsing.

With respect to the style of this chapter, in many cases we provide only a few of all the examples associated with a particular author's points or suggestions (i.e., we might list only two or four of the six categories described by the author). Further, the several authors listed after a general statement are typically useful sources for discussions on the topic, whether as advocates or critics of the general claim.

PROBLEMS AND ISSUES IN BROWSING

Browsing is common but not well understood. We all browse in various contexts to make sense of the world around us, such as when we read newspapers, scan television channels, go window shopping, or seek information in libraries. Various forms of browsing are considered in a wide variety of literatures, although they often focus on a specific resource or context. However, there is little systematic, multidisciplinary, conceptually explicit study of the concept and nature of browsing.

Browsing and searching are often treated as discrete activities, one purposeful and the other casual or "random." However, HERNER states that "much of what we call 'searching' is, upon dissection, prima-

rily browsing" (p. 414), and BATES (1989) argues that browsing is integrated into many forms of searching. Yet we do not have a good vocabulary to describe and discuss various forms or degrees of browsing. Indeed, when authors do attempt to compare browsing and searching, they tend to distinguish browsing in four general ways: (1) as integrated with but not identical to searching (BATES, 1989); (2) as equivalent to searching (see the section on end-user information retrieval); (3) as a subset of searching but distinct from "nonbrowsing" (BATLEY); and (4) as the extremes of multiple overlapping and continuous dimensions of information behavior (CHANG).

Historically, library and information science as well as information systems literatures exhibit biases toward specific, direct searching as opposed to exploratory, iterative browsing (for critiques of this bias, see AYRIS, BATES (1986a; 1989), HILDRETH (1989), HYMAN (1972), and TUORI). This bias is partly due to some unrealistic assumptions about users and the nature of information seeking—e.g., that users have unbounded rationality, have static and well-defined information needs, know what they want, and are output oriented (KATZER; ROBERTS). However, users are often in an anomalous state of knowledge as they initiate a search (BELKIN ET AL., 1982), do not have predefined search criteria, and may alter their interests during a search (BATES, 1989; HILDRETH, 1982).

Computer technologies, multimedia databases, and the growth of end-user searching raise new challenges for understanding and supporting browsing. It is well recognized that a system-oriented approach and the "exact-match" principle in information retrieval are problematic (BATES, 1986a; 1990). Many end-user systems are difficult to use because they require training, knowledge of mechanical and conceptual aspects of searching, and a high cognitive load from end users (BORGMAN, 1986; MARCHIONINI); all of these may be somewhat overcome through browsing (BORGMAN ET AL., 1993; TUORI). BATLEY argues that some types of information, such as pictures, are apt to be browsed because the wide interpretability of their meaning makes searching by specification more difficult. New interactive systems will need to support various search strategies, including browsing (e.g., BATES, 1990; ELLIS). As such, new criteria may be needed to account for a system's "browsability," an emerging issue in system evaluation (THOMPSON & CROFT).

All the above issues call for a multidisciplinary approach for a better understanding of the concept of browsing, the contexts in which browsing occurs, influences on browsing, the functions that browsing serves, and the consequences of browsing.

It is our belief that an understanding of general human processes, such as browsing, requires insights and perspectives from a variety of

disciplines. Limiting the study of browsing to just those concepts, literature, and results from library and information science research, for example, will reinforce the limited and ambiguous focus on browsing noted above. On the one hand, issues or concepts that reappear across disciplines encourage confidence that these are relevant for understanding browsing; on the other, unique or contradictory results may cause us to reevaluate and challenge our own disciplinary presumptions. For that reason, we consider how six different disciplines treat browsing (or related concepts): (1) library and information science, (2) end-user information retrieval and system design, (3) consumer behavior, (4) mass media audiences, (5) organizational communication, and (6) wayfinding and environmental design. Other disciplinary approaches, such as cognitive psychology, acoustics, or graphic design may also provide useful insights and relevant questions.

DISCIPLINARY APPROACHES

The next sections summarize how the literatures of six disciplines relate to three generic research questions about browsing: (1) what browsing is; (2) what the factors are that influence the extent to which people engage in browsing; and (3) what the consequences of browsing are (for a more comprehensive review, see CHANG).

Library and Information Science

While linguistic origins of the word "browse" stem from French or Middle-High German, and refer to animals' nibbling on grass or shoots, one of the earliest references to browsing in relation to reading appeared in the 1823 *Oxford English Dictionary* (see HYMAN, 1972). The notion of browsing in the library community was involved in the discussion of collection-management policy (closed vs. open stacks) in the 1930s, referred to as "a patron's random examination of library materials as arranged for use" (HYMAN, 1972, p. 11).

Browsing as a specific subject for research in the library literature was emphasized in Project Intrex in the mid-1960s, when experiments on browsing were suggested to find out how a university library system might support browsing to foster unplanned discovery through planned facilities (OVERHAGE & HARMAN). Since then, browsing has been related to direct access to shelves in the library (HYMAN, 1972), collection and space management (BOLL; LAWRENCE & OJA), serendipitous findings or creativity (BANKAPUR; BAWDEN; CELORIA; DAVIES; O'CONNOR, 1988; SWANSON, 1987, 1989), search strategies (BATES, 1981, 1989; ELLIS), and exposure by researchers to identify and monitor information resources (BAWDEN; ELLIS; LARSEN;

MENZEL; O'CONNOR, 1993). It has also been related to improving the organization and provision of information via shelf classification (BAKER, 1988), display arrangement (BAKER, 1986a; 1986b), and online public access catalogs (OPACs) (AKERROYD; HANCOCK-BEAULIEU; HILDRETH, 1982).

Two major prior reviews on browsing in libraries (primarily shelf browsing) are by HYMAN (1972) and AYRIS. According to Ayris, the literature before 1972 shows great uncertainty concerning all aspects of browsing, including its definition, importance, practice, and intellectual value. Ayris's review indicates that research has progressed from 1972 to 1985 in recognizing the importance of browsing in both academic and public libraries, although the literature is still often divided on these issues, a division that stems from an inconsistency in the conceptions of browsing.

What is browsing? Browsing has been defined in many ways (APTED; BANKAPUR; BUCKLAND; HERNER; LARSEN; O'CONNOR, 1988; OVERHAGE & HARMAN, p. 119). Many descriptions portray it as an activity that is not task oriented. Terms such as "informal," "unsystematic," "unprogrammed," "casual," and "without design" refer to the unplanned nature of browsing and the lack of a specific plan of action for conducting an information search or reaching a goal, if, indeed, one is present. Elsewhere, however, the terms "formal" and "systematic" in the library literature imply a planned, task-oriented course or a form of subject access (often involving bibliographic tools) for a search (ELLIS; HILDRETH, 1982; O'CONNOR, 1988; OVERHAGE & HARMAN, p. 119). Browsing can thus be both goal directed and nongol directed and "unplanned" rather than simply aimless.

Browsing has been loosely described as a kind of searching, in which the initial search criteria or goals are only partly defined or known in advance. Three degrees of goal orientation in browsing have been suggested (COVE & WALSH, 1987; see also APTED, HERNER, HILDRETH (1982), and LEVINE for similar categories): (1) search browsing (directed browsing, or specific, goal-oriented browsing): a closely directed and structured activity in which the desired goal is known; (2) general-purpose browsing (semidirected, predictive browsing, or purposive browsing): an activity of consulting specified sources regularly because they probably contain items of interest; and (3) serendipity browsing (undirected, not goal-oriented browsing): a purely random, unstructured, and undirected activity. One can move from one type of browsing to another in a single information-seeking episode (BELKIN ET AL., 1993), or one can engage in multiple types of browsing at the same time. These categories are mainly content oriented, "directed" in terms of knowing what to look for. However, it is conceivable that one knows what to look for but does not know how to look for it. Browsing in this situation may appear to be undirected but is not.

Thus, the searcher's knowledge of paths leading to the item can also be an important factor in distinguishing one type of browsing from another (MICHEL). Considering browsing as moving from where to what as opposed to moving from what to where as in searching, ZOELLICK describes four different browsing methods with this distinction in mind: (1) sequential browsing (moving to the next or previous document in a collection), (2) structural browsing (moving between parts of a document according to the structure of that document, such as by book chapter), (3) keyed-access browsing (using some type of access key to move between documents, such as a keyword index), and (4) linked browsing (following explicit links within or between documents, such as citation trails).

BATES (1989) argues that browsing and searching, although separate activities, occur in an integrated fashion. She describes six widely used search strategies that are associated with browsing: (1) journal run, (2) area scanning, (3) subject searches in bibliographies and abstracting and indexing, (4) author searching, (5) citation searching, and (6) footnote chasing. Both of these discussions, however, imply that browsing may involve either the content and/or the search path of the information resource and that particular conceptualizations of browsing are not yet explicit or dominant enough to guide general research.

Based on the assumption that browsing may be specific to a medium, types of browsing have also been grouped according to resource type—e.g., shelf browsing, catalog browsing, vocabulary browsing, full-text browsing, and computer browsing (AYRIS; OVERHAGE & HARMAN). However, it may not be the medium *per se* but the context's display and structure (or, more generally, the interface) that affects the type of browsing done (RICE).

O'Connor (1993) proposes that various strategies for browsing can each be identified with one of the sorts of internal representations of an anomalous state of knowledge that a scholar might bring to a collection. He describes four sorts of browsing activity: (1) expansion, (2) vague awareness, (3) monitoring the information environment, and (4) creativity; he discusses these in terms of the point in the collection at which browsing starts, sampling size, which attributes of the document are considered, which attributes of the scholar are engaged, and the sort of comparison made between the document attributes and the scholar attributes.

Although methodologies and definitions used may vary, empirical studies show that browsing occurs frequently in academic libraries (GREENE), that one-third of the books obtained from the shelves are not specifically sought, and that browsers do not see themselves as having a well-articulated need for the material (LAWRENCE & OJA).

Browsing is an important way of selecting fiction and nonfiction books by public library patrons in several studies (AYRIS), and only about one-fifth of shelf browsing progresses in a linear forward fashion (HANCOCK-BEAULIEU). Further, browsing may serve three functions: (1) identification, (2) familiarization, and (3) differentiation (ELLIS).

Four prominent dimensions of browsing seem to emerge from this literature: (1) scanning, (2) intention, (3) goal, and (4) knowledge. Browsing involves scanning, which has been variously described as looking, examining, or sampling, during which the person's body or eyes move smoothly at will (MORSE, 1973; O'CONNOR, 1993). Although BATES (1989) contends that browsing is usually associated with a sense of random visual movement, it could be either directed or undirected according to the different forms of browsing; thus, while movement is an essential characteristic of browsing, randomness is not. In seeking information, browsing acquires the meaning of a purposeful act characterized by the presence of an intention, regardless of how vague it is, which suggests that browsing cannot be adequately described by behavioral characteristics alone. Browsing varies according to the specificity of search criteria or goal, if any, imposed on the object sought: specific, ill defined, and undefined. The browser's prior knowledge about and experience with the resource (concerning both search paths and content) are important aspects of browsing.

What influences browsing? MARCHIONINI and others suggest four factors that influence different types of browsing techniques. The first factor concerns the object sought, which may be well or ill defined. Further, objects may be distinguished as the item itself (such as a material good or a book) or representations (surrogates, such as indexes). Note, however, that browsing does not have to be visual (consider aural browsing of radio channels) (LEVINE). By implication, electronic representations should probably include multimedia information to compensate for the decreased accessibility of representations compared with objects (O'CONNOR, 1985). The second factor relates to individual searcher characteristics. These include experience and knowledge about objects sought, motivation, purpose, learning patterns, and cognitive style (ALLINSON & HAMMOND; BORGMAN, 1989; BORGMAN ET AL., 1991). The third factor is the purpose of the search, which may include pleasure, fact retrieval, concept formation, interpretation, evaluation of ideas, and keeping abreast of developments in a field (MARCHIONINI). The final factor is the context for conducting the search. Some contextual factors that can influence the extent and type of browsing include collection size, subject divisions, subject discipline, work activity, type of medium, nature of text, display, interfiling of different media or size, vocabulary control and organizational scheme (cataloging, classification and subject arrangement) (AYRIS).

What are the consequences of browsing? Past debates on the value of browsing in the library community often centered around judgments about the "intellectual purposefulness" or educational value of such a "random" activity (HYMAN, 1972). Potential consequences of browsing include serendipity (an accidental fortuitous discovery) (AYRIS; BAWDEN; ELLIS), modification of information requirements (HILDRETH, 1982; LANCASTER, 1968; MARCHIONINI ET AL.; ODDY), valuable learning experiences (HYMAN, 1971; 1972), and unreliable or inefficient use of resources (BOLL; GREENE).

Although there are controversies on the value of browsing, some library researchers in the past decade argue strongly that browsing is an important part of information seeking, which is exploratory and is better characterized as an incremental process, and browsing may be one way to cope with the constraints of formal bibliographic systems (BATES, 1986a, 1989; ELLIS; HILDRETH, 1982, 1989; LARSEN; O'CONNOR, 1988, 1993; SWANSON, 1987, 1989). On the other hand, although earlier literature expressed serious doubts about the feasibility of browsing in computer systems, partly due to hardware and software constraints, research on browsing has focused on and contributed to improving the "browsability" of OPACs, a point discussed below.

End-User Information Retrieval and System Design

In the information retrieval (IR) community, the notion of browsing originated as a task-oriented, problem-solving technique to cope with IR problems arising from the traditional query-based, command-driven computer interface. Browsing has been proposed as an alternative approach to IR that does not use Boolean operations or require specific search queries (ODDY; THOMPSON & CROFT). For instance, a distinction has been made between the analytic search and the browse search (LIEBSCHER & MARCHIONINI), between preplanned (e.g., consulting thesauri before search) or systematically iterated queries involving Boolean operators, and "an exploratory, information seeking strategy that depends on serendipity" (MARCHIONINI & SHNEIDERMAN, p. 71).

Browsing has become an important heuristic search strategy to be used in situations such as when the user does not look for anything specific or is unable to specify initial search requirements or is unfamiliar with the terminology of a domain of interest, or when he or she wishes to discover the general information content of the database (CUTTING ET AL.; PEJTERSEN; THOMPSON & CROFT). As a response to the difficulty in query formulation and terminological issues, earlier browsing capabilities in IR systems, especially the OPAC systems, generally fall into two categories (HILDRETH, 1982). One cat-

egory is related to term selection (e.g., displaying a list of thesaurus or index terms for exploration) or vocabulary browsing (MARKEY & AHTERTON; WALKER); the other is related to result manipulation and display (e.g., showing a set of references or documents according to the user's specifications). In this human-computer interaction context, the concept of browsing is closely related to subject searching and relevance judgment. Some techniques have been proposed to facilitate browsing, including improving display structure of subject headings and classification schemes (DRABENSTOTT ET AL.; HUESTIS; MARKEY) and facilitating relevance judgment of the results via various feedback processes and clustering techniques (CUTTING ET AL.; ODDY; THOMPSON & CROFT).

Studies of browsing in computer-based systems have centered on identification of search techniques used in IR and hypertext systems (AKEROYD; BATES, 1986a, 1990; BELKIN ET AL., 1993; CANTER ET AL.; CARMEL ET AL.; ZOELLICK), disorientation in electronic environments (FOSS; MCALEESE; SODERSTON), and issues of information overload in electronic messaging systems (HILTZ & TUROFF; MALONE ET AL.). Differences between the use of printed materials and their electronic counterparts have been investigated to increase the "browsability" of a system and to devise better techniques for representing and organizing information (EGAN ET AL., 1991; MARCHIONINI & LIEBSCHER). The ultimate goal of this line of research is to facilitate effective, successful communication and information retrieval by supporting various search strategies and task requirements.

What is browsing? In the end-user IR systems literature, browsing typically means scanning a resource, and it is characterized by the presence of a goal but no well-planned search strategy, with ill-defined search criteria at the beginning of the interaction with the resource, which depend somewhat on the user's knowledge of the content and search path of the resource (ALLINSON & HAMMOND; BELKIN ET AL., 1993; COVE & WALSH, 1988; GECSEI & MARTIN; TUORI). Contents can be representations (e.g., catalogs), real objects (books, neckties), or multimedia objects.

Browsing has been associated with visual recognition and spatial reasoning as opposed to linguistic specification and logical reasoning (HULLEY; ODDY & BALAKRISHNAN; TUORI). It is an interactive, exploratory process that has a strong learning component (CARMEL ET AL.; SHNEIDERMAN ET AL.). GECSEI & MARTIN suggest that when people browse, they learn the structure and content of a database. COVE & WALSH (1988) contend that browsing is the art of not knowing what one wants until one finds it, implying that recognition is an important aspect of browsing. Similarly, in an attack on the traditional output-oriented IR paradigm, HILDRETH (1989) calls for an emphasis on a process-oriented paradigm that manifests such a learning effect.

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frames) was used mostly for browsing and studying somewhat familiar material; (3) hypertext links were used mostly for studying familiar material; and (4) the index (directed access to keyword-coded frames or tours) was used mostly for information searching and for seeking references. Thus, system features, users' knowledge about the resource material, and tasks and purposes all influence the way people browse (CANTER ET AL.).

Feedback during browsing is an important feature in human-computer interaction (MARCHIONINI; THOMPSON & CROFT). Of course, feedback is crucial in information systems because the resource object is not otherwise available for assessment. In comparison with traditional IR feedback for query refinement, THOMPSON & CROFT emphasize that browsing as a feedback process is incremental and under the user's control in that the user examines only one item at a time and it is the user who determines which items will be examined, not the system. Further, the types or levels of feedback can vary significantly, according to both displays of organizational schemes (e.g., overviews of semantic structure, links among subject terms) or representations of content (e.g., lists of references, MARC (machine-readable cataloging) records, citations with abstracts, full text).

What influences browsing? MARCHIONINI & SHNEIDERMAN propose five general factors that influence success in seeking information: (1) setting, (2) search system, (3) task domain, (4) user, and (5) outcomes. The setting here includes physical environments as well as the user's contextual environment such as access cost. MARCHIONINI suggests three primary reasons why people browse in end-user systems: (1) the system's structure, commands, and capabilities encourage browsing; (2) the browser cannot or has not defined the search objective; and (3) it takes less cognitive load to browse than it does to plan and conduct an analytical search. A few studies that compare subject-area experts and novice users of hypertext systems show that there are differences between their browsing strategies, indicating that a user's knowledge expertise influences browsing tactics (CARMEL ET AL.; MARCHIONINI ET AL.). Arguing that browsing is the most important form of searching for casual use, TUORI suggests that a system is more browsable if it does not create great demand on users with respect to intention (the degree to which the person begins with a well-defined goal or intention), structure (the real or apparent structure or search paths of the information space), language (the characteristics of the language by which a person communicates with a system), or modality of interaction (various forms of expression or channels of communication).

There are, of course, problems associated with browsing in traditional computerized systems: the systems require precise definitions or terms (thus reducing serendipity), and computer interactions often

With the development and applications of hypertext technology, browsing capabilities have been recognized as one of the central features of hypertext systems, which allow nonlinear organization of text (increasingly also multimedia files) through machine-supported links within and between documents in the database (CONKLIN). Conklin describes how a hypertext database can be explored by following links and opening windows successively to examine their contents, by searching the network (or part of it) for some string, keyword, or attribute value, and by navigating around the hyperdocument using a browser that displays the network graphically (CONKLIN & BEGEMAN). Note that no distinction is made between browsing and searching strategies in this context because browsing is usually the only way to find information in hypertext systems (THOMPSON & CROFT).

Two approaches to classifying browsing can be identified in the hypertext literature: (1) path- vs. content-based browsing; (2) facility- or function-based browsing.

CANTER ET AL. derive a taxonomy of browsing strategies based on the path and/or content focus used by hypermedia users. These strategies include: (1) scanning (covering a large area superficially), (2) browsing (following a path until a goal is achieved), (3) searching (striving to find an explicit goal), (4) exploring (determining the extent of the information given), and (5) wandering (purposeless and unstructured globetrotting). "Exploring," for example, is high in content focus but low in path focus.

In a different approach, CARMEL ET AL. identify a three-level browsing typology; the associated functions of each level are based on the characteristics of users' cognitive processes in performing both closed and open tasks in a hypertext system. The three levels are: (1) search-oriented browse, (2) review-browse, and (3) scan-browse. The first two categories correspond to Canter et al.'s searching and browsing, while the last category refers to exploring and scanning. However, Carmel et al. found that most users adopted review-browse, which is characterized by "scanning and reviewing interesting information in presence of transient browse goals that represent changing tasks," with an emphasis on the evaluation and integration components in such a browsing process (p. 865).

The notion of browsing in the sense of recognition-based, direct exposure to information resources has led to a concern with designing effective browsing capabilities. In a study of a hypertext-learning support system, ALLINSON & HAMMOND found that four major navigation tools were used differently for various types of users' tasks: (1) the tour (users select and then are guided around a sequence of frames until the tour ends or is stopped) was mostly used for studying unfamiliar material; (2) the map (to see where a user is in relation to other display

provide insufficient dialog, which reduces feedback and negotiation (AYRIS). Thus, several authors have suggested a wide-ranging list of new features and structures to facilitate online browsing—e.g., the availability of various types of information, interactive tables of contents, and displays of semantic networks (BATES, 1986b, 1989, 1990; BELKIN ET AL., 1993; ELLIS; HILDRETH, 1989; HUESTIS; LOSEE; MASSICOTTE). Some systems have been devised or suggested to remedy some of these problems and use some of these features (AGOSTI ET AL.; EGAN ET AL., 1989, 1991; ODDY & BALAKRISHNAN; STORY ET AL.; THOMPSON & CROFT).

Implications for browsing may vary across different kinds of systems, such as full-text systems, bibliographic information retrieval systems, and visual/graphics-based systems. Several studies that compare information-seeking behavior associated with printed and electronic versions of materials have implications for browsing. Users' experience with printed materials affects their initial information-seeking strategies when they use electronic versions (EGAN ET AL., 1989; JOSEPH ET AL.; MARCHIONINI & LIEBSCHER). Electronic newsreading has been difficult for "noninstrumental" or nontask-oriented viewers, given hierarchical menu-based database structures and the fact that browsing can be habitual for people using specific media or resources (DOZIER & RICE; ZERBINOS). Finally, users expect to be able to conduct such browsing activities as flipping pages, referencing back and forth, and scanning an entire table in a single display, activities not well supported by current online interfaces or systems (JOSEPH ET AL.).

AKERDYD analyzed three commercial OPAC system interfaces and indicates four reasons why people engage in browsing at OPACs: (1) to correct input errors (e.g., browsing backward to the correct position); (2) to establish the scope of the terminology (e.g., browsing in subject indexes); (3) to expand the scope of retrieved documents (e.g., browsing a hierarchical classified list); and (4) to specify a subset of a retrieved set in a Boolean set. He argues that in text-based bibliographic systems users cannot easily assess the overall size of the file because there are no physical indicators such as there are in a card catalog, for example.

Image- or graphics-based systems provide recognition-based strategies, reducing cognitive load and memory tasks (MARCHIONINI & LIEBSCHER). Pejtersen's Book House is an example that simulates browsing fiction shelves in a public library setting via an icon-based interface (PEJTERSEN). The visual system of BORGMAN ET AL. (1993) models a specific library's physical layout on the screen (including visual displays of book shelves, floor maps, and walking paths) to help children locate science books; interaction with the system is possible only via a mouse. Compared with a previously evaluated Boolean-based system, this browsing, direct-manipulation interface for children

was superior; it was more usable and more favored across the population and less sensitive to a child's computer experience. For the commercial Prodigy graphical videotex system (which models a shopping mall environment) ANTONOFF reports that the small text window and speed problems are major obstacles to browsing.

What are the consequences of browsing? Two positive results of browsing are finding what one wants and/or accidental learning (e.g., of the contents or search path) (e.g., EGAN ET AL., 1989).

One drawback is disorientation, which arises from unfamiliarity with the structure and conceptual organization of the document network due to the cognitive demands placed on the user (FOSS) or elements of the interface design, such as the lack of contextual cues (SODERSTON). Some ways to avoid these problems have been proposed (e.g., provide a history tree to keep track of the user's movement through the system, or offer a layout display of the document network) (AGOSTI ET AL.; FOSS; LELU; MCALEESE; THOMPSON & CROFT).

Browsing can also result in information overload. FOSS suggests that overload stems from inexperience with learning by browsing, which leads to difficulties in remembering, consolidating, and understanding the semantic content. Others argue that information overload may arise from the mode and amount of information presented (HILTZ & TUROFF; MALONE ET AL.) or the complexity or relevance of the information (ISELIN; LOSEE). Various techniques to deal with this problem have been suggested, such as categorization and ranking of the electronic messages (LOSEE) or a "summary box" for the user's annotations during hypertext browsing (FOSS).

Concerned with computer-mediated communication systems in which browsing as a screening strategy is often the only means to identify relevant information from a huge amount of messages, MALONE ET AL. propose three approaches to filtering messages to reduce information overload as commonly experienced by users: (1) cognitive filtering (characterizing the contents of a message and the information needs of potential message recipients), (2) social filtering (supporting the personal and organizational interrelationships of individuals in a community), and (3) economic filtering (cost-benefit assessments or explicit/implicit pricing mechanisms). Along with HILTZ & TUROFF, these authors argue that users should be able to control these retrieval and filtering capabilities directly because negative consequences are essentially social issues that should not be programmed away and opportunities for serendipity and exposure to diverse sources should be maintained.

Browsing in computer systems is characterized by searching without specifying; it is a recognition-based search strategy. The concept of browsing has led to research on various display mechanisms to facili-

tate interactive exploration. The analysis of information-seeking behavior by using computer search logs with users' oral protocols has been fruitful for understanding the cognitive aspects of browsing (CARMEL ET AL.).

Consumer Behavior

Browsing is a recent concept in the marketing literature and has been investigated as a distinct consumer shopping behavior that is related to but not equated with buying behavior.

What is browsing? BLOCH & RICHINS define browsing as "the in-store examination of a retailer's merchandise for informational and/or recreational purposes without an immediate intent to buy" (p. 389). Consumer browsing may be pleasurable in itself and can be done for various reasons. Because there is no "immediate intent to buy," browsing may be largely indeterminate and undirected (BLOCH & RICHINS; SALOMON & KOPPELMAN). Note that here browsing is considered purposeful but not necessarily goal directed or task oriented. Differences between browsing real objects (e.g., clothes) and representations (e.g., pictures and descriptions of clothes in mail-order catalogs) have been noted; real objects have more attributes than do representations (BUCKLEY & LONG; GROVER & SABHERWAL).

What influences browsing? Browsing is positively associated with one's interest in the product, the propensity to engage in other forms of search behavior relating to the product, the knowledge of the product, and word-of-mouth activity (BLOCH & RICHINS). JEON reports that in-store browsing is directly influenced by the preshopping mood and affects both the psychological situation and consequent impulse buying which, in turn, influences post-shopping mood. Consumers browse primarily for information and/or recreation, but the receipt of such benefits is affected by the retail environment and by product involvement (BLOCH ET AL.).

Consumer research into browsing has direct implications for information system design, based on studies of new technologies, such as videotex marketing systems and home-shopping channels. For example, SHIM & MAHONEY find that most teleshoppers are motivated primarily by recreational interests and, counterintuitively, that teleshoppers are less concerned with convenience and time than are nontele shoppers. BUCKLEY & LONG identify three variables that seem to have contributed to the failure of the Viewtron nationwide videotex system: (1) system variables (e.g., the jargon used or the extent of the description of goods); (2) knowledge variables (knowledge of brand names or knowledge of natural language and computer systems); and (3) goods variables (delivery delay or range of goods).

Methodologically, eye movement can be a useful indicator of browsing or scanning and has been used to test the effect of different print ads, catalogs, page layout, direct-mail material, packaging, and shelf-display design on browsers' attention (DRUCKER; VON KEITZ). HOWARD demonstrates how eye-movement research techniques could be usefully applied to IR studies of searchers' judgment of the relevance of retrieved citations.

What are the consequences of browsing? Possible results of in-store browsing include enjoyment, product knowledge, information gathering, opinion leadership, and impulse buying (BLOCH ET AL.; JEON).

The consumer literature emphasizes that browsing can be an "ongoing" information-acquisition activity apart from searching or a purchase plan (SALOMON & KOPPELMAN). As shown in the information science literature, the influence of subject expertise (in this case, product knowledge) on browsing is evident. Consistent with some of the other disciplines, five dimensions of browsing are implied by this literature: (1) behavior (examination or looking around), (2) cognition (without intent), (3) motivation (for fun, recreation, or to get information), (4) resource (merchandise), and (5) context (in-store, shopping mall, mail order). Unlike other fields, attempts have been made here to quantify browsing: consumers can be identified as browsers and nonbrowsers (BLOCH & RICHINS; JEON).

Mass Media Audiences

The notion of browsing is implicit in the media audience behavior known as television "zapping."

What is browsing? With so many television channels to choose from, thanks to cable and satellite TV, the use of a remote control to scan multiple programs (now called "zapping" or "grazing") is becoming more frequent (DORR & KUNKEL; HEETER & GREENBERG). Such interaction with television may indicate "a complex consciousness that derives satisfaction by sampling information in small, seemingly random chunks" (ARRINGTON). Zapping is thus a scanning process and involves both resource search paths (TV channels and schedules) and content (programs and commercials). HEETER & GREENBERG conclude that zapping is not an idiosyncratic behavior aimed solely to avoid TV commercials but one of several systematic approaches to watching television, used as an accompaniment to other activities in the household. Similarly, PERSE argues that zapping is a ritualistic pattern that is characterized by the viewer's high selectivity before and during television exposure and lesser involvement during exposure.

What influences browsing? HEETER & GREENBERG showed that zappers can be differentiated from nonzappers; they are more likely to

have more remote-control channel selectors, do less planning of their TV viewing, watch programs that they do not watch regularly, change channels between and during shows and at commercials, be familiar with more different channels, and do more reevaluation during program viewing. Reasons for channel switching include: to see what else is on, to avoid commercials, to seek variety, to view multiple shows, and simple boredom.

Four theoretical approaches have been used in studying mass media audiences: (1) psychological, (2) social/structural, (3) cultural, and (4) phenomenological (MCGUIRE). From a psychological perspective, cognitive and affective motives are two underlying dimensions of all human motives, including reasons for browsing. The social/structural perspective emphasizes the impact of sociotechnical systems on human behavior (i.e., browsing can be influenced by system factors, including physical and social systems as well as computer systems). The phenomenological perspective focuses on the projected human action (i.e., considers browsing as a rational goal-oriented activity or utility-seeking behavior). Finally, the cultural perspective suggests that browsing can be a form of aesthetic satisfaction, which differs from fulfilling a utilitarian need. Indeed, the play theory of STEPHENSON suggests that much media use is best understood as primarily a pleasurable activity. He proposes that when people are doing things for entertainment, they tend to be less goal oriented and may develop ritualistic and habitual communication behaviors. Thus, as with TV use (both attending to a preselected program as well as zapping through channel offerings), browsing in other resources may be primarily a pleasurable, even ritualistic, process. Conceivably, some browsing activities may involve a combination of all these theoretical perspectives.

Organizational Communication

In the literature of organizational theory and communication, two phenomena may be considered browsing: (1) environmental scanning, and (2) informal communication or social browsing.

What is browsing? The notion of browsing in environmental scanning implies a formal or systematic approach to obtaining information and tends to be goal directed, structured, and planned to identify organizationally relevant information. Scanning the environment assists top management in directing the organization's future course (AGUILAR; KATZER & FLETCHER). It is a process of systematic surveillance and interpretation designed to identify environmental events, elements, and conditions that can affect an organization (COATES). According to an investigation of executive scanning behavior (AUSTER

& CHOO), environmental scanning can be a result of either proactive behavior or a passive, situation-induced exposure behavior, which is often a personal, informal activity that is intrinsic to the managerial function.

SAUNDERS & JONES propose four types of environmental scanning: (1) undirected viewing (general scanning with no particular purpose); (2) conditioned viewing (searching an identified area); (3) informal searching (limited, unstructured effort to obtain particular information for a particular purpose); and (4) formal searching (deliberate, planned searching to obtain specific information for a particular purpose). Unlike undirected browsing in library and information science literature, undirected viewing, from an organizational point of view, implies the purpose of environmental surveillance or monitoring although specific goals for such scanning may not be present.

Serendipitous interactions, such as hallway chatting or after-meeting discussions (what ROOT calls "social browsing"), are a frequent, unplanned, and important component of knowledge-creation processes, especially in collaborative scientific work. They often lead to new ideas, socialization of organizational members, and better monitoring of project status (DOTY ET AL.; KRAUT ET AL.; POLAND). Typically, informal communication occurs through opportunities provided by physical proximity among members who are likely to bump into each other. A more intentional form of social browsing is "management by wandering around" (PETERS & WATERMAN), which emphasizes casual access and unpredictable exposure to social links and environmental information in an organization as a conscious aspect of effective management.

What influences browsing? Environmental scanning is influenced by such informational variables as perceived environmental uncertainty, perceived source accessibility and quality, and decision-makers' roles (AUSTER & CHOO; CHOO & AUSTER). Thus, the extent to which managers engage in environmental scanning is influenced by environmental characteristics and source characteristics as well as individual factors (for a detailed discussion, see the chapter by CHOO & AUSTER in this volume).

Based on the concept of physical "proximity" as defined by ALLEN, authors KRAUT & GALEGHER show how geographic separation may impair workers' ability to browse the social environment effectively, resulting in a reduction in the frequency of informal communication, which, in turn, degrades the intellectual teamwork. KRAUT ET AL. demonstrate how research on informal communication can be applied to the design of an audio and video communication medium to facilitate social browsing. However, the implied knowledge inherent in social interaction in a public space (i.e., whether the other party is

receptive to a face-to-face conversation) cannot be easily transformed into electronic environments (FISH ET AL.).

The organizational communication literature demonstrates the utility of the two extremes of the concept of browsing: the ongoing information acquisition and monitoring activities, on the one hand, and the unplanned, unexpected encounter of the most dynamic resource—people—on the other. In contrast to MENZEL who sees informal communication as inefficient, some serious attempts have been made to encourage social browsing in the "electronic hallway."

Wayfinding and Environmental Design

Browsing is often implicitly assumed in discussions of perceptual experience in visual communication, which can be guided or confined by architectural and display design, and of wayfinding in a complex environment. In this context, browsing is fundamentally scanning and has been related to environmental perception and cognition (ARTHUR & PASSINI).

What is browsing? As a goal-directed activity, wayfinding refers to the cognitive, perceptual, physical, and social process of moving through space, via various routes, to reach a destination in a familiar or unfamiliar environment. Wayfinding depends on how one understands the physical layout of the environment, how immediate and nearby locations are related, how different routes connect these locations, how decisions about directed movements affect reaching one's destination, and how one organizes his or her spatial behavior (DOWNS).

Two basic wayfinding learning processes operate simultaneously and give rise to two types of cognitive representations of environmental information: (1) "nondimensional learning," which generates sequential or route maps and suggests a linear design style for a wayfinding system; and (2) "dimensional learning," which produces a spatial or cognitive map and encourages a spatial design style (ARTHUR & PASSINI; DOWNS). Initial learning of a spatial environment necessarily involves nondimensional learning, but the two forms of representation are not mutually exclusive; they are stages in a learning process.

Keeping on the right track involves continued monitoring. For familiar routes monitoring may go on "outside" of normal consciousness. Sightseeing is an example of environmental browsing as a perceptual experience. People create an image of a city by scanning an environment that presents a large amount of information, but they do not completely absorb all the information. However, when they get lost, orientation can be a goal-directed activity and thus a conscious use of such perception.

Recognition of the objective is the final step in wayfinding, and it depends either on prior knowledge of what the destination looks like (finding some specific identifying sign) or on stimulation of associations between perceived and desired cues.

There are several implications of this literature for browsing. One type of browsing can be based primarily on perception with no specific goal or objective in mind when one processes external information, unless the perceptual experience itself is considered a goal. Another type of browsing can be goal directed, which may be stimulated either before or during perceptual scanning, with or without external demands.

What influences browsing? People's spatial behavior in an environment depends on environmental characteristics because these determine what browsers can be exposed to and have access to in a specific time and space (ARCHEA; DRUCKER & GUMPERT; WALSH & UNGSON). Environmental characteristics that influence people's spatial behavior can include size of the space, architectural design, symbolic aspects (e.g., woodwork and office size), physical audiovisual attributes, location, and layout (O'NEILL & JASPER). People's spatial behavior also depends on personal preferences for and knowledge about the spatial environment, which, in turn, depend on the individual's cognitive map of the environment.

Wayfinding, and thus browsing, can be facilitated or constrained by architectural and display design. For example, both physical and visual landmarks serve as anchor points, allowing people to retain and mentally structure environmental information. Other important spatial elements of wayfinding systems (entrances, exits, paths, and circulation system) can also contribute to the "legibility" of an environment. MICHEL reviews research on library design within the context of wayfinding, showing how physical structure and search aids heavily influence both general searching and browsing. He makes a strong case that library and information resource designs are sadly uninformed by what is known about how people find their way about the world. Conceptualizing wayfinding systems as essentially information systems, researchers in this area suggest that wayfinding systems should support both wayfinding and learning (ARTHUR & PASSINI; POLLET & HASKELL).

As more and more applications of information technology attempt to model physical environments (e.g., virtual reality, electronic libraries, and teleshopping malls), research on wayfinding and environmental design may contribute to a better understanding of browsing physical and electronic places, and to better system design. Interactive video wayfinding systems have indeed been implemented to address two common questions by first-time visitors in public settings: "How do I

get where I want to go?" and "What is here that might interest me?" (ARTHUR & PASSINI, p. 203). BATES (1986b) points out that one of the most neglected areas in designing OPACs is the lack of "orientation" tools by which the user can get a feel of how the system works in order to move about easily and comfortably during later interaction with the system.

What are the consequences of browsing? DRUCKER & GUMPERT discuss differences between public and electronic space in terms of the degree of sensory and emotional involvement and the impact of such differences on unpredictable social interaction. Environmental design research suggests that environments can generate anger, fear, boredom, or pleasure. Further, architectural structure and layout influence personal access and exposure (ARCHEA). Therefore, Drucker and Gumpert assert that although computer-mediated interaction and face-to-face interaction are functionally equivalent, they are contextually and experientially dissimilar.

One reference to a very large and intriguing literature has been rarely considered in discussions of information searching. In looking at foraging/searching approximation mechanisms, BELL provides a remarkable summary of searching behavior in the animal world. Major consequences of scanning and wayfinding there, of course, include feeding, resting, nesting, finding mates, reproduction, depositing eggs or offspring, and survival. Since many disciplines, such as psychology and medicine, have progressed by drawing on animal research, our understanding of human searching behavior in general (and browsing in particular) may be also enhanced by learning from research on animals. For example, Bell describes animal searching behavior as a two-stage process. Before searching, there are movements concerning orientation, scanning, and assessment of resource units. During searching, there are movements concerning locating patches, restricting the search to a patch and foraging in the most profitable patches, and sampling among patches in learning to forage efficiently. In either stage, exploratory behavior may be demonstrated. Interesting questions can be asked: Are there similar behaviors to be found in human information searching behavior? Are some of these patterns of behavior associated with the notion of browsing? The model of ecology influencing animals' foraging/searching behavior may also provide some insights for the development of human information behavior theories.

A MULTIDIMENSIONAL TYPOLOGY

These reviews imply five general dimensions underlying the browsing phenomenon (CHANG). The context dimension indicates where browsing takes place, its associated constraints or features, how re-

sources are organized and presented, the physical arrangement, the display or interface perceived by the user, and the access costs. The behavioral dimension concerns actions in which people engage, including physical movement and scanning. The motivational dimension is related to why people engage in browsing and what they intend to accomplish (e.g., to buy, borrow, or evaluate). The cognitive dimension is related to the mental state of the browser, including knowledge and experience. The resource dimension involves the relevant objects (physical items, representations, or informative symbols) and their local environment.

The important facets of these dimensions, as discussed below, can be used, first, to distinguish browsing from other types of information-seeking behavior and, second, to characterize different types of browsing. In the following sections, we first discuss the concept of each facet and then provide some examples to illustrate how these facets work.

Context Dimension

People construct meanings from a context. Four important aspects of context include: (1) organization (structure), (2) interface (display), (3) feedback, and (4) economics.

Organization (structure). Organization of resources occurs either in physical space or abstract (sometimes electronic) space (MICHEL). Information resources typically have an underlying abstract structure (e.g., the internal architecture for organizing relations among data, records, and files), which is usually invisible and may have no physical counterpart. The structuring of material resources typically is manifested in physical structure, although much of the crucial structuring (such as supports, wiring, and plumbing in a large office building) may also not be directly visible to the user. However, many information resources (such as books) may be visibly structured in visible physical structures (such as shelves in a library's stacks).

How resources are organized or structured influences the type and ease of browsing. For example, the display of journals alphabetically by title facilitates scanning, but journals that are next to each other physically are not necessarily related logically. Yet a structural approach, such as the Dewey decimal system, implies and requires relatedness among physically proximate items, making associative browsing easier.

The possibility of sampling at various depths of detail makes an important difference in terms of browsing objects vs. representations. In the latter, one often needs to take an extra step to locate the item physically in order to assess it fully. This extra step often leads to a different kind of browsing (e.g., orientation to find the location of an item) or to disappointing results that may not happen when scanning in

a physical context (as, for instance, when the item identified through browsing an OPAC is not on the assigned shelf). However, although a person who is attempting to find a physical item may still find that it is not available, he or she can still see what else is available nearby.

Interface (display). For both abstract and physical structuring, the interface or display is the user's view, what the user is exposed to or must use in order to obtain specific objects or representations in the resource environment. The interface affects scanning and movement to a great extent and is most often related to the layout of a spatial (perhaps audio) unit. "Interface" may include the design of window displays in a shopping mall, presentation of programs on television, status differences among offices and floors in corporate headquarters, and choice of signage in buildings. The major difference between scanning and movement in a library vs. a computer system is that browsers have to adjust their ideas from physical shelf arrangement to abstract computer procedures that are often not transparent (APTED; HANCOCK-BEAULIEU).

Scanning via the computer interface may not be the same as scanning via a physical interface; the former is mainly cognitive while the latter involves additional physical movement (walking, head rotation, touching). For example, in comparing various versions of an electronic library catalog system using the browsing metaphor, BORGMAN ET AL. (1993) report that adding the feature of "browsing physically adjacent items" seemed to confuse the children who were the test subjects. One explanation might be that movement in a physical setting also gives people a sense of place, multisensory stimulation, and social/recreational gratification, all of which may not be obtainable in electronic environments (SALOMON & KOPPELMAN). Although some evidence indicates that browsing experience in image-based electronic space can be effective for information seeking (PEJTERSEN), little is known about whether and how such spatial experience in electronic environments is different from that in a physical setting. Perhaps the growing research on virtual reality (VR) and information visualization will provide some insights into this question of electronic space and multimedia, multidimensional interfaces (MACKINLAY ET AL.; NEWBY; SPRING). Spring, for example, speculates on how a VR library interface might use different colors, shadings, or sounds to indicate various degrees of information relevance contained in the books or materials visible to the individual walking through the library stacks in the VR environment.

Feedback. Browsing as an interactive, iterative process depends on the feedback available. A menu-based system that requires the user to specify each command for repeated searches makes the iterative process more time consuming, reducing feedback and choice of alternative routes, and thus makes the system difficult or ineffective to browse

(DOZIER & RICE). Two common forms of feedback in information systems (both physical or electronic systems) are relevance (content related) feedback and orientation (structure/path related) feedback.

Economic factors. The least-effort principle suggests that people do not seek optimal results. Therefore, timing of feedback, accessibility of the system and its information, personal resources available (money, time, energy), and expected or required effort all influence browsing (JEON; MARCHIONINI & SHNEIDERMAN; MARCHIONINI ET AL., 1993). For example, the running cost of online charges during an online search or the length of one's lunch break for store shopping will influence the likelihood and extent of browsing and the criteria for successful outcomes in these contexts.

Behavioral Dimension

The behavioral aspect of browsing involves scanning and movement.

Scanning. Browsing is characterized by scanning as an individual moves through an information or a physical environment. Scanning does not have to be visual and may involve more than one sense, so browsing systems may be differentiated on the basis of sensory involvement (OVERHAGE & HARMAN, p. 130). While scanning for orientation (e.g., identifying landmarks) is typically characterized by quick glances, exploratory scanning within new surroundings (e.g., identifying the potential of a resource environment) seems less hasty. Exploratory scanning may involve movement between resources (BATES, 1989; LANCASTER, 1968) or between "patches" and across "habitats" (BELL).

A consideration of scanning as sampling leads to two implications (O'CONNOR, 1993). Sampling implies an ongoing assessment before one decides whether to seek and/or then use a resource. Assessment depends on what is accessible, how the accessible resource is organized and displayed, how one exposes oneself to that accessible resource, and the extent to which one has the cognitive and practical skills to access and evaluate a resource. Sampling also implies control of exposure between the individual and the resource. Browsing is more possible in an information system in which the user has active and relatively rapid control of the items to be examined as well as initiative over and control of the scanning routes and depth of penetration (O'CONNOR, 1988; OVERHAGE & HARMAN).

Movement. The most general form of browsing behavior is scanning a resource in a manner that allows continuous (random or structured) movement, leading to exposure to new information or objects and thus to learning and/or discovery (MICHEL). One extreme along this di-

mension is directed movement, which occurs when the person moves toward a specific destination, whether a place or object. The other extreme is undirected movement, when the person moves without a specific destination. In between is movement by interruption; this occurs when movement toward a specific destination is interrupted by unexpected information stimuli that might lead the browser to a new destination.

Because scanning and movement may not be easily observable (as when only eye movement, smelling, or hearing is involved), behavioral characteristics of browsing are necessary but not sufficient. Rather, people's motivations and cognition must be also understood to derive adequate descriptions of browsing.

Motivation Dimension

Motivational aspects of browsing include the overall purpose or motive for engaging in certain activities and the individual goal at the local activity level.

Purpose. Motivation as purpose may be extrinsic or intrinsic. Intrinsically motivated behaviors (such as curiosity-based behaviors and play) lack any apparent reward contingencies or lack expectations of extrinsic rewards (DECI & RYAN). Extrinsically motivated behaviors (such as browsing to find a needed book or to buy a gift) are instrumental in that a desired task, outcome, or reward is expected or has been identified. Purpose can also be driven by cognitive or affective motives (MCGUIRE). Information-related browsing behaviors tend to be motivated by cognitive processes. Affective motives tend to lead one to engage in browsing activities that are recreational. These two motives may occur simultaneously (BLOCH ET AL.; JEON).

Goal. The goal is what the person intends to accomplish during scanning. Scanning can be goal directed or nongoal directed.

Scanning activities may take place in three ways. In a goal-directed situation they may be used to support the overall purpose, or they may be incidental to the activities conducted toward the overall purpose. In either situation, the browser is aware of and is able to say what is intended for a given scanning activity. On the other hand, scanning may take place in its own right without an explicit goal to be accomplished, which is nongoal directed and usually manifested in externally driven activities such as window shopping on the way home. Further, a goal during scanning a resource can be content specific or noncontent specific, can be path specific or nonpath specific, or can be location specific or nonlocation specific, depending on the person's state of knowledge. When all three aspects of a goal (not of a resource) are

known to be specific, the person's goal is well defined. If some of the aspects are nonspecific, the goal can be considered as semidefined. To the extent that during scanning neither the content nor path nor location is specific, the goal becomes ill defined. Because the layers of a goal are not explicit in the literature, it is important to note that a goal is well or ill defined depending on the anomalous state of knowledge about not only the content but also the structure or search path of a resource before the interaction with the resource.

At one extreme along this continuum of goal is the well-defined goal: knowing what one wants, how to find it, and where to get it. If one knows what to find and how to find it but does not know the exact location of the item, scanning may be observed while the item is being located. When the person's anomalous state of knowledge extends to the question of what paths to follow in order to find that specific item, scanning may be involved, perhaps to explore the possible search paths. On the other hand, one may scan familiar paths because one lacks a specific goal to begin with or does not know exactly what to look for until one sees something along the way, or one knows that there are usually some things of interest along these paths (such as scanning a familiar journal's table of contents) (BATES, 1989). Such scanning is often associated with serendipitous findings because one is exposed to other items near the targeted item and then to subsequent recognition of the value or relevance of those items. It may also become an ongoing, intrinsically motivated behavior that appears to be purposeless (e.g., looking through a newspaper or window shopping as one walks home) but is a form of preparatory information acquisition (BATES, 1986a). There is also a type of scanning that is nongoal directed but mainly externally induced. Cultural institutions, such as libraries, museums, and shopping malls, are more or less purposefully and more or less successfully designed to encourage such invitational browsing, perhaps through interrupting the browser, as noted above (CARR; FRIEDBERG).

Cognitive Dimension

Cognitive aspects of browsing include plan and knowledge/experience.

Plan. The task of accomplishing a goal can be planned or unplanned. People may accomplish some goals without a plan by taking advantage of a situation (CARR; O'CONNOR, 1988). Thus, browsing is often a situated action (SUCHMAN) or situated learning process (BROWN ET AL.). Indeed, JAMES concludes that "a semiadaptive search plan (one which uses information gained during the process of searching) outperforms a nonadaptive plan" (p. 12).

face involved. While most systems emphasize content-based browsing, scanning for orientation focuses on a path. Television viewers usually "zap" through a linear path of channels (perhaps preprogrammed to expose only a selected subset of channels) for orientation and evaluation before selecting a particular program. Maps or relational graphics in wayfinding contexts help users to see the relationships among the current position, the neighborhood, and the path to the desired destination—a notable characteristic of a geographic information system (SHAFFER). However, little attention has been paid to a path focus in traditional IR systems (but see BATES (1986c) for a discussion of search paths in print sources and BELKIN ET AL. (1993)).

Summary

Each of these six disciplines looks at browsing from a different perspective. Nevertheless, some common dimensions emerge. For example, the concept of social browsing in organizations may seem at first to be quite different from browsing as a search strategy in a library. Nevertheless, one may begin to understand their similarity by comparing these two contexts in terms of the object of browsing (person vs. print) or means of interaction during browsing (visual and oral interaction vs. formal written communication).

The literature discussed above generally points to some salient characteristics of browsing, suggesting the multidimensional nature of browsing: (1) accessibility: the ability to expose oneself to and sample (not necessarily systematically) from many information stimuli that might be otherwise unknown or inaccessible; (2) flexibility: the ability to sample as easily as one wishes; (3) interactivity: the reduced burden with respect to cognitive load of specifying what is needed or intended because individuals may interact directly with informational stimuli that are potentially useful; (4) associativity: the linking of information stimuli (or making associations), which is manifested in or constrained by the underlying organizational structure (or paths) of the items browsed; and (5) multiplicity: the intrinsic and unplanned as well as extrinsic and expectational motivations for browsing.

TOWARD A CONCEPTUAL FRAMEWORK FOR BROWSING

Definition

Based on the above disciplinary and dimensional discussions, a more conceptual definition of browsing than the one that introduced this chapter and a general framework for understanding and studying browsing are proposed.

Knowledge/experience. Browsing often takes place when users are in an anomalous state of knowledge, not knowing either the route (path to the desired items) or the destination (the target information) (MICHEL). Thus, necessary knowledge about a resource can be broadly categorized into content (expertise) knowledge and structure (search path) knowledge. Depending on the types of anomalous states of knowledge and goal, people may engage in different forms of browsing (O'CONNOR, 1993). Further, what a browser wants to find or find out should not be confused with what a browser actually finds or interacts with; for example, an understanding of structure (search path) may be gained while one is vainly seeking content. As a user's knowledge about content and search paths accumulates by using a resource over time, his or her expectations will also change. For example, BLOCH & RICHINS found that store browsing is positively related to the degree of self-perceived knowledge concerning the product class.

Related to path or structure knowledge is location knowledge, which can be the physical location of the item sought. Contexts that facilitate the scanning of neighborhoods along paths toward a location expose the searcher to other potential resources, which, in turn increases the chances for serendipity.

Resource Dimension

Form (objects and representations) and focus (content and path) of the resource may influence browsing.

Form: object or representation. An object in the material world occupies a single physical space and thus a single category in a classified arrangement. A representation is a surrogate or indicator for the object or its attributes. As a special case of the difference between an object and its representations, textual information can be considered both a representation of objects or knowledge and the object sought or browsed. Objects such as books offer more attributes and sensory experiences for browsers than do their representations (at least in traditional textual format). However, it is possible to arrange representations in, say, online catalogs in ways that are not possible in the material world, thus allowing for additional kinds of browsing (e.g., by classifications, title, subject headings). For online catalogs, it is desirable to have different levels of representation or exploratory power, such as citation, full MARC record, or abstract. Differences between objects vs. representations may have important implications for browsing in computer systems or virtual libraries because of the loss of attributes, physical movement, and authentic activity (BAILEY; BROWN ET AL.; STORY ET AL.).

Focus: content or path. One may scan a resource's content or path, depending on one's knowledge about the purpose, resource, and inter-

Browsing is the process of exposing oneself to a resource space by scanning its content (objects or representations) and/or structure, possibly resulting in awareness of unexpected or new content or paths in that resource space. Browsing may be planned or unplanned, habitual or situational, serving to identify (or select), familiarize (or learn), assess, and monitor resources in an environment. Browsing is influenced or constrained by various factors and can have both positive and negative consequences.

A general model for understanding browsing should include four major components—(1) context, (2) influences, (3) browsing process, and (4) consequences—with iterations over time. Figure 1 summarizes this model.

Contexts and Influences

Browsing behavior can be influenced by external factors, such as the way a context structures and displays a resource, and internal factors, such as the browser's motivation, goal, and knowledge about the object sought. Table 1 suggests some of the many different influences discussed in the various disciplines.

Context (organization, interface, feedback, economics)

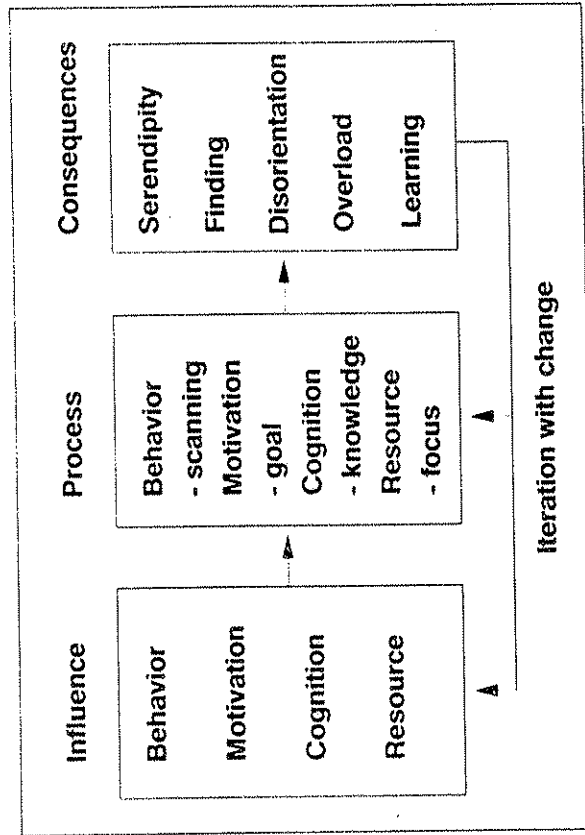


Figure 1. General model of browsing

Table 1
Factors Influencing Browsing in Each Discipline

Factors	Library	IR	Consumer	Media	Organization	Design
Individual Characteristics						
purpose/motive	-	-	x*	x	x	-
goal	x	x	-	-	x	x
plan	y	-	x	x	-	-
knowledge	x	x	-	y	-	-
experience	x	x	-	y	-	-
interest	-	-	x	-	x	-
mood/emotion	-	-	x	x	-	-
expectation	y	y	-	-	-	-
time/money	-	y	x	-	x	-
Contextual Factors						
Environment	-	-	-	-	ES ^b	IC
atmosphere	-	-	x	-	-	x
uncertainty	y	-	-	-	-	x
Interface						
display	x	x	y	-	-	x
organizational structure	x	x	-	-	-	y
Computer-specific						
language	-	x	x	-	-	-
modality	-	x	x	-	-	-
screen size	-	x	x	x	-	-
speed	-	x	x	x	-	-
feedback	-	x	-	-	-	-
Objects/resources						
real things	x	-	x	-	-	-
representations	x	x	y	-	-	-
other attributes	x	y	x	x	x	x
					quality/accessibility	text/image

*The symbol "x" means that the dimensions are explicitly discussed; "y" means that the dimensions are implicitly assumed.

^bES = environmental scanning; IC = informal communication.

Process

Behaviorally speaking, browsing is characterized by iterative movement in a scanning and examining activity. Motivationally speaking, depending on whether browsers are aware of or expect a desired outcome, browsing can be extrinsically or intrinsically motivated. The browser may have but not necessarily express a goal, which can be well defined, ill defined, or not defined. From the cognitive perspective, both browsers' knowledge about the subject sought and experience with the information system in which they interact influence how and the extent to which people browse. The browsing object can be broadly categorized as content (referring to representations or real objects) or search path (such as meta-information or organizing structure).

Figure 2 suggests some important facets involved in differentiating browsing from other types of information-seeking behavior and in characterizing different types of browsing by applying several of the underlying dimensions discussed above. For example, browsing can be differentiated from direct searching such as keying in a title to find the

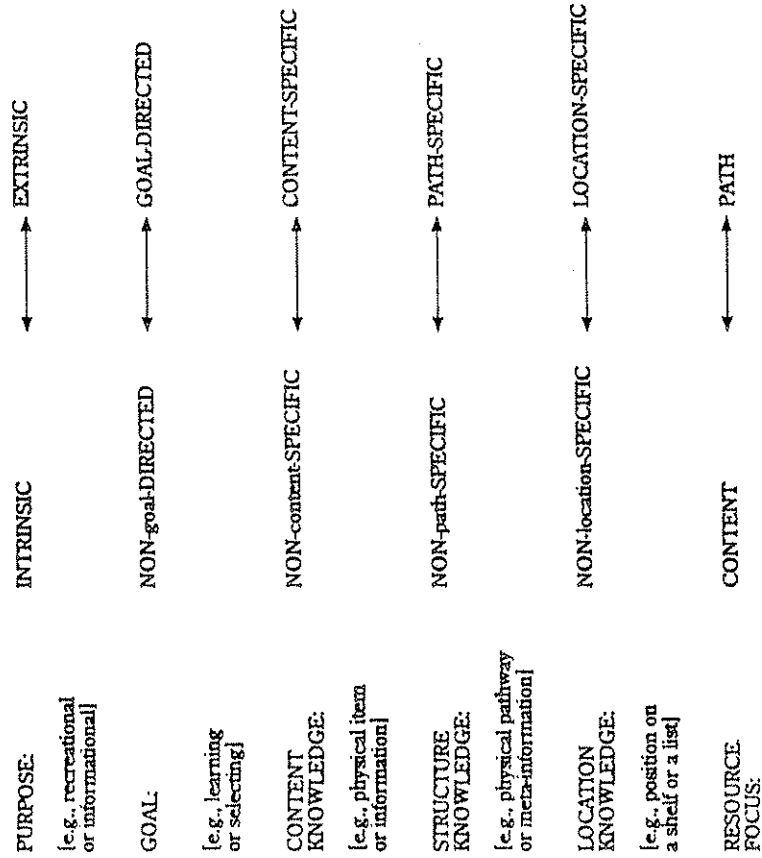


Figure 2. A dimensional typology of browsing

location of a specific item known to be needed by an experienced library user (i.e., knowing what to look for and how to look for the item); this is a goal-directed activity involving extrinsically motivated scanning of the shelves. The anomaly of the person's state of knowledge is location. If the needed item is not found, direct searching may turn into a browsing activity, which may involve scanning the small area near the known item to evaluate the potential relevant items or scanning the areas of interest to gain an overview of what is available. These two episodes characterize two types of browsing in which the goal is either to evaluate or to learn and what is sought is either relatively content specific or noncontent specific (i.e., an anomalous state of knowledge in terms of the content facet) and the resource focus during scanning is content oriented. In another situation, the person may scan the item to find out how its information is organized, which characterizes a type of browsing that focuses on path/structure of the resource. Thus, with more carefully defined operational definitions of each facet, it is possible to use these facets to analyze various information-seeking situations and derive a taxonomy of browsing.

Outcomes

Possible consequences of browsing include satisfaction, serendipitous findings, modification of information requirements, finding the desired information, learning (e.g., about a research topic, product awareness, channel offerings, other R&D projects, route and neighborhood of destination), disorientation, information overload, search inefficiency, costs (time and money), enjoyment, general information gathering, opinion leadership, impulse buying, monitoring and surveillance, and socialization.

Iterations

Finally, the process and outcomes stages can influence change in the prior stages, both within specific browsing episodes as well as in longer term social contexts. For instance, serendipitous findings can change a relatively ill-defined goal to a more well-defined one and may intensify one's underlying motivation. On the other hand, increased experience with and understanding of the paths provided in an information system may improve one's perception of the system's accessibility and thus increase the likelihood and ease of later use.

Even this brief typology can be used to describe various browsing situations generically. Take the goal aspect of the motivation dimension, for example. When people know what they are looking for but not how to look for it, they have a well-defined goal in terms of the content aspect but an ill-defined goal in terms of search path or structure. Thus,

Domain	Well-defined Goal	Semi-defined Goal	Ill-defined Goal
Library	Find a book by an author	Find books on a subject	Find whatever of interest
Shopping	Find an item of a brand of a category (e.g., Tide detergent)	Find an item in a category (e.g., any liquid detergent)	Find something for cleaning (e.g., soap)
TV	Choose specific channel and program	Choose a specific channel	Whatever catches the eye or ear
Communication	Talk to particular person at specific time (formal meeting)	Talk to someone sometime	Unexpected communication (informal conversation)

Figure 3. Example of using motivational dimension (goal) to analyze various browsing situations

their browsing behavior is more likely to focus on discovering how to find things; browsing through a menu system to find out or learn how to search is an example. For this type of user, a useful system design principle would be to make the search path or information structure explicit so that the user can easily browse and decide on the path. Figure 3 gives an example of using the goal aspect of the motivational dimension to help describe various situations in which browsing takes place.

CONCLUSION

This review of and framework for browsing addresses the four problems identified at the beginning of the chapter. First, browsing is not limited to information seeking at library shelves or information system retrieval but appears in a wide variety of human domains. It has been construed as a search strategy, a viewing pattern, a screening technique, and a recreational activity. While it is not yet well understood in any particular discipline, the contributions from each discipline do expand our ability to define, discuss, and analyze browsing. Second, there are many dimensions to browsing, so it is simplistic to dichotomize between, say, "intentional" search vs. "random" browsing. Rather, the degree of browsing differs, depending in part on the specificity of the goal and the types of anomalous states of knowledge. Although a clear taxonomy of browsing has yet to emerge, the inherent richness and complexity of browsing will require researchers to be more specific and explicit in their definitions, measurements, and evalu-

ations of searching and browsing. Third, it should be evident that the traditional bias toward specific, direct searching is unwarranted. Researchers and practitioners should consider browsing as a rich and fundamental human information behavior. Without a better understanding of browsing, our concept of information-seeking behavior cannot be complete. Fourth, designers, evaluators, and users of new computer-based technologies and information resources should consider how these may better facilitate various types of browsing and may better avoid potentially negative outcomes associated with browsing. There are many conceptual and empirical resources concerning browsing from other disciplines that system designers and evaluators can take advantage of (e.g., involving multiple senses or wayfinding perspectives). An important step toward this end is to develop an appropriate conceptual framework for browsing and establish normative data within the browsing domain. We should note that a fundamentally difficult problem yet to be resolved is the operationalization of both the dimensional components proposed in our model as well as of the more fundamental process of browsing itself. While some of the studies referenced in this chapter have attempted to measure aspects of browsing, none is comprehensive, explicit, or consistent enough to use. Our own research is currently engaging this issue (CHANG).

Thus, the multidimensional framework proposed aims to provide a deeper and wider understanding of the concept and nature of browsing in various situations, to facilitate the development of propositions concerning browsing, and to stimulate designs for computer-based and library systems that facilitate successful and/or enjoyable browsing. Clearly this attempt is tentative; future research should elaborate and test the utility of the framework.

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