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Information seeking and searching strategies as plans and patterns of action: A conceptual analysis

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A conceptual analysis

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Abstract

Purpose – The purpose of this paper is to elaborate the picture of strategies for information searching and seeking by reviewing the conceptualizations on this topic in the field of library and information science (LIS).

Design/methodology/approach – The study draws on Henry Mintzberg's idea of strategy as plan and strategy as pattern in a stream of actions. Conceptual analysis of 57 LIS investigations was conducted to find out how researchers have approached the above aspects in the characterizations of information search and seeking strategies.

Findings – In the conceptualizations of information search and information seeking strategies, the aspect of strategy as plan is explicated most clearly in text-book approaches describing the steps of rational web searching. Most conceptualizations focus on the aspect of strategy as pattern in a stream of actions. This approach places the main emphasis on realized strategies, either deliberate or emergent. Deliberate strategies indicate how information search or information seeking processes were oriented by intentions that existed previously. Emergent strategies indicate how patterns in information seeking and seeking developed in the absence of intentions, or despite them.

Research limitations/implications – The conceptualizations of the shifts in information seeking and searching strategies were excluded from the study. Similarly, conceptualizations of information search or information retrieval tactics were not examined.

Originality/value – The study pioneers by providing an in-depth analysis of the ways in which the key aspects of strategy are conceptualized in the classifications and typologies of information seeking and searching strategies. The findings contribute to the elaboration of the conceptual space of information behaviour research.

Keywords Strategy, Information seeking, Conceptual analysis, Information search strategy, Information searching, Information seeking strategy

Paper type Research paper

Introduction

The terminology of library and information science (LIS) contains concepts that are used frequently but analyzed seldom in sufficient detail. Examples of such concepts include information need (Savolainen, 2012) and information use (Fleming-May, 2014). The list can be continued by adding the concepts of information seeking strategy (ISS) and information search strategy. They are used commonly in LIS, but paradoxically, most studies have devoted no attention to what is meant by "strategy" in the context of information seeking and searching. Overall, "strategic" and "tactical" seem to be fundamental qualities of information seeking and searching processes, manifesting themselves in the ways in which such processes are oriented towards a goal. Strategies orient information seeking by suggesting what information is important and what to ignore, and how to access the information that is considered important or desirable (Hjørland, 2011, pp. 599-601). It is obvious that the idea of strategies as orienting factors

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crystallizes much of what strategic action is about, be it dealing with web searching or information seeking from human sources. This suggests that strategies for information seeking and searching are important factors indicating how people plan their search processes, select or exclude information sources, and finally stop the search process.

Since the 1970s, LIS researchers have developed a number of typologies describing the features of search strategies and search tactics (Bates, 1979b; Harter and Rogers-Peters, 1985; Marchionini, 1995; Thatcher, 2006; Smith, 2012). In addition, there are diverse classifications specifying strategies used in information seeking (Belkin *et al.*, 1993; Xie, 2000; Sabbar and Xie, 2016). However, with the increasing number of diverse approaches information seeking and searching strategies, it has become more difficult to capture an overview of these phenomena. While conceptual multiplicity may signify the dynamic nature of a research field, the existence of multiple constructs has a downside. To rephrase Dervin (2003), it manifests itself in an increasing chaos and overload "which plague researchers within and between fields". Because of this, researchers are "drowning in concepts, variables, methods, theories; and in an avalanche of contradictory findings" (Dervin, 2003).

The present study makes an attempt to add conceptual clarity by examining how researches have approached the information seeking and searching strategies. To this end, a conceptual analysis was made by making use of Henry Mintzberg's (1987) characterization of the five fundamental aspects of strategy. Of them, two aspects appeared to be particularly fruitful for the present study: strategy as plan and strategy as pattern in a stream of actions. Both aspects are generic enough for the study of the nature of strategies in particular domains such as information seeking and searching. However, the goal of the analysis is not to identify a universal definition of information seeking and searching strategies, but to clarify the conceptual picture of this phenomenon from viewpoints of plan and pattern in actions.

The paper is structured as follows. First, in order to develop the conceptual framework, the key terms strategy, tactic, information seeking and information search are introduced, followed by the specification of the research setting. The findings will be discussed by focusing on the conceptualizations of information searching and seeking strategies. The paper ends with the dicussion of the main findings, and concludes with the issues related to further research.

Conceptual framework

Strategy

The word strategy comes from Ancient Greek στρατηγία (*stratēgia*). It has a military origin, referring to art of troop leader; office of general, command and generalship (Ronda-Pupo and Guerras-Martin, 2012, p. 164). A closely related term is tactic, coming from the Ancient Greek τακτική (taktike) meaning art of arrangement. In the military context, strategy is concerned with drafting the battle plan before the fight, while tactics are implemented during the battle. Later on, the above terms have been taken into use in other contexts such as sports, chess and business management (Mintzberg, 1987, pp. 11-12). Across diverse contexts of human action, a main characteristic of strategy is that it is oriented towards future action. Strategy specifies a plan to achieve one or more goals under conditions of uncertainty. Strategy may also be needed because the resources available to achieve one's goals are usually limited. From this perspective, strategy generally involves setting goals, determining actions to achieve the goals and mobilizing resources to execute the actions. However, the definition of the concept of strategy is rendered difficult because there is no consensus among

researchers about its meaning. Ronda-Pupo and Guerras-Martin (2012) reviewed the dynamics of the evolution of this concept in the period of 1962-2008 by focusing on the studies of strategic management. The study revealed no less than 91 different definitions of strategy. It appeared that although strategy is one of the most taught and studied concepts, it is paradoxically also one of the least understood. It is a favourite word in the field of management, but due to the lack of a consensual definition, strategy has become such a broad term that it is used to mean almost anything. As the present study demonstrates, similar problems are faced in LIS, too.

Mintzberg (1987) characterized the concept of strategy by distinguishing five main aspects: plan, ploy, pattern, position and perspective. Of them, ploy, position and perspective are not relevant for the present study because they mainly deal with the ways in which business enterprises try to outwit competitors or locate themselves successfully in competitive environments. Therefore, the attention will be directed to the aspects of plan and pattern. First, from the perspective of plan, strategies have two essential characteristics: they are made in advance of the actions to which they apply, and they are developed consciously and purposefully. In this sense, strategy is a "conception preceding action" (Mintzberg, 1987, p. 13). Second, strategy can be understood as a pattern. This aspect is important if strategies are not merely approached at the level of plan but also as constructs that can be realized in a resulting action or behaviour. From this viewpoint, strategy can be conceived of as a pattern in a stream of actions or behaviours. This definition also suggests that strategy is consistency in behaviour, whether or not intended.

On the other hand, plans may go unrealized, while patterns may appear without preconception. This idea allows the elaboration of the concept of strategy because it may be approached in two senses: intended strategy (or planned strategy) describing the plan before action, and realized strategy indicating how the action was implemented in practice. Further, it is possible to distinguish deliberate strategies, where intentions that existed previously were realized, from emergent strategies, where patterns developed in the absence of intentions, or despite them (which went unrealized) (Mintzberg, 1987, p. 13). Figure 1 elucidates the relationships between the above categories.

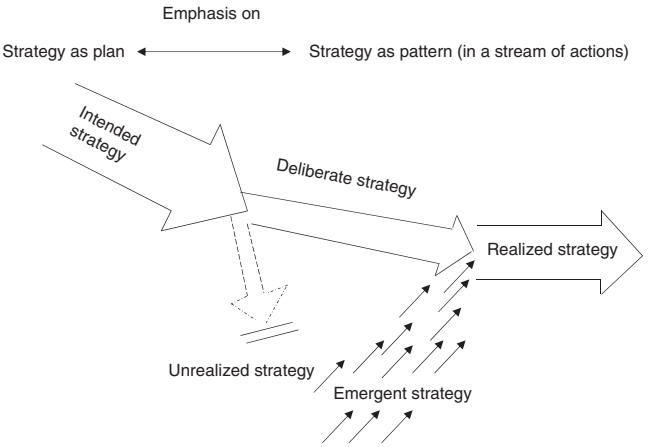

Figure 1.
The aspects and types of strategy

Source: Modified from Mintzberg (1987, p. 14)

Figure 1 indicates that the aspect of strategy as plan emphasizes the role of intended strategies. Plan is a generic concept with multiple meanings such as "something that a person intends to do" and "a set of actions that have been thought of as a way to do or achieve something" (Merriam-Webster Dictionary). More specifically, plan can be defined as "cognitive representations of goal-directed action sequences" (Berger, 2007, p. 50). However, plans are not the action sequences themselves but representations of these sequences in long-term memory. Plans are "products" resulting from planning – a process by which people more or less consciously select a course of action by deciding what they want and making choices (Wilensky, 1983, p. 5). From this perspective, intended strategies can be understood as cognitive representations depicting one's intentions about how to act in order to reach a goal.

However, as Figure 1 illustrates, an intended strategy may fail: it becomes an unrealized strategy. Not all plans become patterns nor are all patterns that develop planned (Mintzberg, 1987, p. 14). On the other hand, approaching strategy from the viewpoint of pattern, the role of realized strategy is emphasized. The category of deliberate strategy devotes attention to both plans and actions that were, in fact, taken in order to realize the intended strategy. The category of emergent strategy emphasizes more strongly the role action that is oriented by situational factors rather than relatively stable intentions preceding action. On the other hand, Mintzberg's (1987) approach is limited in that the distinction between intended and realized strategies suggests the existence of two static states located in the initial and final stages of action. An alternative approach proposed by Rose and Cray (2013) characterizes strategy as a living, dynamic entity that evolves continually, shaped by contextual factors. Because the present study does not discuss the ways in which strategies evolve or shift, the above critique does not undermine the value of Mintzberg's scheme depicted in Figure 1. The aspects of plan and pattern, as well as the types of intended, deliberate, emergent and realized strategies provide useful conceptual lenses to understand the ways in which researchers have approached the features of strategies characteristic of information seeking and searching.

Information seeking and information searching

The term information seeking became widely known through Wilson's (1981) pioneering study on user studies and information needs. With the development of models of information seeking, the above term has received diverse meanings since the 1980s (Case, 2012, pp. 139-161). The conceptual setting has become more complex due to the introduction of related terms such as information acquisition and information search that are sometimes used interchangeably with information seeking. The conceptual setting can be clarified by making use of Wilson's (2000, pp. 49-50) nested model of information behaviour. In this model, human information behaviour is posited as an umbrella category covering all aspects of human information interactions with various forms of information. A subset is information seeking behaviour, which encompasses the range of ways employed in discovering and accessing information resources (both humans and systems) in response to goals and intentions. Information searching behaviour is a subset of information seeking – a micro-level behaviour – referring to the purposive actions involved in interacting with an information search system, including IR systems and the World Wide Web (WWW).

However, the conceptual boundaries are not always clear-cut, and the terms information seeking and information search are sometimes used interchangeably. For example, Kuhlthau (2004) employs the term information search in the meaning of

information seeking, while in Marchionini's (1995) terminology, information seeking mainly describes phenomena characteristic of information search and IR. Ingwersen and Järvelin (2005, p. 386) clarify the relationship between information seeking and IR by noting that the former refers to "human information behavior dealing with searching or seeking information by means of information sources and (interactive) information retrieval systems". However, due to the popularity of web searching, IR is increasingly based on direct end-user searching by the actors themselves. Thus, information search and IR can be regarded as overlapping categories in the context of web searching in particular.

Information seeking and information searching strategies

Similar to the terms information seeking and information searching, there are diverse definitions of the concepts of ISS and information search(ing) strategy, as well as related terms such as information search tactics and IR tactics. Given this fact, nonetheless, a question remains: why does it matter if strategy has been treated differently in these subfields of information behaviour? The answer can be crystallized in a short sentence describing the rationale of the present study: to add conceptual clarity in information behaviour research. Expressions such as ISS and information search strategy are widely used in the above field but their relationships are nebulous.

Bates (1979b, pp. 206-207, 1990, pp. 578-579) was among the first researchers defining the relationships between the constituents of information search strategy. Although she did not approach the phenomena of information seeking in the way proposed by Wilson (2000), her characterization of information search strategy is also relevant for the understanding of ISS. Bates defined four key concepts representing four levels of specificity, proceeding from micro to macro level as follows: (information search) move, information search tactic, information search stratagem and information search strategy.

Bates (1990, p. 578) defined move as the basic unit of analysis of search behaviour. Move is an identifiable discrete thought or small-scale action that may be operationalized in different ways. For example, "enter AND operator" can be defined as a move. Regarding strategic considerations, "move" is a neutral category because it can be applied to any sort of activity associated with searching. Tactic represents the first level at which strategic considerations are relevant (Bates, 1990, p. 578). A tactic is a move (or moves) made with the purpose of improving or speeding the search in some way. A tactic is carried out either in anticipation of problems, or in response to them. For example, the tactic SUPER is to move upward hierarchically to a broader term. SUPER is strategic because the searcher does it to improve the search in some way, for example, to increase the recall, since broader terms often describe larger sets of documents (Bates, 1979b, p. 211). Further, a stratagem is a complex of a number of moves and/or tactics (Bates, 1990, p. 579). Stratagem comes from the military terminology and it means "a maneuver designed to deceive or surprise an enemy" (Bates, 1990, p. 580). However, that there is no implication of deception in the usage of the term in the particular context of information searching. Stratagems refer to the use of one or more tactics to exploit the structures embedded in the document collection (e.g. scan a journal or trace references). Finally, at the highest level of generality there is information search strategy (Bates 1979b, pp. 206-207, 1990, p. 580). Strategy is defined as a plan for the whole search. Given the above hierarchy, a strategy may contain moves, tactics and/or stratagems for an entire information search. Bates (1990, p. 580) reminded that tactics may involve one or more moves, while a stratagem may include tactics and moves, and strategies may include all three.

Although later studies (e.g. Xie, 2008) have elaborated the features of information seeking and searching strategies, the differentiation between strategy, tactic and move presented by Bates (1979b, 1990) is continually relevant. However, the role of the concept of stratagem has remained marginal and researchers seldom refer to it. Since the 1980s, the main attention has been devoted to the terms, information search strategy (ISS) and information search tactic, while the concept of move has mainly been used in the context of IR studies.

Since the 1990s, there is growing interest in the conceptualization of information seeking and searching from the perspective of task performance. Byström and Hansen (2005) provide perhaps the most systematic approach to the characterization of task-related terminology in this context. Information seeking is defined as a subtask to a work task, while ISS is conceptualized as "a method to outline the information seeking ahead" (Byström and Hansen, 2005, p. 1055). Thus defined, ISSs deal with source selection in particular. A task performer's knowledge and experience of information resources are essential factors in source selection. In a similar context, Pharo (2004) introduced a specific term focusing on information searching, that is, search task strategy. It refers to the searcher's plan for executing the search task. Search task strategies may include specification of which sources to use and the techniques that should be used in order to explore them. The strategies may also state in what order sources and queries should be explored and executed. The above definitions suggest that both ISS and information search strategy, or as Pharo (2004) put it: search task strategy exemplify goal-oriented activities driven by a plan. However, strategy as patterns of action is not explicated in the above definitions. As discussed later on, this aspect has been elaborated by Thatcher (2008) who identified a number of ways in which users strategically execute web search tasks.

Research questions

The conceptual framework presented above allowed the specification of the research questions. First, Wilson's (2000) nested model was used to identify relevant domains of information behaviour to which the strategies discussed in the present study apply. To strengthen the focus of the study, the analysis will be directed to strategies for information seeking and information search. However, IR – a subset of information search – will be discussed only in cases in which researchers have conceptualized information seeking or search strategies by using terms such as "IR tactics" (e.g. Xie, 2007). Studies solely focusing on IR were excluded; examples of such investigations include the analysis of moves and tactics used while conducting searches of a video retrieval system (Wildemuth *et al.*, 2010). Second, the study concentrates on the conceptualizations of strategy. Therefore, investigations solely reviewing information search strategems, tactics or moves are excluded from the analysis. The focus will be placed on the key aspects of strategy identified by Mintzberg (1987, pp. 13-14), that is, strategy as a plan, and strategy as a pattern in a stream of actions. As suggested in Figure 1, the former aspect is indicative of intended strategies, while the latter aspect mainly deal with realized strategies, resulting in the use of deliberate or emergent strategies. As no relevant conceptualizations of unrealized strategies for information search or seeking were identified from the research literature, this category was excluded from the study. With this focus, the present study addresses the following questions:

RQ1. In which ways have the aspects of plan and pattern of action been approached in the conceptualizations of information seeking and information search strategies?

RQ2. How are the categories of intended, deliberate and emergent strategies approached in the above conceptualizations?

RQ3. How do such conceptualizations differ in the domains of information seeking and information search?

The focus of the study was further strengthened by excluding issues dealing with the shifts in information seeking and search strategies (Xie, 2007; Sabbar and Xie, 2016). This limitation is necessary, because the conceptualizations of shifts would have required a separate study.

Research material and analysis

To answer the above research questions, the main attention was directed to studies explicitly conceptualizing strategies for information seeking and searching. For the systematic identification of pertinent material, databases such as LIS Abstracts, EBSCO and Google Scholar were used. The keywords used in literature searching included information seeking, information search, information retrieval, strategy and tactic. This effort resulted in the identification of 115 potentially relevant articles, books and conference papers. Based on the preliminary analysis, redundant studies repeating the findings of prior studies were eliminated, resulting in the final sample of 57 key investigations published within the period of 1978-2016.

The research material was examined by means of evolutionary concept analysis (Rodgers, 2000). This method emphasizes the dynamic nature of concept development by examining the application of concepts within a given context or group of contexts in order to identify its attributes within that context (Fleming-May, 2014, p. 205). The analysis includes six major steps:

(1) Identify the concept of interest and associated expressions.

(2) Identify and select an appropriate setting and sample for data collection.

(3) Collect data relevant to identify the attributes of the concept, and the contextual basis of the concept.

(4) Analyse data regarding the above characteristics of the concept.

(5) Identify an exemplar of the concept.

(6) Identify implications for further development of the concept.

In the present study, the concepts of interest are ISS and information search strategy (step 1). The data collection is described above (step 2). As to step 3, the terminology proposed by Rodgers (2000) was slightly modified in that the present study prefers the term constituent, not attribute while examining the characteristics of information seeking and searching strategies. At the next phase (step 4), the constituents of such activities were analyzed. To this end, the research material was examined to identify factors that are conceptually related to the phenomena of information seeking and search strategies. More specifically, attention was devoted to how researchers have approached the constituents of such constructs as indications of the aspects of plan and pattern of action, as well the categories of intended, deliberate and emergent strategies. Relevant constituents include, for example, goal of seeking (Belkin *et al.*, 1993) interactive intentions (Xie, 2000), broad first strategy (Thatcher, 2006) and serendipitous browsing strategy (Catledge and Pitkow, 1995). After having identified such constituents, the analysis was continued by comparing the characterizations of

the constituents presented by various researchers. Then, exemplars depicting information seeking and searching strategies were identified (step 5). Finally, implications for further analysis of concept of such constructs were identified (step 6).

The conceptual analysis was rendered difficult due to the fact that researchers often employ the terms ISS and information search strategy in an unspecified manner or take them for granted. It is also quite common that the terms information search strategy and information search tactics are used interchangeably (e.g. DiMartino and Zoe, 1996, pp. 141-142), rendering it difficult to analyze the particular features of the former construct. Case-based reasoning was used to consider whether the conceptualizations presented in studies such as these would be relevant for the present investigation. Most of them were excluded from the final corpus; the attention was focused on investigations explicitly characterizing the features of information seeking and searching strategies. Drawing on the definitions developed by Mintzberg (1987) and Wilson (2000, pp. 49-50), the former strategies were identified from the research material as plans and patterns of action dealing with the ways in which people discover and access information resources (both humans and systems) in response to goals and intentions. The latter strategies were identified as plans and patterns of action dealing with the ways in which people are involved in interacting with an information search system, including IR systems and WWW. Sometimes, due to the vague conceptualizations presented by researchers, difficulties were encountered while trying to identify conceptualization of intended, deliberate and emergent strategies. Again, case-based reasoning was employed, and unclear characterizations were excluded from the final analysis.

Finally, developing a logical and informative way of reporting the research findings appeared to be a demanding task. For example, categorizations such as analytical vs browsing strategies (Marchionini, 1995), or online vs web searching strategies appeared to be all too general in this regard. On the other hand, the use of detailed categorizations of search strategies developed by Thatcher (2008) or Xie (2008), for example, would have resulted in a fragmented picture. Therefore, as a working compromise, the study drew on the distinction made by Mintzberg (1987), that is, strategy as plan vs strategy as patterns of actions. Categories depicting information seeking and searching strategies such as analytical searching, browsing and web searching were analysed within the above domains identified by Mintzberg (1987). This approach appeared to be useful because it allowed an overview of the entire area of information seeking and search strategies, and enabled a comparative look at the specific features of information seeking and searching strategies.

Findings

The findings will be discussed by starting with the conceptualizations of information search strategies. Thereafter, the research perspective will be broadened to cover the strategies relevant to the domain of information seeking behaviour as a whole (Wilson, 2000). The analysis will mainly proceed chronologically, because the conceptualizations presented in prior studies often influence the ways in which researchers elaborate their own constructs. The best example of an evolving research line of this kind is provided by the series of studies conducted by Xie (2000, 2002, 2007, 2008).

Information search strategies as plans and patterns of action

Early conceptualizations. The first attempts to conceptualize information search strategies date back to the 1970s. At that time, information search was typically

approached in terms of information retrieval from online databases. The early conceptualizations mainly operated at the level of search tactics (Markey and Atherton, 1978; Harter and Rogers-Peters, 1985; Bates, 1979a, b; Chen and Dhar, 1991). In the early approaches to information search strategies, the aspects of plan and pattern of action remained quite implicit. For example, Lancaster (1979) characterized search strategies in terms of critical decision points faced during an online search. They were regarded particularly important when users have to react to unfavourable search results and revise the search logic. In a similar vein, Harter and Rogers-Peters (1985) proposed that information search strategy is someone's action at a particular point in a search: a decision about what might be the best way to proceed. Later on, researchers began to devote more specific attention to the role of the user's goals and plans preceding the actual search process. Marchionini's (1995, p. 7) work on electronic databases distinguished between two different categories of search strategies: analytical and browsing strategies. These search strategy categories were defined by their level of goal-directedness, formality and planning. Analytical strategies are planned, systematic, specialized, goal-driven and formal whereas browsing strategies are opportunistic, heuristic, data driven and informal.

In the early characterizations, the aspects of plan and pattern in actions were conceptualized, though on a general level. According to Xie (2008, p. 231), such conceptualizations represent two main approaches to information search strategies: plan strategies vs situationally sensitive reactive strategies. By applying plan strategies, users make decisions about how to search for information before the first move, such as an author and title. For example, Marchionini's (1995, p. 7) category of analytical strategies represents this approach. It emphasizes the aspect of strategy as a plan and devotes primary attention to intended strategies depicted by Mintzberg (1987, p. 13). In contrast, by applying situationally sensitive reactive search strategies, users make decisions by following one move after another, such as focus shifts, search term relationships and error recovery (Xie, 2008, p. 231). Search strategy of this type consists of a series of sequential tactics that take into account both planned and situational elements. Lancaster's (1979) and Harter and Rogers-Peters' (1985) characterizations place emphasis on the reactive strategies, similar to Marchionini's (1995, p. 7) category of browsing strategies. Interestingly, the early studies also approached strategy as a pattern in a stream of (consistent) actions or behaviours. Depending on the extent to which the searcher was able to realize his or her original intentions, the above strategies can be characterized as deliberate, i.e., the search was implemented as intended, or emergent, if the patterns developed in the absence of intentions, or despite them.

Web search strategies. With the growing popularity of the WWW, increasing attention has been paid to the web search strategies and tactics since the mid-1990s. Compared to early conceptualizations discussed above, these studies often provide more detailed characterizations of search strategies, thus allowing a more specific picture of the aspects of plan and patterns of action. Catledge and Pitkow (1995) were among the first researchers identifying web search strategies according to the goal-directedness of the search task. Of these strategies, search browsing places most emphasis on the aspect of strategy as plan because this approach depicts directed search where the goal is known. In comparison, the aspect of strategy as patterns of action is more characteristic of general-purpose browsing (consulting sources that have a high likelihood of items of interest) and serendipitous browsing. However, a major limitation of their study is that it examined keystrokes in isolation and did not take into

account contextual factors of information search, for example, the intended use of search results (Hsieh-Yee, 2001, p. 173). Thus, there is no evidence demonstrating the extent to which the type of search browsing describes intended strategies. However, serendipitous browsing can be interpreted as an example of emergent strategies because the patterns of moving from a hyperlink to another may develop in the absence of intentions, or despite them. Another example of early studies on web searching strategies is provided by Navarro-Prieto *et al.* (1999). Drawing on log data, they identified three search strategies: top-down searching (searching in a general area then narrowing down the search); bottom-up searching (searching in a narrow area, then broadening the area); and mixed searching. Again, the aspect of plan remains implicit. Minimally, however, the above strategy types can be interpreted as examples of emergent strategies because they exhibit (consistent) patterns in a stream of actions.

Later studies have broadened the repertoire of web search strategies. Fidel *et al.* (1999) identified seven different search strategies among high school students. The empirical data were gathered by verbal protocols, observation and interviews with the study participants providing additional information about their search intentions. Of the search strategies, the aspect of plan is most clearly articulated in the conceptualization of focused searching, because the user following this strategy concentrates exclusively on the assignment topic. In addition, the aspect of plan and thus the type of intended strategies is emphasized in known site strategy (going directly to a website address that is known or guessed) and analytical strategy (consideration of explicit qualities of search task to arrive at explicit search query terms). The aspect of patterns of action is more characteristic of strategies such as intuitive scanning (browsing using hyperlinks, supported by a landmark webpage), empirical (applying rules and tactics learnt from prior searching), similarity (searching for information similar to what had been searched for previously) and swift and flexible (websites scanned quickly and then moving on). These four categories exemplify "reactive strategies" (Xie, 2010). Of them, intuitive scanning and "swift and flexible" may primarily be characterized as emergent strategies. The strategies labelled as "empirical" and "similarity" also contain elements of deliberate strategies because they imply more strongly the existence of the user's original intentions orienting the search process.

The aspect of plan is explicated most clearly in the prescriptive text-book approaches guiding users how to create a systematic search strategy. For example, Ackermann and Hartman (2003, pp. 173-174) detailed a ten-step approach to web search strategy:

(1) Identify the important concepts of your search.

(2) Choose the keywords that describe these concepts.

(3) Determine whether there are synonyms, related terms, or other variations of the keywords that should be included.

(4) Determine which search features may apply, including truncation, proximity operators, Boolean operators, and so forth.

(5) Choose a search engine.

(6) Read the instructions on the search engine's home page. Look for sections entitled "Help", "Advanced search", "Frequently Asked Questions" and so forth.

(7) Create a search expression using syntax that is appropriate for the search engine.

(8) Evaluate the results. How many hits were returned? Were the results relevant to your query?

(9) Modify your search if needed. Go back to Steps 2 through 4 and revise your query accordingly.

(10) Try the same search in a different search engine, following Steps 5 through 9 above.

Approaches such as these describe an ideal and rational search plan. In particular, steps 1-8 emphasize the aspect of strategy as plan and the role of the (original) intended strategy, while steps 9 and 10 are also indicative of a reactive strategy According to Pharo and Järvelin (2006, pp. 230-231), however, the rational plan depicted by steps 1-10 may not be realized in detail in real-world search processes because information seekers tend to be "irrational". Instead of systematically following an intended search plan step-by-step, they tend to favour satisficing and incremental approaches by skipping individual steps and taking "shortcuts".

Based on an empirical study, Thatcher (2006, pp. 1059-1063) provided an even broader and detailed repertoire of web search strategies. Reminiscent of Bates' (1990) four-layered typology, he adopted an inductive approach by proceeding from moves to strategies. Based on retrospective verbal protocol data, a set of 28 moves and 78 tactics were first identified. Then, 12 different cognitive search strategies were specified. Thatcher assumed that such strategies also include generalized thoughts and intentions of the users. The typology developed by Thatcher (2006) is perhaps the best example of deliberate strategies in which intentions that existed prior to search were realized. This strategy type is conceptualized most clearly in the characterizations of safe player strategies. Overall, such strategies are typical to searchers who intend to remain within a familiar search environment and not to wander too far into "unknown" search territory (Thatcher, 2008, p. 1318). Safe player strategies thus indicate deliberate attempts to orient the search process. For example, in the case of broad first strategy, the user first employs one or more general search terms defined by the search task and then uses more detailed, task-specific terms if the broad strategy fails. Alternatively, in the search engine narrowing down strategy, the user selects a search engine based on the known, or perceived, attributes of the search engine or chooses the subject categories on a search engine that would assist in narrowing the search domain. Deliberate strategy is also exemplified by the known address search domain: the user goes directly to a known web page that is not a search engine that could be used as another suitable portal for the particular search task or was a familiar starting point for the participant. Virtual tourist strategy differs from the above approaches in that the user follows a predefined path through a particular website in pursuit of the answer. Finally, in the parallel hub-and-spoke strategy: the user opens up a hyperlink in a new browser window, with the intention of accessing a particular hyperlink as a new webpage in a hub-and-spoke type pattern.

More recently, Xie and Joo (2010) adopted a similar approach to characterize web search strategies. Based on empirical data gathered by means of logs and think-aloud protocols, the authors first identified 13 types of search tactics. Then, eight types of

search strategies were specified, based on the analysis of sequential search tactics (Xie and Joo 2010, p. 266). The strategy categories include:

- Known-item initiation: users began their search tasks from known sites that they are familiar with or that are recommended by someone else.
- Query initiation: users began their search tasks with creating a query statement by using a search engine.
- Whole site exploration: users browse and evaluate most of the information available in one specific source.
- Iterative exploration: users browse and evaluate a series of items mainly using hyperlinks until they are satisfied or they quit.
- Item comparison: users compare the information covered by similar sources.
- Simultaneous multiple resource search: users focus on obtaining relevant and useful information efficiently from different types of sources.
- Multiple query reformulation: users modify an initial query several times continually to obtain the search results that satisfy them. To this end, users can make search queries broader, narrower, or parallel.
- Iterative result evaluation: users evaluate search results repeatedly to access and to find relevant information until they are satisfied or they quit.

Different from Thatcher's (2006) typology, the search strategies identified by Xie and Joo (2010) emphasize more strongly the activities characteristic of IR, as exemplified by the categories of query initiation and multiple query reformulation. However, similar to Thatcher, the strategy categories primarily characterize one sub-type of realized strategies, that is, deliberate strategies, because the patterns of search actions were oriented by users' prior intentions. Such patterns manifest themselves, for example, in the strategy of "known-item initiation" which resembles Thatcher's category "known address". Further, the strategy of "whole site exploration" comes close to Thatcher's category "broad first". The similarities suggest the existence of a set of core categories of realized search strategies, despite the different labels by which the individual researchers have described them.

ISSs: the aspects of plan and patterns of action

The nature of strategies can be examined in a broader context by focusing on the domain of information seeking (Wilson, 2000). Strategies relevant to this domain deal with identifying, selecting and accessing information sources of diverse types, ranging from face-to-face discussion to the use of information systems. Thus understood, ISSs operate on a more general level and they include strategies for information search, though are not confined to them. For the sake of simplicity, the stategy type of this kind will be referred to as ISSs, instead of the compound word "information seeking and searching strategies".

The conceptualizations discussing together both information seeking and information search strategies serve as bridge builders by integrating ideas dealing with strategies characteristic of three domains identified by Wilson (2000), that is, information seeking, searching and retrieval. Bates (1989) was among the first researchers to use the term ISS in the above sense. Drawing on the studies conducted

by Stoan (1984) and Ellis (1989), she identified strategies such as footnote chasing, citation searching and journal run (where searchers identify a relevant journal and search several issues or volumes to find the desired information) (Bates, 1989, p. 412). She did not, however, specify the nature of the above ISSs. Nevertheless, footnote chasing, journal run and related activities may exemplify strategy as a patterns of action because they can be understood as a fairly consistent stream of behaviours resulting in a realized strategy, either deliberate or emergent.

ISSs model

The nature of ISSs was characterized in greater depth by Belkin *et al.* (Belkin, 1993; Belkin *et al.*, 1993, 1995). They mainly used the concept of information seeking in the sense of information searching and IR. Nevertheless, their approach is hospitable to the domain of information seeking as defined by Wilson (2000) because in addition to databases and other information systems, human sources and channels such as libraries are included in the construct of information seeking. The main contribution provided by Belkin and his associates is a multifaceted classification of ISSs. Its main point of departure is the assumption that the variety of behaviours people engage in while seeking for information can be viewed as ISSs, and that these ISSs can be construed as interactions between the user and the other components of the information system. Unfortunately, while introducing the term ISSs, Belkin *et al.* (1993, p. 325) did not specify the meaning of the term strategy. Moreover, the term ISS was merely postulated, as evidenced by the following notion: "when searching for information in some knowledge resource such as a textual database, people engage in a variety of behaviours, which we can term ISSs" (Belkin *et al.*, 1993, p. 325).

In the preliminary attempts to develop the ISSs model, Belkin *et al.* (1993) drew on their own observations of information seeking and IR behaviour and on the empirical findings of others, for example, Ellis (1989). The ISSs classification specifies four behavioural dimensions or facets that are assigned with binary, dichotomous "values". (Belkin *et al.*, 1993, pp. 325-328). The facet of method of information seeking (or method of interaction with texts) has two values: scanning or searching. This approach can be understood in terms of the classic distinction between searching for a known item and looking around, or scanning, for something interesting among a collection of items. The second facet indicates the goal of information seeking that may be learning or selecting. The ISSs scheme assumes that the goal of information seeking is either learning about some aspect of an item or resource, or selecting useful items for retrieval (Belkin *et al.*, 1995, p. 380). The facet of mode identifies two values: recognition or specification. This suggests that looking for identified items can be characterized as retrieval by specification, while identifying relevant items through stimulated association can be characterized as retrieval by recognition. Finally, the facet of (textual) resources with which users interact specifies two values: information or meta-information. Interaction with information items themselves can be contrasted with interaction with meta-information resources that describe the structure and contents of information objects.

The main idea of the ISSs model is that any single ISS can be described according to its location along these four dimensions (Belkin *et al.*, 1995, p. 380). In fact, this assumption supports the view that the ISSs model is primarily a classification scheme that can be used to specify the nature of completed searches, that is, the ways in which the information search processes proceeded from an initial point to the closure within an information seeking episode. The classification thus helps to specify the nature of realized (deliberate or emergent) search strategies by means of the combinations of the

four facets assigned with dichotomous values. In the simplest case, each of these dimensions can be considered as orthogonal, with dichotomous values, resulting in 16 distinct prototypical ISSs.

An example of an ISS is a case in which a person's goal is to learn about characteristics of the knowledge resource before the information search can begin (Belkin *et al.*, 1995, p. 381). A person in this situation might first look for a meta-information resource such as a library catalog in order to learn about the organization of the knowledge resource. After learning about the information system by consulting this resource, the person may choose some descriptors from that scheme as the specification of a topic of information items to be searched for. However, the execution of this particular ISS may not meet the searcher's above goal. Therefore, additional ISSs are needed. In most cases, information seeking behaviour is characterized by movement from one strategy to another within the course of a single information seeking episode, as a person's problematic situation changes. Importantly, as Belkin *et al.* (1993, p. 328) point out, the question of why a person chooses to engage in any particular ISS at any particular time is a function not of the dimensions of ISSs, but of other factors such as the person's problematic situation in particular, the user's state of knowledge and information seeking goals. This characterization is inherently vague because the facet of goal suggests the existence of factors driving information seeking within the constellation of ISSs, that is, the intention to learn or select.

Later on, based on an empirical study of knowledge workers, Cool and Belkin (2002) elaborated the categories of the ISSs model because it was regarded as limited for the review of interactive information seeking occurring in the networked environments in particular. To this end, they developed a faceted classification of interaction with information. In the new scheme, however, the facets were labelled differently. The access facet contains two sub-facets: method (scanning – searching) and mode (recognition – specification), similar to the original ISSs model. Objects interacted with facet has now three sub-facets: level (information – meta-information), medium (image, written text, speech, etc.) and quantity (one object, set of objects, database objects). Similarly, the common dimensions of interaction facet entails three sub-facets: information object (part – whole), systematicity (random – systematic) and degree (selective – exhaustive). Finally, the interaction criteria facet specifies elements such as accuracy, authority, date, person and topic.

Interestingly, the new classification scheme no longer makes references to "strategies". Most importantly, the category of goal of seeking (or interaction) is excluded from the scheme, suggesting a shift of emphasis from an all-encompassing classification to a more specific approach focusing on the observable (actual) modes of information interaction, that is, the ways in which people engage with information objects. More recently, based on an empirical study focusing on web searching, Kim (2009) elaborated the facets of the original ISSs model. Similar to Cool and Belkin (2002), the facet of goal was eliminated from the analysis. Kim's (2009) ISSs scheme contains three facets: method, mode and object – a renamed category with three sub-facets: information, meta-info and tool (e.g. portal and web directory). Raqi and Zainab (2008) applied the original ISSs scheme to observe strategies used by children who selected, browsed, read or borrowed books in children's public libraries. The findings indicate that the children used a variety of strategies matching seven out of the 16 types of behaviours recorded in the ISSs dimension table (Raqi and Zainab, 2008, p. 495). When the respondents entered the library, they acted in three major ways. First, oriented by a defined goal, they clearly knew what they want and purposefully sought

for the items wanted. Second, they were oriented by semi-defined goals that were initially unfocused intentions to find a book by a subject or genre. Third, information seeking or browsing was oriented by ill-defined goals; the children were not particularly looking for something specific but hoping to find something of interest. Following the idea of Belkin *et al.* (1993, p. 328), the nature of such goals was not explained by drawing on the ISS goal facet "learn – select". Instead, goals orienting information seeking originate outside the categories of the ISSs classification, for example, from a task at hand or interest in a topic.

The original ISSs model incorporates both aspects of strategy identified by Mintzberg (1987, p. 13), that is, plan and pattern. The former aspect is conceptualized by means of the category of goal of seeking. In the original ISSs model, the goal is conceptualized quite generally by drawing on the binary "values" of learning – selecting (Belkin *et al.*, 1993, pp. 325-328). Therefore, the goal category may also be interpreted as an element of a deliberate strategy, because the intention to learn or select may become true during a completed search, and the "value" of the goal can only be inferred afterwards. The modified versions developed by Cool and Belkin (2002) and Kim (2009) no longer incorporate the aspect of strategy as plan. On the other hand, this change is not particularly radical because the aspect of plan remained quite marginal already in the original ISSs scheme (Belkin *et al.*, 1993). As a whole, the diverse versions of the ISSs model place the main emphasis to strategy as patterns of action. Thus, the faceted classifications primarily serve as a tool to identify the ways in which search strategies were realized, either in the form of deliberate or emergent strategies.

Xie's models of ISSs

So far, the most sophisticated model for ISSs has been developed by Iris Xie (2000, 2007, 2008). Even though Xie places the main emphasis on information search strategies and often prefers terms related to IR, her approach is relevant to the domain of information seeking as a whole. Compared to the ISSs model discussed above, Xie goes deeper into the micro-level user goals and the situational factors affecting ISSs. In addition, Xie has greatly elaborated the picture of the ways in which ISSs change during the search process; however, due to the limitations of the present study, the strategy shifts will not be discussed in more detail.

Xie's (2000) early approach to ISSs is based on an empirical study focusing on 150 users from academic, public and special libraries. Each participant came to the library to search for his/her own problem(s). Multiple methods were employed to collect the data: questionnaire survey, semi-structured interview, transaction logs and unobtrusive observations. Before they left libraries, users were asked to comment on their information seeking activities based on the transaction logs and observation data.

One of the main points of departure in Xie's (2000) study is Daniels' (1986) classification of goals that allowed the reconstruction of user goals into four levels of a hierarchical structure: long-term goal, leading search goal, current search goal and interactive intention. Compared to the facet of goal (learn – select) identified by Belkin *et al.* (1993, pp. 325-328), Xie's approach is more sophisticated because it specifies the temporal dimension of an individual's goal-directed search activities. User's long-term goal indicates a person's overall aspiration, for example, an ambition to create an academic career, while his or her leading search goal might be to write a doctoral dissertation. Further, his or her current search goal may be to find pertinent material for the doctoral study, while interactive intentions (henceforth IIs) refer to sub-goals that a user has to achieve in the process of accomplishing his or her current search

(Xie, 2000, p. 842). Long-term goal is assumed to influence the leading search goals that a user might work and how to accomplish these tasks. Most importantly, however, this structure highlights the micro level of user goals, i.e., IIs. Xie (2000, p. 843) assumes that plans at diverse levels influence information seeking behaviour in three ways. As plans are goal directed, they may be used to establish a set of intentions or sub-goals along the route to accomplish their current search goals. Second, plans may be used to determine corresponding ISSs that lead towards desired goals. Third, plans also help in monitoring the search process to adjust the original plan. Thus understood, plans are not constituents of IIs and ISSs; instead, plans are factors preceding and shaping them.

In the conceptualization of the factors affecting IIs and ISSs, Xie (2000, p. 843) also drew on the ideas of situated action proposed by Suchman (1987). She maintained that the coherence of action is not adequately explained by either preconceived cognitive schema or institutionalized social norms. On the contrary, the organization of situated action is an emergent property of moment-by-moment interactions between actors and between actions and environments of their actions. Drawing on Suchman's ideas, Xie (2000, p. 843) concluded that not only plans but also elements of situated action influence the information seeking process, and thereby ISSs. This means that plans at different levels of hierarchy and situations codetermine the selection of IIs and ISSs.

Xie's (2000, p. 846) empirical study revealed eight main IIs: identify, learn, find, access, locate, evaluate, keep records and obtain. In addition, a number of sub-intentions such as identify something to get started and learn domain knowledge were identified. The study also conceptualized two dimensions of ISSs, that is, methods and resources (Xie, 2000, pp. 846-847). The methods are instrumental in nature, referring to the techniques users apply to interact with information, information object and human. The methods include various types of activities such as acquiring, scanning, searching, selecting and tracking. The dimension of resources entails, for example, meta-information, part of an item/specific information and human. The combination of methods and resources of diverse types yield diverse ISSs such as scanning meta-information, searching an item, selecting an item and consulting a human.

Overall, the categories of method and resources developed by Xie (2000) are more detailed than the facets of method and resources identified by Belkin *et al.* (1993). On the other hand, similar to the ISSs model, Xie's conception places the main emphasis on the aspect of strategy as a pattern in a stream of actions, while the aspect of plan remains implicit. This is because ISSs are described as combinations of method and resources. Plans at four levels of hierarchy and the elements of situated action shape the strategies thus defined, but the ways in which this happens is not specified. Even though such relationships remain somewhat vague, Xie's (2000) empirical findings demonstrated that people engage in multiple ISSs while accomplishing their IIs within information seeking episodes.

The conceptualization of ISSs was elaborated in Xie's (2002) later study. First, the construct of IIs was specified by introducing a new category, that is, entity having four sub-categories: specific, general, common and area/local. Due to this elaboration, IIs can be described in more detail, for example, locate items with common characteristics (Xie, 2002, p. 66). Second, the dimension of resources was refined by adding the category of one system/multiple databases. Third and more importantly, the picture of ISSs was elaborated by demonstrating that each type of II has its own corresponding ISSs (Xie, 2002, pp. 63-73). It appeared, for example, that scanning an area/location was the most frequently applied ISS for the intention of finding information. The results showed that the eight types of IIs and their associated ISSs occur in almost every type

of current search goal and leading search goal. In other words, the eight types of IIs represent all the IIs within the current search goals and leading search goals. Xie (2002, p. 75) emphasized that different users might not use the same ISS for a specific II, but in general they employ ISSs associated with that type of II.

The above approach to ISSs was further enhanced in a study where Xie (2007) revised her prior framework labelled as "model of interactive information retrieval" (Xie, 2002, p. 854). The revised framework was titled as a "planned-situational interactive information retrieval model" (Xie, 2007). First, the repertoire of IIs was enriched further by adding novel categories such as exploring, modifying and monitoring. Second, the category of IIs was refined by identifying nine new types of entities and associated attributes. Entities refer to what users intend to acquire or work on, while attributes specify the traits/elements of these entities. For example, the attributes for data/information are specific, common, general and undefined, while the attributes for knowledge consist of domain, system and information retrieval knowledge.

Most importantly, however, the construct of ISSs was approached now as an umbrella term, incorporating IIs and a novel category, that is, retrieval tactics. Thus, the planned-situational model places a particular emphasis on the processes of IR (Xie, 2007). In addition, Xie (2007) no longer makes references to methods and resources as dimensions of ISSs. Instead, retrieval tactics are constituted by methods and entities with attributes. Methods refer to the techniques users apply to interact with data/information, knowledge, concept/term, format, item/objects/site, process/status, location, system and humans. The types of methods include, for example, scanning, specifying, selecting, comparing and acquiring. An example of ISS is learning domain knowledge by selecting descriptors of retrieved results. The first part is an interactive intention, and the second part is a retrieval tactic. Different from the earlier approach (Xie, 2000), the category of ISS is now broader because it also incorporates IR tactics. This extension allows the identification of an even broader repertoire of ISSs.

Based on empirical studies of interactive intentions in IR in a variety of digital environments, Xie (2008, pp. 238-240, 274-278) refined further her approach to ISSs by classifying them into 12 types. In addition, relevant IR tactics corresponding to such strategies were identified. To achieve this, Xie (2008, p. 238) associated the constitutive elements of ISSs, that is, IIs and their entities with the attributes and methods of retrieval tactics. As the enhanced typology contains no less than 12 sub-categories of IIs and nine diverse entities of IIs plus 11 attributes and 11 methods of IR, the number of potential combinations depicting ISSs is quite high. Examples of such strategies include "exploring by employing scanning tactics", and "modifying search statement for items with common characteristics by tracking meta-information of retrieved items". The above examples suggest that Xie's (2008, p. 238) typology provides a sophisticated tool for the classification of strategies employed in information seeking processes. However, the price to be paid is the difficulty of comprehending the variety of potential combinations. With the increasing number of diverse categories and their sub-categories, there is a danger that the concept of strategy (or tactic) will lose its distinction power because virtually all elements of information seeking or searching behaviour are characterized as "strategic" or "tactical" in nature. More strongly than in the original model (Xie, 2000), ISS is conceptualized as a pattern of (consistent and realized) actions, while the aspect of strategy as plan remains somewhat secondary. This aspect manifests itself only in the category of IIs indicating micro-level goals that are linked to current search goals in particular.

More recently, Sabbar and Xie (2016) examined ISSs among USA scholars. Their study makes use of a new conceptual model – the information triangle – developed as a result of the authors' research, which facilitates the classification of strategies used by scholars throughout a specific information seeking task, as well as the characterization of the shifts between strategies. The information triangle identifies three main types of information seeking and search strategies. First, formal system strategies are related to the formal bibliographic apparatus in which IR search tactics are used in conjunction with sources such as periodical databases and web-based resources, for example, Google Scholar. Second, informal resource strategies include those that are traditionally considered in relationship to print sources, for example, browsing and citation tracing. Third, interactive human strategies focus on consulting with humans as either an intermediary or a direct resource, including archivists and librarians, colleagues and other knowledgeable humans, whether directly or through electronic means.

Compared to Xie's (2008, p. 238) detailed typology, Sabbar and Xie's (2016) approach provides a more holistic and broader perspective on ISSs because they are not confined to IR tactics: in addition, human sources such as colleagues and librarians are included in the repertoire of potential sources of information. On the other hand, the distinction between formal, informal and interactive strategies does not add much to prior conceptualizations of ISSs, mainly due to the fact that the above categories are defined in a descriptive way.

Discussion

Since the 1970s, studies on information search and seeking strategies have produced a rich tapestry of classifications, typologies and models describing the constituents of such strategies, as well as the factors shaping them. On the other hand, the abundance of diverse, sometimes partially overlapping approaches renders it difficult to capture the core features of these phenomena. To add clarity to the discussion on strategy issues, a conceptual analysis was made by making use of Mintzberg's (1987) idea of the two key aspects of strategy: plan and pattern in a stream of actions. The analysis was refined by examining how researchers have conceptualized the strategy types characteristic of the above aspects. The strategy types indicate the degree to which original intentions are translated into action. Intended strategies are indicative of the plan preceding action: cognitive representations depicting one's intentions about how to act in order to reach a goal, but no implementation of action yet. Patterns of implemented action indicate the existence of realized strategies that may come true through deliberate and emergent strategies. The former exemplify cases in which original intentions were translated into action, while the latter indicates that the patterns of action were developed more or less spontaneously, in the absense of original intentions or despite them.

The findings indicate that overall, LIS researchers have seldom reflected the concept of strategy in more depth. This is paradoxical because the words information search strategy and ISS are used commonly in LIS research. Overall, the critical reflection of the concepts of information seeking (or search) strategies and tactics has not much developed since Bates's (1979a, b, 1989) classic studies. Researchers tend to take Bates's definitions for granted, without reflecting their conceptual bases. Low interest in conceptual reflection may be due to the assumption that fellow researchers and library professionals are sufficiently familiar with the meaning of this concept in order to make it intelligible. However, as Ronda-Pupo and Guerras-Martin (2012) have demonstrated, the meaning of the concept of strategy is far from self-evident.

The main findings are summarized in Tables I and II. The conceptualizations of information search strategies and ISSs are presented by focusing on the key aspects identified by Mintzberg (1987): strategy as plan (Table II) and strategy as pattern in a stream of actions (Table II).

The present study indicated that in the conceptualizations of information search and seeking strategies, the aspect of plan has been characterized at diverse levels of generality. This aspect emphasizes the role of intended strategies (Mintzberg, 1987) or plan strategies (Xie, 2010). Researchers have been somewhat more interested in conceptualizing the aspect of plan while focusing on web searching in particular. There is a number of types of web search strategies emphasizing the qualities characteristic of analytical strategies defined by Marchionini (1995), that is, planned, systematic and goal-driven approach to searching. The examples include the rational step-by-step web search strategy (Ackermann and Hartman, 2003) and focused searching strategy (Fidel *et al.*, 1999). As a whole, however, the viewpoint of intended strategies or plan strategies has remained implicit in the conceptualizations of information search strategies.

Similarly, the aspect of plan is not particularly emphasized in the characterizations of ISSs. In fact, this aspect is reflected only in the conceptualizations made by Belkin *et al.* (1993) and Xie (2007, 2008). In the ISSs model, the facet of goal (learn – select) is

Strategy as plan	Information search strategies	Information seeking strategies
Indicative of intended strategies developed consciously and purposefully in advance (Mintzberg, 1987)	Analytical strategies (Marchionini, 1995) Planned, systematic, specialized, goal-driven Rational step-by-step web search strategy (Ackermann and Hartman, 2003) Identify the important concepts of your search, choose the keywords that describe these concepts, identify synonyms and related terms, determine the Boolean operators, choose a search engine, evaluate the results, modify your search if needed Examples of specific types of web search strategies Catledge and Pitkow (1995) Search browsing Fidel *et al.* (1999) Analytical Focused searching	Information seeking strategies (Belkin *et al.*, 1993) The facet of goal of information seeking (learn – select) Model of interactive information retrieval (Xie, 2000, 2002) No explication of information seeking strategy as plan Long-term goal, leading search goal, current search goal and interactive intentions, together with elements of situated action affect information seeking strategies Planned-situational interactive information retrieval model (Xie, 2007); enhanced typology of information seeking strategies (Xie 2008) Information seeking strategies as combinations of interactive intentions and retrieval tactics Interactive intentions indicate the micro-goals of information seeking Long-term goal, leading search goal and current search goal, together with elements of situated action affect information seeking strategies

Table I.
Information search and information seeking strategies: the aspect of strategy as plan

Strategy as pattern in a stream of actions	Information search strategies	Information seeking strategies
Indicative of realized strategies resulting from Deliberate strategies: intentions that existed previously were realized Emergent strategies: patterns developed in the absence of intentions, or despite them (Mintzberg, 1987)	Browsing strategies (Marchionini, 1995) Opportunistic, heuristic, data-driven and informal Examples of specific types of web search strategies Catledge and Pitkow (1995) Serendipitous browsing Fidel *et al.* (1999) "swift and flexible" Thatcher (2006) Broad first Search engine narrowing down Known address search domain Virtual tourist Xie and Joo (2010) Known-item initiation Query initiation Item comparison Simultaneous multiple resource search Multiple query reformulation Iterative result evaluation	Information seeking strategies (Belkin *et al.*, 1993) The facets of: Method of information seeking (scanning – searching) Mode of information seeking (recognition – specification) Resources interacted with (information – meta-information) Information seeking strategies (Kim, 2009) Method of information seeking Mode of information seeking Object (information, meta-info, tool) Model of interactive information retrieval (Xie, 2000, 2002) Information seeking strategies as combinations of methods and resources Planned-situational interactive information retrieval model (Xie, 2007); enhanced typology of information seeking strategies (Xie, 2008) Information seeking strategies as combinations of interactive intentions and retrieval tactics Retrieval tactics as constituents of deliberate information seeking strategies

Table II.
Information search and information seeking strategies: the aspect of strategy as pattern of actions

defined quite generally from the viewpoint of intended strategies, while Xie has approached plans as contextual factors shaping ISSs. However, in the planned-situational model (Xie, 2007), interactive intentions are considered as elements ISSs, thus emphasizing the role of micro-level goals in the formation of such phenomena.

Table II summarizes the conceptualizations of information search and ISSs from the viewpoint of strategy as pattern in a stream of actions.

The aspect of strategy as pattern in a stream of actions directs the main attention to realized strategies, either deliberate or emergent, or in terms of Xie (2008), reactive strategies. From this perspective, information search and seeking strategies are conceived as a stream of realized behaviours concerning the identification, selection and accessing of information objects. The features of such strategies are typical to browsing strategies that tend to be opportunistic, heuristic, data-driven and informal (Marchionini, 1995). The patterns in streams of action can be identified (or inferred) afterwards by using search logs, observations, verbal protocols and post-search interviews. As Table II indicates, there are diverse examples of the types of web searching strategies that are found in this way. On the one hand, they indicate the employment of deliberate strategies, such as broad first, virtual tourist, known item

initiation and iterative result evaluation (Thatcher, 2006; Xie and Joo, 2010). On the other hand, there are examples of emergent strategies such as serendipitous browsing (Catledge and Pitkow, 1995) and "swift and flexible" (Fidel *et al.*, 1999).

In comparison, the conceptualizations of ISSs have devoted more attention to methods and modes (or ways) by which people identify, select and access information sources of various types. The ISSs model developed by Belkin *et al.* (1993) provides a useful classification for identification of diverse ways in which information seeking is realized as a combinations of methods, modes and resources. Xie (2000, 2002, 2007, 2008) approaches ISSs as combinations of methods and resources. The planned-situational model (Xie, 2007) incorporates interactive intentions and retrieval tactics in order to specify the conceptual approach to ISSs. The strategy types conceptualized by Xie (2007, 2008) emphasizes the role of deliberate strategies in that the category of interactive interactions is incorporated in the construct of ISSs.

Tables I and II suggest that overall, researchers have been less interested in conceptualizing information search and seeking strategies from the viewpoint of "intended strategies" or "plan strategies". Similarly, the conceptualizations of emergent strategies are rare. Most characterizations focus on deliberate strategies, thus suggesting that information searching or seeking is a form of behaviour in which an individual's original intentions are usually translated into action. Some of the classifications and models of ISSs, most notably those developed by Belkin *et al.* (1993) and Xie (2007) discuss both aspects of strategy, that is, plan and pattern of behaviours. On the other hand, Xie's (2007) planned-situational model exemplifies a boundary case because the primary emphasis is placed on IR tactics. Therefore, this framework would also be relevant from the perspective of search strategies. In Tables I and II, however, the above model is located in the area of information seeking because her later study (Xie, 2008, pp. 274-278) indicates that the model can be used to conceptualize information seeking from a range of sources such as colleagues and libraries.

The main contribution of the present study is the elaboration of the conceptual space of issues related to information seeking and search strategies. The evaluation of the novelty value of the findings is rendered difficult due to a lack of conceptual studies focusing on this topic. The analysis revealed the paucity of investigations comparing the similarities and differences of various classifications and typologies, not to mention studies evaluating their strengths and weaknesses. However, for the discusion of the contributory value of the present study, a few comparative notions can be made in order to put the research results in a broader context and suggest topics of further research.

In this regard, one of the key questions deals with the importance of information seeking and searching strategies in today's information world. For what are such strategies any more needed, if search engines do the job for us by providing helpful query suggestions? (cf. Niu and Kelly, 2014). We have gone a long way since the days when Bates (1979b) developed the classification of search tactics for the needs of database searching. The empirical findings of Pharo and Järvelin (2006) suggest that real-life information seekers tend not to follow the logic of a rational, step-by-step search plan. Instead, they behave "irrationally" by favouring satisficing and incremental approaches by adjusting their goals and objectives during searching. This suggests that intended strategies systematically developed prior to search would become less important in the future. As opportunistic and heuristic browsing strategies may occupy the central role in web searching in particular, the emphasis would be shifted to emergent strategies, that is, patterns in a stream of action, developed in the absence of intentions or despite them.

Even though real-life web searching may be increasingly based on emergent strategies, a broader perspective on the issues of information seeking and searching strategies is still relevant. For example, Sabbar and Xie (2016) demonstrated recently that people draw on ISSs of diverse kinds and that all information searching does not occur spontaneously by surfing the web. People make use of formal system strategies used in conjunction with sources such as OPACs, informal resource strategies (e.g. visiting, browsing or consulting bookstores) and interactive human strategies (e.g. consulting with humans as either an intermediary or a direct resource). These examples suggest that the issues of ISSs should not be viewed merely from the angle of emergent strategies; the categories of intended and deliberate strategies are relevant as well.

From this perspective, the issues dealing with source selection are particularly interesting (Freund, 2015). Such decisions are strategically important because they influence the ways in which the user sets potential information sources in a priority order: what sources are accessed first and what sources are excluded during the search process? To examine these questions, Freund (2015) has introduced a highly relevant concept, that is, source-selection strategy. This construct deserves further conceptual and empirical research with regard to diverse source types and information seeking contexts such as work task performance, health and leisure. As Freund (2015, p. 1063) demonstrated, the above issue is relevant because information behaviour tends to be strategic, rather than fundamentally driven by the principle of least effort. It is evident that decisions concerning source selection are associated with people's values, intentions, goals and plans – and through them, to issues of strategic action in the sense of intended and deliberate strategies. Closely related, the concept of satisficing may be potentially relevant for the elaboration of the issues of information seeking and searching strategies (Prabha *et al.*, 2007). People's anticipations and judgements of how much information is enough affect their intended and realized ISSs particularly in cases when they have limited time resources to identify and access alternative sources of information. The ways of satisficing behaviour may be highly indicative of their source-selection strategies, too, particularly while making decisions on when to stop the information seeking process.

The examination of the issues related to satisficing can be extended to the questions of heuristics. Heuristics can be generally understood as a subset of strategies that "ignore part of the information, with the goal of making decisions more quickly, frugally, and/or accurately than more complex methods" (Gigerenzer and Gaissmaier, 2011, p. 454). Particularly in cases of high cognitive load, information seeking and searching strategies may draw on availability heuristic in which an individual relies upon knowledge that is readily available rather than examine other alternatives or procedures (Tversky and Kahneman, 1974). Closely related, familiarity heuristic refers to a mental shortcut applied to in situations in which individuals assume that the circumstances underlying the past behaviour still hold true for the present situation and that the past behaviour thus can be correctly applied to the new situation. So far, we lack empirical studies examining the extent to which people may draw on heuristics such as these while selecting information sources. In addition, fast and frugal heuristics characterized by Gigerenzer and Todd (1999) are relevant from the perspective of information seeking and searching strategies in that such heuristics employ a minimum of time, knowledge and computation to make adaptive choices in real search environments. These heuristics can be used to solve problems of sequential search through objects or options, similar to satisficing. They can also be used to make choices between simultaneously available objects, where the search for information (in the form

of cues, features and consequences) about the possible options must be limited. Fast and frugal heuristics limit their search of objects of information using easily computable stopping and decisions rules. Overall, fast and frugal heuristics seem to particularly interesting from the viewpoint of web searching strategies needed in time-pressurized situations.

Relevant ideas for future research can also be found in Lucy Suchman's (1987) classic book plans and situated action. One of Suchman's key ideas applicable to the study of information seeking and searching strategies is that people often have plans of action mapped out in their heads, but they may need to change that plan depending on what is actually happening in a specific situation. Suchman believes that people construct their plan as they go along in the situation, creating and altering their next move based on what has just happened. People can attempt to make a plan, but their situation will ultimately determine what actual plan of action they make. As the findings of the present study demonstrated, Xie (2000) applied Suchman's ideas in her study on interactive information seeking. Suchman's approach also holds good promises in the examination of web search strategies from the perspective of multiple query reformulations, for example (Rieh and Xie, 2001).

The present study is limited in that the issues dealing with shifts in information seeking and search strategies were excluded from analysis. As shown by the studies of Xie (2000, 2007, 2008) and Sabbar and Xie (2016), ISSs are dynamic constructs, manifesting themselves in diverse kinds of shifts during the information seeking process. This finding supports the assumption that strategy is a living entity that evolves continually, shaped by contextual factors (Rose and Cray, 2013). To examine this issue in greater depth, more attention should be devoted to the situational and other contextual factors shaping the strategies for information seeking and searching (Xie, 2010, pp. 2595-2596). Relevant contextual factors include, for example, the nature of work tasks, the urgency of task performance and the stage of the information seeking process. Another limitation of the study is that Mintzberg's (1987) way to conceptualize strategy as plan vs patterns of action directs the main attention to conscious and intended plans. However, log data analysis of users' search trails on the web have revealed that it is possible extract patterns that look like strategies but do not necessarily follow from conscious or intended plans (e.g. White and Drucker, 2007). Findings such as these suggest that the data mining approach enables a relatively exact picture of the users' realized web search strategies. However, this approach is limited in that on a large scale it is impractical to have users personally describe their interaction behaviour across all searches they conduct (White and Drucker, 2007, p. 29). From this perspective, search strategies as plans can be approached better in small-scale studies making use of think-aloud protocols and interviews. So far, however, we lack methodological approaches combining the strengths of the above approaches so that information seeking or search strategies could be characterized in detail both in terms of plan and pattern in a stream of actions.

Conclusion

Strategies for information search and information seeking belong to the perennial issues of LIS. The key aspects of strategy – plan and pattern in a stream of actions – provided a useful lens for the elaboration of the conceptual space of information search and seeking strategies. The above aspects also provided a perspective on the ways in which LIS researchers have conceptualized information search and seeking strategies in terms of intended, deliberate and emergent strategies. The findings suggest that

researchers working in this area should be more attentive to terminology and definitions and incorporate a more robust notion of strategy. To refine the picture further, there is a need for empirical studies examining the applicability of the above categories within an information seeking process. Studies such as these would first focus on the plan (or intended strategy) created by the searcher. Thereafter, the information seeking process would be scrutinized by examining how and to what extent the realized strategy was constituted by deliberate and emergent strategies, and whether the intended strategy or a part of it failed and why.

The findings indicate that strategies for information seeking and searching are significant factors orienting the ways in people identify, select and access information objects. In this regard, the importance of "strategic" factors is comparable to other motivators for information seeking and searching, for example, information need and task at hand. Comparative studies of factors orienting information seeking and search are worthwhile because they can elaborate the conceptual space of LIS by integrating findings obtained in diverse subfields of information behaviour research.

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