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Looking for Books in Social Media: An Analysis of Complex Search Requests

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Abstract. Real-world information needs are generally complex, yet almost all research focuses instead on either relatively simple search based on queries or recommendation based on profiles. It is difficult to gain insight into complex information needs from observational studies with existing systems; potentially complex needs are obscured by the systems' limitations. In this paper we study explicit information requests in social media, focusing on the rich area of social book search. We analyse a large set of annotated book requests from the Library-Thing discussion forums. We investigate 1) the comprehensiveness of book requests on the forums, 2) what relevance aspects are expressed in real-world book search requests, and 3) how different types of search topics are related to types of users, human recommendations, and results returned by retrieval and recommender systems. We find that book search requests combine search and recommendation aspects in intricate ways that require more than only traditional search or (hybrid) recommendation approaches.

Keywords: Book Search, Social Media, Evaluation, Recommendation

1 Introduction

The rise of social media has had a fundamental impact on how we search and share information, and has radically changed the nature of book discovery. No longer exclusively the domain of libraries, book review sections in newspapers, and real-life book clubs, discovering and discussing books has become easier than ever due to *social cataloging sites*, such as LibraryThing, GoodReads, Shelfari, BookLamp, Libib, and The Reading Room. In this paper we focus on LibraryThing (LT),¹ a popular social cataloging site. The book collections shared on LT by its 1.7 million members cover over 8 million unique works in total. They describe not only the contents of those books,

¹ <http://librarything.com/>

The screenshot shows a forum thread on LibraryThing. The thread title is "Politics of Multiculturalism Recommendations?" and the subtopic is "Political Philosophy". It has 11 messages and was started by user "steve.dason" on Sep 26, 2010, at 11:32pm. The first post by "steve.dason" discusses the author Parekh's book "Rethinking Multiculturalism: Cultural Diversity and Political Theory" and expresses dissatisfaction with its style. A second post by "rsterling" on Sep 27, 2010, at 1:31am recommends Will Kymlicka's "Multicultural Citizenship" and "Politics in the Vernacular". The forum interface includes a navigation menu on the left, a search bar at the top right, and a sidebar on the right with sections for "Group: Political Philosophy", "About", and "Touchstones".

Fig. 1. Book request on the LibraryThing forum

but also aspects such as how the books engaged them, what their impact was, and how this related to other reading experiences. LT also offers a popular discussion forum (see Figure 1) for readers to discuss and review books, authors, and literature in general. A prominent use of the LT forum is book discovery: thousands of LT members use the forum to search for specific books or to receive or provide recommendations for which books to read next. These book requests display a remarkable breadth, ranging from books on specific topics, for certain moods, to books that are similar to what a member has already read.

The main aim of this paper is to investigate the continuum between search and recommendation in the context of book discovery: *how do users express different relevance aspects in their requests for books to read; can we automatically infer these relevance aspects; and how does this impact the effectiveness of search and recommendation approaches?* We study these questions in the context of the INEX Social Book Search Track [12, 14, 15]. In recent years, this track has focused on book requests posted on the LT discussion forums. In these forums anyone can ask for book recommendations for a specific topic and other members reply with book suggestions. These book suggestions can be seen both as relevance judgments and recommendations. The search requests go beyond topical relevance [13] and include many subjective aspects such as quality, interestingness, engagement, and familiarity.

The idea that a user's concept of relevance goes beyond mere topical relevance is not new in IR. Saracevic [19] and Cosijn and Ingwersen [7] are among the many that argue for the existence of different types of relevance in addition to pure topical relevance, such as situational, motivational, and affective relevance. A comprehensive survey of different interpretations of relevance is given by Borlund [4]. In this paper, we explore the relevance aspects present in the book domain by annotating and analyzing a large set of book requests from the LT forums.

Our main finding is that these book requests can be organized along a continuum, with more pure search-oriented requests at one end and pure recommendation-oriented requests at the other and others placed somewhere between these two, suggesting that search and recommendation are not the two completely distinct entities that they are often considered to be. It has indeed been suggested that they are not that different; [?] argues that retrieval and recommendation are strongly related. Depending on one's perspective, recommender systems could be seen as a specialized type of retrieval systems—ranking documents based on user preferences—or retrieval systems could be seen as a specialized recommender system that rank documents by their utility for the user.

A practical consequence of the existence of such a continuum is that the relevance aspects expressed by different book requests are likely to require different approaches. Some book requests may be better served using retrieval algorithms, others by a recommendation-centric approach, and yet other by a combination of the two. To tailor the system to the type of book request, we need a means to automatically separate book requests from non-requests on the LT forums and identify the relevance aspects expressed by these requests. There is related work on automatically detecting question-answer pairs in forum threads [?] or e-mail conversations [? ?]. Our setting goes beyond this, focusing on automatically identifying relevance aspects in search requests.

If we work with the hypothesis that book requests cover a continuum ranging from search-centric requests to recommendation-centric requests, one important question is how this impacts the relative performance of retrieval and recommendation algorithms. There is some related work on applying recommendation algorithms in a search setting, such as the I-SPY search engine by [?], as well as work on comparing content-based filtering and CF in a pure recommendation scenario [? ?]. In contrast, our work investigates in detail the relative performance of both search and recommendation algorithms for book search requests along the continuum of search and recommendation.

To summarize, we aim to address the following research questions in this paper:

- What topical and non-topical relevance aspects are present in book search requests on the LT forums?
- How are topical and non-topical relevance aspects related to search and recommendation?
- Which features of forum threads and posts can we use to identify relevance aspects?
- How do traditional retrieval and recommendation systems compare in their effectiveness for search and recommendation topics?

The rest of this paper is organized as follows. We first present related work in Section 2, followed by an analysis of book requests on the LT discussion forums in Section 3. Section 4 explores how book requests form a continuum of search and recommendation tasks. We describe our experiments with automatic classification of book requests from forum threads in Section ???. Section ??? reports on the evaluation of search and recommendation algorithms on the continuum. Finally, we conclude in Section 5.

2 Related Work

In this section, we discuss the most relevant prior research related to social book search and forum search and classification.

2.1 Social Book Search

The INEX Social Book Search Track [12, 14, 15] investigates book search in collections with both professional metadata and social media content. For evaluation they use book requests on the LT discussion forums as search topics and book suggestions by members as relevance judgments and recommendations. Koolen et al. [13] found that these requests are complex—including many subjective aspects such as quality, interestingness, engagement, and familiarity—and that the forum suggestions are different in nature than editorial relevance judgements. The aim of this paper is to better understand how these requests are related to search and recommendation tasks and what systems are needed to support this.

Ross [18] interviewed readers about their reading experiences and book selections. She found they use a variety of clues to choose books. Reading a book is a substantial investment of time and energy, so readers look for recommendations from known and “trusted” sources for selection. Reuter [17] looked at book selection by children and identified a list of 46 factors influencing their choices. Buchanan and McKay [5] investigated search activities of customers in bookshops. They found that enquiries are often based on cultural context—reading with others, references and reviews in media—and argued that customers mental models may not be built around the bibliographic metadata as access points. Cunningham et al. [8] looked at collaborative information behaviour in bookshops. They found that groups of customers use many different ways to share information about books, e.g., talking aloud, pointing, reading and searching together. Most of the interactions are used to achieve agreement on the appropriateness of the selected books. The gap between mental model and the access points for online book collections may be a reason why users turn to the LT forum for requests. It is not clear to what extent the subsequent discussions are a way to achieve agreement on the suggestions or whether they are merely a list of potentially interesting books.

2.2 Forum Search and Classification

A considerable amount of related work exists on forum search, although the focus is typically on retrieving results from the collection of threads that make up a single forum; cross-forum retrieval is rarely studied. Elsas and Carbonell [10] constructed a thread-retrieval test collection that utilized between-thread links to identify threads relevant for questions posted to the forum. They found that models that used the structure of the thread outperformed models that treated the whole thread as a document. Discourse structure is equally valuable for thread retrieval according to [?], which suggests that detecting elementary speech acts, such as questions asked in the initial post could aid in detecting book requests. Bhatia and Mitra [3] experimented with thread retrieval on two different forums and found that the thread length (in terms of number of replies) was a strong indicator of the popularity and usefulness of a discussion thread. However,

they do note that there are exceptions where the first and only reply already contains the complete answer. We see the same in LT threads for known-item topics, where the first reply contains the correct answer to a request for the name of specific book described in the initial message. In our case, the number of replies containing suggestions might be an useful indicator of the completeness of the set of suggestions.

For book discovery we are not interested in retrieving the most relevant threads matching a user's information need, but wish to identify threads that constitute requests for books along with the suggestions made by other LT members, and use them for evaluating book search on a large collection of book records. This bears similarity to work on extracting question-answer pairs from online forum threads, a problem investigated by, among others, ?]. They found that identifying questions in forum messages can be cumbersome, as many questions do not necessarily end in a question mark, while the sentences that do are not always true interrogative questions. The same problem with question detection was signaled by ?], who reported good results on detecting interrogative questions by using the most salient POS-unigrams and POS-bigrams, but found that declarative and rhetorical questions were much harder to detect successfully. The same problem is present in the LT threads, where requests for books recommendations are often phrased as declarative questions, e.g., "*Please let me know if you know of any relevant books...*" Finally, ?] tackle the related problem of identifying requests for action in e-mails. They find that lexical features (in the form of unigrams and bigrams) are crucial for request classification. To avoid spurious influences on the classifier, they normalize their n-gram features by replacing, for instance, dates and numbers by the fixed symbols. In addition, they show that by dividing e-mail messages up into different zones and considering only content in certain zones, performance can be improved substantially.

The problem we face in detecting book requests is more complex than standard question detection. Question detection classifiers are typically trained and evaluated on single-sentence examples of questions and non-questions. In the LT setting, we are looking at open-ended questions that can be highly complex and typically take many sentences to explain.

3 Relevance in Forum Book Search

We argued in the previous section that searching for books on the LT forums is similar but not identical to forum search in general or detection question-answer pairs in forums. In this section we look at the variety of book search requests on LT and the relevance criteria they contain. The LT discussion forums are used to discuss a broad range of topics, most of which are book-related. Many members turn to this forum asking for book suggestions and other members can reply and provide suggestions. The forum allows users to mark up book titles and author names through simple wiki-like syntax using so-called *touchstones*. While typing their post, the system automatically identifies the correct book/author and creates a touchstone by linking the marked up text to the right book or author record on LT. When the system misidentifies the book or author, the user can correct the touchstone.

This touchstone functionality makes the LT forums an ideal setting to study real book search requests and the provided suggestions. Members are not limited by the functionalities of a search engine or recommender system when expressing their request, but only by the concreteness of their information need and their ability to express it in natural language. By analysing the book requests on the LT forum, we have an unobtrusive method of investigating realistic, complex search requests that go well beyond traditional query log analysis. Topic creators often leave rich descriptions of their information need as well as many contextual clues to ensure others can understand its complexities.

3.1 Relevance Aspects

For the more ‘straightforward’ search tasks, LT users are most likely to use book search engines available at LT, Amazon, other online bookstores, or libraries. Because LT members express their requests in natural language, we expect these forum requests to be focused on the more complex search needs they have.

Our first step is to investigate the complexity of these book search requests. What kind of relevance aspects do members tend to express in their book requests? We use the work by Reuter [17] as inspiration when categorising the different relevance aspects. Reuter collected data from a user study in a children’s library and identified over 40 aspects, grouped into seven broad categories. To analyse the relevance aspects expressed in book search requests on the LT forum, we use those seven categories as our guide for analysing the relevance aspects. Due to its prominence in the LT forums, we introduce *known-item* search as an additional aspect. Known-item search is a search problem without any recommendation aspect: the user is trying to identify a known book, but cannot remember the appropriate metadata that would help locate it. This means we end up with the following eight relevance aspects:

Accessibility The language, length, or level of difficulty of a book.

Content Topic, plot, genre, style, or comprehensiveness of a book.

Engagement Books that fit a certain mood or interest, are considered high quality, or provide a certain reading experience.

Familiarity Books similar to known books or related to a previous experience.

Known-item Descriptions of known books with the sole purpose of identifying its title and/or author.

Metadata Books with a certain title or by a certain author or publisher, in a particular format, or written in certain year.

Novelty Books that are unusual or quirky, or have novel content.

Socio-Cultural Books related to the user’s socio-cultural background or values, have had a particular cultural or social impact or are popular or obscure.

In general, the *content*, *metadata*, and *known-item* aspects tend to be more typical of search tasks, as they provide a topical description of the desired books. The *familiarity* aspect is more typically found in recommendation-oriented tasks. The other aspects are more contextual aspects, dealing with books for certain scenarios (waiting at an airport,

selecting reading material for secondary school or a book club), for certain age groups or personality traits (e.g., trying to get a spouse to pick up reading), or certain moods (e.g., books that are comforting or challenge ones views). Dealing with such contextual information is an active research topic in both search [9] and recommender systems [1].

3.2 Annotating Book Search Requests

To determine how prominent these different relevance aspects are on the LT forums, we collected a sample of topic threads to have them annotated for this and other characteristics.

To make the best use of our annotators' time, we focused on a set of forum threads that most likely contain requests for book recommendations. We implemented a simple regular-expression-based classifier for this task, which filtered out all topics not containing one or more 'trigger' expressions, such as 'suggest', 'looking for' and 'which books'². This resulted in an initial set of 9,403 topic threads containing touchstones. We then had a random set of 2,646 of these topics annotated by eight different Information Science students, three from the [removed to preserve anonymity], three from the [removed to preserve anonymity], and two from [removed to preserve anonymity]. We created a Web interface to help our annotators (1) identify topic threads as either *book requests* (describing a valid information need) or *non-requests* (covering any other type of discussion topic); (2) annotate these selected book search requests by the relevance aspects expressed in them, e.g. *Metadata* or *Familiarity*; and (3) annotate the suggestions provided by other LT members in the thread. This latter task included questions on whether the suggesters appear to have read the suggested books and whether their recommendation is positive, negative or neutral.

Of the 2,646 topics annotated by the students, 944 topics (36%) were identified as containing a book request. For each identified book request, annotators could then specify multiple relevance aspects. For example, for topic 99309 on the "*politics of multiculturalism*" (partly shown in Figure 1 before), the topic starter asks for suggestions about a particular topic—i.e., *content* relevance—but also asks for books similar to what he has already read on the topic (*familiarity*), but written in a less annoying style (*engagement*).

3.3 Analysis

Table 1 shows the distribution of the different relevance aspects in our annotated set of 944 book requests. The majority of book search information needs on the LT forums express *content* aspects (698 topics or 74%). *Familiarity* is the second most frequent aspect at 36%, showing that recommendation is common in social book requests. There are 267 topics (28%) with both *content* and *familiarity* aspects. Search and recommendation are often combined in a single book request. An example of a topic combining search and recommendation is "Can someone recommend a book that has all the joy, charm, numerous characters, pathos, adventure, love of language, etc. that the novel

² This selection method has some consequences for our automatic thread classification experiments; see Section ?? for more details.

Table 1. Distribution of relevance aspects over the annotated requests. The left side of the table displays the distribution of relevance aspects over the 944 topics. The right side of the table shows the distribution of the number of aspects expressed in a single topic.

Aspect	#	%	# aspects	# topics	%
Accessibility	152	16	1	270	29
Content	698	74	2	347	37
Engagement	213	23	3	252	27
Familiarity	338	36	4	62	7
Known-item	202	21	5	11	1
Metadata	264	28	6	2	0
Novelty	34	4			
Socio-Cultural	134	14			
Total	944	100		944	100

David Copperfield has?" (topic 10392). The searcher wants recommendations based on the book *David Copperfield*, but also describes aspects of the book to base these recommendations on. This is querying by example as well as description, which, to the best of our knowledge, is a form of querying that is not supported by any current systems.

Other frequently labeled aspects are *metadata* (28%), *engagement* (23%) and *known-item* (21%). On the LT forum, *metadata* is an interesting aspect. When searching in a catalog, metadata is often used to find known items, either specific books or books by a certain author, where the goal is to find the right book record so that the user can order the book or locate it in the library. We assume that users do not go to the forum for such search tasks. What, then, is the nature of forum search topics where metadata is a relevance aspect? Over all 944 topics, the mean number of aspects is 2.15. Among the topics labelled with a *metadata* aspect the mean is 2.78, indicating that topics with *metadata* aspects are more complex, and that *metadata* is rarely the only relevant aspect in a book search request. Of the 264 topics labelled with *metadata*, only 22 (8%) have no other relevance aspect. These topics typically ask for recommendations on which books to read from specific authors, publishers or series, or for a proper sequence in which to read a set of books. Metadata is most often combined with *content*, *known-item* and *familiarity* aspects.

Engagement is something that is hard to express through a search engine query. For instance, how can a user search for text books that are funny, for high-brow literature that is scary at the same time, or for books that challenge the reader's own views on a topic? Such complex relevance criteria may be a reason to ask for suggestions on the LT forum. Engagement is often combined with either *content* or *familiarity* aspects. The same holds for *known-item* topics where the user knows the book but can only recall certain elements of the plot or attributes of certain characters. Most book search services are of limited use for such known-item topics, as they do not allow searching the full-text. Forum members, however, may be able to help out with such requests. *Accessibility*, *novelty* and *socio-cultural* aspects are less prominent in our sample. Novelty might be a more implicit aspect when searchers are looking for books on topics or in genres that are new to them.

What this suggests, is that relevance for book search in **social media** is complex and is likely to require systems that combine models from multiple paradigms, e.g., best-match retrieval models as well as content-based and/or collaborative filtering algorithms. In our analysis of the annotated requests, we can see a pattern emerge of relevance aspects being combined with either *content*, *familiarity*, or both, forming groups of topics clustered around these two aspects. The main exception is formed by *known-item* requests, which seem to be in a class of their own. Dividing book requests into different groups based on these relevance aspects shows promise in uncovering a continuum of search and recommendation requests. In the next section, we investigate the nature of this continuum in more detail.

4 A Continuum of Search and Recommendation

Our findings in Section 3.3 suggested that clustering our topic set around the relevance aspects *content* and *familiarity* can produce a handful of distinct topic groups. These two aspects are closely related to search and recommendation tasks respectively, and we wish to argue that by grouping our topics according to these relevance aspects we can show the existence of a *continuum* of search and recommendation. Not only do the LT forums contain pure search requests and pure recommendation tasks, but many requests for focused recommendation in between as well. Our goal in this section is to explore this continuum more and provide additional evidence for its existence.

4.1 Grouping Topics on Relevance Aspects

To reduce the complexity of the analyses, we first group topics based on combinations of relevance aspects related to either search, recommendation, neither, or both. Book search on the forums is dominated by *content* aspects, but a large number of requests also have *familiarity* aspects, combining content-based search and recommendation. We assume *known-item* is a separate group. The other five relevance aspects—*accessibility*, *engagement*, *metadata*, *novelty* and *socio-cultural*—are more contextual in nature. Although *metadata* is not a contextual aspect, there are very few topics with only *metadata*. This leads us to the following five topic groups:

Search (S) contains topics with *content* but not *familiarity* (338 topics)

Search and Recommendation (Co+F) contains topics with both *content* and *familiarity* topics (260 topics)

Recommendation (R) contains topics with *familiarity*, but not *content* (66 topics)

Context (C) contains all topics without *content*, *familiarity*, and *known-item* (78 topics)

Known-item (KI) contains all *known-item* topics (202 topics)

We believe these first three topic groups form a continuum of information needs that shift from more search-oriented problems to a combination of both to more recommendation-oriented problems. In the remainder of this section, we compare all five topic groups on

Table 2. Characteristics of our five topic groups in terms of prose genre, example books provided by the topic creator, and cataloging behavior.

Feature	KI	Co+F	S	R	C	All
Genre						
Fiction	0.77	0.53	0.35	0.49	0.29	0.50
Non-fiction	0.06	0.15	0.26	0.10	0.06	0.16
Mix	0.03	0.13	0.15	0.10	0.21	0.12
Uncertain	0.13	0.19	0.24	0.30	0.44	0.23
% of topics with examples						
Example books	0.08	0.50	0.16	0.54	0.26	0.27
% of suggestions catalogued						
Creator						
Pre-topic	0.02	0.04	0.03	0.06	0.02	0.03
Post-topic	0.02	0.03	0.03	0.05	0.02	0.03
Not	0.96	0.93	0.94	0.88	0.96	0.94
Suggester						
Pre-topic	0.30	0.47	0.47	0.48	0.47	0.46
Post-topic	0.04	0.06	0.07	0.07	0.05	0.06
Not	0.66	0.46	0.47	0.46	0.48	0.47
median number of books catalogued						
Creator						
Pre-topic	0	100	177	104	38	84
Post-topic	4	65	108	81	80	65
Total	16	201	415	195	155	197

characteristics such as the genre of books they target, the presence of example books in *touchstones*, and whether requesters have added the suggested books to their catalogues.

Genre

One way in which our five topic groups differ is in terms of the prose preferences expressed by the topic creators: are they looking for a particular genre? With respect to the prose genre, our annotators were asked to indicate whether the request was for fiction, non-fiction, or both. Table 2 shows that, of the 944 topics in total, 469 (50%) asked for suggestions on fiction books, 150 (16%) on non-fiction, 113 (12%) on both fiction and non-fiction, and for 212 topics (22%) the annotator could not tell.

For the **KI** and **C** topics the percentage of non-fiction topics is relatively low at 6%. **C** topics are also more common among the mixed-genre topics and topics where the annotator was not sure about the genre. For the **R** group, and especially the **KI** group, the percentage of fiction topics is higher than the average at 53% and 77% respectively. In contrast, the **S** topics are focused on non-fiction books more frequently than the other topic groups. A possible explanation for this could be that search-oriented topics lend themselves better to describing the contents of non-fiction books for the same reason that non-fiction books lend themselves better to full-text search. Requests for fiction books are more likely to require a recommendation approach, because describing the specific contents of such books is harder to do than for non-fiction.

Providing example books

The information provided by the topic creator in their initial post could be another possible factor that distinguishes our five topic groups. Here, we are interesting in the example books provided by the topic creator in particular. For some topics, the topic creator adds example books to their initial request (i.e., the first post in the thread) in the form of touchstones. These examples can serve different purposes: (1) positive examples of what they are looking for or want more of, (2) negative examples that match some relevance aspect(s) but not all, or (3) examples of what they have already read, so they can move on to more novel suggestions.

Out of the 944 topics in total, only 256 (27%) have example books in the initial request, as shown in Table 2. We would expect that examples are common among **R** topics based on previous reading experiences, and rare among **KI** topics, because they are looking for books that they cannot name and therefore cannot identify via touchstones. These expectations are supported by the relevance labels: the majority of the **R** topics come with examples (54%), whereas only 8% of the **KI** topics contain examples. The average number of example books provided by the topic creator also shows an interesting pattern: if we move along the continuum from search to recommendation, the number of example books provided increases. **S** topics have 0.33 examples on average, **Co+F** topics 1.32 examples on average, and **R** topics have 1.59 examples on average. The same pattern holds for authors mentioned in the initial posts, with an increase from 0.15 (**S**) to 0.40 (**Co+F**) to 0.44 authors mentioned on average (**R**). This suggests that search topics tend to focus more on describing the information need textually, whereas the recommendation-oriented topics describe it through examples. While this may seem a trivial restatement of the difference between search and recommendation, it does lend credence to our division into the different topics groups using the *content* and *familiarity* aspects.

We are left with two additional questions with regard to provided example books. First, what is the nature of **R** topics without examples? In many cases, topic creators are also able to refer to previous reading experiences of book categories without specifying individual books, e.g. they have read books that scared them and they want to read similar books. Another reason could be problem with using touchstone markup: some **R** topics mention examples not marked up using touchstones. Possible explanations here could be (1) a lack of awareness of the technical possibility on the part of the topic creator, (2) the topic creator does not see the value in doing so, or (3) LT might misidentify the touchstone book.

Our second question has to do with why some **KI** topics have example books? An analysis of the **KI** topics revealed several possible answers: (1) the searcher mentions books that she knows are close matches but not the one she is looking for, (2) she sketches the context by describing what other books led to her reading the sought after book, or (3) the message contains both a request for help identifying a known book as well as a request for general recommendations.

Cataloging behavior

Another *way* of distinguishing between our topic groups could be how the topic creators act on the suggestions they receive in terms of their cataloging behaviour on LT. LT members have a personal profile and catalogue, which contains information on when they catalogued each book. Using this, we can see whether the requester added any of the suggestions to her catalogue, either *before* creating the topic (pre-topic) or *afterwards* (post-topic). Although the post-topic percentages are low—most suggestions are ignored—the suggestions for **R** topics seem to better fit the requester’s interests.

Next, we look at whether posters suggest books from their own catalogues. Overall, 47% of the suggestions were added pre-topic, as shown in Table 2. There is little variation between the groups, except for **KI** topics, where only 30% of the suggestions were catalogued pre-topic. This provides further evidence that **KI** topics are different from the rest of the topics, both in the nature of the request as well as in the nature of the suggestions.

Another interesting comparison would be to look at how many books the topic creator catalogued pre-topic, post-topic, and in total (bottom three rows in Table 2). **KI** topics are often posted by LT members who have no books in their catalogue. Private profiles are an unlikely explanation for this, as these are rare among LT forum users. It seems these LT members use the forums mainly as a search engine and discussion board instead of tool for managing their book collections. Requesters of **C** topics tend have small pre-topic catalogues but add more books afterwards. Perhaps they are relatively new users with limited reading experience, who have difficulty describing in detail what books they are looking for. Instead, they describe the context in which they want to read books. Another possibility is that they have no need to describe what they are looking for in detail yet, because their search needs are not yet very specific and the pool of interesting or relevant books is still big. **R** and **Co+F** topics tend to come from more active users who have some 100 books pre-topic and remain active cataloguers post-topic. This suggests they know from experience what they like and that their needs have become more specific, but are still broad enough that they only need to implicitly describe what they want by giving examples. Users with **S** topics are typically heavy

readers, who have large pre-topic catalogues and remain very active users. They can explicitly describe what they are looking for and may want to leave out any examples so that responders do not pick up on the wrong similarity clues from those examples.

Finally, it is interesting to note that it is not just the topic creators that benefit from the suggestions: a small portion of LT members that reply to forum posts also seem to read the suggested books and catalog them.

4.2 Search and Recommendation Continuum

While the interpretations above may be somewhat speculative, if we assume that user catalogues grow over time, these statistics suggest a progression from requests with mainly contextual aspects, through implicit relevance aspects expressed by example books to explicit descriptions of content-based relevance. While more work is necessary to confirm these temporal tendencies, there is plenty of evidence to support our claim of the existence of a continuum between search and recommendation, from genre preferences to providing example books to cataloging behavior.

Furthermore, the [search and recommendation continuum](#) seems to be related to the expertise of the user on particular topics and genres. The impact of topical expertise on search behaviour has been reported before by [?]. They looked at the impact of topic knowledge on search interaction with online book search and found that users with a low degree of topic knowledge tend to look at more books but find fewer relevant books than users with more extensive knowledge of the topic. Inexperienced users tend to consider larger sets of potentially relevant books, which makes it harder to select books without recommendations from others. Experienced users are more capable of making their own selections but may have more specific requests that are harder to satisfy and require search instead of recommendation.

In addition to expertise, prose genre also seems to affect a user's selection of relevance criteria. For fiction it may be harder to identify and express what it is that a reader likes about a book, in which case it may be easier to provide an example book and let other LT members explain how other books are similar to it. This may also be affected by the large variety in book genres and types. Certain genres may require more expertise to express one's interest in than others, thereby affecting a user's choice to opt for search or recommendation. For example, while the subject of a book is relatively easy to describe, other aspects, such as writing style and mood, may be considerably harder.

If book information needs are really distributed along a continuum of search and recommendation, then this is likely to have an effect on the performance of different systems at different locations along this continuum. This comparison is the topic of Section ???. However, a natural prerequisite to tailoring search systems to these different types of information needs is the ability to automatically classify a topic as being search- and/or recommendation oriented. We investigate this problem in the next section.

5 Conclusions

The main aim of this paper was to investigate explicit information requests in social media, in particular focusing on on social book search.

First, we analysed a large set of annotated book requests from the LibraryThing discussion forums. We found that book search requests on the forums cover a broad range of relevance aspects and many requests have multiple aspects. The two dominating aspects are the content of the book (search) and looking for familiar reading experiences (content-based recommendation), while other aspects are more oriented on the reading context. We identified five topic groups: 1) known-item topics, and topics based on 2) content (Search), 3) familiarity (Recommendation), 4) content-and-familiarity (Co+F), or 5) Contextual aspects. Prose genre also seems to affect a user's selection of relevance criteria. Known-item and Recommendation topics mainly request suggestions for fiction, whereas the other topics request both fiction and non-fiction. For fiction it may be harder to identify and express what it is that a reader likes about a book, in which case it may be easier to provide an example book and let other LT members explain how other books are similar to it. The personal LT catalogue of requesters reveals that the topic groups are related to cataloguing activity. Assuming user catalogues grow over time, our findings suggest the nature of book search progresses as the catalogue grows, from requests with mainly contextual aspects, through implicit relevance aspects expressed by example books to explicit descriptions of content-based relevance.

The popularity of books suggested on the forums also shows that recommendation-oriented topics receive suggestions for more popular books than search-oriented topics. For all topic groups the popularity of suggested books falls between that of books returned by retrieval systems and books returned by recommender systems. Recommender systems also perform better on recommendation-oriented topics than on search topics, while retrieval system performance is related to the complexity of the request, with performance dropping as requests move towards the centre of the continuum, combining aspects of search and recommendation.

Our overall conclusion is that book search requests in social media cover the whole continuum between pure search-oriented requests at one end and pure recommendation-oriented requests at the other. This signals that real-world complex information needs are naturally mergings aspects of search and recommendation, and prompts the need for novel information access systems that blend traditional search and (hybrid) recommendation approaches into a coherent whole.

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