

Heuristics elements of information seeking strategies and tactics: a conceptual analysis

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Abstract

Purpose – The purpose of this paper is to elaborate the picture of strategies and tactics for information seeking and searching by focusing on the heuristic elements of such strategies and tactics.

Design/methodology/approach – A conceptual analysis of a sample of 31 pertinent investigations was conducted to find out how researchers have approached heuristics in the above context since the 1970s. To achieve this, the study draws on the ideas produced within the research programmes on Heuristics and Biases, and Fast and Frugal Heuristics.

Findings – Researchers have approached the heuristic elements in three major ways. First, these elements are defined as general level constituents of browsing strategies in particular. Second, heuristics are approached as search tips. Third, there are examples of conceptualizations of individual heuristics. Familiarity heuristic suggests that people tend to prefer sources that have worked well in similar situations in the past. Recognition heuristic draws on an all-or-none distinction of the information objects, based on cues such as information scent. Finally, representativeness heuristic is based on recalling similar instances of events or objects and judging their typicality in terms of genres, for example.

Research limitations/implications – As the study focuses on three heuristics only, the findings cannot be generalized to describe the use of all heuristic elements of strategies and tactics for information seeking and searching.

Originality/value – The study pioneers by providing an in-depth analysis of the ways in which the heuristic elements are conceptualized in the context of information seeking and searching. The findings contribute to the elaboration of the conceptual issues of information behavior research.

Keywords Heuristics, Information search, Strategy, Information seeking, Conceptual analysis, Tactic

Paper type Conceptual paper

Introduction

Since the 1970s, researchers have identified a number of strategies and tactics for information seeking and searching (for an overview, see Savolainen, 2016). Following the classic definitions formulated by Bates (1979b, pp. 206-207), information search tactic can be understood as a move (or moves) made with the purpose of improving or speeding the search in some way, while information seeking (or searching) strategy is defined as a plan for the whole search. Thus understood, “strategic” and “tactical” are fundamental qualities of information seeking and searching because they suggest 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). Often, such strategic and tactical judgments incorporate heuristic elements, for example, rules of thumb that are used to facilitate the search process. However, researchers have diverse views on what types of strategies and tactics are heuristic and how to identify the heuristic elements. For example, Bates (1979b) defined a number of search tactics that can be regarded as search tips with heuristic value, while Marchionini (1995, p. 106) suggested that heuristic elements are particularly characteristic of browsing strategies.

In information behaviour research so far, the picture of the nature of heuristics has remained somewhat vague. Often, the concept of heuristic is taken for granted, as if it were self-explanatory. However, the issues related to heuristics are far from self-evident. The main goal of the present study is to add conceptual clarity by examining how researchers have approached the heuristic elements of strategies and tactics for information seeking and searching. As explained in more detail below, the above question will be examined by concentrating on the familiarity, recognition and representativeness heuristics. This topic is important because the study of the heuristic elements enables a more nuanced picture of the ways in which people identify, select and access information sources particularly in cases in which the information-seeking process is constrained by the lack of time and cognitive overload.

In general, heuristics can be understood as decision-making strategies derived from experience with similar problems, using readily accessible, though loosely applicable, information to problem solving, learning, or discovery (Mousavi and Gigerenzer, 2014, p. 1673). From this perspective, heuristics are something akin to strategies that people use consciously and deliberately in order to simplify judgmental tasks that would otherwise be too difficult to solve (Gilovich and Griffin, 2002, pp. 3-4). However, heuristics can also be used unconsciously. This approach is often referred to as intuition: decision makers sense what to do without being able to explain why (Mousavi and Gigerenzer, 2014, p. 1673).

Even though heuristics may not guarantee an optimal solution, they can facilitate information seeking. In real-world contexts people tend not to invest much time and energy in order to plan and execute their searches systematically. Instead, they often behave “irrationally” by taking heuristic shortcuts (Pharo and Järvelin, 2006, pp. 230-231). Empirical support for this assumption has been received from studies examining consumer information seeking on the Internet. Sillence and associates (2007) demonstrated that consumers first engaged in rapid heuristic processing of information. Within the first few minutes of interaction they sifted information, quickly recognizing and rejecting general portals and sales sites and sites they did not trust, primarily on the basis of design features affecting the “look and feel” of a site. Ylikoski (2005, p. 189) found that among consumers, heuristically oriented search methods such as chaining, browsing, and brief search accounted about 64% of online search events, while the proportion of events indicating systematic (analytic) search efforts was about 36%.

The above examples suggest that heuristics can occupy a significant role in information seeking. On the other hand, information searchers’ preference for heuristic approaches may be associated with the “cognitive miser” metaphor. It suggests, perhaps unfortunately, that heuristics are the products of lazy and inattentive minds. The distinction between systematic (analytic) and heuristic information seeking and processing is not new. For example, Chaiken (1980) proposed that when processing information systematically, individuals exert considerable cognitive effort and actively attempt to comprehend and evaluate the message’s arguments. Conversely, when processing information heuristically, individuals exert comparably little effort, rely on more accessible information, and select information sources on the basis of their identity or other non-content cues. Chaiken (1980, p. 752) concluded that heuristic processing is more likely to occur with low issue involvement, low perceived capacity to process information, or when an individual does not perceive more in-depth processing to be of much consequence. However, heuristic information searching may not be inferior to analytic information processing because heuristics can be helpful when there is a need to find quickly and still effectively enough information by making use of simple methods which have worked in similar situations in the past (Marsh, 2002, pp. 49-50). The growing supply of information particularly from the Internet often necessitates the use of heuristics in order to concentrate on the most pertinent items.

To examine the above issues in greater detail, a conceptual analysis was made by drawing on the ideas developed within two prominent research programmes, that is, *Heuristics and Biases*, and *Fast and Frugal Heuristics*. These programmes examine heuristics in contexts in which

decision makers make judgments under uncertainty. The above research approaches were chosen as a point of departure because they are generic enough for the study of heuristic elements in particular domains such as strategies and tactics for information seeking and searching. To this end, the *familiarity*, *recognition* and *representativeness* heuristics identified by the above research programmes appeared to be particularly relevant. Other research approaches to heuristics were less relevant for the study of such strategies and tactics. For example, the *heuristic-systematic model of information processing* model developed by Chaiken (1980) explains how people receive and process persuasive messages. Due to this focus, however, the above model is more useful for the analysis of information use, rather than information seeking and searching.

Following Wilson (2000, pp. 49-50), *information seeking* is approached as a 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 defined as a subset of information seeking - a micro-level behaviour - referring to the purposive actions involved in interacting with an information search system, including information retrieval (IR) systems and the World Wide Web (WWW). Furthermore, drawing on Bates (1979b, pp. 206-207), *information seeking* (or *searching*) *strategy* is understood as a plan for the whole search, while *information search tactic* is defined as a set of moves made with the purpose of facilitating the search so that the information seeking strategy can be realized in practice.

To give background, the next section reviews diverse approaches to heuristics, followed by the specification of the research setting and the report of the research findings. The final sections discuss the findings and draw conclusions about their significance for information behaviour research.

Approaches to heuristics

The term heuristic (εὐρίσκω) has its roots in Greek, meaning “serving to find out or discover” (Gigerenzer and Brighton, 2009, p. 108). The earliest references to heuristics can be traced to Ancient Greece where mathematicians attempted to find methods for findings proofs and for arriving at new discoveries (Groner *et al.*, 1983, p. 1). Later on, heuristics were associated with the search for algorithms needed in the solving of mathematical problems. In the end of the 19th century, psychologists became interested in the study of the structure and direction of thought processes. In this context, the term heuristic was primarily used to examine problem-solution trees. Later on, *heuristic search* became a central topic of interest in the field of artificial intelligence (Pearl, 1984). In this context, heuristic search refers to a problem-solving technique that by means of algorithms explores a space of problem states, i.e., successive and alternative stages in the problem-solving process (Edelkamp and Schrödl, 2012). The objective is to find a sequence of actions that transforms the start state into a goal state, and also optimizes some measure of the quality of the solution.

From the perspective of the present study, however, the early developments of cognitive science are more pertinent for the conceptualization of heuristics. Herbert Simon (1957) first proposed that people satisfice rather than maximize in decision making. Maximization means optimization, the process of finding the best solution for a problem, whereas *satisficing* means finding a good-enough solution. Simon (1957) approached heuristics as strategies that guide information search and modify problem representations to facilitate solutions. He used the term *satisficing* both as a generic term for everything that is not optimizing as well as for a specific heuristic: in order to select a good alternative from a series of options encountered sequentially, a person sets an aspiration level, chooses the first one that meets the aspiration, and then terminates search (Gigerenzer and Brighton, 2009, p. 108). For Simon, humans rely on heuristics not simply because their cognitive limitations prevent them from optimizing but also because of the requirements of the task environment.

Heuristics as cognitive bias

In the early 1970s, the term heuristic acquired a different connotation. Daniel Kahneman, Amos Tversky, and their collaborators published a series of experiments in which people's reasoning was interpreted as exhibiting fallacies and cognitive illusions. The experimental findings set in motion the Heuristics and Biases (HB) research programme. It examines how people make real-world judgments and the conditions under which those judgments are unreliable from the perspective of formal logic and probability theory. It is assumed that cognitive processes produce both valid and invalid judgments and that systematic deviations from rationality appear as cognitive illusions (Gilovich and Griffin, 2002). The main contributions of early HB studies can be crystallised in three major heuristics identified by Tversky and Kahneman (1974):

- *Availability heuristic* - a mental shortcut that occurs when people make judgments about the probability of events by the ease with which examples come to mind. When an infrequent event such as an earthquake can be brought easily and vividly to mind, people tend to overestimate its likelihood.
- *Representativeness heuristic* - a mental shortcut that is used while making judgments about the probability of an event under uncertainty or judging a situation based on how similar the prospects are to the prototypes or stereotypes the person holds in his or her mind. The representativeness heuristic is used, for example, while judging the credibility of a newspaper article. An individual article has a high representativeness for a category if it is very similar to a prototype of that category, for example, a tabloid article.
- *Anchoring and adjustment heuristic* describes the common human tendency to rely too heavily on the first piece of information offered (the "anchor") when making decisions. This heuristic is used particularly in situations where people estimate a number. At first, they are offered an "anchor" such as whether the percentage of African countries which are members of the United Nations would be larger or smaller than 65% - and then shifting either up or down to reach an answer that seems plausible. The experiments conducted by Tversky and Kahneman (1974, p. 1128) revealed that people did not shift far enough away from the offered anchor. Hence the anchor contaminates the estimate. To take a more recent example, the evaluation of the relevance of items provided by a search engine results page (SERP) may draw on the use of the above heuristic. For instance, a Google SERP usually contains 10 items, thus offering an anchor for the searchers. People tend to focus on the first SERP because they believe that these 10 items provide access to the most relevant sources (Jansen and Spink, 2005).

Later on, HB researchers elaborated the nature of the availability and representativeness heuristics by providing a definition of *attribute substitution* (Kahneman, 2003, p. 707). It occurs when an individual has to make a judgment of a target attribute that is computationally complex, and instead substitutes a more easily calculated *heuristic attribute* that comes more readily to mind. This substitution is thought of as taking place in the automatic intuitive judgment system, rather than the more self-aware reflective system. For example, in a face-to-face conversation with a stranger, judging their intelligence is more computationally complex than judging the colour of their skin. If an individual has a stereotype about the relative intelligence of whites, blacks, and Asians, that racial attribute might substitute for the more intangible attribute of intelligence (Kahneman and Frederick, 2002). As a part of the studies on attribute substitution, HB researchers elaborated the nature of selection (or choice) heuristics that are automatic in nature (Frederick, 2002). For example, *choosing by liking* heuristic is based on an immediate and spontaneous affective evaluation. This heuristic is governed by rapid and intuitive processes, resulting in liking or disliking of diverse options. Therefore, it is also labeled as "How-do-I-feel-about-it" heuristic (Schwarz and Clore, 1988) and *affect heuristic* (Slovic *et al.*, 2002). An affective evaluation may work in conjunction with cognitive evaluation: the former is used as a quick initial screen for alternatives, whereas the latter is reserved

for those alternatives that surpass some affective threshold. Thus, *choosing by liking* heuristic suggests preferring an option that spontaneously generates the most favorable affective response.

The repertoire of heuristics of interest to the present study can be extended by introducing the *familiarity heuristic*. Even though HB researchers have not used the term familiarity heuristic, it can be regarded as a legitimate subtype of the availability heuristic discussed above. Ashcraft and Radvansky (2010, p. 442) prefer the term “familiarity bias” while characterizing the distortions stemming from the availability heuristic. Nevertheless, the use of the term familiarity heuristic can be justified in that Tversky and Kahneman (1974, p. 1127) characterized familiarity as one of the key factors affecting the retrievability of instances from the memory. This means that events are judged as more frequent or important because they are more familiar in memory (Ashcraft and Radvansky, 2010, p. 442). However, the use of the availability heuristic, as well as the familiarity heuristic is not merely affected by the experienced ease of recall from memory (Schwarz and Vaughn, 2002). In addition, the significance of the recalled content plays a role particularly when the decision-making task is of high personal relevance. The familiarity heuristic suggests, for example, that a person prefers a particular website when he or she recalls that it provided useful information in a decision-making situation in the past.

Gilovich and Griffin (2002, pp. 3-4) emphasize that although heuristics are distinguished from normative reasoning processes by patterns of biased judgments, heuristics themselves are sensible estimation procedures that are by no measure “irrational.” Although heuristics may yield “quick and dirty” solutions, they draw on underlying processes such as feature matching and memory retrieval that are highly sophisticated. Thus, heuristics such as *availability*, *familiarity*, *representativeness*, and *choosing by liking* can be regarded as highly efficient mental shortcuts that provide subjectively compelling and often quite serviceable solutions to judgmental problems. Gilovich and Griffin (2002, pp. 3-4) remind, however, that heuristics are just that - serviceable, not exact or perfectly accurate.

Fast and Frugal Heuristics

Since the 1990s, Gerd Gigerenzer and his colleagues have developed an alternative research programme labeled as Fast and Frugal Heuristics (FFH). Intellectually, this programme is rooted in Simon’s (1957) work on satisficing and on ecological and evolutionary views of cognition, where adaptive function and success is central, as opposed to logical structure and consistency emphasized by the HB approach. FFH researchers take a critical stance on the HB approach because it is assumed to be too focused on how heuristics lead to fallacies, thus giving a negative connotation to heuristics more generally (Gigerenzer and Brighton, 2009, p. 115). FFH researchers also question the view that that heuristics would mean an irrational approach to decision making. Conversely, they maintain that heuristics work when there is a positive correlation between a recognized object, for example, an information source and a target value such as the solving of a health problem (Raab and Gigerenzer, 2015).

In general, fast and frugal heuristics can be defined as strategies that ignore a part of information, with the goal of making decisions more quickly, frugally, and accurately than more complex methods (Gigerenzer and Gaissmaier, 2011, p. 454). A heuristic is fast if it can solve a problem in little time and frugal if it can solve it with little information by intentionally ignoring cues, weights, and dependencies between cues (Gigerenzer, 2008, p. 7; Gigerenzer and Brighton, 2009, p. 111.) Fast and frugal heuristics are typically composed of three building blocks. First, *search rules* specify where to look for information. Second, *stopping rules* specify when to end the information search. Third, *decision rules* specify how to make a final decision (Raab and Gigerenzer, 2015).

FFH researchers have specified a few “one-good-reason heuristics” drawing on the ideas of satisficing. Perhaps the most widely known fast and frugal heuristic is *take-the-best* (TTB) (Gigerenzer and Goldstein, 1996, pp. 653-654). TTB is based on the *recognition principle*: if only one of the two objects such as websites is considered as relevant for decision making, then choose

the recognized object. If neither of the two objects is recognized as relevant, then choose randomly between them. If both of the objects are recognized as relevant, then proceed to search for cue values. For the two objects, retrieve the cue values of the highest ranking cue from memory. Further, decide whether the cue discriminates between two objects: if one has a positive cue value, e.g., recency and the other does not. If the cue discriminates, then stop searching for cue values. If the cue does not discriminate, continue with the next cue until a cue that discriminates is found. Finally, TTB advises to choose the object with the positive cue value. If no cue discriminates, then choose randomly.

More recently, FFH researchers have characterized the recognition principle more broadly and defined it as a key heuristic in itself (Gigerenzer and Goldstein, 2011; Goldstein and Gigerenzer, 2002, p. 76). *The recognition heuristic* (RH) suggests: if one of two alternatives is recognized and the other is not, then infer that the recognized alternative has the higher value with respect to the criterion (Gigerenzer and Gaissmaier, 2011, p. 460). Thus, RH is even simpler and faster than TTB because there is no need to continue the search in order to find out which of the cues has the highest ranking value. Gigerenzer and Gaissmaier (2011, p. 460) remind that from the perspective of heuristics, the word *recognition* can be understood at different levels of specificity. First, one may have no knowledge of an object or event because one has never heard, smelled, touched, tasted, or seen it before. Such objects can be defined as “unrecognized.” Second, there can be “merely recognized” objects that one has experienced before but of which one has absolutely no further knowledge beyond this initial sense of recognition. For example, one may recognize another's face but cannot remember his or her name. The third level of knowledge comprises mere recognition plus further knowledge; not only does one recognize the object, but one can provide additional information about it, such as where one encountered it.

The above examples suggest that recognition is a strong force in people's choices (Gigerenzer and Goldstein, 1996, p. 663). If a scholar browses a new book focusing on his or her research topic but does not recognize the name of the author, he or she may make the inference that the book is probably not worth borrowing from the library. Further, if he or she does not recognize most of the authors included in the list of references, he or she may conclude that the book is not even worth reading. Thus, RH orients a limited search by defining stopping points (Gigerenzer and Goldstein, 1996, p. 663). Stopping rules are particularly important while seeking information under limited time.

Goldstein and Gigerenzer (2002, p. 77) contend that RH needs to be distinguished from the availability heuristic proposed by Tversky and Kahneman (1974) because it is based on recall, not recognition. The importance of RH originates from the fact that a sense of recognition in consciousness appear earlier than recollection (Gigerenzer and Gaissmaier, 2011, p. 460). People recognize far more items than they can recall. The availability heuristic refers to the degree of knowledge (or amount of experience) a person has of a task or object. RH, in contrast, treats recognition as a binary, all-or-none distinction. RH-based search is stopped whenever one object is recognized as relevant and the other is not; no further information is looked up about the recognized object.

Bishop (2006) evaluated critically the nature of fast and frugal heuristics and considered *take-the-best* as the most impressive heuristic to come out of the FFH research programme. Nevertheless, FFH are not without challenges. First, the evidence for thinking that people are naturally disposed to use FFH is still spotty (Bishop, 2006, p. 208). One of the limitations of FFH is that such heuristics are “domain specific” (Bishop, 2006, p. 208). RH, for example, only works in environments where recognition is correlated with the criterion to which it applies ecologically. Further, TTB seems to be reliable in rather non-obvious and complex conditions. Bishop (2006, p. 208) concluded that FFH seem to be in principle highly reliable, but it is still unclear how people would be able to apply them properly for the needs of everyday problem solving.

HB and FFH: comparative notions

According to Polonioli (2013), the core disagreement between the HB and FFH approaches is, what constitutes a rational judgment in the first place. On the other hand, the conflict between HB and FFH seems to a matter of emphasis because both approaches suggest that heuristics are strategies that usually succeed but sometimes not (Polonioli, 2011, p. 137).

Kelman (2011) reviewed in detail the “heuristic debate” between the HB and FFH approaches. He concluded that despite diverse viewpoints to the definition of heuristics, HB and FFH researchers share much in common. They agree that people frequently and quite reasonably use heuristics, making factual judgments or reaching decisions about what actions best serve their ends without making use of all potentially relevant information or computational abilities. Kelman (2011) showed, however, that the operationalization of individual heuristics like *availability* and *recognition* is a demanding task in particular domains such as criminal law policy because the above heuristics are constructs that defy an exact definition. As the findings of the present study suggest, the same difficulty is faced in the field of information behaviour research, too.

Research questions

The above review allowed the identification of a few key heuristics defined by HB and FFH researchers. These heuristics include *anchoring and adjustment*, *availability*, *familiarity*, *choosing by liking*, *recognition*, *representativeness*, and *take-the-best*. The examples characterizing the use of these heuristics in the context of decision making suggest that they would also be relevant for the study of strategies and tactics for information seeking and searching because these activities are constitutive of decision making and problem solving. However, the preliminary analysis of the research material revealed that the number of relevant studies characterizing the use of anchoring and adjustment, availability, choosing by liking, and take-the-best heuristics in the context of information seeking and searching is really low; only a few implicit examples of these heuristics were available. Therefore, the attention was focused on the familiarity, recognition and representativeness heuristics, simply due to the fact that there is more research material available elucidating the nature of these heuristics. Moreover, the conceptualizations of these three heuristics were more explicit. To examine the above issues in greater detail, the present study addresses the following research questions:

- RQ1. In which ways have researchers approached the heuristic elements of strategies and tactics for information seeking and searching?
- RQ2. In which ways, if any have researchers characterized the familiarity, recognition and representativeness heuristics as elements of such strategies and tactics?

Answers to RQ1 provide an overall picture of the conceptualizations of heuristics in the context of information seeking strategies and tactics, while answers to RQ2 exemplify how the elements of the familiarity, recognition and representativeness heuristics appear in the characterizations of such strategies and tactics. Even though it turned out that researchers have not explicitly referred to individual heuristics such as these, their elements could be reliably identified in the characterizations of strategies and tactics for information seeking and tactics.

To strengthen the focus of the study, investigations characterizing *satisficing* as a constituent of information seeking and searching were excluded for two major reasons. First, although Simon (1957) considered satisficing as a specific heuristic that can be used to select a good alternative from a series of options encountered sequentially, other researchers have primarily approached satisficing as a fundamental characteristic of bounded rationality. Therefore, due to its generic nature, satisficing can be understood as a characteristic common to diverse heuristics such as *take-the best*, rather than an individual heuristic per se (Gigerenzer and Goldstein, 1996). Second, the analysis of the studies

conceptualizing the nature of satisficing in the context of information seeking and searching revealed that satisficing is not approached in terms of heuristics (e.g., Prabha *et al.*, 2007; Warwick *et al.*, 2009). Instead, satisficing is defined as a general level construct indicating what searches to conduct in order to obtain “good enough” information and when to stop the searching process. Another limitation of the present study is that it excludes the question of whether individual heuristics such as *familiarity* and *representativeness* would serve as effective tools in information seeking or whether they lead to bias in the identification and selection of information sources. It is evident that the analysis of the above issue would have required a separate empirical study.

Research material and analysis

To answer the above research questions, the main attention was directed to studies explicitly conceptualizing heuristic elements in information seeking and searching. For the systematic identification of pertinent material, databases such as Library and Information Science Abstracts, EBSCO and Google Scholar were used. The keywords used in literature searching included *information seeking*, *information search*, *browsing*, *strategy*, *tactic*, *heuristic*, *rules of thumb*, *satisficing* and *mental shortcut*, for example. This effort resulted in the identification of 65 potentially relevant articles, books and conference papers explicitly referring to heuristics in the characterizations of strategies and tactics for information seeking and searching. These studies mainly originated from the field of library and information science; in addition, there were a few investigations published in the forums of cognitive science, communication research and psychology. Based on the preliminary analysis, redundant studies repeating the findings of prior studies were eliminated, resulting in the final sample of 31 pertinent investigations published within the period of 1979-2016.

The research material was examined by means of conceptual analysis. This method can be defined as an approach that treats the components of the study objects as classes of objects, events, properties, or relationships (Furner, 2004). The analysis involves defining the meaning of a concept and its attributes by identifying and specifying the contexts in which it is classified under the concept in question. To conduct the conceptual analysis, relevant text portions (paragraphs and sentences) explicitly characterizing heuristics as elements of strategies or tactics for information seeking and searching were first identified from the research material by means of open coding preceding the designation of categories. To identify relevant material for the first research question, i.e., “In which ways have researchers approached the heuristic elements of strategies and tactics for information seeking and searching?”, terms indicating categories used in the preliminary coding included, for example, “information seeking heuristics” (Gonzales, 2013), “rules of thumb” (Hilligoss and Rieh, 2008) and “information search heuristic” (Harter, 1986). To exemplify, the open coding identified Harter’s (1986, p. 170) explicit definition of search heuristic suggesting that “a search tactic or heuristic is a move made to advance a particular strategy”. After the preliminary coding, the research material was read several times to allow for other categories to emerge. This resulted in the identification of a few novel categories such as “search tips” and “personal heuristics”.

Similarly, to identify relevant material for the second research question, i.e., “In which ways, if any have researchers characterized the familiarity, recognition and representativeness heuristics as elements of such strategies and tactics?”, open coding preceding the designation of categories was used. To this end, the attention was devoted to descriptions that incorporated elements of the familiarity, recognition and representativeness heuristics. Such elements were identified by drawing on the definitions reviewed above in the sections describing the HB and FFH approaches. An example of *familiarity* - a key category of the HB - identified in the open coding is *Check*. It is one of the search tactics identified by Bates (1979b). This tactic exemplifies the familiarity heuristic because Check is based on the identification of similarities between earlier attempts to seek information: “review the original request and compare it to the current search topic to see that it is the same” (Bates, 1979b, p. 208). To compare, *recognition* – a key category of FFH is exemplified

by the construct of *information scent* which refers to cues that inform the value or potential gain of the patches (Fu and Pirolli, 2007). Table I provides illustrative examples of the coding procedure.

	Familiarity	Recognition	Representativeness
Key rationale behind the heuristic	Events are judged as more frequent or important because they are more familiar in memory (Ashcraft and Radvansky, 2010, p. 442).	If one of two alternatives is recognized and the other is not, the recognized alternative has the higher value with respect to the criterion (Gigerenzer and Gaissmaier, 2011, p. 460)	Making judgments about the probability of an event under uncertainty or judging a situation based on how similar the prospects are to the prototypes the person holds in his or her mind (Tversky and Kahneman, 1974)
The use of the heuristic in information seeking and searching	Recalling situations in which an information source provided useful information in the past and preferring the same source on the basis of earlier use experiences	Binary, all-or-none distinction of an information object in an environment; an information source is preferred on the basis of its distinctiveness	Evaluating the relevance of an information source on the basis of its typicality or genre
Examples of the approaches to individual heuristics as elements of strategies and tactics for information seeking and searching	Information search tactics, e.g., Check (Bates, 1979b) Known site strategy, (Fidel <i>et al.</i> , 1999) Known address strategy (Thatcher, 2006) Credibility judgment based on the familiarity with an information source (Hilligoss and Rieh, 2008)	Recognition of “information scent” as a proximal cue of the relevance of an information source particularly in electronic environments (Fu and Pirolli, 2007; Pirolli, 2007; Sundar <i>et al.</i> , 2007; Tomasi, 2014)	Identification of relevant genres while seeking for pleasure reading (Ross, 1999) Credibility judgment based on media-related and endorsement-based beliefs of sources’ authoritativeness (Hilligoss and Rieh, 2008; Sundar, 2008)

Table I. The coding of the research material.

The conceptual analysis scrutinized how the heuristic elements are defined and described in the characterizations of strategies and tactics for information seeking and searching. More specifically, the analysis was based on the identification of similarities and differences between diverse characterizations. The analysis was rendered difficult in that degree of specificity of the definition of heuristic elements varied from a study to another. On the one hand, there were exact specifications. For example, *language heuristics* characterized by Harter (1986, p. 197) advises the searcher to “take utmost care to identify all possible ways of representing a concept, if a language field such as title, abstract, or full text is the object of search”. In most studies, however, the characterizations of the relationship between heuristic and strategy or tactic drew on shared elements or attributes, indicating a loose connection. For example, Bates (1979b, p. 207) described search

strategies and idea tactics as “heuristic” in the sense that “they can facilitate the search process, but not necessarily”. This suggests that search tactics and heuristics share the attribute of uncertainty. Similarly, the analysis of the familiarity, recognition and representativeness heuristics indicated that the relationships between heuristic and strategy or tactic draw on shared elements or attributes. As specified in Table I, the relationships were based on analogy, similarity between earlier and current situations, as well as perception of the prototypicality of an object.

Even though some of the characterizations describing the relationships between heuristics and information searching tactics were vague, the analysis served the purpose of an exploratory study. Most importantly, the study allowed the identification of a few concrete examples of the ways in which the familiarity, recognition and representativeness heuristics figure in such strategies and tactics.

Findings

The findings will be discussed by starting from the general level approaches to heuristic elements of strategies and tactics for information seeking and searching. Two main approaches were identified: heuristics as general constituents of strategies for information seeking and searching, and heuristics as search tips. The picture of heuristics will then be refined by reporting the findings concerning the conceptualization of *familiarity*, *recognition* and *representativeness* heuristics.

Heuristics as general constituents of strategies for information seeking and searching

The conceptual analysis revealed considerable variation in the ways which researchers have characterized the heuristic elements of information seeking and searching. In most cases, such elements have been approached at a general level only. For example, Ylikoski (2005) described heuristic searches by referring to the generic features of information seeking identified by Ellis (1989). Such features include *starting* (identifying where to start), *chaining* (following hyperlinks), *browsing* (scanning top level pages), *differentiating* (selecting sites for further analysis), and *monitoring* (using alerts or revisiting favorites). General level characterizations such as these are not without problems because they leave open the question of the criteria by which activities like starting and differentiating would be regarded as heuristic in nature. Individual characteristics are just labeled as heuristic. This approach is also evident in studies in which the concept of heuristic is used to denote related phenomena. For example, Gonzales (2013) aimed at examining the “information seeking heuristics” of undergraduate students, but the empirical findings reveal that in fact, the study describes these students’ information source preferences.

However, there are studies characterizing the heuristic elements in a more focused manner. Marchionini (1995, p. 8) distinguished two major categories of search strategies by their level of goal-directedness, formality and planning. *Analytical strategies* can be characterized by qualities such as planned, systematic, specialized, goal-driven and formal, whereas *browsing strategies* are opportunistic, heuristic, data driven and informal. This suggests that the heuristic elements in information searching are associated with spontaneous (rather than planned) ways of identifying and accessing information sources, as well as interacting with them. Marchionini (1995, p. 106) differentiated between three main types of browsing. *Directed browsing* occurs when this activity is systematic, focused and directed by a specific object or target. Examples include checking a list for a known item, and verifying information such as dates. *Semi-directed browsing* occurs when browsing is predictive or generally purposeful: the target is less definite and browsing is less systematic. An example is entering a single, general term into a database and casually examining the retrieved records. Finally, *undirected browsing* occurs when there is no real goal and very little focus. Examples include flipping through a magazine and surfing on the Web.

Common to studies reviewed above is that they leave open the question about the exact meaning of heuristics in the context of information seeking and searching. Heuristics are approached as general constituents of strategies for information seeking, searching or browsing. However, Marchionini (1995, p. 7) shed additional light on the nature of browsing behaviour by proposing that it draws on the recognition of relevant information. This suggests, though implicitly, that browsing makes use of the recognition heuristic in particular. The importance of this heuristic becomes understandable in that most forms of browsing, for example, surfing on the Web rely strongly on vision - our predominating sense (Bates, 2007). Naturally, recognizing an information object, for example, an underlined hyperlink by eye is insufficient for the recognition: in addition, the object has to be interpreted cognitively as something meaningful. The heuristic elements in browsing may originate from the use of other senses, too. As Bates (2007) put it, “we may examine something only visually, or with touch or other senses, such as smell or hearing”. Interestingly, the heuristic potential of the sense of smell is conceptualized - though metaphorically - in Information Foraging theory. It proposes that people base their decisions about the relevance of information sources on “information scent” (Pirolli, 2007). The foraging approach will be discussed in more detail in the context of recognition heuristic below.

Heuristics as search tips

Another general level approach to heuristic elements is to describe them as rules of thumb serving as search tips. One of the pioneering researchers approaching heuristic elements from this perspective is Marcia Bates. Her studies on information search tactics (Bates, 1979b) and idea tactics (Bates, 1979a) are among the most important contributions to the early studies characterizing heuristic elements of information searching, even though she did not explicitly define the nature of heuristics. Both types of tactics were characterized generally as “heuristic” in the sense that they can facilitate the search process, but not necessarily (Bates, 1979a, p. 281; Bates, 1979b, p. 207). There can be good or effective information tactics and bad ones. The same caveat applies to heuristics more generally (Gilovich and Griffin, 2002, pp. 3-4). Interestingly, Bates (1979b, p. 213) also devoted attention to a central question common to heuristics and search tactics: when to stop the information search? To this end, pertinent questions include, for example, how does one judge when enough information or citations have been gathered, and how does one decide to give up an unsuccessful search?

Bates identified no less than 29 diverse search tactics and 16 idea tactics. Overall, search tactics are thought likely to improve the effectiveness or efficiency of a search (Bates, 1979b, pp. 206-207). The focus of idea tactics is psychological: they are intended to improve the information specialists’ thinking and creative processes in searching particularly in cases in which the searcher is “stumped” (Bates, 1979a, p. 280). Thus, basically, idea tactics may serve as rules of thumb. For example, the idea tactic labeled as *Focus* advises the searcher to “look at the query more narrowly, in one or both of two senses: 1) to move from the whole query to a part of it or 2) to move from a broader to a narrower conceptualization of the query” (Bates, 1979a, p. 282).

Somewhat later, Harter (1986, pp. 179-204) dedicated a whole chapter to the issues “search strategies and heuristics” in his textbook *Online information retrieval: concepts, principles and techniques*. Drawing on Bates’s (1979b, pp. 206-207) definition, he approached heuristic and search tactic synonymously: “a search tactic or heuristic is a move made to advance a particular strategy” (Harter, 1986, p. 170). From this perspective, a search strategy means an overall plan for achieving a goal, while heuristics are “actions taken to meet limited objectives, either planned in advance or formulated as the search progresses, to help achieve that goal” (Harter, 1986, p. 170). He compared online searching to a heuristic problem-solving activity that proceeds from the establishing an overall search strategy to specific search formulations (Harter, 1986, p. 194).

A closer analysis of the heuristics for online searching described by Harter (1986, pp. 194-202) reveals that they primarily deal with search tips of diverse kinds. Search heuristics suggest, for example, how to increase the recall by deleting a facet, or how to increase precision by deleting ambiguous or overly broad terms in the facets (Harter, 1986, pp. 174-175). There are also a number of search heuristics related to the use of natural language words and controlled vocabularies. One of language heuristics advises the searcher to “take utmost care to identify all possible ways of representing a concept, if a language field such as title, abstract, or full text is the object of search” (Harter, 1986, p. 197). This search tip is useful in traditional database searching, because natural languages are extraordinarily rich in variety of ways ideas can be expressed. Further, Harter (1986, pp. 198-202) described command language, database and file structure heuristics such as “know the stop words used by the search system” and “always question null sets”. Moreover, there were recall and precision heuristics such as “use more generic terms in addition to specific terms to represent search concepts” and “use more restrictive proximity operators”.

Another example of early studies approaching heuristics from the viewpoint of search tips is provided by Chen and Dhar (1991). Drawing on two empirical studies, they identified five types of information search strategies. Of them, the *search-option-heuristics strategy* is most pertinent for the present study because it explicitly refers to the use heuristic elements in searching, more specifically, the ways in which searchers use different online search options to perform subject-based searches for unknown documents in some subject areas (Chen and Dhar, 1991, p. 411-413). In particular, controlled subject search, title search, keyword subject search and keyword title search appeared to be the four most frequently used search options.

Based on the searchers’ ways to use the above options, Chen and Dhar (1991, pp. 411-413) identified a “set of heuristics” that indicate appropriate situations for applying each search option. Unfortunately, however, the concept of “heuristics” was not characterized in greater detail. Nonetheless, it is evident that “heuristics” primarily refer to search techniques or tactics in the sense described by Bates (1979b). First, *heuristic for controlled subject search* is appropriate if the index terms have already been identified, possibly via other strategies such as the known-item-instantiation strategy (Chen and Dhar, 1991, pp. 411-412). For example, by using the search term “international corporation”, a searcher can get index terms such as international corporation - United States and international corporation - Japan. Second, the *heuristic for keyword subject search* draws on only a single-word input from the searchers. For example, by using “planning” in keyword subject search, the search system can match index terms such as “hierarchical *planning*” and “system *planning*”. Third, a *heuristic for title search* is appropriate for multi-word queries where search terms are likely to appear in the leftmost position of book titles. For example, by using “corporate finance” in title search, searchers can find books with titles like “corporate finance: an introduction” or “corporate finance for MBAs”. Fourth, users can make use of the *heuristic for keyword title search*. Similar to title search, keyword title search is appropriate when the search term is likely to appear in the book title. For example, by using “deregulation” in keyword title search, searchers can find all books that have the term “deregulation” in the title, such as “airline deregulation” and “deregulation of the banking industry”. Chen and Dhar (1991, pp. 413) remind that the search-option-heuristics strategy is iterative in nature. Searchers can use different search terms repeatedly until they are either satisfied or decide to give up.

The above examples suggest that from the viewpoint of search tips, the heuristic elements of search tactics can be specified quite well. However, as Harter (1986, p. 201) reminded, the choice of a relevant search heuristic is not necessarily an easy task. Because there are no recipes applicable to every search situation, the searcher has to rely on his or her intuition, problem solving abilities and personal knowledge base in the choice of appropriate heuristics. Nonetheless, in order to help searchers, Harter (1986, p. 201) formulated a few “personal heuristics” such as “be willing to look at a search in more than one way”, and “evaluate your own work critically”. Heuristics of this kind come close to the idea tactics formulated by Bates (1979a). Even though personal heuristics

(Harter, 1986) and idea tactics (Bates, 1979a) were developed in times when Boolean database searching was the standard approach, it is obvious that some of the search tips such as “be willing to look at a search in more than one way” and “always question null sets” are relevant in web searching, too.

Approaches to individual heuristics in strategies and tactics for information seeking

Familiarity

The conceptual analysis revealed that of the individual heuristics identified in HB and FFH studies, researchers have most often devoted attention to elements characteristic of the familiarity heuristic while conceptualizing the nature of strategies and tactics for information seeking and searching. As noted above, the familiarity heuristic is based on the recall of a particular information source that appeared to be useful in a past decision-making situation. The heuristic draws on the assumption that the circumstances underlying the past information-seeking behaviour still hold true for the present situation and that the past behaviour thus can be correctly applied to the new situation because such a behaviour is familiar in memory (Ashcraft and Radvansky, 2010, p. 442).

Examples of studies in which the familiarity heuristic is identifiable from the characterizations of information search tactics and strategies can be found since the 1970s. For instance, *Check* - one of the search tactics identified by Bates draws on the familiarity heuristic because this tactic is based on the identification of similarities between earlier attempts to seek information: “review the original request and compare it to the current search topic to see that it is the same” (Bates, 1979b, p. 208). Later studies have shown that the familiarity heuristic is constitutive of web searching strategies, too. Fidel and associates (1999) identified the *known site strategy*, i.e., going directly to a website address that is known or guessed. Thatcher (2006, p. 1061) characterized a similar strategy, though he named it as a *known address strategy*. Users following this strategy go straight to a known site where he or she expects to find the information being sought. If they are able to recall the webpage address, they can type in it in the web browser address command line. They also can access the known webpage through their bookmark or favourites menu or by using the scroll bar if they had been to the webpage previously. More recently, Xie and Joo (2010, p. 266) identified a closely-related search strategy, that is, *known-item initiation*. Individuals making use of this strategy begin their search tasks from known sites that they are familiar with or that are recommended by someone else. Finally, Joseph (2013) demonstrated how the familiarity heuristic manifests itself in the use of mental shortcuts. Web searchers recall the search conducted previously and return to it if the website had saved into their “favourites” function of the search system, or if it was possible to access the information from their recent items folder.

The nature of the familiarity heuristic has also been characterized in the context of credibility assessment. Credibility judgments form a significant part of information seeking and searching strategies because they result in the acceptance or rejection of a source candidate. Therefore, credibility assessment is particularly relevant from the viewpoint of choice heuristics. Based on an empirical study, Hilligoss and Rieh (2008, p. 1476) demonstrated that the familiarity heuristic occupies a significant role in this context because people often assess the credibility of a source by using a binary criterion: familiar versus unfamiliar sources. In this case, the familiarity heuristic leads to think that known sources are more credible than unfamiliar ones.

Recognition

According to Gigerenzer and Gaissmaier (2011, p. 460), the recognition heuristic (RH) is based on a binary, all-or-none distinction: if one of two alternatives is recognized and the other is not, then infer

that the recognized alternative has the higher value with respect to the criterion. RH is particularly relevant from the perspective of Information Foraging theory (IFT) because it suggests that information sources are identified and accessed on the basis of their distinctiveness. IFT explains how people seek and gather information, and how they stop the information-seeking process (Pirolli and Card, 1999; Pirolli, 2007; Tomasi, 2014). IFT assumes that information is distributed in the environment much in the way that food is distributed in the wild, in clusters or “patches”. Such patches can vary in the amount of resources they contain (i.e., energy or information) and how easy these resources are to extract (Liu *et al.*, 2016, p. 212).

While making decisions on which particular patches to select and in which order, information foragers draw on *information scent* cues that inform the value or potential gain of the patches (Fu and Pirolli, 2007). More specifically, information scent may be defined as “terse representations of content ... whose trail leads to information of interest” (Pirolli, 2007, p. 69). Cues in the immediate environment - so-called “proximal cues” - let out a scent about the nature of “distal information” so that users can decide whether to pursue information by navigating towards particular sources or ignore it in favour of more promising search paths (Sundar *et al.*, 2007, p. 366). Hyperlinked text on Web pages (indicated with an underline) is an oft-used example of a proximal cue that can possess a strong scent, weak scent, or no scent based on the degree to which the hyperlinked words overlap with the user's information needs. This suggests that the selection of an information source draws on RH: a source is either selected (accepted) or rejected (ignored), depending on whether an information scent recognized by an individual indicates high or low informational value. Strong scent suggests that a source has a value that distinguishes it positively from other source candidates. Thus understood, scent following based on RH is very much like heuristic search studied in human problem solving and in artificial intelligence (Pirolli and Card, 1999, pp. 646-647). If the scent is recognized as sufficiently strong, the forager will be able to make the correct choice at each decision point. If there is no scent, the forager will perform a random walk, either literally in physical space or metaphorically in abstract search space (Pirolli, 2007, p. 62). RH also triggers a stopping behaviour: leave an information patch when the strength of the information scent falls below a certain threshold value.

Representativeness

The representativeness heuristic refers to a mental shortcut that is used when making judgments about the probability of an event under uncertainty or judging a situation based on how similar the prospects are to the prototypes the person holds in his or her mind (Tversky and Kahneman, 1974). This heuristic is used when an individual evaluates an information source, for example, a website by considering whether it is typical of a category. An individual thing has a high representativeness for a category if it is very similar to a prototype of that category, for example, an official website of a university.

The use of the representativeness heuristic is obvious in situations in which people make judgments about the relevance of an information source by identifying the genre to which it belongs. For example, Ross (1999) examined the criteria by which people identify and choose pleasure reading. The findings indicate that such criteria draw on a great deal originate from “behind the eyes” knowledge that the reader brings to the particular text - knowledge about genres, authors, cover art, and the reputation of publishers; memory of reviews and advice from friends, as well as the ability to perform tests on the text itself by reading a sample paragraph or page (Ross, 1999, p. 797). Each successful choice makes it more likely that the reader will repeat the rewarding experience by reading something further. On the other hand, the findings of her study suggest that the representativeness heuristic does not alone dictate the choices because the readers may simultaneously draw on heuristics of other types such as choosing by liking (Frederick, 2002). As the motivators for seeking for pleasure

reading tend to affectively coloured, choosing by liking heuristic may occupy a central role because it suggests preferring an option that generates the most favorable affective response.

The representativeness heuristic is also embedded in the credibility assessment of information sources of diverse types. This heuristic can manifest itself in rules of thumb affecting the scrutiny or skepticism with which one can approach information found in a given media format (Hilligoss and Rieh, 2008, pp. 1476-1477). For example, if people develop media-related representativeness heuristics about certain digital media such as online discussion forums, they may not need to examine various characteristics of information sources in order to evaluate the information they encounter. An individual may also draw on a heuristic of this kind while assessing the credibility of books, peer-reviewed journal articles, blogs, and libraries. The representativeness heuristic may suggest, for example, that the peer-review process lies behind the positive judgment of the credibility of scholarly journal articles. The representativeness heuristic can also be based on endorsement-based beliefs: a particular information source is judged as credible because it has been endorsed, recommended, or otherwise upheld by knowledgeable and trusted individuals. In this case, the representativeness heuristic might also be labeled as a kind of “authority heuristics”, because one of the major criteria for assigning credibility to an information source is whether it can be categorized as an official authority (Sundar, 2008, p. 75; 84). For example, a message on a Web site about a health issue may be more likely to be taken on face value (i.e., without much scrutiny or counter argumentation) if an information seeker finds out that the message is endorsed by a seemingly expert source such as the American Medical Association.

Discussion

The present study examined the nature of heuristic elements of strategies and tactics for information seeking and searching. Such elements were approached by drawing on the ideas developed within the HB and FFH research programmes. The study showed that researchers have rarely detailed the heuristic elements of strategies and tactics for information seeking and searching the heuristic elements. At the highest level of generality, heuristic elements are associated with browsing strategies in particular (e.g., Marchionini, 1995). A more specific picture of heuristics is based on the identification of search tips which may be used to facilitate the search process (Bates, 1979b; Harter, 1986). Overall, these two approaches were particularly characteristic of early studies on this topic. Even though the number of studies explicitly characterizing the nature of individual heuristics in information seeking is relatively low, more recent investigations have provided somewhat more detailed picture of the familiarity, recognition and representativeness heuristics in particular. These findings are summarized in Table II.

	Familiarity	Recognition	Representativeness
Key rationale behind the heuristic	Events are judged as more frequent or important because they are more familiar in memory (Ashcraft and Radvansky, 2010, p. 442).	If one of two alternatives is recognized and the other is not, the recognized alternative has the higher value with respect to the criterion (Gigerenzer and Gaissmaier, 2011, p. 460).	Making judgments about the probability of an event under uncertainty or judging a situation based on how similar the prospects are to the prototypes the person holds in his or her mind (Tversky and Kahneman, 1974).
The use of the heuristic in information seeking and searching	Recalling situations in which an information source provided useful information in the past and preferring the same source on the basis of earlier use experiences	Binary, all-or-none distinction of an information object in an environment; an information source is preferred on the basis of its distinctiveness	Evaluating the relevance of an information source on the basis of its typicality or genre
Examples of the approaches to individual heuristics as elements of strategies and tactics for information seeking and searching	Information search tactics, e.g., Check (Bates, 1979b) Known site strategy, (Fidel <i>et al.</i> , 1999) Known address strategy (Thatcher, 2006) Credibility judgment based on the familiarity with an information source (Hilligoss and Rieh, 2008).	Recognition of “information scent” as a proximal cue of the relevance of an information source particularly in electronic environments (Fu and Pirolli, 2007; Pirolli, 2007; Sundar <i>et al.</i> , 2007; Tomasi, 2014).	Identification of relevant genres while seeking for pleasure reading (Ross, 1999) Credibility judgment based on media-related and endorsement-based beliefs of sources’ authoritativeness (Hilligoss and Rieh, 2008; Sundar, 2008).

Table II. Approaches to three key heuristics as elements of strategies and tactics for information seeking and searching.

As Table II indicates, the repertoire of studies characterizing the familiarity heuristic ranges from the conceptualizations of search tactics to web searching strategies such as known-item initiation and judging source credibility on the basis of its familiarity. The recognition heuristic has primarily been conceptualized in the context of the Information Foraging theory. This heuristic advises to prefer an information source that can be distinguished from others due to “information scent. Finally, the representativeness heuristic has mainly been characterized in the context of credibility judgment. This heuristic draws on the identification of diverse genres of information sources, based on the beliefs about their typical content.

Overall, the findings indicate that role of other heuristics has remained marginal in the conceptualizations of the strategies and tactics for information seeking and searching. For example, no sufficiently clear examples could be found of the use of *the take-the-best* (TTB) heuristic. However, searchers may draw on it, at least implicitly. We may speculate, for example, that *Cut* - one

of the file structure tactics identified by Bates (1979b, p. 209) incorporates the elements of TTB. This tactic advises the searcher as follows: “When selecting among several ways to search a given query, to Cut is to choose the option that cuts out, eliminates, the largest part of the search domain at once” (Bates, 1979b, p. 209). This tactic follows the maxim of TTB suggesting “take the best, ignore the rest” (Gigerenzer and Goldstein, 1996, pp. 653-654). Naturally, the successful use of the Cut tactic requires that the searcher is able to identify the “best” part of the search domain on the basis of minimal cues. Similarly, thus far, the role of the *choosing by liking* heuristic has not been examined in greater detail in information behaviour research. This heuristic draws on an affectively-coloured immediate evaluation, which is governed by rapid and intuitive processes, resulting in liking or disliking of diverse options. The use of this heuristic is obvious in aesthetics-based credibility judgments because they can be connected to the evaluation of the credibility and aesthetic design in Web sites (Hilligoss and Rieh, 2008, p. 1477). For example, an individual may prefer a website based on the quality of its layout.

The above examples suggest that there is a considerable potential for further research in the study of strategies and tactics for information seeking and searching. One of the research topics is the nature of unconscious use of heuristics, often referred to as intuition (Mousavi and Gigerenzer, 2014, p. 1673). Studies examining intuitive judgment and decision making are highly relevant for the elaboration of the picture of heuristics more generally. Allen (2011, p. 2116) draws attention to the fact that although the concept of intuition is still contested, it is widely used in information seeking serving the ends of decision making. In information behaviour literature, intuitive decision making is often linked with the HB approach suggesting that decision making of this type would lead to suboptimal decision making (Gigerenzer and Brighton, 2009). Nevertheless, as Allen (2011, p. 2168) points out, studies on information processing within cognitive and social psychology, social cognitive neuroscience, and decision research have led to a resurgence of interest in intuition and information processing. Within the field of information behaviour, however, the concept of intuition is under-theorized, and it has not been incorporated into mainstream models of information behaviour. On the other hand, as Allen’s (2011, p. 2179) empirical findings demonstrate, intuitive decision making should not be examined as a separate category. Instead, there is a need to analyze the “dance” between deliberative and intuitive modes of information behaviour as complementary, rather than conflicting systems of information processing. The same conclusion about the complementarity rather than conflict applies to the role of heuristic and analytical modes of information seeking.

To clarify the nature of diverse heuristics, the present study has approached them as separate categories. However, it is evident that strategies and tactics for information seeking and searching can simultaneously incorporate elements of diverse heuristics. For example, familiarity, representativeness and choosing by liking heuristics may occur together while an individual identifies and selects information sources. Diverse heuristics can support each other, resulting in an immediate acceptance or rejection of a source. Alternatively, diverse heuristics can compete with each other. An initial judgment based on choosing by liking heuristic may be positive, due to an attractive layout of a website, but the representativeness heuristic suggests that the credibility of this source is somewhat dubious because it seems to belong to the category of “infotainment”, for example. In these cases, the final decision of the acceptance or rejection may require systematic cognitive effort to evaluate the relevance of the information source, as suggested by the heuristic-systematic model of information processing developed by Chaiken (1980).

More research is needed to find out how the use of diverse heuristics affects the decisions on source preferences. The research setting is complicated by the fact that heuristics are not necessarily stable constructs or manifestations of information-seeking habits (Hilligoss and Rieh, 2008, p. 1473). A person making a credibility judgment based on certain cues from a source of information may find later that the judgment contradicts the original heuristic. In such cases, the current heuristic can be elaborated by incorporating new elements regarding the representativeness of certain sources or the degree they are found familiar.

The findings have implications for the design of information search systems. As the search tactics and idea tactics proposed by Bates (1979a; 1979b), as well as heuristic search tips formulated by Chen and Dhar (1991) and Harter, 1986) date back to the pre-Internet era, they may have limited value in Web searching. Nevertheless, as Smith (2012) demonstrates, the repertoire of search tips can be updated by developing new search tactics such as Parallel and Context in order to support Web searchers. However, the heuristic support provided by search systems is probably most useful in the context of exploratory search because it is open-ended, opportunistic and multi-faceted in nature (White and Roth, 2009, p. 5). There are various possibilities to support exploratory information-seeking processes by providing heuristic cues. For example, information systems could be developed to help users formulate queries, as well as adjust queries and views on search results in real time (White and Roth, 2009, pp. 41-59). Moreover, there is a need to develop search systems which allow users to explore and filter results through the selection of facets and document metadata. It is also increasingly important to offer visualizations to support insight and decision making. In this regard, the support of recognition heuristics such as information scent holds a particular potential for system design.

Conclusion

Heuristics are common, though largely unexplored elements of information behaviour. Overall, the study of such elements is still in its infancy in the field of information science. Research on this topic has not much progressed since the 1970s and 1980s when first attempts were made to identify information search tactics (Bates, 1979b) and develop tips for database searching (Harter, 1986). The dearth of research suggests that the analysis of heuristics is an intellectually demanding topic; heuristics are difficult to conceptualize and capture empirically. Despite relatively scarce research material, the present study provided two main contributions to information behaviour research. First, the study elucidated the nature of heuristics in the particular context of strategies and tactics for information seeking and searching by drawing on the findings of two prominent research programmes, that is, Heuristics and Biases (HB), and Fast and Frugal Heuristics (FFH). Second, the study provided examples of the ways in which three key heuristics identified by HB and FFH scholars have been conceptualized in the investigations of strategies and tactics for information seeking and searching.

These findings of the present study are explorative and thus not generalizable to other domains of information behaviour research. The findings are also limited in that they focus on three heuristics only: familiarity, recognition and representativeness. Additional research is needed to examine the role of other heuristics such as *choosing by liking*, as well as the role of intuition in the selection of information sources. These issues are gaining new importance in times of an ever growing information supply from the Internet in particular. To fight the information overload and to ease the search process, people prefer satisficing approaches by making use of mental shortcuts. Another critical factor strengthening the role of heuristics such as choosing by liking is convenience in accessing information sources: people want information conveniently and quickly (Connaway *et al.*, 2011). To examine the above assumptions in more detail, empirical investigations are needed to elucidate the nature of heuristics in real-life information seeking and searching, both in work-related as well as everyday contexts such as health and leisure.

References

Allen, D. (2011), "Information behavior and decision making in time-constrained practice: dual-processing perspective", *Journal of the American Society for Information Science and Technology*, Vol. 62 No. 11, pp. 2165–2181.

- Ashcraft, M.H. and Radvansky, G.A. (2010), *Cognition*, 5th ed., Pearson, Boston, PA.
- Bates, M.J. (1979a), "Idea tactics", *Journal of the American Association for Information Science*, Vol. 30 No. 5, pp. 280-289.
- Bates, M.J. (1979b), "Information search tactics", *Journal of the American Society for Information Science*, Vol. 30 No. 4, pp. 205-214.
- Bates, M.J. (2007), "What is browsing - really? A model drawing from behavioural science research", *Information Research*, Vol. 12 No. 4, available at: <http://InformationR.net/ir/12-4/paper330.html> (accessed 29 November 2016).
- Bishop, M.A. (2006), "Fast and frugal heuristics", *Philosophy Compass*, Vol. 1 No. 2, pp. 201-223.
- Chaiken, S. (1980), "The heuristic model of persuasion", in Zanna, M., Olson, J. and Herman, S. (Eds), *Social Influence: the Ontario Symposium*, Vol. 5, Lawrence Erlbaum Associates, Hillsdale, NJ, pp. 3-39.
- Chen, H. and Dhar, V. (1991), "Cognitive processes as a basis for intelligent retrieval system design", *Information Processing & Management*, Vol. 27 No. 5, pp. 405-432.
- Connaway, L.S., Dickey, T.J. and Radford, M.L (2011), "If it is too inconvenient, I'm not going after it. Convenience as a critical factor in information-seeking behaviors", *Library & Information Science Research*, Vol. 33 No. 3, pp. 179-190.
- Edelkamp, S. and Schrödl, S. (2012), *Heuristic Search: Theory and Applications*, Elsevier, Amsterdam.
- Ellis, D. (1989), "A behavioural model for information retrieval system", *Journal of Information Science*, Vol. 15 Nos 4-5, pp. 237-247.
- Fidel, R., Davies, R.K., Douglas, M.H., Holder, J.K., Hopkins, C.J., Kushner, E.J., Miaygishma, B.K. and Toney, C. (1999), "A visit to the information mall: web searching behavior of high school students", *Journal of the American Society for Information Science*, Vol. 50 No. 1, pp. 24-37.
- Frederick, S. (2002), "Automated choice heuristic", in Gilovich, T., Griffin, D. and Kahneman, D. (Eds), *Heuristics and Biases. The Psychology of Intuitive Judgment*, Cambridge University Press, Cambridge, UK, pp. 548-558.
- Fu, W-T. and Pirolli, P. (2007), "SNIF-ACT: a cognitive model of user navigation on the World Wide Web", *Human-Computer Interaction*, Vol. 22 No. 4, pp. 355-412.
- Furner, J. (2004), "Conceptual analysis: a method for understanding information as evidence, and evidence as information", *Archival Science*, Vol. 4 No. 3-4, pp. 233-265
- Gigerenzer, G. (2008), *Rationality for the Mortals. How People Cope with Uncertainty*, Oxford University Press, Oxford, UK.

- Gigerenzer, G. and Brighton, H. (2009), “Homo heuristicus: why biased minds make better inferences?”, *Topics in Cognitive Science*, Vol. 1 No. 1, pp. 107-143.
- Gigerenzer G. and Gaissmaier W. (2011), “Heuristic decision making”, *Annual Review of Psychology*, Vol. 62, pp. 451-482.
- Gigerenzer, G. and Goldstein, D.G. (1996), “Reasoning the fast and frugal way: models of bounded rationality”, *Psychological Review*, Vol. 104 No. 4, pp. 650-669.
- Gigerenzer, G. and Goldstein, D.G. (2011), “The recognition heuristic: a decade of research”, *Judgment and Decision Making*, Vol. 6 No. 1, pp. 100-121.
- Gilovich, T. and Griffin, D. (2002), “Introduction - heuristics and biases: then and now”, in Gilovich, T., Griffin, D. and Kahneman, D. (Eds), *Heuristics and Biases. The Psychology of Intuitive Judgment*, Cambridge University Press, Cambridge, UK, pp. 1-18.
- Goldstein D.G. and Gigerenzer G. (2002), “Models of ecological rationality: the recognition heuristic”, *Psychological Review*, Vol. 109, No. 1, pp. 75-90.
- Gonzales, G.M. (2013), “Information seeking heuristics of undergraduate library and information science students of the University of Philippines Diliman”, *Journal of Philippine Librarianship*, Vol. 33 No. 1, pp.15-25.
- Groner, M., Groner, R. and Bischof, W.F. (1983), “Approaches to heuristics: a historical review”, in Groner, R., Groner, M. and Bischof, W.F. (Eds), *Methods of Heuristics*, Routledge, New York, pp. 1-18.
- Harter, S.P. (1986), *Online Information Retrieval: Concepts, Principles, and Techniques*, Academic Press, Orlando, FL.
- Hillgoss, B, and Rieh, S.Y. (2008), “Developing a unifying framework of credibility assessment: construct, heuristics, and interaction in context”, *Information Processing & Management*, Vol. 44 No. 4, pp. 1467-1484.
- Hjørland, B. (2011), “The importance of theories of knowledge: browsing as an example”, *Journal of the American Society for Information Science and Technology*, Vol. 62 No. 3, pp. 594-603.
- Jansen, B.J. and Spink, A. (2005), “Analysis of document viewing patterns of Web search engine users”, in Scime, A. (Ed.), *Web Mining: Applications and Techniques*, Idea Group Publishing, Hershey, PA, pp. 339-355.
- Joseph, P., Debowski, S. and Goldschmidt, P. (2013), “Models of information search: a comparative analysis”, *Information Research*, Vol. 18 No 1, available at: <http://InformationR.net/ir/18-1/paper562.html> (accessed 29 November 2016).
- Kahneman, D. (2003), “A perspective on judgment and choice: mapping bounded rationality”, *American Psychologist*, Vol. 58 No. 9, pp. 697-720.

- Kahneman, D. and Frederick, S. (2002), "Representativeness revisited: attribute substitution in intuitive judgment", in Gilovich, T., Griffin, D. and Kahneman, D. (Eds), *Heuristics and Biases. The Psychology of Intuitive Judgment*, Cambridge University Press, Cambridge, UK, pp. 49-81.
- Kelman Mark (2011), *The Heuristics Debate*, Oxford University Press, Oxford, UK.
- Liu, X., Chin, J., Payne, B.R., Fu, W-T., Morrow, D.G. and Stine-Morrow, E.A.L. (2016), "Adult age differences in information foraging in an interactive reading environment", *Psychology & Aging*, Vol. 31 No. 3, pp. 211-223.
- Marchionini, G. (1995), *Information Seeking in Electronic Environments*, Cambridge University Press, Cambridge, UK.
- Marsh, B. (2002), "Heuristics as social tools", *New Ideas in Psychology*, Vol. 20 No. 1, pp. 49-57.
- Mousavi, S. and Gigerenzer, G. (2014), "Risk, uncertainty, and heuristics", *Journal of Business Research*, Vol. 67 No. 8, pp. 1671-1678.
- Pearl, J. (1984), *Heuristics: Intelligent Search Strategies for Computer Problem Solving*, Addison-Wesley, Reading, MA.
- Pharo, N. and Järvelin, K. (2006), "'Irrational' searchers and IR-rational researchers", *Journal of the American Society for Information Science and Technology*, Vol. 57 No. 2, pp. 222-232.
- Pirolli, P. (2007), *Information Foraging Theory: Adaptive Interaction with Information*, Oxford University Press, New York, NY.
- Pirolli, P. and Card, S. (1999), "Information foraging", *Psychological Review*, Vol. 106 No. 4, pp. 643-675.
- Polonioli, A. (2011), "Gigerenzer's 'external validity argument' against the heuristics and biases program: an assessment", *Mind & Society*, Vol. 11 No 2, pp. 133-148.
- Polonioli, A. (2013), "Re-assessing the heuristics debate (Mark G. Kelman: *The Heuristics Debate*, Oxford University Press, Oxford, 2011)", *Mind & Society*, Vol. 12 No 2, pp. 263-271.
- Prabha, C., Connaway, L., Olszewski, L. and Jenkins, L. (2007), "What is enough? Satisficing information needs", *Journal of Documentation*, Vol. 63 No. 1, pp. 74-89
- Raab, M. and Gigerenzer, G. (2015), "The power of simplicity: a fast-and-frugal heuristics approach to performance science", *Frontiers in Psychology*, Vol. 6, available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4625029> (accessed 29 November 2016).
- Ross, C.S. (1999), "Finding without seeking: the information encounter in the context of reading for pleasure", *Information Processing & Management*, Vol. 35 No. 6, pp. 783-799.
- Savolainen, R. (2016), "Information seeking and searching strategies as plans and patterns of action: A conceptual analysis", *Journal of Documentation*, Vol. 72 No. 6, pp. 1154-1180.

- Schwarz, N., and Clore, G. L. (1988), “How do I feel about it? Informative functions of affective states”, in Fiedler, K. and Forgas, J. (Eds.), *Affect, Cognition, and Social Behavior*, Hogrefe International, Toronto, pp. 44–62.
- Sillence, E., Briggs, P., Harris, R. and Fishwick, L. (2007), “How do patients evaluate and make use of online health information?”, *Social Science & Medicine*, Vol. 64 No. 9, pp. 1853-1852.
- Simon, H.A. (1957), *Models of Man: Social and Rational*, John Wiley and Sons, Inc., New York, NY.
- Slovic, P., Finucane, M., Peters, E. and MacGregor, D. (2002), “The affect heuristic”, in Gilovich, T., Griffin, D. and Kahneman, D. (Eds), *Heuristics and Biases. The Psychology of Intuitive Judgment*, Cambridge University Press, Cambridge, UK, pp. 397-420.
- Smith, A.G. (2012), “Internet search tactics”, *Online Information Review*, Vol. 36 No 1, pp. 7-20.
- Sundar, S.S. (2008). “The MAIN model: a heuristic approach to understanding technology effects on credibility”, in Metzger, M.J. and Flanagin, A.J. (Eds), *Digital Media, Youth, and Credibility*, The MIT Press, Cambridge, MA, pp. 73-100.
- Sundar, S.S., Knobloch-Westerwick, S. and Hastall, M.R. (2007), “News cues: information scent and cognitive heuristics”, *Journal of the American Society for Information Science and Technology*, Vol. 58 No. 3, pp. 366-378.
- Thatcher, A. (2006), “Information seeking behaviours and cognitive strategies in different search tasks on the WWW”, *International Journal of Industrial Ergonomics*, Vol. 36 No. 12, pp. 1055-1068.
- Tomasi, S.D. (2014), “Using cues to forage for information on the Web”, *Journal of Systems and Information Technology*, Vol. 16 No. 4, pp. 296-312.
- Tversky, A. and Kahneman, D. (1974), “Judgment under uncertainty: heuristics and biases”, *Science*, Vol. 185 No. 4157, pp. 1124-1131.
- Warwick, C., Rimmer, J., Blandford, A., Gow, J. and Buchanan, G. (2009), “Cognitive economy and satisficing in information seeking. A longitudinal study of undergraduate information behavior”, *Journal of the American Society for Information Science and Technology*, Vol. 60 No. 12, pp. 2402-2415.
- White, R.W. and Roth, R.A. (2009), *Exploratory Search. Beyond the Query-Response Paradigm*, Morgan & Claypool, San Rafael, CA.
- Wilson, T.D. (2000), “Human information behaviour”, *Informing Science*, Vol. 3 No. 2, pp. 49-56, available at: www.inform.nu/Articles/Vol3/v3n2p49-56.pdf (accessed 29 November 2016).
- Ylikoski, T. (2005), “A sequence analysis of consumers' online searches”, *Internet Research: Electronic Networking Applications and Policy*, Vol. 15 No. 2, pp. 181-194.
- Xie, I. and Joo, S. (2010), “Tales from the field: search strategies applied in web searching”, *Future Internet*, Vol. 2 No. 3, pp. 259-281.

