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A study of academic library users' decision-making process: a Lens model approach

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Abstract

Purpose – The purpose of this paper is to investigate the mediating role different information sources (or cues) play in forming users' mental representation of a work in an academic library setting. Of particular interest is discerning how these information sources influence borrowing decisions.

Design/methodology/approach – A large-scale user survey featuring two-part questionnaires was utilized in an academic library setting. The questionnaires were designed to ascertain those information sources exerting a formative influence on users' information-seeking behavior, especially the routes by which users came to know of a title and the sources by which they infer its content.

Findings – Evidently users adaptively make use of a variety of cues to help them fulfil their information needs. These cues significantly reduced the uncertainty faced by users making a borrowing decision, even after their sense of domain familiarity was controlled for. The paper concludes with a discussion of the implications of the findings for library services. It is suggested that libraries could provide a more "cue-rich" environment that supports users' decision making and facilitates exploration of their collection.

Originality/value – The research questions were framed in the language of decision-making theory, which, as the research demonstrates, sheds light on the dynamics between "cue validity" and judgment uncertainty. It also demonstrates the applicability of the "accuracy-cost" framework in the study of human information-seeking behavior.

Keywords Decision making, Academic libraries, Bibliographies

Paper type Research paper

Introduction

This study sets out to investigate how users make use of the information cues available when making a book borrowing decision. Individuals become aware of and form a first impression of a work by way of various information sources before deciding whether to obtain it. The availability and effectiveness of these sources play an important role in determining one's reading list. With a view to investigating the intermediary role of various sources of information, this study uses the perspective of a Lens model to frame the decision-making processes of users of an academic library (Brunswick *et al.*, 2000; Wang and Soergel, 1998). The operating assumption of this approach is that all experiences are mediated by mental representations, which are constructed from sensory information (or cues) in the environment. These cues will then help users decide whether the information is of sufficient quality to merit the expenditure of effort required for acquisition.

The Lens model perspective opens up interesting questions regarding the nature of the cues users rely on and how they contribute to users' confidence when making a



borrowing decision. As in all cultural products, the decision of whether to attain a book almost inevitably entails a certain degree of uncertainty. Rarely do we acquire a title after we experience it in its entirety. At best, individuals base their decisions about a work on partial information, therefore the inevitable uncertainty in predicting the content and relevance of a work. Shapiro and Varian (1999) argued that uncertainty is one of the defining characteristics of information that qualifies as an “experience good”; that is, the users do not know what it is worth to them until they experience it.

Within the LIS literature, the notion of “cognitive authority” developed by Wilson (1983), though originated more specifically out of epistemological concerns, can also be seen as a reflection on the credibility aspect of the uncertainty faced by the information user. In the absence of direct knowledge test, users need to resort to various “cognitive authorities” or sources of credibility they deem proper to evaluate the quality of the information. Higgins (1999) coined the phrase “meta-information” (i.e. information about information) to denote the similar notion of the information cues one relies on to infer the quality of information. She examined in an experimental setting how one particular facet of meta-information, source credibility, and time constraint might influence subjects’ decision making (Higgins, 1999). While source credibility is an important aspect one can derive from meta-information surrounding a work, it is by no means the only aspect that matters when one ponders its worth, as meta-information is also used to help us determine a work’s appeal, pertinence, accessibility, relevance and so forth. In a traditional library setting, structured bibliographic information or “meta-data” has been constructed as the surrogate that performs exactly the function. Compared to meta-data, the notion of meta-information affords a broader consideration able to encompass other information cues, such as word-of-mouth recommendations, and professional and user-generated reviews. Succinctly stated, cues users rely on can go beyond the traditional library or information retrieval setting. Thus here we extend the notion of meta-information to include any forms of representation, be it of a descriptive, evaluative, personal or institutional nature, that might mediate one’s perception of a work. It is felt that such a theoretical consideration is in order as the boundary between bibliographic information and other forms of representation has become blurry with other information services such as online bookstores actively seeking to incorporate user-generated content to provide a much richer set of decision aids for or their users.

In the context of book borrowing in a library setting, the source of meta-information can be roughly divided into two categories: those available in users’ memory or their immediate information environment, such as author name recognition, social recommendations (i.e. word-of-mouth recommendations from individual’s social network), online recommendation (i.e. those made available in online communities), and book reviews. The other category includes those made available by the library in the form of bibliographic information such as title, summary/abstract, table of contents, publication date, publisher and the physical copy of the book. Notice that the information cues picked up in users’ immediate information environment are more evaluative in nature, while cues afforded in the library context remain mostly descriptive.

Owing to the inherent uncertainty regarding the actual content of a work, users are likely to experience differing degrees of information adequacy when making the borrowing decision, depending on what types of meta-information are made available.

Models can be constructed to investigate the extent to which different types of information cues contribute to users' felt sense of information adequacy regarding their judgment. Furthermore, one can imagine that these cues are likely to vary in their availability and predictive power in different information-seeking situations; for example, whether the user is familiar with the subject domain or whether the various forms of meta-information are available in her or his immediate information environment.

Theoretical framework

Our research questions are mainly informed by research in decision theory in the field of cognitive psychology – specifically from the perspectives of “bounded rationality” (Simon, 1955) and adaptive decision making (Payne *et al.*, 1993; Gigerenzer and Selten, 2002). First proposed by Herbert Simon (Simon, 1955), the theory of bounded rationality presents an alternative to the rational-agent model in classic Economics, wherein individuals are afforded perfect information, complemented by unlimited time and cognitive capacity. As Simon pointed out, individuals are, in reality, quite limited in terms of the amounts of time and cognitive resources available to them, rendering them boundedly rational at best. One of the legacies of bounded rationality is the investigation of all sorts of judgment “biases” individuals are prone to commit and the heuristics that they utilize in the face of ill-defined and complex judgment tasks (see, for example, Kahneman, 2003).

Previous studies have approached information seeking on the Web from the perspective of the bounded rational agent (Mansourian and Ford, 2007; Agosto, 2002). In each case, this entailed an emphasis on the impacts of information overload and time constraints on information seeking, especially on users' sensitivity to cognitive efforts. Mansourian and Ford used two dimensions – expected search efforts and perceived risk of missing information – to characterize users' search situations and their corresponding heuristics (Mansourian and Ford, 2007).

Individuals face a dual difficulty when deciding how selective to be in the face of the vast plethora of information that has become available. Instead of thoroughly examining the content, we increasingly rely on meta-information (in a broader sense that includes any type of representation of a work) to make our judgment. On the other hand, users often lack enough expertise to judge which form of information best serves their purposes. Anderson (2006) observed in a longitudinal, ethnographic study, the uncertainty scholars experienced at the margins of their understanding. A work is only relevant to an individual's need when it is positioned at the very boundary of her/his state of knowledge. It needs to be novel enough to provide new information, yet at the same time not too foreign to assimilate.

The abundance of choices and the lack of understanding underline the uncertainty involved in making a borrowing decision, thus also bringing to the foreground the significance of the cues users rely on to alleviate this condition. Various forms of cues, especially those of an evaluative nature, such as book reviews, word of mouth recommendations, citing contexts, and more recently the collective filtering feature in online bookstores, have become important cues (or “information scents”; see Pirolli, 2007) by which users make inferences regarding the relevance and quality of a work. Other than information sources external to the aforementioned traditional library

setting, library users also rely on their examination of bibliographic records, browsing the physical copy on the bookshelf and other techniques to inform their judgment.

So far little study has been carried out on how users might incorporate these cues, whether derived from within or outside of the library setting, into their decision making process. In order to redress this deficit, the Lens model developed in psychology will be used to conceptualize users' decisions. The main idea behind the Lens model concerns how objects in the world can only be indirectly approached through a "Lens" of information that mediates between reality and our internal representations (see Figure 1 for a diagram of the Lens model).

The left side of the Lens model diagram represents the relationships between the information items, called "cues", and the "true" state of the world, often referred to as "criterion." In our case, the "criterion" will be a user's confidence of eventual satisfaction with the book. The right side of the diagram represents how the user utilizes the cues to infer the intellectual contents and relevance of a work. The Lens model analyzes judgment by constructing a linear regression model to sum up the weights assigned on the cue values for each case. Thus a linear regression equation will be used to study the salience of the cues in users' decision making. Subsequent questions were asked to determine whether the "salience" of the cues changes according to context and task factors. This component of the inquiry is mainly informed by adaptive decision-making in consumer behavior and information-seeking behavior research.

Drawing considerable influence from the theory of bounded rationality, Payne *et al.* (1993) looked into how individuals utilize different decision strategies adaptively

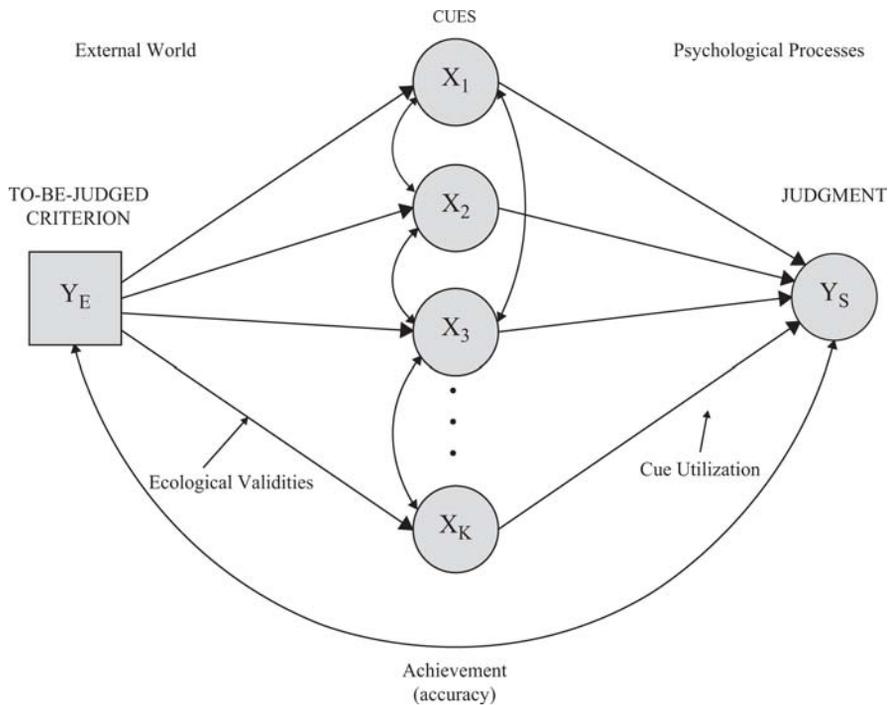


Figure 1. Diagram of the Lens model

according to the nature of the tasks at hand. They argued that decision behavior is shaped by the interaction between the structure of the human information processing system and the structure of the task environment (Payne *et al.*, 1993, p. 125). Underlying the framework for adaptive decision behavior is the assumption that the goal of a decision maker is to maximize his or her chances of making the most accurate judgment while minimizing the cognitive efforts involved. In the framework of Brunswick's Lens model, accuracy and cognitive efforts can be conceptualized as cue validity – that is, how well a cue is correlated with the predicted phenomenon – and availability; how much cognitive effort is involved in making use of a cue.

As increasing the accuracy is generally expected to increase the amount of effort one puts into a decision, individuals need to make tradeoffs between accuracy and effort when choosing a decision strategy. More importantly, the choice of the appropriate means or strategy to achieve this goal is contingent on the structure of the task environment. As different strategies vary greatly in performance as a function of task and context factors (e.g. the number of alternatives, time constraints, and the availability of cues afforded in the information environment etc.), the decision maker must be flexible in the manner in which their strategy is deployed across different task environments. From this perspective, the decision maker is conceptualized as choosing among different strategies adaptively in response to different task environments.

While the theory of adaptive decision making originated in the field of consumer research, one can see the applicability of the effort-accuracy framework in the context of human information-seeking in general, and searching in the library in particular. The different types of information cues that users exploit to infer the content of a work can likewise be characterized by their acquisition and processing costs, in tandem with their predictive power. For example, “examining the physical copy of a book on the shelf” might produce the most accurate assessment of its quality; it also demands the highest cognitive effort. Or while the strategy of “following the works of an established author” might reduce significant cognitive effort, it also risks missing important information. The search strategy and information cues utilized are also influenced by the user's task environment, which sets the parameters for their availability and performance (in terms of achieving the dual goals of high accuracy and low expenditure of effort).

There is a growing attention to a wide variety of task and contextual factors that affect users' online retrieval behavior. The landmark study by Saracevic *et al.* marked the first systematic attempt to incorporate these factors into what was widely regarded as the isolated event of information retrieval (Saracevic *et al.*, 1988; Saracevic and Kantor, 1998a, b). It is now well-established that these contextual factors greatly influence users' information-seeking behavior, inclusive of the complexity of the task engaged in (Byström and Järvelin, 1995), or the users' cognitive states (Belkin *et al.*, 1990). Along with recognition of the contextual factors of the information retrieval process is the gradual acceptance that information seekers are often engaged in different methods of access, depending on their state of knowledge and what the information environment affords (Bates, 1989; Belkin *et al.*, 1993). These studies reveal that individuals, though limited in knowledge and cognitive resources, often adaptively make use of what is given in the task environment to produce “satisfying” results at the specific juncture of their information-seeking process.

This study focuses specifically on one aspect of information seeking: namely, how individuals make use of the cues available when making a borrowing decision, along with the associated uncertainty, in an academic library setting. Researchers interested in information retrieval have long been concerned with the provision of surrogates by which relevance judgment can be made effectively without referring to the full-text of the documents (e.g. Janes, 1991; White *et al.*, 2005; Ruthven *et al.*, 2008). More attention has also been recently given to how the effectiveness of different surrogates might be subject to variation under different task environments (Woodruff *et al.*, 2001). Ruthven *et al.* (2008) reported a study that looked into how different contextual factors might affect the utility of document surrogates in the complex interactive question-answering task (ciqa) setting, in which the system has the chance to interact with users with complex information needs. While previous studies in document surrogates have mainly focused on the effective description of web page content or scientific journal articles, it is felt that accessing monographs in a library presents a significantly different search situation. Further investigation is warranted given that cues of a more evaluative nature, such as word-of-mouth recommendations, and professional or user generated reviews are more prevalent in forming a user's perception of a work. As mentioned earlier, we are particularly interested in those encounters with a work that go beyond the confines of traditional bibliographic means, which, from the user's perspective, are but one of many sources that contributed to his or her mental representation of a work.

We thus summarize our research questions below:

- RQ1.* What are the sources by which the user comes to know of a title s/he is about to borrow?
- RQ2.* Does the user's uncertainty in making the borrowing decision differ in different information-seeking situations?
- RQ3.* How much weight does each different information cue carry with respect to contributing to the user's (self-assessed) sense of information adequacy when making the decision?
- RQ4.* Furthermore, does the composition of the weights differ in different information-seeking situations?

Users' information-seeking situations are further characterized according to the following attributes:

- The search modes adopted: "known-item" and subject search.
- The purpose the book is borrowed for: self growth, homework, research, and teaching.
- Users' familiarity with the knowledge domain.

It is easy to envisage how users become reliant on cues tailored to suit their search situation. For example, those conducting a subject search in all likelihood will depend more heavily on information provided by library means (e.g. bibliographic record, browsing the physical copy). Conversely, unfamiliar areas stimulate reliance on adaptive cues as compensation for perceived shortcomings in domain knowledge. Hence one can expect to find considerable variation in a user's confidence in having

made judicious use of their available information sources. Based on users' self-assessed reliance on the information cues, linear models that represent the weighted sum of the cues can be built to predict users' felt sense of information adequacy in different search situations.

Research design

The major source of our data was drawn from a two-part questionnaire. The first part of the questionnaire was administered onsite at the circulation desk after the user checked out the book. The second part was conducted through e-mail one week after the user had checked out the title. To offer some incentive for participation, interviewees were entered into a monthly draw in which they were eligible to win a 1500 NT (approximately 45 USD) gift certificate.

Onsite questionnaire

The users were asked to answer questions regarding the book they had just checked out (only one book was selected if the interviewee was checking out multiple titles). Each was required to indicate the search methods they used to locate the title, whether they had known of the title prior to the library search, how they came to know of it, and why they were motivated to use the item to fulfill their information needs. They were also asked to assess, on a 1 to 7 scale, the following variables: the degree to which they relied on various information sources; how confident they were that the title would be able to fulfill their information needs; whether they had enough information to make judgment; the degree to which the title could be substituted; and their familiarity with the title's respective knowledge domain. At the end of the questionnaire, participants were asked to specify their academic status, areas of expertise, and lastly, their e-mail address so they can be reached for a follow-up question (see the Appendix (Figure A1) for the full text of the questionnaire).

Follow-up questions

One week after each onsite interview was conducted, a follow-up questionnaire was sent by e-mail, asking users to assess the degree to which they were satisfied with the borrowed title.

The survey was conducted at the main branch library of the National Taiwan University from May to July, and two other major branches (medical and law libraries) from July to September, 2007.

The two-step questionnaires yielded three groups of variables: search situation variables, information cue variables and user judgment available. The extent of their interrelationships could then be subjected to empirical investigation (see Table I for the list of variables analyzed).

Results

Descriptive statistics

A total of 2,544 valid questionnaires were collected by onsite questionnaire, of which 1,542 (61 per cent) answered the follow up questions. The breakdown of the interviewees' backgrounds can be seen in Table II (by academic background) and Table III (by academic status).

Variable label	Question based	Nature
<i>Search situation variables</i>		
Search modes (known item versus subject search)	Q1	Nominal
Purpose the title is for	Q4	Nominal
Academic status	Q11	Nominal
Familiarity with the topic	Q7	Numerical; Nominal
<i>Information cue variables</i>		
Sources in one's immediate information environment by which the title was known	Q2	Nominal
Sources in library context by which the title is known	Q3	Nominal
Cue contribution	Q6	Numerical
<i>User judgment variables</i>		
Information adequacy for decision	Q9	Numerical
	Q10	Numerical
Whether title meets expectation	Follow-up questionnaire	Numerical
Satisfaction with the title	Follow-up questionnaire	Numerical

Table I.
Variables analyzed

	Freq.	%
Art-humanities	570	22.4
Sciences	196	7.7
Social-sciences	305	12.0
Medical	237	9.3
Engineering	308	12.1
Bio-resources-agriculture	256	10.1
Management	206	8.1
Public-health	43	1.7
EE-computer	217	8.5
Law	133	5.2
Life-sciences	73	2.9
Total	2,544	100.0

Table II.
Interviewees' academic background

	Freq.	%
Undergraduate	1,296	50.9
Graduate	1,041	40.9
Faculty	36	1.4
Staff	137	5.4
Alumni	34	1.3
Total	2,544	100.0

Table III.
Interviewees' academic status

It should be noted that our sample is not quite an accurate representation of the population of NTU community, given under-representation of the faculty population. The ratio of faculty-graduate students-undergraduates in 2006 was 1:8.3:10, yet faculty only accounts for 1.4 per cent of our interviewees. One should therefore use caution when making any generalization about the university community as a whole.

Table IV shows the purposes for which the readers borrowed the book, with “self growth” accounting for over 40 per cent of the cases. Table V indicates whether the borrowed book was the readers’ first choice.

As mentioned earlier, we are particularly interested in whether readers search the books by “known item” or “subject search”, as these two very different modes indicate the extent to which users rely on bibliographic information provided by the library to learn about a title. When conducting a “known item” search, users become aware of the title sought by sources available in their immediate information environment.

Interviewees were asked, “Before conducting a library search, have you known the complete or partial title of the book you just checked out?” Those who answered “yes” were classified as performing a “known item search”, while their counterparts who responded “no” were considered as conducting a “subject search”. It transpired that the majority (68.6 per cent) of the checked out titles were found by “known item” search. (see Table VI).

Figure 2 reports users’ responses to the question of how they came to know the known title if they had known it before conducting a library search (a multiple choice question as the user might learn of a title from multiple sources). “Recommended by

Table IV.
The reasons for which to borrow the book

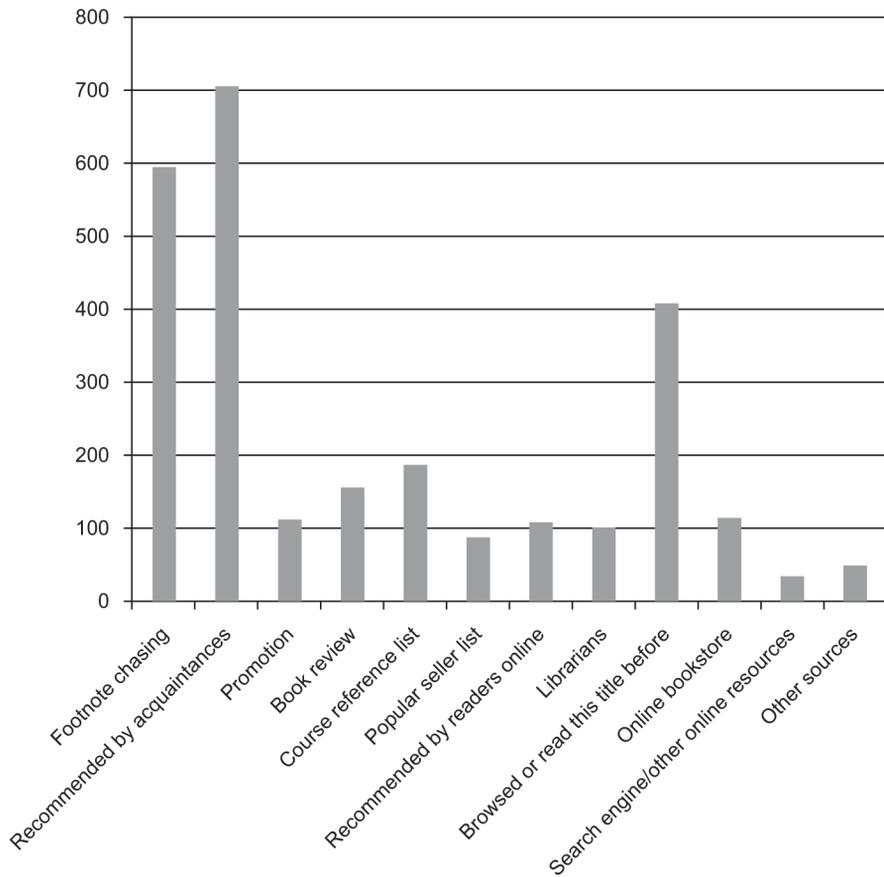
	Freq.	%
Self-growth	1,041	40.9
Homework	651	25.6
Research	766	30.1
Teaching	35	1.4
Missing	51	2.0
Total	2,544	100.0

Table V.
Is the title first choice?

	Freq.	%
Yes, this is my first choice	1,997	78.5
No, my first choice has been checked out	311	12.2
No, my first choice is not available in the collection	227	8.9
Missing	9	4
Total	2,544	100.0

Table VI.
Breakdown of search modes

	Freq.	%
Subject search	799	31.4
Known item	1,745	68.6
Total	2,544	100.0



Note: $n = 2,656$

Figure 2. Sources in users' immediate information environment by which a known item was known

acquaintances” and “footnote chasing” proved to be the most frequently mentioned sources. Figure 3, on the other hand, shows the frequency of the sources by which the users come to know the titles within the library context. It is worth noting that OPAC searches (subject and author search combined) account for only 15 per cent of the total checkouts, slightly less than the three browsing-based methods (“browse the bookshelf”, “browse the new arrival area”, and “come across the title in the process of finding another book”) combined, totaling 17 per cent of the overall checkouts. Some confirmation is offered in this instance of how, even where users did not have a known item in mind, a significant amount of the titles were found by browsing, rather than direct searching.

Inferential statistics

The report of the inferential statistics section has been subdivided into two sub-sections that address our two major research questions: the readers’ felt adequacy

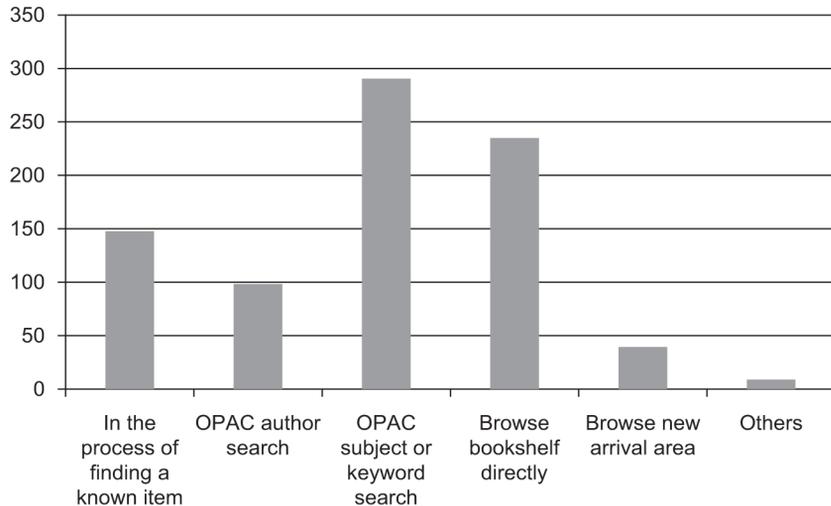


Figure 3.
Sources in the library by which a title was found through subject search

Note: $n = 822$

of information, and the cues on which they rely to make the borrowing decision in different information-seeking situations.

Adequacy of information

Information adequacy and search modes. Tables VII and VIII report interviewee's self-assessed information adequacy for the borrowing decision under different search modes, along with the different levels of familiarity with the subject areas, respectively. All the differences were shown to be statistically significantly at $p < 0.001$, thereby indicating how the degree of uncertainty fluctuates in accordance with the search situations users find themselves in.

Table VII.
Sources in users' immediate information environment by which a known item was known

	Known item		Subject search	
	Mean	SD		
Information adequacy	4.99	1.50	4.25	1.62
Satisfaction	4.97	1.47	4.57	1.52

Note: $n = 2,656$

Table VIII.
Sources in the library by which a title was found through subject search

	Familiar		Unfamiliar	
	Mean	SD		
Information adequacy	5.03	1.43	4.12	1.71
Satisfaction	5.04	1.42	4.38	1.58

Note: $n = 822$

A 2×4 one-way analysis of variance was conducted to evaluate the effects of search modes (“known-item” versus “subject search”) and purposes for borrowing the title on users’ information adequacy. The means for information adequacy as a function of the two factors are presented visually in Figure 4. The results for the ANOVA indicated a significant main effect for search modes, $F(1, 2491) = 39.07, p < 0.001$; and purposes for borrowing, $F(3, 2489) = 9.75, p < 0.001$; as well as a significant interaction between search modes and purposes for borrowing $F(3, 2489) = 2.70, p < 0.005$.

It is apparent that the degree of information adequacy declines most markedly when the users are carrying out a “subject search” for teaching purposes, which is suggestive of an area that might stand to benefit from library intervention.

Information adequacy and satisfaction. As stated earlier, users were asked, in the follow-up questionnaire, two questions that indicate the overall accuracy of their decision, namely, how satisfied they were with the title, and whether the title meet their expectation. It is of interest to see users’ information adequacy and confidence at the check-out time related to these accuracy indicators. Thus correlation coefficients were computed among the four variables. The results of the correlational analyses are presented in Table IX. Notice that information adequacy is highly correlated with both satisfaction and expectation met with the title.

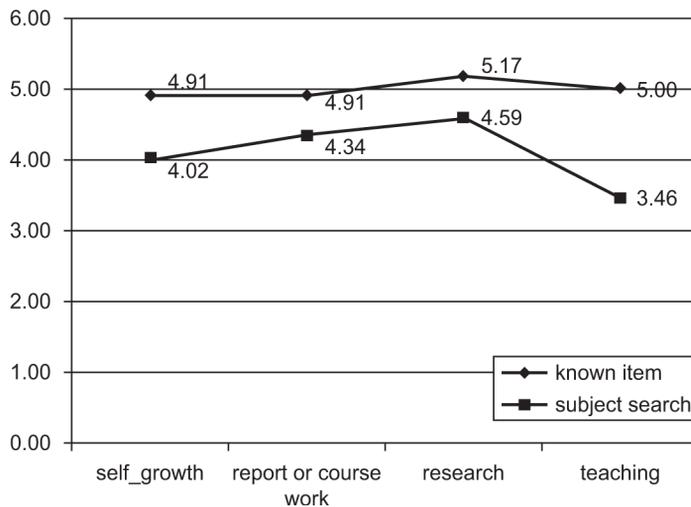


Figure 4. Marginal means of information adequacy in different search situations

Spearman's rho	Confidence	Info adequacy	Satisfaction	n
Confidence in decision				2,543
Information adequacy	0.61*			1,452
Satisfaction with title	0.39*	0.29*		1,452
Title meets expectation	0.37*	0.32*	0.69*	

Note: * Correlation is significant at the 0.01 level (two-tailed)

Table IX. Users’ information adequacy and satisfaction with the title by search modes

Cues for decision making

Overall. A multiple regression analysis was conducted to evaluate how well the users' familiarity with a knowledge domain predicted their self-assessed information adequacy when borrowing books from the library. The results of this analysis indicated that domain familiarity accounted for a significant amount of the information adequacy variability, $R^2 = 0.10$, $F(1, 2541) = p < 0.01$.

A second analysis was conducted using SPSS stepwise procedure to evaluate whether users' reliance on various information cues predicted the information adequacy over and above domain familiarity. The ten information cues demonstrably accounted for a significant proportion of the information adequacy variance after controlling for the effects of domain familiarity, $R^2 = 0.14$, $F(10, 2531) = p < 0.01$.

Of the ten cues, "recognition of author", "recommendations by acquaintances", "browsing the content of the physical copy", "book review", and "publication year" were found to be the strongest predictors of information adequacy.

Subject search versus known-item search. To test our hypothesis that users rely on different information cues in different search situations, two more multiple regression analyses using the same predictors and criterion were conducted separately in two search situations. These were, respectively, cases where the title was found by subject and known item search. Both results offered further confirmation that users' reliance on various cues predicted information adequacy over and above domain familiarity, with differences in the predictors used having a crucial bearing on information adequacy.

In subject searches, content-related cues such as "author recognition", "browsing the content of the physical copy", and "title" became significant predictors of information adequacy, while "recommended by acquaintances", "book review", and "publication date" paled into insignificance. In known item searches, "author recognition" retained its instrumental role. However, the same could not be said for "browsing the physical copy", which was supplanted by "recommended by acquaintances" and "recommended by online users" (see Table X). Based on these results, two contrasting pictures can be drawn of how users become familiar with a work during the process of subjective assessment. The pattern of known item

Predictors	Overall	Subject search	Known item
Topic familiarity	0.32***	0.35***	0.28***
Author recognition	0.20***	0.12*	0.19***
Title		0.14*	
Table of content			
Browse the physical copy	0.12***	0.19***	
Cited by others			
Recommended by internet users			0.02**
Recommended by acquaintances	0.12***		0.11***
Book review	0.05***		
Publication date	0.02**		
Publisher			
<i>n</i>	2,544	799	1,745

Notes: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table X.
Correlations between
each predictor and
information adequacy

searching is more informed by prior acquaintance, hence little use is made of library holdings in the more expansive sense associated with content browsing. Users who were not the beneficiaries of outside cues, on the other hand, tended to rely more heavily on examination of the content.

Discussion

This article reports the results of a large-scale user survey at an academic library setting aimed to investigate the role of various “meta-information” plays in users’ decision making. Specifically it traces the information sources by which users come to know of the title they were about to check out and the degree to which each source contributes to their information adequacy regarding the judgment.

Findings suggest that the extent of users’ self-assessed information adequacy is contextual; cues are differentially weighted in accordance with the information environments they operate in.

Our research questions were informed by psychological theories of decision making: Simon’s bounded rationality, Brunswick’s Lens model and the effort-accuracy framework postulated by Payne *et al.* When combined, these theories provide a framework for a portrayal of the information seeker as a decision maker who, though reliant on limited cognitive resources, is still able to adaptively make use of the information cues afforded by their information environment, thereby maximizing the accuracy of judgments while minimizing the expenditure of any effort involved in meeting their information needs. The availability of these cues in one’s information environment, and how much weight they carry for her/him therefore become two important parameters that determine one’s reading list.

The decision-making perspective sheds some much needed light on the dynamics between different information cues about a work and judgment uncertainty, that have hitherto not featured prominently in the discourse of information provision. While uncertainty has long been identified as an important characteristic of information seeker’s cognitive and affective state (Kuhlthau, 1993; Wilson, 1999; Wilson *et al.*, 2002), little attention has been given specifically to the uncertainty at a micro level, namely, the uncertainty experienced with the whole content of a document, and how it might be alleviated by various information cues.

Our first question is concerned with the sources by which one comes to know of a borrowing, whether they are from within or outside of the library context. As reported earlier, we found that nearly 70 per cent of the time, users came with a known item to search for, as per previous studies maintaining that Humanities scholars use catalogs mostly for known item searching (Watson-Boone, 1994; Wilberley and Jones, 1989; Stone, 1982). We suspect that subject searches were not the favored option in most cases because they entail more cognitive effort and higher uncertainty. Therefore, instead of conducting formal subject searches, users relied heavily on cues in their immediate information environment to sniff out what to read next. Our findings show that the two most frequent routes for users to know of a title were chasing footnotes and the recommendations of acquaintances; both are arguably cues with high validity and relatively low acquisition cost.

Not only are they more readily available, cues acquired outside of the library also seem to be more accurate predictors as they contributed to higher information adequacy. Our second question asks if users’ decision uncertainty varies with different

search situations. It was found that when doing “known-item” searches, users are more assured about their decision, suggesting high cue validity for sources acquired in their immediate environment. On the other hand, results indicate that users felt less adequately informed when performing subject searches, particularly when the sought-after title was for teaching purposes. Hence the discrepancy between known item and subject search in information adequacy suggests an area where the library intervention might be appropriate.

Our third and fourth research questions have to do with how well various information cues contribute to users’ self-assessed information adequacy, and whether they vary in different search situations; namely, in subject and known item search. It was found that, after controlling for users’ familiarity with the domain in which the title was sought, several cues were still found to be significant predictors of information adequacy, among which author recognition was found to be consistently important across different search situations. In subject searches, browsing the book on the shelf became an important means to reduce uncertainty. During known item searches, word-of-mouth recommendations, whether from acquaintances or online users, was often found adequate enough for users to forgo examining the whole content, which entails more cognitive effort.

Viewing library patrons from a decision-making perspective buttresses support for the provision of more decision aids than are presently available in the library. As it was found that information adequacy was closely related to satisfaction with a work (see Table IX), it is reasonable to expect that the provision of pertinent meta-information (to enhance accuracy) in a more accessible manner (to reduce cognitive effort) might lead to better user satisfaction. One of the practical implications of our research is thus to open up a new information service dimension that traditional usage measures such as circulation and availability fail to capture. Users can be better served if bibliographic information is provided with a view to helping decision making. Compared to the usages measure, users’ information adequacy seems to better reflect how well the user is served in terms of the provision of a cue-rich environment and therefore a potentially more user-oriented measure of library performance.

Our research also points to the need to support exploratory mode of search. As online bookstores have aggressively adopted features like collaborative filtering and other means to enhance browsing, libraries have so far provided relatively few means to help users explore their collection. This is most apparent when users do not have known titles in mind, so they have to resort to an exploratory search strategy (White *et al.*, 2006). One particularly interesting finding in our research is that even in those cases where the users had not had a known title in mind before their library search – in other words, when the subject search was attempted – the browsing based methods were adopted more frequently (17 per cent) than author and subject searches combined (15 per cent) (see Figure 3). The fact that titles found by author and subject retrieval combined accounts for a relatively small portion of total checkouts (15 per cent) merits further scholarly corroboration. A possible explanation might lie with the fact that, compared to browsing, formal subject searches entail higher cognitive costs and higher uncertainty. It has been long recognized that end-users might not be equipped with the necessary conceptual knowledge to carry out OPAC searches effectively (Fast and Campbell, 2004; Borgman, 1996; Large and Beheshti, 1997). The other reason, as highlighted in the literature (East, 2006; Knutson, 1991) is that the OPAC is not

providing enough access points for effective subject retrieval. East therefore calls for an enrichment of the subject content, inclusive of the indexing terms and other information such as table of contents, and book reviews – in other words, representations that afford not only a higher level of indexing exhaustivity but also richer meta-information to help user decision making. On the other hand, the surprisingly high prevalence of browsing-based methods in subject searching also suggests an area where library-based information provision can be improved. A fair amount of checkouts resulted from browsing, which occurred both when users did not have a known item in mind and in the process of finding another known title. The serendipitous finds through browsing uncovered in this study can be encouraged by more linkage among works made possible by text mining and social filtering tools, which facilitate exploratory navigation behaviors. It is hoped that our study will lend support to libraries and other information service providers interested in implementing techniques that support more exploratory modes of access to their collections. These exploration facilitating techniques help expose works that might otherwise remain unknown to users therefore could go a long way toward achieving “every book its reader,” one of the fundamental laws of library science.

One of the obvious limitations of our study is the lack of representativeness of faculty population in our samples. Facing a rather different task environment, the faculty members are likely to have very different information seeking patterns. Further studies are needed to investigate specifically faculty members’ reliance on various information cues for judgment. The argument for creating a more cue-rich environment is also weakened by the fact that little is known regarding the information adequacy level where those decision aids are present. A stronger case can be made by future studies interested in comparing users’ information adequacy, be it either in an experimental setting where the nature and amount of information cues can be manipulated, or in a real life situation such as ours. It would be interesting to compare users’ information adequacy of their judgment, their reliance on different cues, and their information seeking patterns before and after more decision and exploration aids are provided.

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Further reading

- Kahneman, D. (2002), *Maps of Bounded Rationality: A Perspective on Intuitive Judgment and Choice*, Nobel Prizes, Almqvist & Wiksell Int., Stockholm.

Appendix

Dear reader,

The Department of Library and Information Science at NTU is conducting a research regarding readers' decision making in book borrowing. Please take five minutes to fill out this questionnaire for us, based on the book you have just charged out. By participating in the research, you will be entered into a monthly draw for a gift certificate worth 2000 NTD. The analysis of the results will be conducted aggregately and reported anonymously without any reference to any specific interviewee.

1. Before conducting a library search, have you known the complete or partial title of the book you are checking out ?

- YES (Please go directly to Q2 and skip Q3)
- NO (Please go directly to Q3)

2. If you have known the title beforehand, by which sources have you learned about it? (multiple choices)

- Cited or mentioned in another work that I have read before
- Recommended by people in my social network (e.g. teachers, friends, or classmates)
- By promotion
- Through a book review
- Included in a reading reference list
- On the top sellers list
- Recommended by other readers online
- Librarians
- Have browsed or read the book before

Other _____

(Please go directly to Q4)

3. If you had not known this title, how did you come across this title?

- Chanced upon in the process of finding another known item
- By OPAC author search
- Starts with OPAC subject or keyword search
- Browse the bookshelf directly without searching OPAC (not including the new arrival area)
- Browse the new arrival area

Other _____

4. What do you borrow this title for?

- For self-growth
- For term paper or other class assignments
- For research
- For teaching

5. Is this title your first choice?

- Yes
- No, my first choice has been charged out
- No, the library does not own my first choice

Figure A1.
Translated text of the
questionnaire

(Continued)

6. Now please reflect on the importance of each of the following bibliographic information on your decision on borrowing the title (0 stands for not applicable or not important at all, 7 stands for very important).

Author	0	1	2	3	4	5	6	7
Title	0	1	2	3	4	5	6	7
Table of content	0	1	2	3	4	5	6	7
Browse the physical copy	0	1	2	3	4	5	6	7
Cited by other work	0	1	2	3	4	5	6	7
Social recommendation	0	1	2	3	4	5	6	7
Online recommendation	0	1	2	3	4	5	6	7
Book review	0	1	2	3	4	5	6	7
Publication year	0	1	2	3	4	5	6	7
Publisher	0	1	2	3	4	5	6	7

7. How familiar you are with the subject area the title falls in (0 stands for not at all, 7 stands for very much)

0 1 2 3 4 5 6 7

8. Please assess how replaceable this title is by other similar works ("0" stands for not at all easy, "7" stands for very much)

0 1 2 3 4 5 6 7

9. Did you think you have enough information in deciding whether to check out this title (0 stands for not at all adequate, 7 very adequate)

0 1 2 3 4 5 6 7

10. How confident are you that the title will fulfill your information need? (0 stands for not at all confident, 7 stands for very confident)

0 1 2 3 4 5 6 7

11. Your academic status Undergraduates Graduate students Faculty Staff Alumni

12. Your area of study Art-humanities Sciences Social Sciences Medicine Engineering Bio-resources-agriculture Management Public Health EE-computer Law Life Sciences

Please leave your e-mail

In a week or so an e-mail that includes two further questions will be sent to you. You will have to answer and reply the e-mail to conclude the survey.

We will announce the lottery monthly on the department web site. Thank you very much for your help.

Figure A1.

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